CITY OF FORT LUPTON
CITY COUNCIL/ENTERPRISE BOARDS
TOWN HALL MEETING AGENDA
Tuesday, November 28, 2023
6:00 PM
130 South McKinley Avenue

Zo Hubbard, Mayor
Valerie Blackston, Ward 1
Chris Ceretto, Ward 2
Carlos Barron, Ward 3
David Crespin, Ward 1
Claud Hanes, Ward 2
Bruce Fitzgerald, Ward 3

You may join in person or join remotely by clicking on:
https://global.gotomeeting.com/join/851983253

Call to Order

General Discussion – The Town Hall meeting is for the Public to have open discussion with Council regarding any topic. This list is not all-inclusive. The following topics are items to be presented to Council by staff and may or may not be followed by discussion. No transcripts or summary are taken during Town Hall meetings.

a. Water Shut Off Changes
b. Mountain Sky Irrigation
c. Coyote Creek Green Fees Rate Increase
d. Dig Deep Renewal
e. Automatic Data Processing (ADP) Contract
f. Purchasing Policy
g. Fixed Asset Policy
h. Debt Book Software
i. Design Standards and Construction Specifications
j. Coyote Creek Filing 5 Subdivision Improvements Agreement (SIA)
k. Water Treatment Plant Expansion Project Construction Bid Award
l. Public Hearing- Not Followed by Discussion
Transfer of Retail Liquor License for Whipsaw Wine & Spirits to Manihani Manihani, Inc.

Adjourn

City of Fort Lupton
Procurement Policies

Effective – January 1, 2023

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INTRODUCTION

I. General

These Procurement Policies (collectively, the "Policy") are intended to ensure adequate and uniform control of the City of Fort Lupton's purchasing and payment activities. Principles and policies incorporated into this Policy are in accordance with Generally Accepted Accounting Principles (GAAP) and applicable State of Colorado Law.

All parties involved in the negotiation, performance, or administration of procurement and/or contracts for the City shall act in good faith. All procurements should be made for the purpose of meeting the City's current budget goals.

Information in this Policy will be reviewed and updated by the Finance Department as necessary so that the maximum use and benefit may be derived in accordance with its intended purpose. Questions on any purchasing or payments should be directed to the Finance Director.

II. Decentralized Purchasing

This is a system of purchasing in which limited purchasing authority, responsibility and control is given to the Department Heads. Department Heads are responsible for ensuring personnel in their department are knowledgeable of and trained in the purchasing procedures established by this Policy and the Finance Department. By following the requirements established within this Policy, Department Heads shall be able to properly plan purchases, to allow sufficient time to obtain proposals, quotations, or bids (with an allowable lead time for delivery). Departments shall not only be able to realize savings through competition between vendors but shall also increase efficiency. Departments may establish procedures specific to their Department with approval by the Finance Department.

III. Goals and Objectives

The objective of this Policy is to give employees guidelines that set a standard when purchasing goods or services on behalf of the City, provide for the most efficient use of taxpayer's dollars, and provide for timely purchases by being easy to interpret, with the best overall cost, quality, and quantity. In selecting products and service providers, the City considers and weighs all the following criteria:

1. **Pricing:** Ensure the City receives the required product or services at the lowest possible cost and highest value.
2. **Competition:** Provides vendors equal opportunity to sell to the City.
3. **Quality/Experience:** Using the purchasing and bidding parameters, acquire the highest quality product and service for the City.
4. **Customer Service:** Vendor is consistent, reliable, and timely throughout the procurement process.

IV. Procurement Contrary to this Manual

Except as may be otherwise provided by law, it shall be unlawful for any City officer or employee to order or purchase goods and/or services contrary to the policy and rules set forth herein.

GENERAL RESTRICTIONS AND GUIDELINES

I. General

All purchases shall be made in accordance with the policies prescribed in this Policy. Any procurement or agreement made contrary to these policies shall not be binding to the City.

II. General Provisions/Restrictions

A. No personal purchases may be made using City funds. Purchasing guidelines provided within this Policy may be utilized only in the interest of the City.

B. Only City employees, and department heads a, may make purchase utilizing City funds.

C. Purchases must be charged to the proper account, regardless of budget availability in that line item.

D. Alcohol may not be purchased with City funds, except for Golf Course Operations and City sponsored events.

E. Sales tax is not to be charged on purchases. The City's tax-exempt number should be given to the vendor before the sale is completed. The City's tax-exempt certificate is available from the Finance Department. Fuel purchases are the exception.

F. All City personnel, including employees, elected officials, and volunteers, are obligated to establish and maintain ethical relationships with all vendors or suppliers of City goods and services. Acceptance or solicitation of entertainment, loans, gifts, or special consideration from vendors or suppliers for personal benefit by City personnel is limited per state law. No employee or official of the City shall participate in a transaction, contract, activity, or service of the City which has a direct or predictable effect on the employee's/official's financial interest or the financial interests of an employee's/official's immediate family member or is otherwise prohibited by law.

G. No multi-year financing obligations (i.e., space rentals, copier leases, etc.) may be entered into without the review and concurrence of the Finance Director, the City Administrator, and the City Council unless the total amount to be paid on such obligation is within the amount that the Mayor and City Administrator are authorized to approve.

H. All purchases by the City require that funds for the purchase have been budgeted and appropriated. Requests that are not budgeted must be approved by the City Council. In the case of emergency purchases, the City Administrator must approve the expenditure and seek a budget amendment and appropriation, if necessary, at the next Council meeting.

PURCHASING PROCESSES

I. Procurement Classifications

The following procurement classifications shall determine the procurement method and approvals required as set forth in this Policy.

Procurement Classifications	Procurement Value / Dollar Limit	Type of Purchase	Approvals
1	< $10,000	Informal Purchase	Department Head or designee
2	$10,001 - $30,000	Semiformal Purchase	Department Head Finance Director
3	$30,001 - $50,000	Semiformal Purchase	Department Head, Finance Director, City Administrator
4	> $50,000	Formal Purchase	Department Head, Finance Director, City Administrator Council

II. Procurement for Purchases of Goods or Services Using Federal, State or Grant Funds

When any procurement involves the expenditure of federal or state funds or restricted grant funds, the procurement shall be conducted in accordance with any mandatory applicable federal and/or state laws, regulations, or grant requirements. The procurement requirements for any procurement involving the expenditure of federal funds shall, at a minimum, comply with the requirements of Appendix A, incorporated herein. In the event of a conflict between such federal fund procurement requirements and the requirements of the City as otherwise set forth herein, the stricter requirements shall apply.

III. Procurement Procedures By Classification

PROCUREMENT CLASSIFICATION 1: Informal Purchase. Informal purchase procurement is used for the purchase of goods and services under $10,000 and such purchases require only that the City staff member making the purchase ensures that a reasonable and adequate number of price checks or quotes is made by email, personal inspection, or discussions with vendors to ensure a quality product or service is obtained and best value is determined.

PROCUREMENT CLASSIFICATION 2 and 3: Semiformal Purchase. Semiformal purchase procurement is utilized for simple purchase activities of goods and services of $10,001 up to $50,000. A reasonable and adequate number of price checks or quotes of no less than three (3) should be solicited by email, personal inspection, or discussions with vendors to ensure a quality product or service is obtained and best value is determined. Prior to commencing any purchase classified as Semiformal Procurement, the proposed purchase and process shall be reviewed by the Finance Director.

PROCUREMENT CLASSIFICATION 4: Formal Purchase. Formal purchase procurement is utilized for purchase activities of goods and services greater than $50,000 and requires a competitive sealed process such as an Invitation for Bid (IFB), Reverse Auction, or Request for Proposal (RFP) process. Prior to commencing any purchase classified as Formal Procurement, the proposed purchase and process shall be reviewed by the Finance Director. One of the following procedures may be utilized to fulfill Formal Procurement requirements at the direction of the Department Head in consultation with the Finance Director:

A. Invitation for Bid (IFB). Unless otherwise provided in a specific IFB, the following shall control:

i. Generally. The IFB is a method of source selection in which the award is made to the responsive and responsible bidder submitting the lowest cost bid that complies with the detailed specifications and/or scope of work contained in the IFB. An IFB shall include specifications and all contractual terms and conditions applicable to the procurement, as well as the bid opening place, time and date. Bids are sealed and opened in public at the time and place as set forth in the IFB, unless all bidders have been notified by the City of a change in the time or place by written addendum to the IFB. Bids may be submitted electronically to the Finance Director or designee with a written signed statement "I waive my right to a sealed bid". The finance director or designee will release electronic submissions to the soliciting department at the time designated in the IFB. A tabulation of all received and opened bids shall be formulated and made available for public inspection.

ii. Bid Submission and Bid Evaluation. Bids shall be unconditional and submitted without alteration or correction except as authorized in this subsection. Bids shall be evaluated based on the requirements set forth in the IFB, which may include criteria to determine acceptability, such as inspection, testing, quality, workmanship, delivery and suitability for a particular purpose. Those criteria that shall affect the price and be considered in evaluation for award shall be objectively measurable, such as discounts, allowances, transportation costs and total or life cycle costs.

iii. Specifications. Specifications shall be made available to all interested parties as stated in the IFB. If for any reason whatsoever it is necessary to change the specifications or any other of the formal data and there is adequate time as determined by the Department Head prior to the date of bid opening, an addendum shall be issued setting forth the changes. It shall be the obligation of bidders to ensure they have received all addenda.

iv. Bid Submission. Bids must be received prior to the specified time as established in the IFB. Bids may be received earlier and shall be kept sealed and confidential until the bid opening. Bids received after the specified deadline may be immediately returned to the nonresponsive submitter unopened.

v. Bid Opening. The opening of sealed bids shall be conducted in a manner to protect confidentiality and to ensure fairness.

vi. Correction or Withdrawal of Bids. Correction or withdrawal of inadvertently erroneous bids before and after a bid opening may be permitted in accordance with the IFB.

vii. Award. Generally, an award shall be made by written notice to the lowest responsible and responsive bidder whose bid meets the requirements and criteria set forth in the IFB including, without limitation, consideration of performance on similar projects or contracts, letters of reference and prior performance with the City. The City retains the right to reject or modify any bids, awards always being subject to negotiation and execution of a mutually acceptable agreement. The City reserves the right to review and award bids at its discretion to responsive and responsible companies which may or may not be the low bidder.

B. Request for Proposal (RFP). Unless otherwise provided in a specific RFP, the following shall control:

i. Competitive Sealed Proposal/Competitive Negotiation Process. Proposals shall be solicited through a RFP process when, for example: (1) the Department Head or his/her designee determines that the complex nature or technical details of a particular procurement make the use of competitive sealed bidding either not practical or not advantageous to the City; (2) specifications cannot fairly or objectively be prepared as to permit sufficient competition; (3) high technology and electronic equipment is available from a limited number of sources; or (4) specifications cannot practically be prepared except by reference to specifications of the equipment of a single source of supply.

ii. Receipt of Proposals. Sealed proposals shall be submitted at the time and place as set forth in the RFP. Proposals may be submitted electronically to the Finance Director or designee with a written signed statement "I waive my right to a sealed proposal". The finance director or designee will release electronic submissions to the soliciting department at the time designated in the RFP. Only the names of the proposer will be read in public at the time proposals are due. No proposals shall be opened until the time designated in the proposal document or addenda.

iii. Evaluation Factors. Proposal evaluation criteria shall be as set forth in the RFP. Final consideration for awarding of contract shall not be based solely on price. A combination of qualifications, experience, demonstrated successes, references, fees and costs, capacity to fulfill all requirements of the contract and other qualifying considerations may be considered for evaluation purposes.

iv. Discussion with Responsible Proposers and Revisions to Proposals. As provided in the RFP, discussions may be conducted with responsible proposers who submit proposals determined to have a reasonable likelihood of being selected for award.

v. Award. Award shall be made to the responsible proposer whose proposal is determined to be the most advantageous to the City, taking into consideration price and evaluation factors. This process may include discussions and negotiation between the City and proposer. The City retains the right to reject or modify any

proposals, awards always being subject to negotiation and execution of a mutually acceptable agreement.

C. Request for Qualifications (RFQ).

i. Pre-Qualifying Submitters or Multi-Step Sealed Bidding. When it is considered impractical to initially prepare a purchase description to support an award based on price, prior to the issuance of a Soliciting Document, the City may determine to issue a Request for Qualification, RFQ, requesting the submission of un-priced offers to be followed by a Soliciting Document limited to those bidders whose offers have been determined to be technically acceptable under the criteria set forth in the first solicitation. Only the providers of products or services that meet the specifications or experience will be permitted to submit bids or cost proposals. In addition, the RFQ process is used when the desired services are not as well defined and depend on the submitter's ability to appropriately identify and address the problem(s) or issue(s). This process is most often used for selection of professional services. The submitters submit statements of qualifications, and the City then issues a Soliciting Document limited to those submitters whose response to the RFQ have indicated ability and satisfied other criteria such that the City desires to seek a proposal from such Submitter.

ii. In determining whether to issue an initial Soliciting Document only to Pre-Qualified Submitters, the Department Head shall consider the best interests of the City and may consider whether a project or contract:

a. requires complex or unusual expertise or techniques;

b. involves a particularly tight time frame;

c. involves experience in a very specific field; or

d. has a projected budget of $500,000 or more.

iii. The method of submitting pre-qualification information and the information required in order to be pre-qualified shall be determined by the Department Head.

IV. Non-responsive Bids/Proposals

A. Defined. A responsive bid/proposal is one that is in substantial conformance with the requirements of the Soliciting Document.

B. Determination of Non-responsiveness. The following are examples of nonresponsive submittals:

i. A Submitter who fails to deliver a bid/proposal prior to the specified place, time and date as shown on the Soliciting Document is considered late and the bid/proposal shall not be opened.

ii. A Submitter who fails in the bid/proposal to conform to required delivery schedules as set forth in the Soliciting Documents or in the permissible alternatives.

iii. A Submitter who qualifies prices in such a manner that the firm's bid/proposal price cannot be determined (such as "price in effect at time of delivery").

iv. A Submitter who fails to offer goods or services that comply with the specifications of the Soliciting Document.

v. A Submitter who makes the City the responsible party for determining that the bidder's alternative products or services conform to the specifications.

vi. A Submitter who fails to furnish bid surety when required.

vii. A Submitter who limits the rights of the City under any contract clause unless information on such limitations are invited.

V. Solicitation Irregularities

The Department Head has authority to waive irregularities if: (a) the item being waived is only a matter of form or is an immaterial variation from the exact requirements set forth in the Soliciting Document; (b) the item being waived has trivial or no effect on price, quality, quantity, delivery or performance; and (c) such a waiver would not affect the relative standing of bidders or proposers or be otherwise prejudicial to them. Examples of minor irregularities that may be waived are:

A. Failure to furnish with the bid certain required information regarding the vendor's qualifications to perform the contract.

B. Failure to submit required descriptive information on the products offered.

C. Failure to return the proper number of executed bids or attachments, including certifications and affidavits.

D. Failure to return a bid addendum or amendment if on the face of such bid the bidder acknowledges receipt of addendum or amendment or if the addendum or amendment does not have material effect on the bidder's liability under the terms of the contract.

E. Failure to sign a bid, when evidence is submitted with the bid that clearly shows that the bid was the one intended by the bidder and that failure to sign was strictly an oversight.

When such minor irregularities are discovered, the Submitter is requested to remedy the problem within a reasonable timeframe by later submitting omitted data or by providing a written statement of intent.

VI. Rejection of Bids/Proposals

Unless otherwise specified in the Soliciting Document, bids/proposals may be rejected when one or more of the following occur:

A. Bids/proposals exceed the budgeted amount;

B. There are no responsible Submitters;

C. There are no responsive Submitters;

D. The project is abandoned;

E. The specifications, scope and/or terms and conditions are revised; or

F. Irregularities exist in the procurement process as determined by the Department Head and/or the City Administrator.

V. Confidentiality

To the extent permitted by the Colorado Open Records Act and consistent with any language in the Soliciting Document, after solicitations are opened, they become confidential documents until the City awards the contract or the solicitation project is cancelled. Staff, contractors and City officials shall not discuss solicitations with competing vendors. Vendor questions must be referred to the Department Head. Unless directed to do so by the City Administrator, Staff shall not discuss with any vendor the recommended award or the reasons for awarding or not awarding.

VI. Exemptions to Formal Procurement

A. Procurement Classification 1 and 2 purchases do not require formal procurement processes.

B. Regardless of dollar amount, the following purchases are exempted from the requirement to engage in formal procurement processes:

i. Cooperative Purchases. Purchases made cooperatively with other units of government such as the State of Colorado and government cooperative groups utilizing extended awards from other governmental agencies.

ii. Piggybacked Purchases. Purchases made by piggybacking on prices, bids and offers made to other units of government such as the State of Colorado or other counties, municipalities or special districts when agreeable by the vendor and the City determines such approach is in the best interests of the City.

iii. Government Contracts. Purchases/contracts with federal, state and local government and political subdivisions of the state.

iv. Published Materials. Purchases of magazines, books, publications and periodicals.

v. Purchases of water or real property rights. All such purchases require approval of the City Council.

vi. Hardship. Purchases in the presence of hardship, which exemption requires satisfaction of the following criteria and approval procedure:

a. Exemption shall be granted when formal procurement is deemed not to be in the best interest of the City because, due to circumstances beyond the reasonable control of the person or department requesting the waiver:

1. the process may cause unavoidable time delay or unavoidable hardship for a department of the City; or

2. the process may cause undue expense for the City.

b. In order for an exemption to be granted:

1. the Department Head requesting the exemption must complete an Exemption Request Form as provided by the Finance Director;

2. the completed Exemption Request Form must be submitted to the Finance Director for a recommendation and signature; and

3. the Exemption Request Form with the Finance Director's recommendation must be submitted to the City Administrator for final authorization of the exemption.

vii. Sole Source. Purchases of supplies, products or services indispensable to the City for which there is only one source practicably or reasonably available, which exemption requires satisfaction of the following criteria and approval procedure:

a. $10,001 to $30,000. To take advantage of the sole source exemption for purchases between $10,001 and $30,000, Department Heads are responsible for selection and contract administration. Semiformal procurement processes are not required; however, Department Heads are responsible for selection based on applicable and appropriate qualifications, experience, referenced successes and cost factors. The Finance Director must approve reliance on this exemption in writing in advance.

b. Over $30,000. To take advantage of the sole source exemption for purchases with a total cost of over $30,000, Department Heads are responsible for selection and contract administration. Formal procurement processes are not required; however, Department Heads are responsible for providing the written justification for the exemption and obtaining written approval before engaging any such exempted services or procuring exempted goods. Approval must be obtained in accordance with the following procedure.

1. the Department Head requesting the exemption must complete the Exemption Approval Form as provided by the Finance Director;

2. the completed Exemption Approval Form must be submitted to the Finance Director for a recommendation and signature; and

3. the Exemption Approval Form with the Finance Director's recommendation must be submitted to the City Administrator for final authorization of the exemption.

viii. Professional Services. Contracts for professional services from certain professional, technical and expert service providers which exemption requires satisfaction of the following criteria and approval procedure:

a. Criteria. To take advantage of the exemption, the following criteria must be met:

1. the service provider has such required specialized knowledge, skill, reputation and/or experience to satisfy the specialized needs of the department or City; and

2. the service provider provides services recognized as professional in nature by licensure, certification or other specialized training such as accountants, actuaries, appraisers, architects, attorneys, business consultants, business development managers, specialized engineers, public relations professionals, public finance professionals, recruiters, researchers, real estate brokers, or translators; and

3. the service provider proposes a reasonable approach to achieve the project or service objectives in an acceptable timeframe;

4. the service provider has a satisfactory record of performance in developing and implementing similar projects or providing similar services in other jurisdictions; and

5. the service provider will perform the project or services at a reasonable cost compared with the level of effort expended.

b. $10,001 and to $30,000. To take advantage of the professional services exemption for purchases between $10,001 and $30,000, Department Heads are responsible for selection and contract administration. Semiformal procurement processes are not required; however, Department Heads are responsible for selection based on applicable and appropriate qualifications, experience, referenced successes and cost factors. The Finance Director must approve reliance on this exemption in writing in advance.

c. Over $30,000. To take advantage of the professional services exemption for purchases with a total cost of over $30,000, Department Heads are responsible for selection and contract administration. Formal procurement processes are not required; however, Department Heads are responsible for providing the written justification for the exemption and obtaining written approval before engaging any such exempted services or procuring exempted goods. Approval must be obtained in accordance with the following procedure.

1. the Department Head requesting the exemption must complete the Exemption Approval Form as provided by the Finance Director;

2. the completed Exemption Approval Form must be submitted to the Finance Director for a recommendation and signature; and

3. the Exemption Approval Form with the Finance Director's recommendation must be submitted to the City Administrator for final authorization of the exemption.

ix. Emergency Purchases. Emergency purchases which exemption requires satisfaction of the following criteria and approval procedures:

a. Criteria. To take advantage of the exemption, the following criteria must be met:

1. dangerous condition, potentially dangerous condition, or immediate need for supplies, equipment or services exists requiring the purchase to protect the public safety, health or welfare of citizens when in imminent jeopardy;

2. immediate repair is necessary to prevent further damage to public property, machinery or equipment;

3. the functioning and operation of a City department would be seriously hampered or delayed through use of the normal purchasing process; or

4. equipment breakdown or act of God threatens to terminate essential services.

b. Process.

1. To take advantage of the emergency purchase exemption, the appropriate Department Head must contact the City Administrator and provide the following information:

a. The nature of the emergency;

b. The estimated cost of the services/goods required; and

c. The vendor recommended to receive/fulfill the order.

2. The City Administrator may authorize the procurement of such emergency needs by informal procedures, as expeditiously as possible, at not more than commercially reasonable prices. When expenditures exceed the then-effective City Administrator approval authority, a full report of the circumstances necessitating the emergency action shall be timely reported to the Council by the City Administrator.

x. Fine Art. The material qualifies as an object of fine art.

xi. Materials Conformity. A particular material is required to match materials currently in use by the City.

xii. OEM Parts. Original Equipment Manufacturer (OEM) repair parts purchased from the source vendor.

xiii. Original Provider Maintenance and Support. Annual maintenance and service agreements when the terms of the original purchase specify that the original provider performs ongoing maintenance.

xiv. Additional Materials or Services. Procurement resulting from a formal procurement process may be used as the basis for the negotiated purchase of additional quantities of the same materials or services at any time; provided, however, that subsequent procurements are expressly limited to the specific terms, conditions and pricing established by the original procurement.

VII. Valuing Procurement for Purpose of Proper Classification and Permissible Renewals/Extensions

a. Purchases shall not be artificially divided to circumvent the procurement classification and associated procurement process above.

b. If numerous items are being purchased from one vendor on a single order, the aggregate price is the determining factor regarding procurement classification.

c. In determining procurement value when purchasing services by contract or purchase order, the following guidelines shall be used:

   i. If services are provided on a lump sum basis, the lump sum amount shall determine the value of the procurement. If lump sum services are compensated on an annual basis (instead of on a one-time basis) the procurement value shall be determined by multiplying the annual lump sum amount by the number of years in the term (not to include optional as opposed to automatic) renewal terms contemplated by the contract.

   ii. If services are provided on a time and materials basis, the value of the procurement shall be determined by multiplying the annual maximum or not-to-exceed compensation by the number of years in the term (not to include optional as opposed to automatic renewal terms contemplated by the contract).

   iii. If a contract is for fees to be retained by a vendor (such as banking agreements) and not actual expenditures of the City (no additional checks or payments are issued to the vendor), an estimate of the cost to the City (retained fees) shall provide the basis for procurement value determination. If the estimate is erroneous, actual cost shall be used for determining value at renewal time or when resoliciting for such services.

   iv. A clause which permits termination of the contract or other form of purchase agreement before the end of its stated term, to include for non-appropriation, shall not be considered in determining procurement value.

   v. The Finance Department shall have the ultimate authority to determine final procurement value for any contract or other form of purchase agreement.

d. Contracts may be extended, renewed or amended to extend or renew without further procurement action or additional approvals only if:

   i. The Soliciting Document contemplated amendment or optional renewal terms; and

   ii. the contract specifically recognized that renewal or amendment was an option; and

   iii. approval of the contract as set forth in the table above was at the level that would be required for the contract adding in the additional compensation payable due to the extension, renewal or amendment; and

   iv. any additional services or service scope change are reasonably related to the services contracted for in the original contract; and

   v. the aggregate dollar value of the compensation payable under the term and the renewal or extension term(s) (with or without additional compensation for reasonably related additional services) does not equal a value greater than a threshold amount for an elevated procurement classification level (ex. 2 year contract for $6,000/year can be renewed for additional one year term as the value of the term ($12,000) plus the renewal ($6,000) equals $18,000 and does not reach the Classification 3 threshold).

Additional Considerations:

- Electronically transmitted bids are acceptable for informal written bids, provided the bid is a firm written price or quote for specific goods or services valid for no less than 30 days.
- Contracts for service shall include a City Attorney- approved Professional Services Agreement.
- If the recommended bid is not the lowest, a detailed explanation must accompany the bid's submission.
- Resolutions are required for all service contracts and bids presented to the Council for approval.
- If less than the required number of informal or formal bids are received, the City may consider seeking additional bids if time allows. If less than the number of required bids is received, the City may award to a bidder if the City finds that the price is fair and reasonable, and that other prospective bidders had a reasonable opportunity to respond.

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AUTHORIZATION REQUIREMENTS

I. General

Signature authority is granted on an individual basis and must be consistent with Section I above. All departments shall keep current a list of designated staff authorized to approve City expenditures. The list shall include the full signatures and initials of each authorized individual and the amount of signature authorization granted to the individual.

II. Responsibility for Compliance

Ultimate responsibility for expenditures within each department is placed on the relevant department head.

III. Procedures

A. A Signature Authorization Summary must be submitted to the Finance Department on an annual basis (January 1).

B. The Finance Department shall be responsible for deleting signature authority for terminated employees. Should authority need to be revoked prior to termination, the applicable department shall be responsible for notifying the Finance Department.

C. All changes and additions to the Signature Authorization Summary must be submitted in writing and must include the following information:

Name of employee
Title
Authorization amount
Effective date
Employee signature and initials
Signature of employee delegating authorization

D. Unless signature authorization has been formally delegated, no employee shall sign on behalf of another otherwise authorized employee. Written notification of delegation must be sent to the Finance Department.

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CONTRACT AUTHORITY

I. The City Administrator shall have the power and duty to approve and execute, by signature, all contracts or agreements of, or on behalf of, the City or its enterprises, subject to the following limitations:

A. The City Attorney must review and approve contracts as to form.

B. No contract or agreement shall exceed $50,000. Contracts or agreement exceeding $50,000 shall require City Council approval.

C. No contract or agreement shall involve conveyances of interest in land, water, bonds, indentures, evidence of indebtedness, or proclamations, unless the authority to approve and execute such documents shall be granted by the City Council.

D. Such contract or agreement does not constitute an "intergovernmental agreement" under Colorado law.

E. It shall be the City Administrator's duty to ensure that all City contracts and agreements are procured in compliance with the requirements of the Fort Lupton Municipal Code and any applicable rules and regulations.

F. The City Administrator may delegate the City Administrator's signatory authority for the approval and execution of contracts and agreements to Department Heads where the contractual matters fall within their area of responsibility. With the City Administrator's prior approval, Department Heads may further delegate signatory authority for limited purposes.

G. No City contract shall be approved or executed unless funds for the payment of obligations under the contract or agreement are in the Budget approved by the City Council and the funds have been appropriated by the City Council. This section shall not prohibit approval and execution of multi-year contracts or agreements where such agreements are legally permissible.

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CAPITAL IMPROVEMENT CONTRACTS

I. General

The Capital Improvement Contracts Policy applies to any capital improvement contract that the City enters into. A City Project Manager (or City contact person) MUST be designated for each capital improvement project and specified within the contract. This individual will be accountable for all aspects of proper contract administration surrounding the construction in progress. Refer also to **Procurement Procedures by Classification** for information on the bidding process. Each department and its personnel are responsible for the effective planning for its capital improvement projects.

II. Contract Performance and Payment Bonds

A. When a capital improvement contract is awarded, unless the City Administrator or designee deems otherwise, the following bonds or security shall be delivered to the City and shall become binding on the parties upon the execution of the contract:

1. Bid security in an amount equal to five (5) percent of the total amount of bid may be required for all competitive sealed bidding for capital improvement contracts. Bid security shall be a bond provided by a surety company authorized to do business in this state, or the equivalent in certified funds, or otherwise supplied in a form satisfactory to the City.

   When the invitation for bid requires security, noncompliance requires that the bid be rejected.

2. A performance bond, satisfactory to the City, executed by a surety company authorized to do business in this state, or otherwise secured in a manner satisfactory to the City, in an amount equal to one hundred (100) percent of the price specified in the contract; and

3. A payment bond, satisfactory to the City, executed by a surety company authorized to do business in this state, or otherwise secured in a manner satisfactory to the City for the protection of all persons supplying labor and material to the contractor or its subcontractors for the performance of the work provided for in the contract, in an amount equal to one hundred (100) percent of the price specified in the contract.

B. Nothing in this section shall be construed to limit the authority of the City to require a bond or other security in addition to the bonding requirements as stated above.

III. Insurance

Contract documents must require the contractor to procure and maintain minimum insurance coverage at the direction of or as prescribed by standard contract forms by the City Attorney.

IV. Retainage

The contract shall include provisions for retainage of contract sums as prescribed by state law and may include provisions for retainage in contracts not covered by state law.

V. Damage or Delay

The City may, by contract, require the contractor to waive, release, or extinguish its rights to recover costs or damages, or obtain an equitable adjustment, for delays in performing such contract if such delay is caused, in whole or in part, by the acts or omissions of the City or its agents, if the contract provides that an extension of time for completion of the work is the contractor's remedy for such delay. Such clause is valid and enforceable, any provision of state law to the contrary notwithstanding.

VI. Review

Contracts are to be reviewed by the City Attorney. Generally, all contracts/agreements should use the City's standard form. Exceptions can only be approved by the City Attorney or City Administrator.

VII. Final Payment

The last payment on a capital improvement contract, in an amount of ten thousand dollars ($10,000) or more, will not be made until at least ten (10) days after notice of intention to pay is published at least twice in a newspaper of general circulation in the City and after the City has received a release of statements of claim or liens. Proof of publication should be submitted to the Finance Department. Claims against the contract shall be filed as prescribed by state law.

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DEBARMENT OR SUSPENSION

I. General

The City Administrator is authorized to debar or suspend a vendor or contractor for just cause.

II. Guidelines

A. No vendor or contractor shall be debarred or suspended until an opinion regarding the same has been obtained from the City Attorney and until procedures recommended by the City Attorney have been followed.

B. The period for debarment shall be determined by the City Administrator on a case-by-case basis.

C. Reasons for debarment or suspension include the following:

1. Commission of fraud or a criminal offense as an incident to obtaining or attempting to obtain a public or private contract or subcontract or in the performance of such a contract or subcontract.

2. Conviction or indictment under a state or federal statute of embezzlement, theft, forgery, bribery, falsification, or destruction of records, or receiving stolen property.

3. Conviction or indictment under a state or federal antitrust statute.

4. Failure or default without good cause to perform in accordance with the terms of any contract or unsatisfactory performance of any contract.

5. Debarment, disqualification, or suspension by another government entity for any reason.

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CITY ISSUED CREDIT CARDS / PURCHASE CARDS

I. General

The purpose of this Policy is to maintain the financial integrity of the City's funds. This Policy applies to all items procured using a City-issued purchase or credit card. The use of a City issued card is a privilege and should be treated as such.

II. Issuance

City cards may be issued to Department Heads or other personnel as authorized by the City Administrator and Finance Director.

III. Card Use

Card purchases are limited to those transactions completed upon purchase. Purchaser shall verify the availability of the item being charged when placing an order. Back orders should not be charged until time of shipment. Purchaser shall verify that the combined price and freight charge being charged is under the purchaser's signature authority dollar limit. Purchaser shall also verify that sales tax is not being charged. A copy of the tax-exempt certificate is available from the Finance Department.

When placing an order by FAX, phone, mail or email, purchaser shall request that the **receiver's name** and **"credit card purchase"** be put on the shipping label or packing list to expedite delivery and request that a receipt be sent with the purchase. All charges will require a receipt be attached.

The Internet may be used to place orders only when the receiving website is secure. To determine whether a website is secure, look for a closed padlock in the search bar by the site's name. If the padlock is open or non-existent, the website is not secure and should not be used for placing orders.

If merchandise is to be returned, verify that the vendor will credit the purchasing card account, request a copy of the credit issued, and submit it with the monthly credit card statement.

If an attempt to make a purchasing card transaction is denied, contact the Finance Department as soon as possible to resolve the problem. If there is concern that a transaction may be denied, contact the Finance Department in advance to authorize the vendor, or ask the vendor to run a pre-authorization on the purchasing card to make sure the transaction will go through.

IV. Prior Authorization of Expenditures

Proper approvals must be obtained for the purchase of goods and services prior to ordering as with any other City purchase.

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V. Unacceptable Uses

- Purchases over the holder's signature authority limit. Dividing an order to satisfy this limit is not allowed.
- Cash advances, traveler's checks, or the use of ATM machines.
- Fuel for personal vehicles. Reimbursement for mileage must be made on the Expense Reimbursement Form (see employee handbook).
- Personal or non-business uses. If personal or non-business-related items are accidentally charged on the card, immediately notify the Finance Department, and reimburse the City via cash, credit, or a personal check payable to the City of Fort Lupton, with a note attached showing the account to be credited. Reimbursement must be completed at or before the time of statement reconciliation. Repeated occurrences of personal or non-business-related items being charged to the card and/or intentional misuse of the card may result in charging privileges being revoked and disciplinary action taken.

VI. Lost Receipts

If a receipt is lost, or was never provided by the vendor, a "Missing Purchasing Card Receipt Form" (available on the City server) shall be completed and attached to the monthly credit card statement.

VII. Disputing Transactions

If there is a dispute about a transaction, the cardholder should first try to resolve it with the merchant. If an item has been charged but has not been received, contact the merchant to verify shipment date. If the item has been or will be shipped soon, it is recommended that the charge be paid at the time of the statement. If charges are paid but not received by the next statement, contact the Finance Department for assistance in resolving the problem.

VIII. Change in Employment Status

The cardholder will surrender possession of his/her card upon termination of employment. The cardholder may be asked to surrender the card at any time deemed necessary by the Department Head, the Finance Director, or the City Administrator.

IX. If Card is Lost or Stolen

Keep the card in a safe place at all times. Contact the Finance Department immediately if the card is lost or stolen. If this contact cannot be made, call the card issuer immediately and then notify Finance as soon as possible.

X. Monthly Statements

It will be the responsibility of the Department Head to reconcile the monthly credit card statement to receipts. Reconciled statements must be forwarded to the Finance Department within one (1) week of statement receipt.

PETTY CASH

I. General

Petty cash is available to cover small purchases (not to exceed $25), may be disbursed as an advance or reimbursement, and must be approved by the employee's Department Head or designee.

II. Internal Controls

A. Petty cash funds may only be established, or the amount of the petty cash on deposit increased or decreased, by the Finance Director or designee.

B. Petty cash must be kept in a locked box in a secured location.

C. The Finance Department is responsible for ensuring that the cash in the box plus the total of all petty cash slips exactly equals the total amount assigned to petty cash funds.

III. Procedures

Cash Advance/Reimbursement

A. To obtain a cash advance for a petty cash purchase, a petty cash slip must be filled out by the employee indicating the following:

1. Amount of advance
2. Vendor
3. Account number
4. Description of purchase
5. Date
6. Employee's signature
7. Approval signature

The slip is kept in the petty cash box until the employee returns with the cash receipt. The actual amount of the purchase should be recorded and circled on the petty cash slip, the cash receipt stapled to the petty cash slip, and the change from the advance returned to the petty cash box. Cash advances may not be held by the employees for more than two (2) business days.

B. To obtain reimbursement for a purchase made, a petty cash slip must be filled out by the employee indicating the same as in III. A. above.

Attach the cash receipt to the petty cash slip. The slip is then exchanged for a cash reimbursement.

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C. The $25 limit shall not be circumvented by making two separate purchases of related items and submitting two receipts, when the total exceeds the $25 limit.

IV. Replenishment

A. To obtain a funding/reimbursement check to reimburse the fund, all petty cash slips and remaining cash should be turned into the Finance Department to ensure that the balance is properly accounted for and create a funding check. Petty cash slips must be accompanied by the appropriate receipt or acceptable notation of why a receipt was not available to be funded.

B. Petty cash funds are subject to internal audits by the Finance Director or designee and are also subject to audit any time the fund is reimbursed. Such audits shall be conducted in accordance with Generally Accepted Auditing Standards (GAAS) and will evaluate the effectiveness of risk management, control, and governance processes.

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RECEIVING PROCEDURES AND CHECK PREPARATION

I. Receiving Procedures

A. It shall be the responsibility of the receiving department to ensure that goods are received as ordered and in good condition. Immediately upon receipt of merchandise, check quantity, quality, and any specifications such as model number, etc. to ensure that the goods have been received as indicated on the packing slip.

B. If the goods are faulty or damaged, notify the vendor and Finance Director or designee immediately. If damage is concealed or not noticed at time of delivery, leave all boxes and packing lists intact and notify vendor immediately.

C. It shall be the responsibility of the receiving department to inform the Finance Director or designee of the delivery and acceptance of an order by submitting the receiving documents with the check request for payment.

D. It shall be the responsibility of the receiving department to inform the Finance Director or designee when full or partial payments are authorized.

E. All invoices shall be mailed by the vendor directly to the accounts payable department.

II. Check Preparation

Checks are prepared based on the following:

A. Checks are cut in accordance with the Finance Department schedule on a weekly basis
B. Original invoices must be attached
C. All invoices must be approved by the Department Head
D. All invoices must be properly coded
E. Receiving documents, if available, must be attached and signed off

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REFUNDS

I. General

Refunds of money paid to the City are to be initiated by the department responsible for the revenue collection. All refunds must be run through the Finance Department. Exceptions may be made on a case-by-case basis.

II. Procedures

A. A Refund Request, or other department specific refund form, must be completed, approved and submitted to the Finance Department.

B. Refunds for overpayment of on-going receipts (i.e., Sales Tax, Utilities) may be given in the form of a credit on a future billing.

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MISCELLANEOUS PURCHASING

I. General

Miscellaneous purchasing refers to purchasing outside of the aforementioned items.

A. Professional Dues and Licenses: Professional dues, licenses, and memberships to associations and organizations that benefit the City will be paid from City funds but shall be the responsibility of the employee to obtain and maintain. Examples include, but are not limited to: CDL and regular driver's licenses, professional engineering license, water/wastewater treatment operator's licenses, etc.

B. Magazine and Newspaper Subscriptions: Any necessary subscriptions, approved by the Department Head or City Administrator, shall be delivered to the City address.

C. Purchase of Food/Meals: Food/meals for employees shall be paid for via a City issued credit card, purchasing card, or check or reimbursed at a reasonable level, for justified expenses. Examples include, but are not limited to, the items listed below. Exceptions require written approval of the Department Head or other appropriate City official. Consult the Travel Policy for meals relating to employee travel and training per diem.

- Council/Commission/Committee business meetings
- City Administrator staff and/or business meetings
- Department Head meetings when required outside normal working hours
- Development related activities/meetings
- Meetings or events hosted and/or sponsored by the City
- Meals purchased for employees required to work beyond normal meal breaks
- Special events approved in advance by the City Administrator.

D. Purchase of Flowers/Plants: The City Administrator or his designee can authorize the purchase of flowers/plants for employees/elected officials that are hospitalized or in the event of the death of an employee/elected official or immediate family member. A maximum amount of $100 including delivery is authorized. Donations, not to exceed $100, may be made in lieu of flowers/plants in the event of a death or serious illness.

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DEFINITIONS

Bid Package

Documentation prepared and distributed by the City in the solicitation of bids.

Business

Any corporation, partnership, individual, sole proprietorship, joint stock company, joint venture or any other private legal entity.

Capital Improvement

A fixed public improvement, including, but not limited to: streets, alleys, sidewalks, water or wastewater facilities, flood control facilities, traffic control devices, street lighting, parks, public structures, and landscaping.

Change Order

A written order signed by the City Administrator or designee, directing the contractor to make changes, or changing non-contractual information on the City's purchasing system (i.e., account number, budgeted amount, etc.)

City

The City of Fort Lupton, Colorado, a municipal corporation with a primary business location of 130 S. McKinley Avenue, Fort Lupton, CO 80603.

City Council

The legislative and governing body of the City.

City Administrator

The chief administrative officer of the City.

Confidential Information

Any information which is available to an employee only because of the employee's status as an employee of the City and is not a matter of public knowledge or available to the public on request.

Construction

The process of building, altering, repairing, improving, or demolishing any public structure or building, or other public improvements of any kind to any public real property.

Consulting Services

Services provided by individuals possessing specialized educational qualifications, practical expertise or professional certification, including without limitation to architects, engineers, legal counsel, planners, accountants, and actuaries, where the final product is predominantly oral or written advice or information.

Contract

All types of City agreements, regardless of what they may be called, for the procurement or disposal of supplies, services, or construction. The term shall not include intergovernmental agreements or any interest in real property by the City or another governmental body.

Contract Modification

Any written alteration in specifications, delivery point, rate of delivery, period of performance, price, quantity, or other provisions of any contract accomplished by mutual action of the parties to the contract.

Cooperative Purchasing

Procurement conducted by, or on behalf of, more than one (1) governmental body.

Department Head

Department Heads include Public Works Operations Manager, Finance Director, City Clerk, Police Chief, Human Resources Director, and any other head of a department as designated by the City Administrator.

Designee

A duly authorized representative of a person holding a superior position.

Governmental Body

Any department, division, commission, Council, Council, bureau, committee, institution, legislative body, agency, government, corporation, or other establishment of this City.

Invitation for Bids (IFB)

All documents, whether attached or incorporated by reference, utilized for soliciting bids.

Managerial Contingency

The difference between total project budget and award of bid as approved by City Council. Managerial Contingency must be approved by Council at the time the bid is awarded. Adequate funds must be available and are to be encumbered as managerial contingency on the Purchase Order.

Non-Capital Purchases

Services, supplies and non-tangible property.

Person

Any business, individual, union, committee, club, other organization, or group of individuals.

Procurement

The process through which the City acquires goods and services for its own use.

Professional Services

Services of a specialized nature, including, but not limited to: architecture, engineering, legal, accounting, hiring screening process (drug testing, psych testing, etc.), equipment repair and maintenance, etc.

Purchase Description

The words used in a solicitation to describe the supplies, services, or construction to be purchased, and includes specification attached to, or made part of the solicitation.

Purchase Order

A request to purchase goods or services, typically provided to the vendor as a confirmation of the City's commitment to purchase.

Purchasing Agent

Any person duly authorized to enter into and administer contracts and make written determinations with respect thereto. The term also includes an authorized representative acting within the limits of authority.

Purchasing

The process through which solicitations are issued, advertisements run, vendors selected, and goods or services received.

Regulation

A governmental body's statement, having general or particular applicability and future effect, designed to implement, interpret, or prescribe law or policy, or describing organization, procedure, or practice requirements.

Request for Proposals (RFP)

A process used to acquire supplies and services that involves the review of written proposals and the use of negotiations with the most qualified bidder(s). This process may also include the use of a Request for Information (RFI) as a preliminary step to the RFP process in an attempt to gather information and pre-qualify prospective bidders.

Services

The furnishing of labor, time, or effort by a contractor not involving the delivery of specific end product other than reports which are merely incidental to the required performance, or repairs to an existing product.

Soliciting Document

The City-issued document (most often IFB or RFP) detailing the scope, qualifications, specifications and/or scope of work and terms and conditions of the proposed contract or acquisition, including, if applicable, in the City's discretion, any bonds or security required to secure any bid or performance.

Specification

Any description of the physical or functional characteristics, or the nature of a supply, service, or construction item. It may include a description of any requirement for inspection, testing, or preparing a supply, service, or construction item for delivery.

Supplier

Any person having or soliciting a contract, professional service agreement, purchase order arrangement or any other agreement to provide goods or services with a governmental body. Interchangeable with "contractor."

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Supplies

Tangible property that is typically used or consumed within a year. Examples include: pens, paper, staples, fertilizer, chemicals, repair parts, etc.

Tangible Property

Personal property and materials, including without limitation supplies, equipment, parts, printing and consumable supplies, but not including insurance, real property leases, securities, or water rights.

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APPENDIX A
Procurement Policies and Procedures for Federally Funded Programs
Reference 2 CFR 200.318-326

1. Purpose of procurement standards. These standards establish procedures for City of Fort Lupton ("City") procurement of supplies and other expendable property, equipment, and services utilizing federal funds. All departments and operations of the City expending federal grant monies shall adhere to these standards, as follows, as they may be amended or supplemented over time. In the event the federal government regulations that govern procurement policies and procedures for federally funded programs or for procurements made with federal funds, these standards and procedures will be deemed automatically amended to conform to such requirements.

2. Code of conduct. No employee, officer, or agent shall participate in the selection, award, or administration of a contract or purchase order if a real or apparent conflict of interest would be involved. Such a conflict would arise when the employee, officer, or agent, any member of his or her immediate family, his or her partner, or an organization which employs or is about to employ any of the parties indicated herein, has a financial or other interest in the entity selected for an award. The officers, employees, and agents of the City shall neither solicit nor accept gratuities, favors, or anything of monetary value from contractors, or parties to sub agreements except for where the financial interest is not substantial, or the gift is an unsolicited item of nominal value. Members of the City Council shall comply with all relevant fiduciary duties, including those governing conflicts of interest, when they vote upon matters related to procurement contracts in which they have a direct or indirect financial or personal interest. Officers, employees, directors, and agents of the City shall be subject to disciplinary actions for violations of these standards. This code of conduct supplements any other applicable Code of Ethics.

3. Competition.

Procurement transactions shall be conducted in a manner to provide, to the maximum extent practical, open and free competition. The City shall be alert to organizational conflicts of interest as well as noncompetitive practices among contractors that may restrict or eliminate competition or otherwise restrain trade. To ensure objective contractor performance and eliminate unfair competitive advantage, contractors that develop or draft specifications, requirements, statements of work, invitations for bids and/or requests for proposals shall be excluded from competing for such procurements. Awards shall be made to the bidder or offeror whose bid or offer is responsive to the solicitation and is most advantageous to the City, price, quality and other factors considered. Solicitations shall clearly set forth all requirements that the bidder or offeror shall fulfill in order for the bid or offer to be evaluated by the City. All bids or offers may be rejected when it is in the City's interest to do so. In all procurement, the City shall avoid practices that are restrictive of competition. These include but are not limited to:

a. Placing unreasonable requirements on firms in order for them to qualify to do business
b. Requiring unnecessary experience and excessive bonding;
c. Noncompetitive pricing practices between firms or between affiliated companies;
d. Noncompetitive awards to consultants that are on retainer contracts;
e. Organizational conflicts of interest;
f. Specifying only a brand name product instead of allowing an equal product to be offered and describing the performance of other relevant requirements of the procurement; and
g. Any arbitrary action in the procurement process.

4. Methods of Procurement to be followed.

a. Procurement by Micro-purchases. Micro-purchase is the acquisition of supplies or services under $3,500. To the extent practicable, the City must distribute micro-purchases equitably among qualified suppliers. Micro-purchases may be awarded without soliciting competitive quotations if the City considers the price to be reasonable.

b. Procurement by Small Purchase Procedures. Small purchase procedures are those relatively simple and informal procurement methods for securing services, supplies, or other property that do not cost more than $150,000 (OMB memo dated June 20, 2018 M-18-18). If small purchase procedures are used, price or rate quotations must be obtained from an adequate number of qualified sources.

c. Procurement by Sealed Bids (formal advertising). Bids are publicly solicited, and a firm fixed price contract (lump sum or unit price) is awarded to the responsible bidder whose bid, conforming with all the material terms and conditions of the invitation for bids, is the lowest in price. The sealed bid method is the preferred method for procuring construction, if the conditions in paragraph (c)(1) of this section apply.

(1) In order for sealed bidding to be feasible, the following conditions should be present:

i. A complete, adequate, and realistic specification or purchase description is available;
ii. Two or more responsible bidders are willing and able to compete effectively for the business; and
iii. The procurement lends itself to a firm fixed price contract and the selection of the successful bidder can be made principally on the basis of price.

(2) If sealed bids are used, the following requirements apply:

i. Bids must be solicited from an adequate number of known suppliers, providing them sufficient response time prior to the date set for opening the bids, for state, local and tribal governments, the invitation for bids must be publicly advertised;

ii. The invitation for bids, which will include any specifications and pertinent attachments, must define the items or services in order for the bidder to properly respond;

iii. All bids will be opened at the time and place prescribed in the invitation for bids, and for local and tribal governments, the bids must be opened publicly;

iv. A firm fixed price contract award will be made in writing to the lowest responsive and responsible bidder. Where specified in bidding documents, factors such as discounts, transportation cost, and life cycle costs must be considered in determining which bid is lowest. Payment discounts will only be used to determine the low bid when prior experience indicates that such discounts are usually taken advantage of; and

v. Any or all bids may be rejected if there is a sound documented reason.

d. Procurement by Competitive Proposals. Competitive proposals are normally conducted with more than one source submitting an offer, and either a fixed price or cost- reimbursement type contract is awarded. It is generally used when conditions are not appropriate for the use of sealed bids. If this method is used, the following requirements apply:

(1) Requests for proposals must be publicized and identify all evaluation factors and their relative importance. Any response to publicized requests for proposals must be considered to the maximum extent practical.

(2) Proposals must be solicited from an adequate number of qualified sources;

(3) The City agency must have a written method for conducting technical evaluations of the proposals received and for selecting recipients;

(4) Contracts must be awarded to the responsible firm whose proposal is most advantageous to the program, with price and other factors considered; and

(5) The City must use competitive proposal procedures for qualifications-based procurement of architectural/engineering (A/E) professional services whereby competitors' qualifications are evaluated and the most qualified competitor is selected, subject to negotiation of fair and reasonable compensation. The method, where price is not used as a selection factor, can only be used in procurement of A/E professional services. It cannot be used to purchase other types of services though A/E firms are a potential source to perform the proposed effort.

e. Procurement by Noncompetitive Proposals. Procurement by non-competitive proposals is procurement through solicitation of a proposal from only one source and may be used only when one or more of the following circumstances apply:

(1) The item is available only from a single source;

(2) The public exigency or emergency for the requirement will not permit a delay resulting from competitive solicitation;

(3) The Federal awarding agency or pass-through entity expressly authorizes noncompetitive proposals in response to a written request from the City; or

(4) After solicitation of a number of sources, competition is determined inadequate.

5. Procurement procedures.

a. All procurement by the City shall comply, at a minimum, with the requirements of subsections (i), (ii), and (iii) below:

(1) the City avoids purchasing unnecessary items.

(2) Where appropriate, an analysis is made of lease versus purchase alternatives to determine which would be the most economical and practical procurement.

(3) Solicitations for goods and services provide for all of the following.

i. A clear and accurate description of the technical requirements for the material, product or service to be procured. In competitive procurements, such a description shall not contain features which unduly restrict competition.

ii. Requirements which must be fulfilled and all other factors to be used in evaluating proposal submitted in response to solicitations.

iii. A description, whenever practicable, of technical requirements in terms of functions to be performed or performance required, including the range of acceptable characteristics or minimum acceptable standards.

iv. When relevant, the specific features of "brand name or equal" descriptions that are to be included in responses submitted to solicitation.

v. The acceptance, to the extent practicable and economically feasible, of products and services dimensioned in the metric system of measurement.

vi. Preference, to the extent practicable and economically feasible, for products and services that conserve natural resources and protect the environment and are energy efficient.

b. All necessary affirmative steps shall be made by the City to utilize small businesses, minority-owned firms, women's business enterprises, and labor surplus area firms, whenever possible. The City shall take all of the following steps to further this goal.

(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;

(3) Dividing total requirements, when economically feasible, into smaller tasks or any quantities to permit maximum participation by small and minority businesses, and women's business enterprises.

(4) Establishing delivery schedules, where the requirements permit, which encourage participation by small and minority businesses, and women's business enterprises;

(5) Using the services and assistance, as appropriate, of such organizations as the Small Business Development Agency of the Department of Commerce; and

(6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (i) through (v) of this section.

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c. The type of procuring instruments used (e.g., fixed price contracts, cost reimbursable contracts, purchase orders, and incentive contracts) shall be determined by the City but shall be appropriate for the particular procurement and for promoting the best interest of the program or project involved. The "cost-plus-a-percentage-of- cost" or "percentage of construction cost" methods of contracting shall not be used.

d. Contracts shall be made only with responsible contractors who possess the potential ability to perform successfully under the terms and conditions of the proposed procurement. Consideration shall be given to such matters as contractor integrity, record of past performance, financial and technical resources or accessibility to other necessary resources.

e. Debarment and Suspension - No contract shall be made to parties listed on the General Services Administration's List of Parties Excluded from Federal Procurement or No procurement Programs in accordance with E.O.s 12549 and 12689, "Debarment and Suspension." Contractors with awards that exceed the small purchase threshold shall provide the required certification regarding its exclusion status and that of its principal employees.

f. Contracts shall be made only with responsible contractors who possess the potential ability to perform successfully under the terms and conditions of the proposed procurement. Consideration shall be given to such matters as contractor integrity, record of past performance, financial and technical resources or accessibility to other necessary resources.

g. Debarment and Suspension - No contract shall be made to parties listed on the General Services Administration's List of Parties Excluded from Federal Procurement or Nonprocurement Programs in accordance with E.O.s 12549 and 12689, "Debarment and Suspension." Contractors with awards that exceed the small purchase threshold shall provide the required certification regarding its exclusion status and that of its principal employees. Contractors with multiple year contracts will be checked against the GSA list at each renewal time.

h. To foster greater economy and efficiency, and in accordance with efforts to promote cost-effective use of shared services across the Federal Government, the City is encouraged to enter into state and local intergovernmental agreements or inter-entity agreements where appropriate for procurement or use of common or shared goods and services.

i. The City is encouraged to use Federal excess and surplus property in lieu of purchasing new equipment and property whenever such use is feasible and reduces project costs.

j. The City is encouraged to use value engineering clauses in contracts for construction projects of sufficient size to offer reasonable opportunities for cost reductions. Value engineering is a systematic and creative analysis of each contract item or task to ensure that its essential function is provided at the overall lower cost.

k. The City must ensure that all prequalified lists of persons, firms, or products which are used in acquiring goods and services are current and include enough qualified sources to ensure

maximum open and free competition. Also, the City must not preclude potential bidders from qualifying during the solicitation period.

6. Procurement of Facilities or Land Special Requirements. There are no proposals expected for this activity. If such an activity is proposed in the future this section will be updated prior to any such procurement.

7. Cost and price analysis. Some form of cost or price analysis shall be made and documented in the procurement files in connection with every procurement action in excess of the Semiformal Acquisition Threshold (48 CFR Subpart 2.1) as Adjusted and currently at $150,000. Price analysis may be accomplished in various ways, including the comparison of price quotations submitted, market prices and similar indicia, together with discounts. Cost analysis is the review and evaluation of each element of cost to determine reasonableness, allocability and allowability.

8. Procurement records. Procurement records and files for purchases in excess of the Micro purchase threshold as fixed at 48 CFR Subpart 2.1 (currently $3,500) shall include the following at a minimum: (a) basis for contractor selection, (b) justification for lack of competition when competitive bids or offers are not obtained, and (c) basis for award cost or price.

9. Contract administration. A system for contract administration shall be maintained to ensure contractor conformance with the terms, conditions and specifications of the contract and to ensure adequate and timely follow up of all purchases. The City shall evaluate contractor performance and document, as appropriate, whether contractors have met the terms, conditions and specifications of the contract.

10. Contract provisions. The City shall include, in addition to provisions to define a sound and complete agreement, the following provisions in all contracts. The following provisions shall also be applied to subcontracts.

a. Contracts more than the Semiformal Acquisition Threshold shall contain contractual provisions or conditions that allow for administrative, contractual, or legal remedies in instances in which a contractor violates or breaches the contract terms and provide for such remedial actions as may be appropriate.

b. All contracts in excess of the Semiformal Acquisition Threshold shall contain suitable provisions for termination by the City, including the manner by which termination shall be affected and the basis for settlement. In addition, such contracts shall describe conditions under which the contract may be terminated for default as well as conditions where the contract may be terminated because of circumstances beyond the control of the contractor.

c. For contracts dealing with construction or facility improvements the City shall comply with all requirements imposed by its funding sources (and the government regulations applicable to those funding sources) with regard to construction bid guarantees, performance bonds, and payment bonds.

d. All negotiated contracts (except those for less than the Semiformal Acquisition Threshold) awarded by the City shall include a provision to the effect that the City shall have access to any books, documents, papers and records of the contractor which are directly pertinent to a specific program for the purpose of making audits, examinations, excerpts and transcriptions.

e. All contracts, including small purchases, awarded by the City and their contractors where the source of the funds, directly or indirectly, is the federal government, shall contain the following procurement provisions as applicable.

i. Equal Employment Opportunity - All contracts, when funded in whole or part by monies derived from the Federal government (either directly or indirectly), shall contain a provision requiring compliance with E.O. 11246, “Equal Employment Opportunity," as amended by E.O. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

ii. Copeland "Anti-Kickback" Act (18 U.S.C. 874 and 40 U.S.C. 276c) - All contracts in excess of $2000 for construction or repair, when funded in whole or part by monies derived from the Federal government (either directly or indirectly) shall include a provision for compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. 874), as supplemented by Department of Labor regulations (29 CFR part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or sub recipient shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he is otherwise entitled. The recipient shall report all suspected or reported violations to the Federal awarding agency.

iii. Davis-Bacon Act, as amended (40 U.S.C. 276a to a-7) - **When required by Federal program legislation**, all construction contracts awarded by the recipients and sub recipients of more than $2000 shall include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 276a to a-7) and as supplemented by Department of Labor regulations (29 CFR part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction"). Under this Act, contractors shall be required to pay wages to laborers and mechanics at a rate not less than the minimum wages specified in a wage determination made by the Secretary of Labor. In addition, contractors shall be required to pay wages not less than once a week. The recipient shall place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation and the award of a contract shall be conditioned upon the acceptance of the wage determination. The recipient shall report all suspected or reported violations to the Federal awarding agency.

iv. Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333) - All contracts in excess of $2000 for construction contracts and in excess of $2500 for other contracts that involve the employment of mechanics or laborers, when funded in whole or part by monies derived from the Federal government (either directly or indirectly), shall include a provision for compliance with Sections 102 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), as supplemented by Department of Labor regulations (29 CFR part 5).

v. Rights to Inventions Made Under a Contract or Agreement - Contracts or agreements for the performance of experimental, developmental, or research work, when funded in

whole or part by monies derived from the Federal government (either directly or indirectly), shall provide for the rights of the Federal Government and the recipient in any resulting invention in accordance with 37 CFR part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

vi. Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), as amended - Contracts and sub grants of amounts in excess of $100,000, when funded in whole or part by monies derived from the Federal government (either directly or indirectly), shall contain a provision that requires the recipient to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 et seq.). Violations shall be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

vii. Byrd Anti-Lobbying Amendment (31 U.S.C. 1352) - Contacts for an amount above $100,000, when funded in whole or part by monies derived from the Federal government (either directly or indirectly), shall include a certification by the contracting parties that they have not and will not use Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352, and to further require disclosure of any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award.

viii. Third party contracting requirements (FTA Circular 4220.1F) - This circular sets forth the requirements a grantee must adhere to in the solicitation, award and administration of its third-party contracts. Provisions of this circular will be added to all operating contracts utilizing formula funds for operating assistance.

DRAFT

FIXED ASSET AND CAPITALIZATION POLICY

It is the policy of the City of Fort Lupton (City) to set forth guidelines for physical and reporting controls of fixed assets. It is the purpose of this policy:

- To define the capital asset and set thresholds
- That capital assets are properly recorded and depreciated, and comply with state and federal regulations and Generally Accepted Government Accounting Practices (GAAP) for accurate assets records.
- Provide necessary documentation for the effective use, maintenance, management and reporting of the asset.
- Ensure that the asset is adequately protected from loss, theft, etc.

Further, the Finance Director is responsible for establishing and maintaining a written set of Administrative Procedures in regard to the recording, inventorying, maintaining, and disposing of assets.

Asset Acquisition and Disposal:

Capital asset purchases are subject to fund availability and budget limitations.

Annually, the City Council considers capital asset acquisitions as part of the budget process. Each asset represented in the capital budget should be individually identified with an estimated cost. Capital assets may be added or changed during the budget year.

Approved capitals asset acquisition shall be purchased in compliance with the City's Purchasing Policy requirements. It shall be recorded and depreciated. Staff shall ensure appropriate insurance coverage is in place as required.

Any changes to an asset's condition or location will be reported to the Finance Department. Disposal of assets (transferred, sold, retired, lost or destroyed) must be reported to the Finance Department along with all available documentation regarding the identification of the asset and the details of the disposal.

Capital asset definitions and purchasing thresholds:

1) **Land** – All land owned as evidenced by a deed regardless of value
2) **Water**- All water shares owned regardless of value
3) **Buildings**
   a) A structure that is permanently attached to the land, has a roof, is partially or completely enclosed by walls, and is not intended to be mobile.
   b) A permanently attached fixtures, machinery, and other components that cannot be removed without damage resulting to the building.
   c) Cost minimum of $25,000.00.

4) **Infrastructure /Roads and Bridges / Pipelines**
   a) Infrastructure assets are long-lived capital assets that normally are stationary in nature.
   b) Includes all expenditures within an identified project classification of "Construction" or "Preservation and Structural Improvements"
   c) Cost minimum $25,000
5) **Machinery, Equipment, Vehicles and Tools**
   a) Equipment, vehicles and tools purchased and owned by the City with a value exceeding $25,000
6) C**omputer Equipment**
   a) Computers equipment (excluding external components) with a cost minimum of $25,000.00. Examples of external components may include monitors, keyboards, mice, scanners, and external drive devices.
   b) The expected useful life should extend beyond the depreciable years.
7) **Computer Software**
   a) Single user application cost a minimum of $25,000.00 per user
   b) Multi-user or system applications cost a minimum of $25,000.00
   c) The expected useful life should extend beyond the depreciable years.
8) **Furniture, Fixtures, Machinery, Tools and Other Equipment**
   a) Individual items with a cost minimum of $25,000.00
   b) The expected useful life should extend beyond the depreciable years.
9) **Groups of Assets** – A group of individual pieces if all of the following are true:
   a) Collectively cost a minimum of $75,000.00
   b) Similar purchase dates
   c) Include but not limited to computers, software, furniture, equipment
   d) The expected useful life should extend beyond the depreciable years.
10) **Renovations and Significant Repairs**
   a) Renovations or repairs to equipment or buildings in excess of $25,000.00 will be reviewed by the Finance Director or their designee to determine the nature of the classification.
   b) The expenditure for reparations must extend the life of the base asset beyond its depreciable life and significantly add to the permanent value of the asset.
11) **Other Assets** – Assets not specifically addressed herein determined by the Finance Director or their designee.
12) **Non-capitalized assets:**
   a) Items that are below the Policy threshold for capitalization.
   b) Items that may be over the Policy threshold, yet the reasonable estimate of expected useful life is less than the approved number of years to be depreciated.
   c) Maintenance: The recurring work required to preserve or immediately restore a facility to such condition that it can be effectively used for its designed purpose. It includes work done to prevent damage to a facility. Examples: repainting a room; replacing a leaky faucet.
   d) Preservation/Restoration Costs: Expenditures associated with maintaining special assets in, or returning them to, a level of quality as close to the original as possible.

Valuation

In accordance with generally accepted accounting principles, the City will value its capital assets at historical cost. Historical cost includes the cost or estimated cost at the time of acquisition, freight charges, installation and site preparation charges, and the cost of any subsequent additions or improvements, excluding repairs. If a capital asset is donated to the City of Fort Lupton the asset will be valued based on the fair market value at the time the asset is donated.

Capital Assets Inventory Report

As part of the financial audit, the Finance Department shall submit a capital asset report to the City's external auditor on an annual basis. This report will include the following information:

Type of asset (i.e. land, building, infrastructure)
Date of acquisition
Acquisition cost
Estimated useful life
Annual depreciation
Accumulated depreciation

Depreciation

The City will use the Straight-Line Method as its "basic approach" (standard approach) to depreciate capital assets.

Estimated Useful Lives

The City will use the following Estimated Useful Lives for asset depreciation:

Useful lives of assets constructed or purchased with debt financing shall no exceed the term of the debt.

Description	Estimated Useful Life
Water Rights	N/A
Land	N/A
Land Improvements	10-50
Buildings & Improvements	10-50
Streets	20-100
Distribution Systems	20-100
Machinery & Equipment	5-15

Capital vs. Repair and Maintenance Expense

The following criteria are the basis for distinguishing costs as either capital or repair and maintenance expense:

With respect to improvements on non-infrastructure and infrastructure capital assets, under the Basic Approach, costs should be capitalized if the useful life of the asset is substantially extended, or the cost results in a substantial increase in the capacity or efficiency of the assets.

Otherwise, the cost should be expensed as repair and maintenance.

Inventory

For internal control purposes, the **City** may maintain an inventory listing of certain assets (controlled equipment) that do not meet the above reference capitalization amounts. Controlled equipment includes items that should be specifically accounted for and inventoried periodically due to the high re-sale value of the equipment and potential risk of theft. Controlled equipment may include items such as computers, construction equipment, and other office equipment. Each Department Head is responsible for all controlled equipment within their areas of responsibility.

Disposal and Transfer of Assets

Disposition of assets will be performed in accordance with applicable policies and procedures.

CAPITAL ASSET MANAGEMENT POLICY
GLOSSARY OF TERMS

Capital Assets: Capital assets include land, land improvements, buildings, building improvements, construction in progress, machinery and equipment, vehicles, infrastructure, easements, intangible assets (such as computer software), and works of art and historical treasures.

Capitalization: Capitalization of an asset occurs when the cost of the asset meets the "threshold" and the "estimated useful life" set in the organizational guidelines. Under capitalization, the cost of an item is initially recorded as an asset rather than an expense.

Depreciation: Depreciation is the process of allocating the cost of property over a period of time, rather than recognizing the cost as an expense in the year of acquisition. Generally, at the end of an asset's life, the sum of the amounts charged for depreciation in each accounting period (accumulated depreciation) will equal the original cost less salvage value.

Donated Capital Asset: Donated assets are those assets contributed to the City. The donated assets are treated like a capital asset (using the fair market value).

Estimated Useful Life: Estimated useful life means the estimated number of months or years that an asset will able to be used for the purpose for which it was purchased. In determining useful life, consideration is given to the asset's present condition, use of the asset, construction type, maintenance policy, and how long it is expected to meet service demands.

Fair Market Value: The amount that would be paid if the item were sold currently in a transaction between a willing buyer and a willing seller.

Historical Cost: The historical cost of a capital asset includes the cost or estimated cost at the time of acquisition, freight charges, installation and site preparation charges, and the cost of any subsequent additions or improvements, excluding repairs.

Infrastructure Assets: Infrastructure assets are long-lived capital assets that normally can be preserved for a significant greater number of years than most capital assets (non-infrastructure assets). Infrastructure assets are normally stationary in nature and are of value only to the government entity. Examples include the water and sewer lines, storm drainage lines, and streets, gutters and sidewalks.

Modified Approach: The Modified Approach is the election *not* to depreciate infrastructure assets that are part of a network that meet two specific requirements. The government entity manages the eligible infrastructure assets using an asset management system that has certain specified characteristics. To meet this requirement the asset management system should: Have an up-to-date inventory of eligible infrastructure assets within the network for which the modified approach is adopted. Perform or obtain condition assessments (physical assessment) on infrastructure assets and summarize the results using a measurement scale. The condition assessment must be performed at least once every three years. The condition assessments must be replicable (conducted using methods that would allow different measurers to reach substantially similar results). Each year, the government entity must estimate the amount needed to maintain and preserve infrastructure assets at a condition level established and disclosed by the government entity. The government entity documents that the eligible infrastructure assets are being preserved approximately at (or above) a condition level established and disclosed by that government entity. If any of the above conditions are not met, reporting must revert

back to the depreciation method.

Salvage Value: The salvage value of an asset is the value it is expected to have when it is no longer useful for its intended purpose. In other words, the salvage value is the estimated amount for which the asset could be sold at the end of its useful life.

Straight-Line Method: The straight-line method is the simplest and most commonly used for calculating depreciation. It can be used for any depreciable property. Under the straight-line method, the basis of the asset is written off evenly over the useful life of the asset. The same amount of depreciation is taken each year. In general, the amount of annual depreciation is determined by dividing an asset's depreciable cost by its estimated life.

Threshold: The threshold is the dollar amount that an asset must equal or exceed if that asset is to be capitalized. Otherwise, the item would be considered as an expense at the time of acquisition.

Design Standards

For Public Improvements

Adopted January 12, 2024
Resolution 24-??
AM 24 -???

Previously Adopted November 28, 2015
Ordinance 2015-992
AM 2015-136

Previously Adopted July 12, 1995
Resolution 95-030
AM 95-110

City of Fort Lupton

Standards and Specifications for the Design and Construction of Public Improvements

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CHAPTER 1
GENERAL REQUIREMENTS

1.00.00 AUTHORITY AND PURPOSE

1.01.00 TITLE

These regulations, together with all future amendments, shall be known as the City of Fort Lupton ~~STANDARDS AND SPECIFICATIONS FOR THE~~ DESIGN STANDARDS ~~AND CONSTRUCTION OF~~FOR PUBLIC IMPROVEMENTS, ~~2014~~2018 Edition, and may be cited as such and will be referred to herein as the DESIGN STANDARDS ~~AND SPECIFICATIONS~~.

The companion document "The City of Fort Lupton SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS, 2018 Edition will be cited as such and will be referred to herein as the CONSTRUCTION SPECIFICATIONS.

1.02.00 APPLICABILITY

These DESIGN STANDARDS ~~AND SPECIFICATIONS~~ shall apply to construction, enlargement, alteration, relocation, removal, conversion, demolition, repair, and excavation of any public improvements or private improvements of common ownership specifically regulated herein. The provision of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~ applies to City contracts as well as to contracts made for the development of property in the City. In the case of City capital improvement contracts, the project specifications may supersede or modify these DESIGN STANDARDS ~~AND SPECIFICATIONS~~. Alterations, additions or repairs to existing improvements shall comply with all requirements of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~ unless specifically exempted, in writing, by the City. The City retains the right to require additional information, criteria, or requirements as conditions may warrant.

1.03.00 AUTHORITY

These DESIGN STANDARDS ~~AND SPECIFICATIONS~~ have been enacted pursuant of the Municipal Code of the City and Title 31 of Article 16 of the Colorado Revised Statutes and shall have the same force and effect as all other ordinances of the City.

1.04.00 PURPOSE

The purpose of these DESIGN STANDARDS ~~AND~~ and CONSTRUCTION SPECIFICATIONS ~~is~~ are to provide MINIMUM standards to safeguard life, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use, location, and maintenance of all public improvements and private improvements of common ownership including, but not limited to, sanitary sewer systems, water supply systems, storm drainage systems, streets, open space, parking lots, and appurtenances thereto.

The purpose of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS is~~are also to ~~insure~~ ensure that the City receives public facilities which are constructed with the care and materials such that the facility meets or exceeds the normal service life requirements for similar installations and to insure that when said facilities are

transferred to the City's ownership that they will be free from all defects and in suitable working order to provide the service capabilities anticipated with such a facility.

1.05.00 INTERPRETATION

In the interpretation of the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ the following shall govern:

(A) In its interpretation, the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ shall be regarded as the minimum requirements for the protection of the public health, safety, comfort, convenience, prosperity, and welfare of the residents of the CITY.

(B) Whenever a provision of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ or any provision in any law, ordinance, resolution, rule or regulation of any kind, contain any restrictions covering any of the same subject matter, whichever standards produce higher quality shall govern.

(C) These DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ shall not abrogate or annul any permits or approved drainage reports and construction plans issued or any easement or covenant granted before the effective date of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~. However, if the review and approval of construction plans, specifications, and associated engineering reports by the City has occurred more than twelve (12) months prior to execution of the Public Improvements Agreement ~~/~~or commencement of construction activities, the City shall have the right to require another review process for the plans, specifications, and reports to ensure ~~insure~~ compliance with these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

1.06.00 ENFORCEMENT RESPONSIBILITY

It shall be the duty of the City Manager or his representative to enforce the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

1.07.00 VIOLATIONS

No person, firm, or corporation shall construct, enlarge, alter, repair, relocate, improve, remove, excavate, convert, or demolish any public improvements or private improvements in common ownership or permit the same to be done in violation of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. Whenever any work is being done contrary to the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~, the City Manager or his designee may order the work stopped by a written notice in accordance with Section 1.26.04 of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

1.08.00 VARIANCES

The provisions of these DESIGN STANDARDS ~~STANDARDS AND SPECIFICATIONS~~ are not intended to prevent the use of any material or method of construction not specifically prescribed by these standards, provided any alternate has been previously approved and its use authorized in writing by the City. Whenever there are practical difficulties involved in carrying out the provisions of these procedures, the City may grant a variance for individual cases, provided that the City shall first find that a unique reason makes these standards impractical and that the modification is in conformity with the

intent and purpose of these standards, and providing that such variance does not lessen any design requirements or any degree of structural or operational integrity. The City shall require that sufficient specifications, evidence, justification, and/or proof be submitted to substantiate any claims that may be made regarding the alternate material, detail, or technique. The City, in its sole discretion, will decide upon the acceptability of any proposed variance.

1.09.00 AMENDMENTS AND REVISIONS

These DESIGN STANDARDS ~~STANDARDS AND SPECIFICATIONS~~ may be amended as new technology is developed and/or if experience gained in the use of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ indicate a need for revision. The City shall have full power and authority to promulgate rules, regulations, or new standards of a technical nature, which rules, regulations, or standards shall be effective immediately upon their approval and certification by the City Manager or his designee. It is the responsibility of the Consultant/Contractor/Developer to obtain all revisions to these DESIGN STANDARDS ~~STANDARDS AND SPECIFICATIONS~~.

1.10.00 SEVERABILITY

If any section or article of these DESIGN STANDARDS ~~STANDARDS OR SPECIFICATIONS~~ is found to be unconstitutional or illegal by any court, the said section or article shall have no bearing on the effectiveness of the rest of these DESIGN STANDARDS~~STANDARDS OR SPECIFICATIONS~~.

1.11.00 DEFINITIONS

CITY shall mean the City of Fort Lupton, in the State of Colorado, acting by and through the City Manager, Mayor, and City Council.

CITY CODE shall mean the official adopted City Code of Fort Lupton, Colorado.

CONTRACTOR shall mean a person, company, firm, or corporation licensed and bonded in the City in accordance with the City Code.

CITY REPRESENTATIVE shall mean the Public Works Director/City Engineer or the City's authorized representative acting on behalf of the City.

DEVELOPER shall mean a person, company, firm, or corporation that is seeking to develop a property within the City.

EXPRESSIONS Wherever the words "as directed", "as required", "as permitted", or words of like meaning are used, it shall be understood that the direction, requirements, or permission of the City Representative is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the City Representative.

Whenever the words "DESIGN STANDARDS" ~~AND SPECIFICATIONS"~~ are used it shall be understood that reference is made to the "City of Fort Lupton~~"~~, DESIGN STANDARDS ~~AND SPECIFICATIONS~~ FOR ~~THE DESIGN AND CONSTRUCTION OF~~ PUBLIC IMPROVEMENTS".

Whenever the words "CONSTRUCTION SPECIFICATIONS" are used it shall be understood that reference is made to the "City of Fort Lupton, SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS".

OWNER shall mean a person, company, firm, or corporation holding title to land that is being developed or modified within the City.

PUBLIC IMPROVEMENTS include: all work in the public right-of-way, City property, easements dedicated to the City, private property that will become City property or an easement to the City in the future, and projects or utilities that will become the City's responsibility to maintain.

DESIGNATED PRIVATE CONSTRUCTION WORK includes: private sewer systems, water and sewer service lines to buildings, grading, drainage structures, retaining walls, parking lots, private streets and walks, fire lanes, driveways, and associated construction.

SUBCONTRACTOR Any person, company, firm, or corporation licensed and bonded in the City in accordance with the City Code which has a direct or indirect contract with the Contractor or other Subcontractor and furnishes and/or performs on-site labor, and/or furnishes materials in connection with the performance of the work.

SURETY shall mean the entity which is bound with and for the Contractor for the performance of the work as described in these specifications. (Bonded)

TESTING AGENCY Any individual, partnership, or corporation which is qualified and licensed to perform the required sampling, analysis, testing, and professional recommendation service.

~~TRAFFIC ENGINEER shall mean the Traffic Engineer of the City.~~

1.12.00 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AASHTO	"Green" **A Policy on Geometric Design of Highways and Streets, Latest Edition.** American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association
ASA	American Standards Association
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
CDOT	Colorado Department of Transportation
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CUHP	Colorado Urban Hydrograph Procedure
CWCB	Colorado Water Conservation Board
DIP	Ductile Iron Pipe
DRCOG	Denver Regional Council of Governments
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
HERCP	Horizontal Elliptical Reinforced Concrete Pipe
IMSA	International Municipal Signal Association
ITE	Institute of Transportation Engineers

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MUTCD	Manual on Uniform Traffic Control Devices
NEC	National Electric Code
NEMA	National Electric Manufacturers Association
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
ODP	Official Development Plan
OSHA	Occupational Safety and Health Association
PDP	Preliminary Development Plan
PSCO	Public Service Company of Colorado
PUD	Planned Unit Development
PVC	Polyvinyl Chloride
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SCS	Soil Conservation Service
SPP	Structural Plate Pipe
SPPA	Structural Plate Pipe Arch
UDFCD	Urban Drainage and Flood Control District
UNCC	Utility Notification Center of Colorado
USDCM	Urban Storm Drainage Criteria Manual (MANUAL)
USGS	United States Geological Survey

1.20.00 GENERAL CONDITIONS

1.21.00 RESPONSIBILITY FOR DESIGN AND CONSTRUCTION

The City shall have full authority to review and approve all submittals and construction for compliance with these DESIGN STANDARDS ~~AND~~ and CONSTRUCTION SPECIFICATIONS. An approval or acceptance by the City does not relieve the owner, engineer, designer, or contractor from responsibility for ensuring that the calculations, plans, specifications, construction, and record drawings are in compliance with these DESIGN STANDARDS ~~AND SPECIFICATIONS~~. Any approval or acceptance by the City shall not result in any liability to the City or its employees for any claim, suit, loss, damage, or injury resulting from the use or implementation of the approved documents. Nothing in these DESIGN STANDARDS ~~AND SPECIFICATIONS~~ shall be construed to circumvent any sections of the City of Fort Lupton Code or sub codes, pertaining to responsibility for reports, studies, designs, and construction.

1.22.00 PRE-CONSTRUCTION MEETINGS

In conjunction with the "Notice to Proceed" for a development, the contractor shall arrange a "pre-construction meeting" which shall be attended by the owner/developer, all of the owner/developer's engineers, contractors, subcontractors, affected utility companies and the appropriate City representatives. This meeting shall be held before any construction-related activities can commence on said development, and its purpose is to introduce all of the "parties" involved in the development as well as establish guidelines that the City feels are appropriate for the development.

1.23.00 WORK CONDITIONS

1.23.01 Emergency Work

When, in the opinion of the City, the contractor has not taken sufficient precautions for the safety of the public or the protection of the work to be constructed, or if adjacent structures or property which may be damaged by processes of construction on account of such neglect, and an emergency arises and immediate action is considered necessary in order to protect private or public interests, the City, WITH OR WITHOUT NOTICE to the contractor or the developer, may provide suitable protection by causing work to be done and material to be furnished and placed as the City may consider necessary and adequate. The cost and expense of such work and material so furnished will be borne by the contractor or developer and will be paid within 30 days of presentation of the bills. The City may also draw from the developer's surety to cover any non-payment, including accrued interest and applicable overhead costs. The performance or non-performance of such emergency work under the direction of the City will in no way relieve the contractor of responsibility for damages which may occur during or after such precaution has been taken.

~~**1.23.02 Final Clean Up**~~

~~Upon completion of the work and prior to any inspection by the City, the contractor shall remove from the project area all surplus and discarded material, rubbish, and temporary structures and leave the project area in a neat and presentable condition. The contractor shall restore all work which has been damaged by his operations to general conformity with the specifications for the item(s) involved. The contractor shall inspect the interior of all manholes and catch basins within the construction limits for construction materials, dirt, stones, or other debris and remove same prior to any inspection by the City.~~

1.24.00 CONTROL OF WORK AND MATERIALS

1.24.01 Authority of City

The City will have the authority to stop work whenever such stoppage may be deemed necessary. The Public Works Director/City Engineer will resolve all questions which arise as to the quality and acceptability of materials furnished, work performed, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these DESIGN STANDARDS ~~AND~~ and CONSTRUCTION SPECIFICATIONS.

City inspectors are authorized to inspect all work and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector is not authorized to revoke, alter, or waive any requirements of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. They are authorized to call the attention of the contractor to any failure of the work or materials to conform to these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. The Inspector will have the authority to reject materials until any questions at issue can be resolved by the City.

The Inspector will, in no case, act as foreman or perform other duties for the contractor nor interfere with the management of the work done by the contractor. Any "advice" or "opinion" which the inspector may give the contractor will not be construed as binding upon the City Engineer or the City in any way or release the contractor from fulfilling all of the terms of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS. The presence or absence of the inspector will not relieve, in any degree, the responsibility or the obligation of the contractor, owner or developer.

The City and its inspector will, at all times, have reasonable and safe access to the work as it progresses and the contractor will provide proper facilities for such access and inspection.

~~1.24.02~~ ~~Responsibilities of the Contractor~~

~~In case of suspension of work for any cause, the contractor, before leaving the job site, will take such precautions as may be necessary to prevent damage to the project, provide for public safety, normal drainage, and erect any necessary barricades, signs, or other facilities at his expense as directed by the City and required by these STANDARDS AND SPECIFICATIONS. The contractor is responsible for ensuring that all construction and construction activities and materials are in compliance with these STANDARDS AND SPECIFICATIONS. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures. The contractor shall be responsible for the acts and omissions of his employees, subcontractors, and their agents and employees. The contractor shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating. City utility maps are intended to be used for general information only, and the location of any utilities or property lines as shown on the utility maps are not necessarily accurate.~~

~~1.24.03~~ ~~Unauthorized and/or Unacceptable Work~~

~~Work which does not conform to the approved construction plans and these STANDARDS AND SPECIFICATIONS and results in an inferior or unsatisfactory product will be considered unacceptable work. Unacceptable work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause which is found to exist prior to the final acceptance of the work will be immediately removed and replaced or otherwise satisfactorily corrected by and at the expense of the developer or contractor. This expense includes total and complete restoration of any disturbed land or surface to original or better condition that existed before the repairs or replacement.~~

~~1.24.04~~ ~~Samples and Tests~~

~~To ascertain that materials and procedures comply with contract requirements, testing will be taken at the source or at the job destination at the discretion of the City and as often as the City deems it advisable or necessary. Taking of samples will be in accordance with standard practices except where methods and procedures for sampling materials are otherwise set forth in these STANDARDS AND SPECIFICATIONS.~~

~~The contractor will furnish, without charge, all samples and test results required by the City and will afford such facilities as may be necessary for collecting and forwarding them. The contractor may be required to furnish, when requested by the City, a written statement giving the origin, composition, and process of manufacture of a material.~~

~~Whenever any of the provisions of these STANDARDS AND SPECIFICATIONS or evidence that any material or construction does not conform to the requirements herein, the City may require that the contractor have tests performed, at his expense, which will be used as proof of compliance. Test methods will be as referenced by these STANDARDS AND SPECIFICATIONS. If there are no recognized and accepted test methods for the proposed~~

~~alternate, the City will determine the test procedures. All tests will be made by an agency approved by the City. Reports and results of such tests will be retained by the City.~~

~~**1.24.05 Storage of Materials**~~

~~Materials will be stored so as to ensure the preservation of their quality and suitability for the work. Stored materials, even though approved prior to storage, will be subject to inspection prior to their use in the work and will meet all requirements of these STANDARDS AND SPECIFICATIONS at the time they are used. Stored materials will be located so as to facilitate inspection. With the prior written approval of the City, portions of the right-of-way not required for public travel may be used for storage purposes and for the placing of the contractor's plants and equipment, but any additional space required will be provided by the contractor at his expense.~~

~~**1.24.06 Defective Materials**~~

~~Materials not in conformance with requirements of these STANDARDS AND SPECIFICATIONS will be considered defective and will be rejected. Rejected materials will be removed from the work site at the contractor's expense, unless otherwise permitted by the City.~~

1.25.00 PROTECTION OF PUBLIC INTERESTS

1.25.01 Public Convenience and Safety

Unless otherwise specified, the contractor will give written notice, to the proper authorities in charge of streets; gas and water pipes; electric service, cable television, and other conduits; railroads; poles; manholes; catch basins; and all other property that may be affected by the contractor's operations at least 72 hours prior to any construction. The contractor will not hinder or interfere with any person in the protection of such property or with the operation of utilities at any time. The contractor must obtain all necessary information in regard to existing utilities, protect such utilities from injury, and avoid unnecessary exposure so that they will not cause injury to the public.

The contractor will obtain all necessary information in regard to the planned installation of new utilities and cables, conduits and transformers, make proper provision and give proper notification so that new utilities and appurtenances can be installed at the proper time and location without delay to the developer or contractor, nor cause unnecessary inconvenience to the owner or the public. New underground utilities and appurtenances will not be covered with pavement prior to the City's inspection of such facilities. When the work involves excavation adjacent to any building or wall along the work, the contractor will give property owners due and sufficient written notice thereof, with a copy to the City.

1.25.02 Protection of Property and Monuments

The developer and contractor will use every reasonable precaution to prevent the damage or destruction of public or private property such as, but not limited to, poles, trees, shrubbery, crops, fences, monuments and all overhead structures such as, but not limited to, wires or cables which are either within or outside of the right-of-way. The contractor will protect and

support all water, gas, sanitary sewer, storm sewer, electrical pipes, conduits, and all railway tracks, buildings, walls, fences, or other properties which are liable to be damaged during the execution of his work. The contractor will take all reasonable and proper precautions to protect persons, animals and vehicles from injury or damage and, wherever necessary or as directed by the City, will erect and maintain a fence or railing around any excavation and place a sufficient number of amber lights about the work and keep them operational from twilight until sunrise. The contractor will employ one or more watchmen as additional security whenever they are needed or required by the City. The contractor will not prevent the flow of water in the gutters of the street and will use proper means to permit the flow of surface water along the gutters while the work is in progress.

The contractor will protect and carefully preserve all land boundary and City survey control monuments until the owner's authorized registered land surveyor has referenced their location for replacement. All monuments disturbed or removed by the contractor through negligence or carelessness on his part or on the part of his employees or subcontractors will be replaced by a land surveyor registered in the State of Colorado, at the contractor's expense. The developer and contractor will be responsible for the repair of any damage or destruction of property resulting from neglect, misconduct, or omission in this manner or method of execution or non-execution of the work, defective work or the use of unsatisfactory materials. The contractor will restore such property to a condition equal to or better than that existing before such damage or injury was done by repairing, rebuilding, or replacing it as may be directed by the City, or they will otherwise make amends for damage or destruction in a manner acceptable to the City. The developer and contractor will be responsible for the repair of underground pipes, wires, or conduits damaged by them or their subcontractors.

The developer and contractor will be liable for all damage caused by storms and fire until the work is accepted into warranty.

1.25.03 Installation of Survey Monuments

Permanent survey monuments, and lot pins shall be set at locations approved by the City provided that such monuments shall be set not more than 1,400 feet apart along any straight boundary line; at all angle points; and at the beginning, end, and points of change of direction or change of radius of any curved boundary. In addition, 5/8-inch steel pins, or larger, shall be set at all lot corners. Affixed securely to the top of each monument shall be an aluminum cap marked with the Colorado registration number of the land surveyor responsible for the establishment of the monument.

The Professional Land Surveyor will assure that the monuments he/she establishes or re-establishes conform both in location and physical character with the specifications called for in Section 38-51-104, Colorado Revised Statutes. Each found monument verified in location shall be restored or rehabilitated as necessary so as to have it readily identifiable ad reasonably durable.

~~**1.25.04 Explosives**~~

~~When blasting is permitted and approved in writing by the City, the developer and contractor will use the utmost care to protect life and property. Signals warning persons of danger will be given before any blast. Excessive blasting or overshooting will not be permitted. The City will have authority to order any method of blasting discontinued which leads to overshooting, is dangerous to the public, or destructive to property, environment or natural features.~~

~~Before any blasting will be done by the contractor, a certificate of insurance indicating special blasting coverage in the following minimum amounts will be filed with the City:~~

~~Property Damage, each accident~~	~~$1,000,000~~
~~Public Liability, bodily Injury~~	~~$1,000,000~~
~~single limit or equivalent, each accident~~	

~~The City reserves the right to require additional insurance coverage if the circumstances warrant.~~

~~The City has the right to require detailed inspections by an independent consultant or by City inspectors on any structures or properties located in the vicinity of the blasting, both before and after the blasting activity. The cost for such inspections shall be the responsibility of the developer and contractor.~~

1.25.05 Protection of Streams, Lakes, and Reservoirs

The developer and contractor will take all necessary precautions to prevent pollution of streams, lakes, and reservoirs by sediment, fuels, oils, bitumens, calcium chloride, fertilizers, insecticides, or other harmful materials. They will conduct and schedule their operations to avoid or minimize siltation of streams, lakes, and reservoirs. A plan for erosion protection shall be submitted and approved by the City. All required erosion control measures shall be in place before starting work. All work must conform to all applicable local, state, and federal regulations.

1.26.00 WORK IN PUBLIC RIGHT-OF-WAY

1.26.01 Permit Required -- Right-of-Way Permit

It shall be unlawful for any person to perform work within a public way of the City of Fort Lupton without first obtaining permission from the City of Fort Lupton. If the work to be performed involves a City of Fort Lupton utility in a State of Colorado Highway right-of-way, both a right-of-way permit from the City and the appropriate permit from the Colorado Department of Transportation shall be required. An application for work done under a right-of-way permit shall be submitted to the City on a form provided by the City for each job. The application shall be submitted at least 48 hours prior to the planned start of work to allow for review and approval by the City. Permittees may be required to increase this time up to 10 days when the work consists of more than a single spot excavation. An application form (when approved) shall constitute a valid "right-of-way permit." Incomplete permit applications will not be reviewed or processed by the City.

The City may require submittal of plans and specifications. No work shall commence until the City has approved the plans and specifications and/or permit application, except in emergency conditions. A permit application shall be required for emergency conditions within 72 hours after the performance of the work and all conditions of a right-of-way permit shall apply.

1.26.02 Issuance of Permits

The City may grant permits to work in, construct, or excavate within the public way or to close traffic lanes or work in connection with a City utility system to any Class D public way

contractor filing an application as herein provided, which application shall pertain to work which shall comply with the requirements of this chapter. All permits shall be issued according to the provisions of the Official Code of the City of Fort Lupton for Class D public way contractors.

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1.26.03 Liability for Damage

Any person who shall undertake work pursuant to a permit issued under the provisions of this chapter, perform work under contracts with the City, or perform work under the terms of a Public Improvements Agreement, or by virtue of permission obtained from the Council in accordance with the provisions adopted by the said Council, shall be answerable for any damage or injury to persons, animals, or property as a result of any circumstances of such work. Prior to any excavation within the public right-of-way, the contractor shall contact UNCC, the City of Fort Lupton's Public Works and Utilities Department and any other affected utility company for field location of any utility lines which may be in the vicinity of the work.

~~**1.26.04 Suspension or Revocation of Permits – Stop Work Order**~~

~~(A) Any permit may be revoked or suspended by the City and a stop work order may be issued after notice to the permittee for:~~

~~1. Violations of any condition of the Public Improvements Agreement, or of the approved construction drawings or specifications; or~~

~~2. Violation of any provision of these STANDARDS AND SPECIFICATIONS; or~~

~~3. Violation of any other ordinance of the City, state law, or federal law pertaining to the work; or~~

~~4. Existence of any condition or the occurrence of any act which may constitute or cause a condition endangering health, life, or safety, or serious damage to property.~~

~~(B) A suspension or revocation by the City and stop work orders shall take effect immediately upon notice to the person performing the work in the field and shall remain in effect until such time as the City cancels the order in writing. A failure to abide by the terms of the suspension or revocation will be considered a violation of City code.~~

~~(C) Upon receipt of a stop work order, the contractor shall be responsible for taking such precautions as may be necessary to prevent damage to the project, prevent inconvenience or hazardous conditions for the general public, provide for normal drainage, and to erect any necessary barricades, signs, or other facilities which may be necessary or directed by the City.~~

1.26.05 Application Form

Application for a permit to work in the public way shall be made on an original form provided by the City and shall recite specifically and illustrate by sketch or plan the exact location, depth, extent, nature, and purpose of the excavation to be made and the duration of the time

required for the work. The application shall include the name of the applicant requesting the permit and the applicant's business address, registration number, business phone number, after business hours phone number, and contact person. The application will include other pertinent information such as application date, the start and finish dates of work within the public way, the completion date, the permit fee, a City contact phone number for inspection requests, a traffic control plan if required, and any other relevant information required by the terms of the right-of-way permit.

Applicants shall pay a fee to the City before issuance of such permit. The amount of that fee shall be established by the City and displayed on the permit.

~~1.26.06 Exhibition of Permit~~

~~All required permits shall be kept at the site of the excavation while the work is in progress and shall be exhibited upon request to any police officer or other authorized representative of the City. Failure to comply with this provision shall be grounds for a revocation of the permit and the issuance of a stop work order.~~

~~1.26.07 Guarantee~~

~~The permittee, by acceptance of the permit, expressly guarantees complete performance of the work therein described and guarantees all work done by him for a period of one year after the date of completion as shown on the permit form. The permittee agrees upon demand to maintain and to make all necessary repairs during the one year warranty/maintenance period, and to hold harmless the City of Fort Lupton for any and all claims arising from such work. This guarantee shall include all repairs and actions needed as a result of:~~

~~(A) Defects in workmanship or materials~~

~~(B) Settling of fills or excavations~~

~~(C) Failures caused by unknown reasons~~

~~(D) Any unauthorized deviations from the approved plans and specifications~~

~~(E) Failure to barricade~~

~~(F) Failure to clean up during and after performance of work~~

~~(G) Any other violation of these STANDARDS AND SPECIFICATIONS.~~

~~If repairs are required during the subsequent one year warranty period, those repairs need only be guaranteed until the end of the initial one year period starting with the date of initial completion. However, in the event the City deems that the repairs are severe enough to constitute a reconstruction it may require that a new one year guarantee be provided for subsequent repairs after the completion of the reconstruction.~~

~~The permittee shall be responsible for providing materials and construction methods complying with these STANDARDS AND SPECIFICATIONS. If the permittee defaults in completion or conformance with these STANDARDS AND SPECIFICATIONS, the City shall submit a letter to the permittee describing the default or non-conformance at least 10 days prior to authorizing City personnel to perform suitable repairs and reconstruction. City personnel shall be authorized to remove and replace non-conforming work and/or materials to a reasonable distance beyond the limits of the non-conforming work as required to produce a suitable repair. The permittee shall be responsible for all costs incurred by the City to accomplish the work in a safe and timely manner.~~

1.26.08 Performance

(A) **Inspection.**

There shall be a minimum of two inspections for each permit. The first shall occur upon notification by the contractor that the work is ready for inspection and the second inspection will be made 30 days prior to the expiration of the one-year warranty period. At any time prior to completion of the one-year warranty period, the City may notify the permittee of any needed repairs. Such repairs shall be completed within 24 hours if the defects are determined by the City to be an imminent danger to the public health, safety, and welfare. Non-emergency repairs shall be completed within 10 days after notice.

(B) **Barricading and Traffic Control.**

1. All work within a traveled public roadway area shall be protected at all times by safety devices as prescribed by the MUTCD and in such manner as to minimize the disruption of the flow of traffic in the vicinity of the work. Normally, only one side of a street may be closed at any given time. Traffic must be provided a minimum lane width of 10 feet in the construction area. Any plan for traffic control during construction must be approved by the Traffic Engineer prior to issuance of permit. Plans that indicate complete closures must show detour routes and must be approved by the Traffic Engineer at least one week prior to the issuance of the permit. The City reserves the right to require longer lead times if it deems necessary.

2. All work within the roadway shall take place between 8:30 a.m. and 3:30 p.m. unless otherwise stipulated on the right-of-way permit.

3. As directed by the City, street excavations must be backfilled prior to leaving the site at the end of the work day, even if the work has not been completed.

4. No person shall dig or cause to be dug any hole, drain, ditch, or any other excavation in any street, alley, sidewalk, or other public place within the City without providing sufficient amber lights to be placed with a suitable barricade or temporary fence around such hole, drain, or other excavation in order to prevent persons, animals, and vehicles from sustaining injury. During the daytime the barricades shall be maintained but warning lights are not required. All barricades and lights shall be left in place until a permanent patch or temporary cold-mix patch can be made to the excavation.

~~(C) **Removal of Safety Devices or Barricades.**~~

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~~No person shall damage, displace, remove, or interfere with any barricade warning light or any other safety device which is lawfully placed around or about any street, alley, sidewalk, or other excavations or construction work in the City.~~

1.27.00 OTHER PERMITS

This section discusses only those permits and agreements which may be required by the City of Fort Lupton as part of the construction of the public improvements or private improvements in areas of common ownership (for example; landscaping, parking lots, etc.). It does not address other City permits (for example; building permits, tap permits, etc.) or permits which may be required by other government entities (for example; CDOT, FEMA, EPA, etc.).

1.27.01 Land Disturbance Permit

The fee for this permit shall be as established by City Code. This permit is required if any owner/developer wishes to begin overlot grading within a particular development before the public improvements agreement is executed and good and sufficient surety is provided to the City. It should be noted that the City is under no obligation to issue a land disturbance permit prior to the execution of the public improvements agreement. However, if the City has approved the Official Development Plan, completed at least one review of the construction drawing package, and believes that the necessary revisions to that package are minor and that the review process is progressing in an acceptable manner, the City may issue a land disturbance permit. In addition, the owner/developer will be required to sign a letter acknowledging that he is doing the overlot grading at his own risk, and that any subsequent changes to that grading that may be required as a result of additional review comments will be his sole responsibility. Prior to the issuance of a land disturbance permit, all provisions of Section 1.28.02 of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~ shall be complied with.

1.27.02 Temporary Water Service Permit

All water used in the City for construction purposes is to be metered and charged to the user. The application for temporary water service shall be made at the City's Utility Division. The application and fee for each temporary meter shall be in accordance with Fort Lupton Municipal Code. A deposit must be made to the City when the application is made. The deposit will be refunded to the applicant, less water usage charges and any consequential damages to the City provided equipment, once certification of water usage has been made. In such cases where water usage charges and equipment damages exceed the deposited amount, additional charges will be billed to the applicant. Water usage rates are established by Title VIII, Water Rate Schedule, Multiple Units, Commercial and Public of the City Code. In the event a water metering device cannot be provided to the applicant by the City other means will be established by the City to estimate water usage.

1.28.00 IMPROVEMENTS AGREEMENT

1.28.01 Definition

An improvements agreement is a written contract between the developer/owner and the City of Fort Lupton for installation of all public improvements and/or private improvements in areas of common ownership, related to a particular project. Two agreements are required. One addressing "public improvements" and one addressing "private improvements". These agreements specify the nature of all public and/or private improvements, the time frame for construction and, in standard format, identifies the obligations of the developer/owner and the City. This contract binds the owners of property being developed and any successors, assignees with interest to that property.

The improvements agreement is a mandatory part of the development process and must be executed before construction activities can commence and before a final plat can be recorded. The agreement will be prepared by the City with the information provided by the developer/owner after the final construction package has been approved and will be forwarded to the developer/owner for their signatures.

1.28.02 Surety

The improvements agreement cannot be executed nor the final plat executed and recorded until good and sufficient surety is provided by the owner/developer to the City. The surety represents ~~115~~ 125 percent of the total estimated cost of all public improvements and private improvements in areas of common ownership with respect to a specific project. Two separate sureties are required, one for public improvements and one for private improvements.

(A) **Types of Surety.**

There are four types of surety that the City will accept:

1. ~~1.~~ A letter of credit from a financial institution acceptable to the City that guarantees the monies stated in the letter of credit.
2. A Surety Bond from a local Colorado firm
3. 2A plat restriction (for single-family detached residential developments only)
4. Cash

~~2. A plat restriction (for single-family detached residential developments only).~~

~~4. Cash~~

(B) **Reduction of Surety.**

Requests for reductions in surety must be made in writing to the City and must include an itemized cost breakdown in the same format as that included in the exhibit of the improvements agreement. Only after the City has responded in writing approving such a reduction can the reduction be made. At no time shall the amount of surety retained by the City be less than ~~15~~25% of the total cost of the improvements.

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(C) **Expiration of Surety.**

The expiration date on the surety should coincide with the expiration date on the improvements agreement. Once the project is accepted into the warranty period, the surety shall be amended so that the expiration date coincides with the end of warranty period date.

At least fourteen (14) calendar days prior to the expiration date of any surety, Owner shall provide the City an amended form of surety with a term sufficient to cover the time for completing any remaining obligations of the Owner pursuant to this Agreement. The Owner's failure to provide such an extended form of surety prior to said fourteen (14) day period shall constitute a failure to perform in accordance with Agreement and shall give the City the right to proceed immediately to liquidate the existing surety.

1.29.00 CONSTRUCTION DRAWING SUBMITTAL REQUIREMENTS

Construction drawings shall contain the information and be in the format outlined in the separate document titled "Plan Submittal Document Guidelines", available from the Public Works Director/Engineering Division of the City.

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CHAPTER 2
EARTHWORK, EROSION CONTROL, AND SEEDING

2.00.00 EARTHWORK AND GRADING

All earthwork operations shall be executed in a manner which will minimize dust, noise, excessive accumulation of debris, danger to the public, and interference with other construction. Positive drainage and adequate erosion control shall be provided at all times during the earthwork operations.

Earthwork operations shall be executed to provide compaction to a minimum 85-percent Standard Proctor density at ± 3 percent of optimum moisture in areas to be eventually turfed or planted and compaction to minimum 95 percent Standard Proctor density at ± 2 percent of optimum moisture under all walks, trails, streets, structures, and other site improvements. Testing, if required by the City to demonstrate compliance with this specification, shall be performed per AASHTO T-180 by a Professional Engineer registered in the State of Colorado and practicing in the field of soils mechanics. All costs for such testing shall be paid by the contractor/developer. Refer to the applicable section in these STANDARDS AND SPECIFICATIONS for compaction requirements within the public right-of-way.

Upon completion of earthwork operations, the contractor shall leave the site and soil clean to allow for proper installation of irrigation, plantings, and related site improvements. Completed grades shall be smoothly and uniformly sloped, properly compacted, and shall provide drainage away from site improvements. All banks or slopes constructed shall be maintained in a stable condition by approved methods to prevent slips, washouts, or erosion. No area to be seeded or sodded shall be steeper than a 4:1 maximum slope (4 horizontal: 1 vertical), nor flatter than a 2-percent minimum slope. Final grades shall conform to the final drainage study and grading plans.

2.10.00 EROSION CONTROL

The primary goal of all erosion control systems is to prevent unacceptable erosion and maintain water quality at acceptable levels. This shall be accomplished by analyzing pertinent environmental factors and applying technical procedures which result in a workable plan.

There are two major elements in developing an erosion and sedimentation control plan. The first is an investigation and analysis of the natural characteristics of a site (such as soil type, steepness of slopes, and available vegetation) that will help the developer anticipate where erosion problems might occur. Detailed information on soils, vegetation, topography, geologic, and hydrologic conditions shall be obtained for the site. The second element is use of effective control measures. Attention shall be given to identify and evaluate problems that may cause serious erosion during and after construction. Runoff from the site, as well as runoff from the watershed above, shall be controlled and discharged safely. Measures shall be taken to prevent erosion and sediment deposition on downstream properties.

2.10.01 Limitations

No person shall clear or grade land without implementing soil erosion and sediment controls in accordance with the requirements of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS, and the City of Fort Lupton's Municipal Code.

2.10.02 Exemptions

(A) Agricultural land management practices and construction of agricultural structures;

(B) Clearing or grading activities that disturb less than ~~2~~ 1 acre~~s~~ of land area and disturb less than 200 cubic yards of earth, provided the existing grades are less than 8 percent and the effected property does not abut public lands.

(C) Clearing or grading activities that are subject exclusively to State approval and enforcement under State law and regulations. A copy of the state approved SWMP shall be provided to the City Engineer.

2.11.00 EROSION AND SEDIMENT CONTROL PLANS

2.11.01 Review and Approval

(A) A person may not clear or grade land without first preparing an erosion and sediment control plan which has been approved by the City.

(B) The applicant shall submit an erosion and sediment control plan and any supporting computations to the City for review and approval. The erosion and sediment control plan shall contain sufficient information, drawings, and notes to describe how soil erosion and off-site sedimentation will be minimized. The City shall review the plan to determine compliance with these DESIGN STANDARDS ~~AND SPECIFICATIONS~~, and the City of Fort Lupton's Municipal Code prior to approval. The plan shall serve as a basis for all subsequent grading and stabilization.

(C) In approving the plan, the City may impose such conditions thereto as may be deemed necessary to ensure compliance with the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS, and the City of Fort Lupton's Municipal Code for the preservation of public health and safety.

(D) The erosion and sediment control plan shall not be considered approved without the inclusion of the signature and date of signature of the City Engineer.

(E) Approved plans may remain valid for one year from the date of approval unless renewed by the City.

(F) Approved plans will become an exhibit to the City's Land Disturbance Permit. In addition, the developer/contractor will be required to execute an improvements agreement and provide surety in a form outlined by City Code prior to beginning earthwork operations.

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2.11.02 Modifications to Approved Erosion and Sediment Control Plans

When inspection of the site indicates the approved erosion and sediment control plan needs modification, the modification shall be made in compliance with the erosion and sediment control criteria contained in these DESIGN STANDARDS ~~AND SPECIFICATIONS~~, and the City of Fort Lupton's Municipal Code.

(A) The permittee shall submit requests for major modifications to approved erosion and sediment control plans, such as the addition or deletion of a sediment basin, to the City to be processed appropriately. This processing includes modifications due to plan inadequacies at controlling erosion and sediment as revealed through inspection.

(B) The City may approve minor modifications to approved erosion and sediment control plans in the field if conditions so merit.

2.11.03 Grading and Erosion Control Notes

The following minimum grading and erosion control notes shall be stated on, as well as incorporated into the overlot grading and erosion control plan:

GRADING AND EROSION CONTROL NOTES

(A) All site grading (excavation, embankment, and compaction) shall conform to the recommendations of the latest soils investigation for this property and shall further be in conformance with the City of Fort Lupton's **"~~STANDARDS AND~~ SPECIFICATIONS FOR ~~THE DESIGN AND~~ CONSTRUCTION OF PUBLIC IMPROVEMENTS,"** latest edition.

(B) Natural vegetation shall be retained and protected wherever possible. Exposure of soil to erosion by removal or disturbance of vegetation shall be limited to the area required for immediate construction operation and for the shortest practical period of time.

(C) Topsoil shall be stockpiled to the extent practicable on the site for use on areas to be revegetated. Any and all stockpiles shall be located and protected from erosive elements.

(D) Temporary vegetation shall be installed on all disturbed areas where permanent surface improvements are not scheduled for installation within three months. Vegetation shall be a vigorous, drought tolerant, native species mix. (Refer to Section 2.26.00 of the~~se STANDARDS AND~~CONSTRUCTION SPECIFICATIONS for seeding mix.) Project scheduling should take advantage of spring or fall planting seasons for natural germination, but seeded areas shall be irrigated, if conditions so merit.

(E) At all times, the property shall be maintained and/or watered to prevent wind-caused erosion. Earthwork operations shall be discontinued when fugitive dust significantly impacts adjacent property. If earthwork is complete or discontinued and dust from the site continues to create problems, the owner/developer shall immediately institute mitigative measures and shall correct damage to adjacent property.

(F) Temporary cut/fill slopes shall not exceed a steepness of 2:1 (2H:1V). Permanent slopes shall not exceed 4:1 (4H:1V) in areas to be seeded or sodded.

(G) Utility construction is not approved under this plan.

(H) The owner/developer shall provide any additional dust abatement and erosion control measures deemed necessary by the City, should conditions merit them.

(I) Temporary fences shall be installed along all boundaries of the construction limits or property lines as shown on the approved erosion control plan, to prevent grading on property not owned ~~-~~by the developer. In addition, the City may require additional temporary fences if field conditions so merit them.

2.11.04 Standard Erosion Control Details

In the Appendix of these ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS are the standard erosion control details which are acceptable to the City of Fort Lupton.

2.20.00 LANDSCAPING

For the purpose of this chapter, the term "landscaping" refers to ground cover only. "Formal" landscaping requirements are specified in a separate document titled City of Fort Lupton Landscape Regulations. Final drawings, specifications, and details shall be submitted to the City for review and approval prior to construction.

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2.21.00 SOIL PREPARATION

2.21.01 Materials

Soil preparation shall be provided on all areas to be seeded, sodded, or otherwise planted. Organic matter for soil amendment shall be well aged dairy cattle manure, thoroughly composted organic material, and other organic matter as approved by the City, and shall contain a minimum of 60-percent organic matter. The mixture shall be free from clay subsoil, stones, lumps, plants or their roots, sticks, weed stolons and seeds, high salt content, and other materials harmful to plant life. The materials shall be coarsely ground and thoroughly mixed together to ~~insure~~ ensure an even composition. The mix shall have an acidity no greater than pH 7.5 and shall meet the following mechanical analysis:

	% PASSING	% RETAINED
1-1/2 Inch Screen	100	0
1-Inch Screen	90-100	0-10
1/2 Inch Screen	50-80	20-50
#100 Mesh Sieve	0-15	85-100

If testing is required, it shall be done by a Professional Engineer registered in the State of Colorado and practicing in the field of soil mechanics. Testing shall be at the contractor's/ developer's expense.

2.21.02 Placement

Upon establishment of approved grades, the soil surface shall be loosened by rototilling to a minimum of 8 inches, and all materials over 2 inches in diameter shall be removed. The organic matter shall be evenly spread over the entire surface at the rate of 5 cubic yards per 1,000 square feet and shall be mixed thoroughly into the soil surface to a depth of 8 inches by means of a rototiller, soil mixer or similar equipment. The surface shall then be finish-graded and compacted to the approved elevations. Prior to seeding or sodding, D1-ammonium phosphate (18-46-0) shall be spread evenly over the entire surface at the rate of 15 pounds per 1,000 square feet.

2.22.00 TOPSOILING

Topsoiling is not considered a portion of the ordinary soil preparation operations as described in these ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS. However, the use of good topsoil is desirable, and may help in reducing water consumption and encouraging plant growth. When topsoil exists on the project site, the contractor shall strip and stockpile the topsoil and redistribute the topsoil over the open space areas after the overlot grading is complete. The City has the prerogative of deleting all or a portion of the soil preparation requirements when topsoil is provided, depending on topsoil quality and quantity.

2.2201 Material

Topsoil shall be fertile sandy loam topsoil, taken from a well-drained site and free from clay subsoil, stones, lumps, plants or their roots, sticks, weed stolons and seeds, high salt content, and other materials harmful to plant life. The topsoil shall have an acidity in the range of pH 5.5 to pH 8.5, and shall be screened and meet the following mechanical analysis:

	% PASSING	% RETAINED
1 Inch Screen	100	0
1/2 Inch Screen	97-100	0-3
#100 Mesh Sieve	60-40	40-60

If soil testing is required, it shall be by a Professional Engineer registered in the State of Colorado and practicing in the field of soil mechanics and in accordance with "Methods of Soils Analysis -- Agronomy No. 9" as published by the American Society of Agronomy. Testing shall be at the contractor's expense.

2.22.02 Placement

Upon establishment of the approved grade, the subsoil surface shall be loosened to a minimum depth of 8 inches by tilling and all objects over 2 inches in diameter shall be removed. The topsoil shall be spread over the area to a minimum of 6 inches compacted depth, and mixed lightly into the subsoil by means of a rototiller, soil mixer, or similar equipment. The surface layer shall then be finish graded and compacted to the approved elevations.

2.23.00 FERTILIZATION

A booster fertilizer with the chemical analysis of Nitrogen-12, Potash-12, Phosphorous-4 with 4 percent iron and 8 percent sulphur shall be applied on the prepared soil at the rate of 5 pounds per 1,000 square feet immediately prior to seeding. If a soil analysis indicates sufficient amounts of the above elements the City may, at its discretion, waive the requirement to fertilize.

2.24.00 MULCHING

A mulch may be needed to conserve moisture, prevent crusting, reduce runoff and erosion and help establish a plant cover. The need for mulch will be at the sole discretion of the City. Mulching material shall be applied immediately before or immediately after seeding. One of the mulching methods listed below will be acceptable:

(A) Application of hydro-mulch (wood fibers in a water slurry) -- minimum rate of 2,000 lbs/acre. Tackifier, fertilizer, etc. will be included in the hydro-mulch.

(B) Weed and seed grass hay or grain straw shall be used at an application rate of 4,000 lbs/acre of air dried material. At least 50-percent of the mulch by weight shall be 10 inches or more in length. Mulch shall be anchored immediately after distributing with a mulch crimper, and tackifier.

(C) Mulch netting shall be firmly held in place with pins spaced not more than ~~ten~~ 10 linear feet apart. In sandy or extremely loose soil, the pins shall be located not more than 5 linear feet apart.

(D) Jute netting, enkamat, and similar approved materials shall be installed according to the manufacturer's recommendations.

(E) Excelsior mat shall be installed according to the manufacturer's recommendations.

2.25.00 SEEDING - GENERAL

Seeding of grasses or ground cover plants is required for either of two purposes:

(A) Temporary erosion control.

(B) Permanent seeding for erosion control and appearance

Temporary seeding for erosion control shall be in accordance with Sections 2.11.03 and 2.26.00 of these STANDARDS AND SPECIFICATIONS.

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2.26.00 DRY LAND SEEDING

Prior to any seeding, a depth of tillage sufficient to establish a seed bed will be done based on specific site conditions.

Germination Standard

The minimum standard for any dryland grass is 5 seedlings of the seeded species per square foot. This count/inspection shall be taken four (4) weeks after germination by a qualified botanist. Any area not meeting the specifications on germination will be touch up seeded in one of the following methods:

Hand Broadcast and Incorporation
Mechanical Broadcast and Incorporation
Interseeding with Seed Drilling Equipment

Dry land seeding, sometimes referred to as "native" seeding, shall be accomplished with mechanical power-drawn drills which have depth bands set to maintain a planting depth of at least 1/4-inch and shall be set to space the rows not more than 7 inches apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application. When requested by the contractor and approved by the City, seeding may be accomplished by means of approved broadcast or hydraulic-type seeders. Seed shall not be drilled or sown during windy weather or when the ground is frozen or otherwise untillable.

All seed sown by broadcast-type seeders shall be "raked in" or otherwise covered with soil to a depth of at least 1/4-inch. Hand method of broadcasting seed will be permitted only on small areas not accessible to machine methods. Water shall be applied as necessary to establish the cover crop. Hydraulic seeding equipment and accessories shall conform to that described in Section 2.28.00 of these STANDARDS AND SPECIFICATIONS. If inspections indicate that strips wider than the specified space between the rows planted have been left or other areas skipped, the City may require immediate resowing of seed in such areas at the developer's expense. Dry land seed shall be applied at the following rate:

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Dry Land Seeding Rates

			Lbs. Per Acre PLS	
Species	C-W-N	Variety	Drilled	Broadcast
Western Wheatgrass	N	Barton	25	50
Blue Grama	N	Lovington	2.5	5
Buffalo Grass	N	Sharps Improved	20	40
Alkali Sacaton	N	**	2.5	5
Pubescent Wheatgrass	C	Lune	7.5	15
Kentucky Bluegrass	C	Merion	1.25	2.5

** = Seed source should come from within 150 miles of an area to be seeded.
PLS = Pure Live Seed is the amount of seed expected to grow based on the purity and germination rate of the bulk seed.
C = Cool season grass
W = Warm season grass
N = Native species

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CHAPTER 3
WATER SYSTEM

3.00.00 INTRODUCTION

All water distribution systems constructed within the City of Fort Lupton shall comply with the requirements of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~ and may include additional special criteria established by the City for overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the City.

In the case of water mains larger than 16 inches, the owner or his representative shall submit construction specifications to the City for review and approval prior to the City's approval of the construction drawings.

3.01.00 INTERRUPTION OF SERVICE

The City's Public Works Division will operate all existing valves, hydrants, blow-offs and curb stops. **NO VALVE OR OTHER CONTROL DEVICE ON THE EXISTING PUBLIC SYSTEM WILL BE OPERATED FOR ANY PURPOSE BY ANYONE OTHER THAN THE CITY WITHOUT PRIOR WRITTEN AUTHORIZATION**. Twenty-four hours prior to the interruption of service, the contractor shall notify all users whose service will be interrupted in order for them to make provisions for necessary water storage. For water mains servicing commercial areas (i.e., restaurants) 48 hours prior notice shall be given, and work affecting the shut-down shall be coordinated with each business. No water line in service will be shut down for more than a four-hour period at one time. Prior approval by the City is required for all shutdowns.

3.02.00 WATER BREAKS

If notification prior to shutdown is impossible, the contractor shall notify all users within one hour after the shutdown. Since prior notification was not possible, it will be the responsibility of the contractor to supply potable water to the users affected. The contractor shall also contact the City's Public Works Division and Fire Department in reference to this emergency shutdown within one hour.

3.03.00 METER SET INSTALLATION REINSPECTION FEE

Water tap fees provide for the initial inspection of the meter set only. Where additional inspections are made necessary by incomplete or faulty work, a fee in accordance with City Code will be charged for the second inspection and each subsequent inspection. This fee shall be charged to the holder of the permit and paid to the City before any additional inspections will be made.

TO SCHEDULE AN INSPECTION DURING REGULAR BUSINESS HOURS, CONTACT PUBLIC WORKS DEPARTMENT AT 303-857-6694. FOR AFTER HOURS EMERGENCIES CALL POLICE DISPATCH AT 720-652-4222.

3.10.00 DESIGN CRITERIA

3.11.00 SCOPE

It is the intent of this "design criteria" section to provide sufficient detailed information to enable the Engineer for the Owner/Developer to correctly and efficiently design the overall water system for a particular development. If there is a question or a concern regarding the design of any portion of the water system that is not adequately answered within this chapter, the owner/developer or his representative shall contact the City to get all issues resolved prior to design. Any deviation from these DESIGN STANDARDS ~~STANDARDS AND SPECIFICATIONS~~ must be approved in writing by the City.

3.12.00 GENERAL

The water system shall be designed by or under the direct supervision of a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The engineer shall have experience in the design and construction of municipal water distribution systems. The development approval process includes the submittal of a Preliminary Development Plan, an Official Development Plan, utility study and construction drawings for review and approval by the City.

For design of the water system, the Fire Department shall be contacted early in the design process in order to determine the required fire flows for proposed facilities. Fire flow requirements will likely dictate the sizing and layout of the water distribution system.

3.12.01 Water System Utility Study Requirements

The Utility Study shall include the following information and shall be bound in an 8 ½ x 11 inch folder:

A) **Certification statement** - shall be included at the beginning of the report and shall read as follows: "This Utility Report for the design of the _____ development was prepared by me or under my direct supervision in accordance with the City of Fort Lupton's Design Standards ~~and Specifications~~ and acceptable professional practices of the industry. We acknowledge that the City of Fort Lupton's review of this Utility Study is only for general conformance with submittal requirements, current design criteria and standard engineering ~~principals~~principles and practices. We are also aware of the provisions of the City Code of the City of Fort Lupton." The seal and signature of the professional engineer responsible for preparing the report shall follow this statement.

B) **Report text** for the water system design shall include the following at a minimum:

a) **Project location and Description** – a description of the boundary streets, project area and type of development proposed or anticipated use. Include a vicinity map.

b) **System layout** – a description of the existing and proposed water infrastructure in conformance with the City's latest master plan shall be provided and reference shall be made to a figure in the back of the report illustrating these improvements. The description shall include the sizes and types of existing and proposed pipes and the influence of the improvements on the project and surrounding area.

c) **Design flow requirements** – Complete design flow calculations and a

discussion explaining the calculations and assumptions shall be provided. Items shall include types of facilities to be served, fire flow calculations based on building construction type and floor area, developed land area, number of units based on land use, and population densities. Calculations for Average Day, Max Day and Peak Hour demands shall be presented. Max Day plus Fire Flow and Peak Hour demand scenarios shall be evaluated for worst case and shall include domestic demands, building sprinkler flows and domestic irrigation flows. Data shall be presented in table format, if possible, for ease of reading. The report shall acknowledge that the Public Works Department/Fire Department has provided the required fire flows and that they approve of the proposed fire hydrant locations.

d) **Hydraulic Analysis** – A detailed description of modeling assumptions and rationale shall be provided in the report text such that the analysis is clear and can be confirmed. Results of the analysis at a minimum shall include: minimum and maximum system pressures for the various scenarios modeled, corresponding node locations, distribution of fire flows among hydrants, and maximum pipe velocities. Data should be presented in table format. Reference shall be made to modeling data in the appendix and a figure of the pipe and node network provided.

e) **Conclusions** – a description of the results and how they follow the City criteria shall be provided. Any deviations from the City criteria shall be described and applicable variances requested.

C) **Appendices** - Printed data output from the modeling results shall be provided in the appendix and shall correspond with a figure of the pipe and node network. The appendix shall also include hydrant flow test results, hand calculations and any other pertinent data. A large size figure (24" x 36") illustrating the existing and proposed utility improvements shall be provided and shall conform to the City's latest master plan. The drawing shall include pressure zone boundaries, building finished floor elevations, elevation contours and locations of proposed and existing utility easements and right-of-way.

3.13.0 DESIGN DEMAND

The domestic demands for a particular development vary depending on the type of development, land use density, irrigation demand and building fire sprinkler flow requirements. However, the demand used to design a water system is largely a function of the required fire flow for a particular development.

There are two general categories of development for which domestic flow rates are determined: residential and commercial/industrial. Domestic demands for these developments are determined from Tables 3.13.A, 3.13.B and 3.13.C below and then peaking factors are applied to develop the Maximum Day Demand and Peak Hour Demand as follows:

Maximum Day Demand = 2.5 x Average Day Demand
Peak Hour Demand = 4.0 x Average Day Demand

Domestic demands for a development shall be combined with peak irrigation demand, building fire sprinkler demand and the project fire flow. The peak irrigation demand shall be determined by the irrigation designer and the fire sprinkler demand shall be determined by the fire sprinkler Engineer. The fire flow for a project is determined from the 2006 International Fire Code and requires the approval of the City Fire Marshal. Factors such as building area and construction type are required to determine the fire flow for a structure.

The design of the water distribution system shall be based on the higher of the two demand scenarios:

Maximum Day Demand + project fire flow + building fire sprinkler flow + peak irrigation flow, or

Peak Hour Demand + peak irrigation flow.

The City shall be consulted for design criteria with regard to non-standard developments, design of municipal infrastructure such as transmission mains, pump stations, etc. and for development with unusually high demands. The Public Works Director/City Engineer shall have final input in these instances.

Residential Average Day Demand shall be based on density, and zoning as determined by the Preliminary Development Plan and Official Development Plan for the project. A per capita demand of 200 gallons per person per day shall be applied toward the People per Unit specified in Table 3.13.A below. For residential planning purposes, Average Day Demand can be calculated on an acreage basis as specified in Table3.13.A.

Table 3.13.A – Residential Average Day Demand Data.

Zoning	Type of Development	Units per Acre*	People per Unit*	Gallons per Acre-Day**
R-1 to R-5	Single Family Detached	Up to 5	2.62	1650
R-8 to R-18 and District Center	Single Family Attached	Up to 18	2.62	4150

Commercial and industrial Average Day Demands will vary widely depending on the type of development. The following criteria in Table 3.13.B is based on historic information from the City's water records and can be used to estimate the water usage for the various developments listed. The City of Fort Lupton Water Resources Division should be consulted to determine tap fees.

Table 3.13.B – Commercial/Industrial Average Day Demand Data (Based on Building Area)

Type of Development	Unit	Design Demand (gallons/unit-day)
Auto Service and Repair	sf	0.12
Car Wash	bay	528
Childcare	sf	0.32
Church	sf	0.18
Grocery Store	sf	0.22
Gas Station with Car Wash	sf	8
Gas Station without Car Wash	sf	1.32
Hospital	sf	0.32
Hotel/Motel	room	130
Medical Office	sf	0.2
General Offices	sf	0.04
Restaurant	sf	1.1

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Retail/Shopping Center	sf	0.16
School	sf	0.06
Warehouse/Industrial	sf	0.04

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For commercial and industrial planning purposes, average day demands can be calculated on an acreage basis as specified in Table 3.13.C.

Table 3.13.C – Commercial/Industrial Average Day Demand Data (Based on Acreage)

Type of Development	Gallons per Acre-Day**
Retail Commercial	1400
Office	1400
Business Park	1400
District Center (non-residential)	1400
Industrial	220
School/Church	630

* From the "2004 City of Fort Lupton Comprehensive Land Use Plan"

** From the City of Fort Lupton "Water and Sewer Infrastructure Master Plan", URS, 2010.

3.14.00 HYDRAULIC DESIGN

A computer generated hydraulic analysis of the proposed infrastructure, or "model", shall be developed using standard industry software such as WaterCAD or City approved equal. In order for the model to properly correlate with the City's distribution system, a hydrant flow test needs to be performed on nearby hydrants and static and residual pressures obtained as a function of flow rate. This data shall be used in the model to develop a water source curve, represented by a reservoir and pump, and this will allow modeled pressures to vary over a range of imposed demands. The water source curve functions as a boundary condition in the model where proposed piping interfaces with the existing distribution system at this boundary.

The objective during hydrant flow testing is to obtain a flow rate similar to the design demand required for the proposed development. The hydrants to be tested shall be determined by the City and data obtained during this test shall be valid for up to one-year, unless otherwise approved in writing by the City. Distribution system factors may require that a fire flow be increased for a particular area of the system, as determined by Public Works/City engineering staff. A hydrant flow test shall be requested by the design engineer from the City Public Works/Engineering Division.

Special analysis may be required by the City for developments requiring large flow demands and shall be discussed with the Utilities Division. Future changes in zone pressures, in conformance with the City's latest master plan, shall be considered in the hydraulic analysis.

Upon approval by the City, exceptions to the computer generated hydraulic analysis may be made for the following:

- Developments requiring low domestic demands (less than 600 gpm) and with no fire flow requirement; or

- Developments proposing less than 200 feet of water main and no required fire hydrants.

For the above cases, hydraulic calculations should be provided as part of the Utility Report and shall demonstrate acceptable system pressures and velocities as a result of required flows.

3.15.00 OPERATING PRESSURES WITHIN THE DISTRIBUTION SYSTEM

Minimum recommended pressure within the distribution system shall be 50 pounds per square inch during the Peak Hour Demand and the maximum recommended pressure during the Average Day Demand shall be 100 pounds per square inch.

The maximum pressure fluctuation at any location in the distribution system between Peak Hour Demand and Average Day Demand shall not exceed 30 pounds per square inch.

The minimum pressure involving a fire flow scenario shall be 20 pounds per square inch as measured at the highest living space in the building(s).

3.16.00 PRESSURE REGULATING STATIONS

Pressure-reducing valve (PRV) installations are used to control pressure between distribution system pressure zones. When main extension plans are submitted for review, the need for a pressure-regulating valve installation shall be determined jointly by the developer's engineer and the City. Plans shall be submitted as part of the utility study indicating size, type, and location of the PRV installation. All calculations shall be submitted to the City for review.

For individual water services to buildings, water pressure regulators will be required if system pressures exceed 80 psi or at the discretion of the Building Division.

3.17.00 SIZING OF MAINS

3.17.01 Distribution Mains

All water mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area serviced. The maximum acceptable head loss for six, eight, ten and twelve inch mains is two feet per thousand feet of main for the Peak Hour Demand scenario. This acceptable head loss rate shall not apply for fire flow scenarios. The maximum pipe velocity for non-fire flow scenarios shall be 5 feet per second and for fire flow scenarios shall be 7 feet per second. Final size of distribution mains shall be approved in writing by the City. Over sizing of mains may be required by the City, and the recovery of the costs of such over sizing shall be in accordance with the City of Fort Lupton Municipal Code.

The minimum diameter for water mains in residential areas, including cul-de-sacs, shall be ~~6~~ 8 inches. All schools, shopping centers, business parks, industrial parks, and high-density residential areas shall be looped with mains at least 8 inches in diameter. All waterlines shall be looped. No dead-end mains, except lines extending into cul-de-sacs serving not more than 6 single-family residential units, nor mains extending more than 150 feet from the lateral connection, will be permitted. All stubs and dead end mains shall have a blow-off installed. With the exception of fire hydrant laterals, only polyvinyl chloride (PVC) pipe is approved for water main installations 12 inches in diameter and smaller. Any other material proposed must be approved in writing by the City prior to construction. A Hazen-Williams "C" coefficient of 130 shall be used when modeling PVC and DIP pipe.

3.17.02 Transmission Mains

All transmission mains shall be sized in compliance with the City's "Water Distribution System Study," latest edition, or as otherwise approved in writing by the City. See section 3.22.00 for further details.

3.18.00 SYSTEM LAYOUT – CONSTRUCTION PLAN CRITERIA

3.18.01 General

All water mains shall be installed in dedicated rights-of-way or public easements. Water main installation in easements between single-family residential lots will only be allowed for the purpose of looping a water main at the end of a cul-de-sac. Waterlines should NOT be installed parallel to and directly below any concrete such as sidewalks, curbs, or gutters. Lines shall normally be located 5 feet north or west of street centerline, or 5 feet north or west of a curbed median, unless otherwise approved in writing by the City.

The minimum depth of cover for water mains from the final approved grade of the surface to the top of the water main shall be 5 feet. Where final grades have not been established, mains shall be installed to a depth great enough to insure 5 feet of cover below the approved future grade but in no event less than 5 feet of cover from the temporary grade. The maximum depth of cover for water mains shall be 8 feet below the final approved grade of the surface unless approved otherwise, in writing, by the City.

Plan and profile shall be required for all water main designs. Utility crossings shall be identified in the profile views for all known or planned utilities. The vertical alignment of water mains shall be designed such that unnecessary high points are avoided. If a high point in the main cannot be avoided, a controlled high point shall be located at a fire hydrant tee where trapped air in the system can be bled. For controlled high points in transmission mains (16 inch and larger), combination air valves shall be provided. High points at a water main lowering should be avoided by deflecting the main on both sides of the lowering such that positive pipe grades are maintained to controlled high points in the system. To maintain positive pipe grades to controlled high points, the maximum depth of cover to the main can increase to 8 feet, if approved in writing by the City. Refer to Sections 3.18.02 and 3.18.06 for the alignment of water lines with sewer lines. Refer to Section 3.18.07 for the design of combination air valves.

Water mains shall be laid a minimum of ten feet, horizontally and edge to edge, from any existing or proposed utility. Upon written approval by the City, a water main may be laid closer than ten feet to a parallel sewer main if it is laid in a separate trench and if the elevation of the invert of the water main is at least 18 inches above the crown of the sewer main and, in addition, PVC C-900 is used for the sewer main.

Water mains shall be designed such that they extend the entire frontage of the property to be served or as otherwise approved in writing by the City.

When the water main passes under a highway, railroad, or waterway, there shall be a minimum of five feet of cover and a steel casing shall be installed in accordance with the detail drawing in the Appendix of this chapter. The steel casing shall extend the entire width of the

right-of-way or easement of the crossing structure or as directed by the City. In all cases, valves shall be located such that the water main at such crossings can be completely isolated without interruption of any services.

3.18.02 Waterline Crossing Over A Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer, the sanitary sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900, pressure class 305 psi may be used for the sanitary sewer.

3.18.03 Waterline Crossing Over A Storm Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the storm sewer, each joint of the storm sewer within nine feet of the centerline of the crossing shall be encased in concrete.

Freeze potential of a water main shall be evaluated when crossing storm sewers or other exposures to the elements. If a water main crosses a storm sewer with 3 feet or less of vertical clearance, a 12" thick layer of extruded polystyrene insulating foam, also referred to as "XPS" shall be provided all around the water main for a minimum of 5 feet on each side of the storm sewer. The sheets of "XPS" shall be thick enough to allow shaping of the material so it fits snugly around all sides of the pipe leaving a minimum 12" thickness around all sides of the pipe. Bonding of individual sheets of "XPS" shall be in accordance with section 3.61.03 of these Standards and Specifications. Crossings of dead end water mains and storm sewer with less than 18 inches of vertical clearance shall be prohibited.

3.18.04 Sanitary Sewer Line Crossing Over A Waterline

In all cases, regardless of vertical clearance, the sanitary sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900, pressure class 305 psi may be used.

3.18.05 Storm Sewer Line Crossing Over A Waterline

In all cases, regardless of vertical clearance, the joints of the storm sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing.

Freeze potential of a water main shall be evaluated when crossing storm sewers or other exposures to the elements. If a water main crosses a storm sewer with 3 feet or less of vertical clearance, a 12" thick layer of extruded polystyrene insulating foam, also referred to as "XPS" shall be provided all around the water main for a minimum of 5 feet on each side of the storm sewer. The sheets of "XPS" shall be thick enough to allow shaping of the material so it fits snugly around all sides of the pipe leaving a minimum 12" thickness around all sides of the pipe. Bonding of individual sheets of "XPS" shall be in accordance with section 3.61.03 of these Standards and Specifications. Crossings of dead end water mains and storm sewer with less than 18 inches of vertical clearance shall be prohibited.

3.18.06 Limits on Vertical Separation

Under no circumstances shall the vertical clearance between any waterline and sanitary sewer or storm sewer be less than 18 inches without written approval from the City.

3.18.07 Combination Air Valves

Combination air valves are necessary to serve several functions: they exhaust large volumes of air from the system during start-up, they open during draining or if a negative pressure occurs and they release accumulated air from the system during operation. The vertical alignment of water mains shall be designed such that unnecessary high points are avoided as described in section 3.18.01 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~. If a high point in a distribution water main cannot be avoided, a controlled high point shall desirably be located at a fire hydrant tee where trapped air in the system can be bled through the fire hydrant. If this is not possible due to legitimate design constraints, an air valve shall be located at the high point and within a manhole. For controlled high points in transmission mains (16 inch and larger), combination air valves shall be provided (refer to the detail drawing in the appendix of this Chapter).

Combination air valves for distribution mains and transmission mains shall be sized by the engineer in accordance with the manufacturer's recommendations and approved by the Public Works Director/City Engineer.

3.19.00 EASEMENTS

All water mains shall be in an easement which has a horizontal width of at least two times the depth to the pipe invert. The minimum easement shall be 20 feet in width for one utility, 30 feet in width for two utilities, and 40 feet in width for three utilities. Site-specific circumstances may dictate the need for wider easements. For normal depths, the main shall be located a minimum of 10 feet from and parallel to the edge of the easement. Meters and fire hydrants not installed within the right-of-way will require an easement dedication ten feet wide and extending five feet behind the meter or fire hydrant. If a fire hydrant lateral or water meter extends behind the curb more than ten feet, then the width of the easement shall be a minimum of 15 feet. All easements shall be for the exclusive use of the City of Fort Lupton. Neither landscaping (except grass and private irrigation systems) nor permanent structures (sheds, buildings, etc.) shall be placed in the easement.

The easement agreement, provided by the City, shall state that any temporary structures (including paving and fencing) placed in the easement shall be removed and replaced by the owner of the land when requested by the City so that maintenance can be performed. The owner of the land shall agree to hold the City of Fort Lupton harmless for any replacement of structures removed from the easement.

The following statement shall appear on all official development plans and all final plats**.**

UTILITY MAINTENANCE STATEMENT

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All public water, storm sewer and sanitary sewer mains and appurtenances located in public ROW shall be maintained by the City of Fort Lupton Public Works Department. All public water, storm sewer, sanitary sewer mains and appurtenances under private drives are located in utility easements. City is responsible for maintenance of these water, storm and sanitary sewer facilities. City is not responsible for repair or replacement of private drive, curb and gutter or landscaping damaged during utility repair or maintenance.

3.20.00 FUTURE CONNECTIONS

A blow-off is required at the end of any water main which terminates and is anticipated to be extended in the future. Refer to the detail drawing in the Appendix of this chapter. When a future main extension is anticipated, the main shall include valves so that only one valve will have to be closed when the main is extended. The valve shall be restrained so when the one valve is closed and the line to be extended is exposed, the valve will not blow off. Restraint shall be made by the use of a mechanical joint anchoring tee (swivel tee), swivel cross, and by installing a minimum of two full lengths of pipe on the extension side of the valve (8 inch pipe and smaller). No service taps shall be allowed on a main which can be extended in the future between the single valve to be closed and the dead end.

3.21.00 SERVICES

Calculations for meter and service line sizes shall be prepared using the "Plumbing Data Sheet" available from the Building Division. The applicant shall prepare building plans and calculations and submit them to the Building Division for review and approval. The Building Division must approve all meter and service line sizes (before and after the meter) prior to beginning construction. The service lines, tap and meter shall be the same size, unless otherwise approved and/or required by the City. If the tap and meter are of different sizes, the fee shall be paid based on the larger size, unless a larger tap is approved and/or required by the City in which case the fee for the meter size shall be paid.

Each separated structure shall be served by a separate service line and meter. All non-residential developments with any irrigated areas are required to have separate irrigation taps and meters from the water main in accordance with the Fort Lupton City Code. Utility easements shall be required for service lines up to and including the meter pit.

No pressure booster facility of any kind shall be allowed on any service line between the public main and the meter. All service line pressure booster facilities shall be privately owned and maintained.

Water service lines shall be located a minimum of 10 feet away from all sewer services and a minimum of 5 feet away from all fire protection service lines (measured horizontally). All service lines shall be constructed perpendicular to the front property line of the property they are going to serve and not less than 5 feet from the side of a front property line. Service lines through private property to serve a separate property are prohibited.

Size changes, if allowed between the service line and the meter, shall be accomplished by providing a full sized meter vault and setter for the line size installed and using industry standard adapters to install a reduced size meter in the full size line.

Water taps cannot be issued prior to a building and/or tap entitlement approval. Exceptions must be approved by the City ~~Manager~~Administrator; for example, conversion from well water to the City water system.

All service lines 3/4-inch through 2-inch shall be copper and shall be installed continuous without joints between the corporation stop at the water main and the meter or curb stop. Services shall be tapped at the main with a 45 degree angle from horizontal and shall have a minimum of 5 feet of cover and be laid as shown on the detail drawing in the Appendix of this chapter. The minor exception to this is allowed for the "slack" section in the service line near the tap which may have slightly less than 5 feet of cover.

Service connections requiring a flow greater than can be delivered through a 2-inch corporation and service line shall be 4-inch, 6-inch, or 8-inch connections and shall be polyvinyl chloride pipe in accordance with section 3.52.02 of the~~se STANDARDS AND~~CONSTRUCTION SPECIFICATIONS. Service connections (4-inch, 6-inch, or 8-inch) to new lines shall be made with mechanical joint anchoring tees (swivel tees) or reducing mechanical joint anchoring tees (swivel tees) if installed at the time of main line construction. Later connections, if installed, may also be made with tapping sleeves and tapping valves and at the developer's expense.

3.22.00 TRANSMISSION MAINS

All water mains larger than 12 inch in diameter shall be classified as "transmission mains."

All transmission mains shall have combination air valves installed at all high points on the line and on each side of butterfly valves in accordance with the detail drawing in the Appendix of this chapter.

All transmission mains shall have blow-off assemblies installed at all low points on the line and constructed in accordance with the detail drawing in the Appendix of this chapter.

With the exception of fire hydrant laterals, only polyvinyl chloride (PVC) pipe is approved for water main installations 12 inches in diameter and smaller. Any other pipe material must be approved in writing by the City. Lines 20 inches in diameter and larger may be ductile iron pipe or steel pipe, as approved in writing by the City. A Hazen Williams C coefficient of 130 shall be used when modeling PVC and DIP pipe and shall be 100 for steel pipe, unless otherwise approved in writing by the City.

The design of ductile iron and steel transmission mains and other critical direct bury appurtenances such as valves, shall require cathodic protection. Cathodic protection shall be designed by a qualified cathodic protection engineer, registered in the State of Colorado and shall conform to NACE Standard RP-01-69, latest revision. As a minimum, the cathodic protection system shall include magnesium anodes; test station thermal board and shunts; exothermic weld caps and coating; conductor, test stations, joint bond wires; wire splice kits; exothermic weld equipment and materials; wire and cable marker tags; and one-piece insulating sleeves and washers, all in conformance with section 3.62.00 of the~~se STANDARDS AND~~CONSTRUCTION SPECIFICATIONS. All of the data for these materials shall be submitted to the City for approval prior to installation. Test stations shall be shown on design drawings and as-built drawings. Cathodically protected pipe, except steel casing pipe, shall also require polyethylene wrap as described in section 3.61.02.

No service line taps or any taps less than six inches in diameter shall be made to transmission mains. Exceptions to this will be for combination air valves only.

Valves on transmission mains shall be placed no more than 1,200 feet apart. Where there are connections to transmission mains, all connecting mains shall include valves at the connection. There shall be a minimum of two valves at a tee connection and three valves at a cross connection.

3.23.00 UNLAWFUL CONNECTION

No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptacle, equipment, or plumbing fixture by reason of back siphonage, suction, back pressure, or any other cause, either during normal use and operation or when any such tank receptacle, equipment, or plumbing fixture is flooded, or subject to pressure in excess of the main line operating pressure. No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by the City and any pipes, conduits, or fixtures containing or carrying water, chemicals, liquids, gases, or any other substances from any other source. Refer to Section 3.24.08, Backflow Prevention Assemblies for further requirements.

3.24.00 APPURTENANCES

3.24.01 Valves

Residential distribution systems shall include valves to ensure that no more than 600 feet of main or 18 residential units and 1 fire hydrant will be out of service in the event of a single water main break. Valve placement shall be such that there are at least two valves at every tee and three valves at every cross.

Valves 16 inch or larger shall be butterfly valves. Main line valves shall be located at a tee, cross or elbow if possible. Under no circumstances shall a valve be located in concrete areas, such as sidewalks, crosspans, aprons, curbs, or gutters. Butterfly valve operators shall be located on the north or east side of the water main. Any valve located in a greenbelt area shall have an 18-inch-wide by 6-inch thick concrete collar around the valve box.

3.24.02 Fire Hydrants

The maximum distance, as measured along the centerline of the street, between fire hydrants shall be 500 feet in residential areas with homes that are less than 3,600 square feet, 450 feet spacing for homes 3,600 square feet and greater. ~~and 300 feet in~~B~~ b~~usiness and other high-value areas ~~unless otherwise approved in writing by the City~~the spacing will be as provided by Fire Code, but not less than 300 feet and approved by the Fort Lupton Fire District's Fire Chief. Dead-end water mains shall be avoided and every effort will be made to loop all water mains. In the event a loop cannot be made, o~~O~~ne fire hydrant will be ~~allowed~~ provided on the dead-end ~~line~~ main ~~provided~~ with that the line ~~is an~~being an 8" line. The number and location of fire hydrants in a given area shall be approved in writing by the Fire ~~Department~~District. If hydrants are to be installed at locations other than street intersections, they shall be located on the extension of property side lot lines. In no case shall a hydrant be located closer than 5 feet to obstructions, driveways, etc. The fire hydrant shall be located within the right-of-way or pocket Utility Easement and on the same side of the street as the water main unless otherwise approved in writing by the City. Fences, landscaping, etc., shall in no way hinder the operation of the fire hydrant. In addition, clear distances to the fire hydrant shall be in accordance with Section 3.19.00 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

The fire hydrant lateral lines shall be set at 90 degrees to mains. The length of the fire hydrant lateral line shall be minimized and shall be no more than 70 feet long. No horizontal bends or

offsets shall be used in fire hydrant lateral lines. Under no circumstances shall any tap be made on a fire hydrant lateral line.

3.24.03 Thrust Blocks and Joint Restraint Devices

All bends, tees, plugs, dead-ends, wet taps (in certain cases), hydrants, and blow-offs shall be designed and constructed with concrete thrust blocks. If the soil-bearing strength is unknown, the soil-bearing capacity used in design shall be 2,000 pounds/square foot. Refer to the detail drawings in the Appendix of this chapter.

Joint restraint devices shall be used on both sides of valves and fittings for pipe sizes 12 inches in diameter and smaller and in addition to thrust blocks. For transmission mains, 16 inches in diameter and larger, joint restraints shall be used for a specified distance as recommended using the latest edition of the pipe restraint calculator provided by EBAA Iron, or equivalent (https://rcp.ebaa.com/calculator.php~~www.rcp.ebaa.com~~). Thrust blocks will be required to be used in addition to joint restraint devices on transmission mains. Vertical bends in all pipe sizes shall be restrained using joint restraint devices and shall be restrained for a specified distance as recommended using the latest edition of the pipe restraint calculator provided by EBAA Iron, or equivalent (https://rcp.ebaa.com/calculator.php~~www.rcp.ebaa.com~~).

Harness rods, or "rodding", are not an acceptable means for restraining pipe and fittings unless it is specified inside vaults as shown on the detail drawings in the appendix of this Chapter. Under no circumstance shall steel harness rods be allowed to be in contact with soils.

3.24.04 Meters

Calculations for meter and service line sizes (before and after the meter) shall be prepared using the "Plumbing Data Sheet" available from the Planning Division at the City. The applicant shall prepare building plans and water demand calculations and submit them to the Building Division for review and approval. The Planning Division/Public Works Department must approve all meter and service line sizes prior to beginning construction. The service lines, tap and meter shall be the same size, unless otherwise approved and/or required by the City. If the tap and meter are of different sizes, the fee shall be paid for the larger, unless a larger tap is approved and/or required by the City in which case the fee for the meter size shall be paid.

Water taps cannot be issued prior to a building and/or tap entitlement approval. Exceptions must be approved by the City ~~Manager~~Administrator; for example, conversion from well water to the City water system.

Public water meter installations inside any buildings are prohibited unless otherwise approved, in writing, by the City. Meters shall be located within publicly-owned rights-of-way or easements. Meter pits shall not be located within concrete areas or areas exposed to vehicle traffic, unless otherwise approved in writing by the City. If the City approves of locating a meter pit in a concrete area or an area exposed to light vehicle traffic, then a heavy duty meter pit design shall be used in accordance with the design detail in the Appendix of this Chapter.

All water meters connected to the City of Fort Lupton's utility system shall be the property of the City. Under no circumstances shall anyone other than City personnel remove a water meter once the pit or vault has been inspected and approved. No connections shall be made in the meter pit, for irrigation or otherwise, by anyone other than authorized City personnel.

Irrigation system connections shall be made downstream from the meter and a minimum of five feet from the meter pit or vault.

For any installation where special or unusual conditions might exist, detailed drawings, accompanied by a letter of explanation, shall be submitted to the City for review and approval.

For any water meter installation over 2 inches in size, detailed drawings of the proposed installation shall be submitted to the City for review and approval prior to construction.

There shall be no electrical wiring allowed in any water meter pit or vault unless authorized, in writing, by the City.

Inspections of all residential pits and commercial pits or vaults shall be conducted by the City. Locations and details for commercial pits or vaults shall be reviewed and approved in writing by the City.

3.24.05 Fire Protection Service Line

Valves on newly constructed fire lines shall be located on the tee at the main line. The owner shall maintain all private fire lines beginning at and including this valve. All fire sprinkler taps shall be installed with an approved backflow prevention device as defined by The Fort Lupton City Code 8-7-27 and a flow switch which will indicate when water has flowed through the line. A property requiring a domestic service line and a fire protection service line will have separate taps for each. Fire protection service lines shall be constructed of PVC from the fire line valve to the 90 degree bend for the building standpipe. The 90 degree bend and standpipe shall be ductile iron pipe in conformance with the International Fire Code as adopted by the Building Division. Fire line valves shall have a flange connection and shall bolt directly to a mechanical joint anchoring tee (swivel tee) at the main.

3.24.06 Valve Vaults

All valves larger than 12 inches shall be installed in a vault in accordance with the detail drawings in the Appendix of this chapter. All valve vaults shall be capable of withstanding AASHTO H-20 highway loading. The vault shall also have lift hooks in the roof for valve removal inside the vault.

Vaults shall be made water proof after construction by use of sealants, epoxies or other approved methods. All vaults shall be designed with wall sleeves and link seal and be capable of handling thrusts caused by removing valves. All vent pipes for vaults shall be installed in conformance with the detail drawings in the Appendix of this chapter.

3.24.07 Manholes

Manholes shall be installed on all pressure regulating valves, permanent blow-off installations, and air release valves in accordance with the detail drawing in the Appendix of this chapter.

3.24.08 Backflow Prevention Assemblies

To prevent backflow contamination of the City of Fort Lupton's potable water system, a reduced pressure zone (RPZ) backflow prevention device shall be installed inside the structure

after the main shut off valve on all non-residential water service lines or where any condition might exist that would result in a higher pressure downstream of the water meter than exists in the main line and that could allow backflow or back siphonage of polluted or contaminated water or other substances from the water user's system. The assembly shall be installed per Colorado Department of Public Health and Environment guidelines and Colorado Plumbing Code to allow for proper operation and easy access for annual testing and maintenance.

A reduced pressure zone backflow prevention device shall be used for all non-residential irrigation services. This shall be required for both domestic potable and ~~reclaimed~~ well water sources. The assembly shall be located a minimum of five feet downstream of the water meter and installed per Colorado Department of Public Health and Environment guidelines and Colorado Plumbing Code to allow for proper operation and easy access for annual testing and maintenance.

3.24.09 Backflow Prevention Cross Connection Control

(1) Purpose

The purpose of this program is to protect the public water system from contaminants or pollutants that could enter the distribution system by backflow from a customer's water supply system through the service connection.

(2) Authority

The authority to implement this program is contained in the following statute, legislation and regulations and acts:

a. Article 1-114 and Article 1-114.1 of Title 25 of the Colorado Revised Statutes (CRS)

b. Section 39 of 5 CCR 1002-11, Colorado Primary Drinking Water Regulations

c. Colorado Plumbing Code

(3) Applicability

This Standard applies to all commercial, industrial and multi-family residential service connections within the public water system and to any persons outside the City who are, by contract or agreement with the public water system, users of the public water system. This Standard does not apply to single-family-residential service connections unless the Public Works Director becomes aware of a cross connection at the single family connection.

(4) Definitions

a. "ACTIVE DATE" means the first day that a backflow prevention assembly or backflow prevention method is used to control a cross-connection in each calendar year.

b. "AIR GAP" is a physical separation between the free flowing discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel installed in accordance with standard AMSE A112.1.2.

c. "BACKFLOW" means the undesirable reversal of flow of water or mixtures of water and other liquids, gases or other substances into the public water systems distribution system from any source or sources other than its intended source.

d. "BACKFLOW CONTAMINATION EVENT" means backflow into a public water system from an uncontrolled cross connection such that the water quality no longer meets the Colorado Primary Drinking Water Regulations or presents an immediate health and/or safety risk to the public.

e. "BACKFLOW PREVENTION ASSEMBLY" means any mechanical assembly installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the mechanical assembly is appropriate for the identified contaminant at the cross connection and is an in-line field-testable assembly.

f. "BACKFLOW PREVENTION METHOD" means any method and/or non-testable device installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the method or non-testable device is appropriate for the identified contaminant at the cross connection.

g. "CERTIFIED CROSS-CONNECTION CONTROL TECHNICIAN" means a person who possesses a valid Backflow Prevention Assembly Tester certification from one of the following approved organizations: American Society of Sanitary Engineering (ASSE) or the American Backflow Prevention Association (ABPA). If a certification has expired, the certification is invalid.

h. "CONTAINMENT" means the installation of a backflow prevention assembly or a backflow prevention method at any connection to the public water system that supplies an auxiliary water system, location, facility, or area such that backflow from a cross connection into the public water system is prevented.

i. "CONTAINMENT BY ISOLATION" means the installation of backflow prevention assemblies or backflow prevention methods at all cross connections identified within a customer's water system such that backflow from a cross connection into the public water system is prevented.

j. "CONTROLLED" means having a properly installed, maintained, and tested or inspected backflow prevention assembly or backflow prevention method that prevents backflow through a cross connection.

k. "CROSS CONNECTION" means any connection that could allow any water, fluid, or gas such that the water quality could present an unacceptable health and/or safety risk to the public, to flow from any pipe, plumbing fixture, or a customer's water system into a public water system's distribution system or any other part of the public water system through backflow.

l. "MULTI-FAMILY" means a single residential connection to the public water system's distribution system from which two or more separate dwelling units are supplied water.

m. "SINGLE-FAMILY" means:

i. A single dwelling which is occupied by a single family and is supplied by a separate service line; or

ii. A single dwelling comprised of multiple living units where each living unit is supplied by a separate service line.

n. "UNCONTROLLED" means not having a properly installed and maintained and tested or inspected backflow prevention assembly or backflow prevention method, or the backflow prevention assembly or backflow prevention method does not prevent backflow through a cross connection.

o. "WATER SUPPLY SYSTEM" means a water distribution system, piping, connection fittings, valves and appurtenances within a building, structure, or premises. Water supply systems are also referred to commonly as premise plumbing systems.

(5) Requirements

a. Under no circumstances shall any connection of the non-potable irrigation water system be made to the domestic potable water system.

b. Commercial, industrial and multi-family service connections shall be subject to a survey for cross connections. If a cross connection has been identified an appropriate backflow prevention assembly and or method shall be installed at the customer's water service connection within 120 days of its discovery. The assembly shall be installed downstream of the water meter or as close to that location as deemed

practical by the public water system. If the assembly or method cannot be installed within 120 days the Public Works Director must take action to control or remove the cross connection, suspended service to the cross connection or receive an alternative compliance schedule from the Colorado Department of Public Health and Environment.

c. In no case shall it be permissible to have connections or tees between the meter and the containment backflow prevention assembly.
    i. In instances where a reduced pressure principle backflow preventer cannot be installed, the owner must install approved backflow prevention devices or methods at all cross-connections within the owner's plumbing system.

d. Backflow prevention assemblies and methods shall be installed in a location which provides access for maintenance, testing and repair.

e. Reduced pressure principle backflow preventers shall not be installed in manner subject to flooding.

f. Provisions shall be made to provide adequate drainage from the discharge of water from reduced pressure principle backflow prevention assemblies. Such discharge shall be conveyed in a mater which does not impact waters of the state.

g. All assemblies and methods shall be protected to prevent freezing. Those assemblies and methods used for seasonal services may be removed in lieu of being protected from freezing. The assemblies and methods must be reinstalled and then tested by a certified cross-connection control technician upon reinstallation.

h. Where a backflow prevention assembly or method is installed on a water supply system using storage water heating equipment such that thermal expansion causes an increase in pressure, a device for controlling pressure shall be installed.

i. All backflow prevention assemblies shall be tested at the time of installation and on an annual schedule thereafter. Such tests must be conducted by a Certified Cross-Connection Control Technician.

j. The Public Works Director shall require inspection, testing, maintenance and as needed repairs and replacement of all backflow prevention assemblies and methods, and of all required installations within the owner's plumbing system in the cases where containment assemblies and or methods cannot be installed.

k. All costs for design, installation, maintenance, testing and as needed repair and replacement are to be borne by the customer.

l. No grandfather clauses exist except for fire sprinkler systems where the installation of a backflow prevention assembly or method will compromise the integrity of the fire sprinkler system.

m. For new buildings, all building plans must be submitted to the Public Works Director and approved prior to the issuance of water service. Building plans must show:
    i. Water service type, size and location
    ii. Meter size and location
    iii. Backflow prevention assembly size, type and location
    iv. Fire sprinkler system(s) service line, size and type of backflow prevention assembly.
        i. All fire sprinkling lines shall have a minimum protection of an approved double check valve assembly for containment of the system.
        ii. All glycol (ethylene or propylene), or antifreeze systems shall have an approved reduced pressure principle backflow preventer for containment.
        iii. Dry fire systems shall have an approved double check valve assembly installed upstream of the air pressure valve.
        iv. In cases where the installation of a backflow prevention assembly or method will compromise the integrity of the fire sprinkler system the

Public Works Director can choose to not require the backflow protection. The Public Works Director will measure chlorine residual at location representative of the service connection once a month and perform periodic bacteriological testing at the site. If the Public Works Director suspects water quality issues the Public Works Director will evaluate the practicability of requiring that the fire sprinkler system be flushed periodically.

(6) Inspection, Testing and Repair

a. Backflow prevention assemblies or methods shall be tested by a Certified Cross-Connection Control Technician upon installation and tested at least annually, thereafter. The tests shall be made at the expense of the customer.

i. Any backflow prevention assemblies or methods that are non-testable, shall be inspected at least once annually by a certified cross-connection control technician. The inspections shall be made at the expense of the customer.

b. As necessary, backflow prevention assemblies or methods shall be repaired and retested or replaced and tested at the expense of the customer whenever the assemblies or methods are found to be defective.

c. Testing gauges shall be tested and calibrated for accuracy at least once annually.

(7) Reporting and Recordkeeping

a. Copies of records of test reports, repairs and retests, or replacements shall be kept by the customer for a minimum of three (3) years.

b. Copies of records of test reports, repairs and retests shall be submitted to the Public Works Director by mail, facsimile or e-mail by the testing company or testing technician.

c. Information on test reports shall include, but may not be limited to,

i. Assembly or method type
ii. Assembly or method location
iii. Assembly make, model and serial number
iv. Assembly size
v. Test date; and
vi. Test results including all results that would justify a pass or fail outcome
vii. Certified cross-connection control technician certification agency
viii. Technician's certification number
ix. Technician's certification expiration date
x. Test kit manufacturer, model and serial number
xi. Test kit calibration date

b. The Public Works Director shall give notice in writing to any owner whose plumbing system has been found to present a risk to the public waters system's distribution system through an uncontrolled cross connection. The notice and order shall state that the owner must install a backflow prevention assembly or method at each service connection to the owner's premises to contain the water service. The notice and order will give a date by which the owner must comply.

i. In instances where a backflow prevention assembly or method cannot be installed, the owner must install approved backflow prevention assemblies or methods at all cross-connections within the owner's water supply system. The notice and order will give a date by which the owner must comply.

(10) Conflict with other codes.

a. If a dispute or conflict arises between the Colorado Plumbing Code, and any plumbing, mechanical, building, electrical, fire or other code adopted by the State, then the most stringent provisions of each respective code shall prevail.

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CHAPTER 4
SANITARY SEWER SYSTEM

4.00.00 INTRODUCTION

All sanitary sewer systems shall comply with the requirements of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS and may include special criteria established by the City for overall hydraulics of the sanitary sewer system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the City Engineer.

4.01.00 USE OF SANITARY SEWER

The use of sanitary sewers within the City of Fort Lupton shall be in accordance with the Fort Lupton Municipal Code.

4.10.00 DESIGN CRITERIA

4.11.00 SCOPE

It is the intent of this ~~"design criteria"~~DESIGN STANDARDS ~~section~~ to provide sufficient detailed information to enable the Engineer for the Owner/Developer to correctly and efficiently design the overall sanitary sewer system for a particular development. If there is a question or a concern regarding the design of any portion of the sanitary sewer system that is not adequately answered within this chapter, the Owner/Developer or his representative shall contact the City Engineer to get all issues resolved prior to design. Any deviation from these DESIGN STANDARDS ~~STANDARDS AND SPECIFICATIONS~~ must be approved in writing by the City Engineer.

Outfall sewers, pumping stations, interceptors and appurtenances are included under the definition of "Sewage Treatment Works" in the State Water Quality Control Act. Section 2.2.4(1) of the State Water Quality Control Act states: "No person shall commence construction or expansion of any domestic wastewater treatment works with a design capacity of more than two thousand gallons per day unless site location and design for the construction or expansion have been approved by the Division or the Commission if the matter is appealed. Therefore, all plans falling under ~~this criteria~~this criterion shall be submitted to the State Water Quality Control Division for approval prior to construction.

4.12.00 GENERAL

The sanitary sewer system shall be design by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The design process includes the submittal of a utility study and construction drawings for review and approval by the City Engineer. The following note shall be incorporated into the utility study:

"We acknowledge that the City of Fort Lupton's review of this study is only for general conformance with submittal requirements, current design criteria and standard engineering principles and practices. We are also aware of the provisions of the City Code of the City of Fort Lupton."

4.12.01 Study

The study shall include, as a minimum, the following information and shall be typed and bound in an 8-1/2-inch x 11-inch folder:

(A) Text, which addresses, a minimum of project location and description, project concept, discussion of any information that would affect the City's ability to serve the new area, and any recommendations and conclusions of the analysis.

(B) The area, in acres, which could be served by gravity by the new sewer, shown on a topographic map which delineates the basin boundaries as stated in (G) below.

(C) The estimated population densities and total population based on land use projections to be served by the new sewer.

(D) The estimated quantity and quality of any industrial wastes to be discharged to the system.

(E) Design flow rates, minimum and maximum flow velocities, minimum and maximum pipe slopes, and infiltration allowances.

(F) The impact of the additional flows on the existing sanitary sewer system at all critical points between the proposed site and the major interceptor.

(G) A utility map which includes, a minimum of, the following information:

- Location of all proposed and existing easements and/or rights-of-way.
- Existing and proposed sanitary sewer lines and appurtenances with sizes and slopes shown.
- Basin delineation
- All other existing and proposed utilities.

4.13.00 DESIGN FLOW

The flows used to design the sanitary sewer system for a particular development vary depending on the type of development. There are three general categories of development for which flow rates are given: residential development, commercial development and industrial development. Once the specific type of development is determined, the peak flows are calculated based on average demand, peak factor and infiltration/inflow amounts.

The following is a list of the criteria to be used in the preparation of all sanitary sewer system analyses:

Utility Study Criteria
Assume 2.90 People/Unit for all single family residential units *

Assume 1.80 People/Unit for all multi family units, including apartments.
Average Use: Residential -- 70 Gallons/Capita/Day **

Commercial -- 1000 Gallons/Acre/Day **
Industrial -- 1000 Gallons/Acre/Day **
School -- 25 Gallons/Capita/Day ***

Peak Factor = 3.0 **

Infiltration and Inflow Rate for all uses -- 1000 Gallons/Acre/Day **

Sanitary sewers shall be designed to convey the peak daily flow plus Infiltration and Inflow. If an industry uses more than the average allowance, then the sewer must be designed to handle that industry's peak daily flow.

Flow rates downstream of lift stations shall take into account the flow generated at the maximum pumping rate plus peak daily flow plus Infiltration and Inflow.

* From "1988 Population and Household Estimates," published by the Denver Regional Council of Governments with revisions by City of Fort Lupton planning staff.

** From "1986 Sewer System Master Plan - City of Fort Lupton," Brown and Caldwell

*** From "WPCF Manual of Practice No. 9, fifth printing," American Society of Civil Engineers and the Water Pollution Control Federation.

4.14.00 HYDRAULIC DESIGN/SIZING OF SEWER LINES

4.14.01 General

Sanitary sewer shall be designed to carry the discharge calculated in accordance with Section 4.~~23~~13.00 and to transport suspended material such that deposits in the sewer are precluded

The minimum diameter for sanitary sewer mains shall be 8-inches.

Oversizing of mains may be required by the City, and the recovery of the costs of such oversizing shall be in accordance with the Municipal Code.

The minimum diameter for sanitary sewer service lines shall be 4 inches.

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4.14.02 Sanitary Sewer Mains

(A) The following table gives the minimum and maximum allowable slopes for sanitary sewer mains:

TABLE 4.14.01
Sanitary Sewer Main Slope Criteria

Diameter (Inches)	Minimum Slope (Feet/Feet)	Maximum Slope (Feet/Feet)
8	0.00500	0.190
10	0.00500	0.140
12	0.00220	0.110
15	0.00150	0.082
18	0.00120	0.064
21 or larger as approved by City		

(B) The sewer must be designed at a slope great enough to produce a flow velocity of two feet (2') per second at the peak design flow using the Manning equation and n = 0.015 but not less than the minimum slope given above.

Hydraulic design of pressure sanitary sewers shall be in accordance with chapter 3 of these standard specifications.

4.14.03 Sanitary Sewer Service Lines

The following table shows the minimum and maximum allowable slopes for sanitary sewer service lines:

TABLE 4.14.04
Sanitary Sewer Service Slope Criteria

Diameter (Inches)	Minimum Slope (Feet/Feet)	Maximum Slope (Feet/Feet)
4	.0208	.0800
6	.0104	.0600

4.15.00 SYSTEM LAYOUT

4.15.01 General

All mains shall be installed in dedicated rights-of-way or public easements. Under no circumstances should sanitary sewer mains be installed parallel to and directly below any concrete such as sidewalks, curbs or gutters. Lines shall normally be located five feet south or east of street centerline, unless otherwise approved, in writing, by the City Engineer. Sanitary sewer mains shall be straight between manholes, both in horizontal and vertical alignment.

Sewer mains will ordinarily have a minimum of eight feet of cover to finished ground surface. Where this will provide less than nine feet of elevation difference between the finished lot grade at building line and the top of the sewer main, it will be indicated on the plans that the lot is served by a "shallow sewer" and appropriate elevation information will be given.

Sewer mains will be extended at least ten feet uphill from the lowest lot corner of the uppermost lot to be served adjacent to the sewer main. Sewer mains will terminate in a manhole.

Sanitary sewer mains shall be laid a minimum of ten feet horizontally from any existing or proposed utility. Upon written approval by the City, a sanitary sewer main may be laid closer than ten feet to a parallel water main if it is laid in a separate trench and if the elevation of the invert of the water main is at least eighteen inches above the crown of the sewer main and, in addition, polyvinyl chloride pressure pipe is used for the sewer main.

When the sanitary sewer main passes under a highway, railroad or drainage or irrigation ditch, there shall be a minimum of 3-1/2 feet of cover and steel casing shall be installed in accordance with the detail drawing in the Appendix of this chapter. The steel casing shall extend the entire width of the right-of-way or easement of the crossing structure or as directed by the City Engineer.

4.15.02 Waterline Crossing Over A Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer, the sanitary sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 Class 200 may be used.

4.15.03 Sanitary Sewer Line Crossing Over Water Line

In all cases, regardless of vertical clearance, the sanitary sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 Class 200 may be used.

4.15.04 Storm Sewer Line Crossing Over Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the sanitary sewer line and the storm sewer line, the sanitary sewer line shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 may be used.

4.15.05 Sanitary Sewer Line Crossing Over A Storm Sewer Line

The sanitary sewer line shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 may be used. In addition, each joint of the storm sewer within nine feet of the centerline of the crossing shall be encased in concrete.

4.15.06 Limits On Vertical Separation

Under no circumstances shall the vertical clearance between any lines involving a waterline, sanitary sewer line, or storm sewer be less than 12 inches without prior written approval from the City Engineer.

4.16.00 EASEMENTS

All sanitary sewer mains shall be in an easement which has a width of at least two times the depth to the pipe invert. The minimum easement shall be 20 feet in width for one utility, 30 feet in width for two utilities and 40 feet in width for three utilities. Site-specific circumstances may dictate the need for wider easements. The main shall be located a minimum of ten feet from and parallel to the edge of the easement. All easements shall be for the exclusive use of the City of Fort Lupton. No landscaping (except grass and private irrigation systems) nor permanent structures (i.e., mailboxes, sheds, buildings, etc.) shall be placed in the easement.

The easement agreement shall state that any structures placed in the easement shall be removed and replaced by the owner of the land when requested by the City so that maintenance can be performed. The owner of the land shall agree to hold the City of Fort Lupton harmless for any replacement of structures removed from the easement. The following statement shall appear on all Official Development Plans and all Final Plats:

"All public water, storm sewer and sanitary sewer mains and appurtenances located in public right-of-way shall be maintained by the City of Fort Lupton Public Works Department. All public water, storm sewer, sanitary sewer mains and appurtenances under private drives are located in utility easements. City is responsible for maintenance of these water, storm and sanitary sewer facilities. City is not responsible for repair or replacement of private drive, curb and gutter or landscaping damaged during utility repair or maintenance."

4.17.00 FUTURE CONNECTIONS

Manholes shall have pipes stubbed out which are sized to accommodate flows from the upstream basin whenever a future extension of the sanitary sewer main is anticipated. The main line stub-out shall be capped and sealed.

4.18.00 SERVICES

Each structure shall be served by a separate service line. Sanitary sewer service lines shall be located a minimum of ten feet away from all water services (measured horizontally). All service lines shall be constructed perpendicular to the property line of the property they are going to serve and not less than five feet from the side property line. Typical installations should locate the sanitary sewer service line five feet downstream of the centerline of the lot. Six inch service lines and larger shall require connection to the main with a manhole. Any service line tying into a main line larger than 8" shall also be made in a manhole.

The City shall not be responsible for locating sewer service lateral stub-outs for future connections.

4.19.00 TAPS

All sanitary sewer service connections to the sanitary sewer main shall be made using "wye" fittings, unless otherwise approved by the City.

4.20.00 UNLAWFUL CONNECTIONS

It shall be unlawful to discharge roof drainage, foundation drainage, sump pumps, surface drainage or any other non-acceptable wastes to the sanitary sewer which would violate any of the provisions of the Municipal Code.

4.21.00 SANITARY SEWER PRE-TREATMENT

Any new building to be constructed in an industrially-zoned area with a floor space greater than five thousand square feet, or with a water meter size greater than three-quarter inch or if otherwise required by the City shall install a sewer-monitoring facility in accordance with the Detail Drawing in the Appendix of this chapter prior to final building inspection approval. The monitoring facility shall be situated outside of the building on the user's premises. If the industrial user's service line ties into an existing City manhole and such manhole allows for safe sampling and isolation of the industrial user's discharge, the City may allow said manhole to serve as the industrial user's monitoring facility.

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4.22.00 APPURTENANCES

4.22.01 Manholes

The maximum spacing between manholes shall be four hundred feet. Manholes shall not be located in areas which are subject to flooding from surface runoff. Manholes shall be located in areas which allow direct access by maintenance vehicles when it is not feasible to locate the manhole in the public street.

If the possibility of surface runoff cannot be avoided, an internal watertight insert shall be installed to prevent inflow. All manholes located outside dedicated street rights-of-way shall be designed and constructed with locking-type cover and the manhole ring shall be bolted to the manhole cone and steel marker posts.

At the termination of a force main or other locations at which hydrogen sulfide gases (H_2S) is deemed to be a problem, a chemical and or gas resistant manhole lining will be required.

4.22.02 Outside Drop Manholes

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Drop manholes will only be allowed when the design engineer proves that alternates are not feasible and when approved, in writing, by the City. Outside drop manholes will be required whenever a sewer entering a manhole is at an elevation twenty-four inches or more above the manhole invert. Outside drop manholes shall be in accordance with the Detail Drawing in the Appendix of this chapter.

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4.22.03 Underdrains

Where underdrains are to be constructed under sewer mains, separate clean-outs shall be provided next to each manhole in accordance with the Detail Drawing in the Appendix of this chapter. Further, all underdrain service lines originating from within lots shall meet these requirements including size, marking tape and sock.

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CHAPTER 5
STORM SEWER SYSTEM

5.00.00 INTRODUCTION

All storm sewer systems shall comply with the requirements of the "Drainage Criteria Manual" and these DESIGN STANDARDS~~STANDARDS~~ and CONSTRUCTION SPECIFICATIONS. Special criteria shall be outlined at pre-design meetings and in the approved construction plans, as determined necessary by the City.

5.01.00 USE OF STORM SEWER

The use of storm sewers within the City of Fort Lupton shall be in accordance with the Fort Lupton Municipal Code.

5.10.00 DESIGN CRITERIA

The City of Fort Lupton's "Drainage Criteria Manual" shall be the design criteria for the analysis and design of storm drainage facilities within the City of Fort Lupton. All subdivisions, resubdivisions, planned unit development, or any other proposed construction submitted for approval under the provisions of the City of Fort Lupton Municipal Code shall include adequate storm drainage system analysis and appropriate drainage system plans in conformance with the requirements of the City of Fort Lupton's "Drainage Criteria Manual."

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CHAPTER 6
ROADWAY

6.00.00 GENERAL PROVISIONS

6.01.00 APPLICABILITY

This chapter contains minimum criteria to be met on all streets and parking lots designed and constructed in the City, both by private land developers and by the City.

6.02.00 VARIANCES

Where any particular minimum requirements contained in this chapter can be shown to be inappropriate when applied to an "out-of-the-ordinary" situation, variances to said minimum requirements will be considered and may be authorized by the ~~Public Works Director/~~City Engineer where the proposed variance in minimum requirements will result in a level of safety, service, and quality equal to or greater than that intended by the application of the minimum requirements.

6.03.00 PRIVATE STREET SYSTEMS AND PARKING LOTS

Private street systems and parking lots shall be subject to all minimum requirements of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~ except that variances, as provided for in Subsection 6.02.00, will be allowed subject to the review and approval of the ~~Public Works Director/~~City Engineer.

6.04.00 CITY CAPITAL IMPROVEMENT PROJECTS

It is recognized that the minimum requirements contained in these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~ are not necessarily sufficient for plans, specifications, and contract administration purposes for City administered street capital improvement projects. Accordingly, the Public Works Director/City Engineer is authorized to develop and/or approve such additional requirements and procedures necessary for bidding, awarding, and administering for such projects, provided said additional requirements and procedures are substantially consistent with these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~ and applicable provisions of other City ordinances and resolutions.

6.10.00 ROADWAY DESIGN AND TECHNICAL CRITERIA

This section sets forth the minimum design and technical criteria and specifications to be used in the preparation of all roadway plans. Within this chapter, ~~" AASHTO~~"AASHTO ~~"~~Green Book" refers to "A Policy on Geometric Design of Highways and Streets ~~—~~ ~~1990~~Sixth Edition" as published by the American Association of State Highway and Transportation Officials.

6.11.00 REPORTS

6.11.01 Submittal Format

All reports shall be bound in an 8-1/2" x 11" folder and shall include the seal and signature of the Professional Engineer registered in the State of Colorado who is responsible for the report contents. In addition, all reports shall include the following statement:

"We acknowledge that the City of Fort Lupton's review of this study is only for general conformance with submittal requirements, current design criteria, and standard engineering principles and practices. We are also aware of the provisions of the City Code of the City of Fort Lupton."

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6.11.02 Traffic Analysis Report

All subdivision, Planned Unit Development (PUD), and commercial developments shall require a traffic analysis report giving information and details as may be required by the ~~Public Works Director/~~City Engineer and as specified in Chapter 8 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

6.11.03 Pavement Design Report

All roadway construction in the City of Fort Lupton shall require a pavement design report. The report content shall be in accordance with Section 6.30.00 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

6.11.04 Pavement Evaluation Report

After installation of the bituminous surface course, except for the final two ~~inchs~~inches (2") on residential streets, the developer may be required to furnish the Public Works Director/City Engineer with a copy of a report prepared by a Professional Engineer registered in the State of Colorado utilizing non-destructive deflection testing to ~~access~~ assess and predict the performance of the pavement. This testing may be required if evidence exists that the pavement section may not meet the design specifications. The Professional Engineer shall have a past history and knowledge in performing these tests. Qualifications of Professional Engineers shall be submitted to the Public Works Director~~/City Engineer~~ for approval before the start of work.

The pavement evaluation shall be performed in accordance with good engineering practices. The report shall generally embody the following testing and pavement evaluation techniques:

(A) Environmental Study (Frost Cycle, Drainage, etc.).

(B) Pavement Surface Elevation.

(C) Soil Borings in Areas of High Deflections.

(D) Pavement Deflection Analysis.

The report shall evaluate the existing condition of the base and binder course by performance of deflection tests at one-hundred-foot (100') ~~spacings~~spacing per traffic lane. Spacing will be staggered in each lane. The report shall determine whether or not the pavement section will meet a 20-year pavement life or greater.

If the pavement section is not projected to meet a life expectancy of 20 years or more, the report shall propose asphalt overlays in excess of the existing pavement section to bring the new pavement section to a 20-year life expectancy. The ~~Public Works Director/~~City Engineer

will evaluate the results of the report and inform the developer of the acceptable solution mentioned in the report.

6.12.00 LOCAL STREET

6.12.01 Local

A local street is a general term denoting a roadway designed or operating with the following characteristics:

(A) **Posted Speed Limit.** ~~Between~~ 25 ~~and 30~~ miles per hour. Posted or prima facia speeds for the various street classifications are normally five (5) to ten (10) miles per hour less than the design speed of that street.

(B) **Traffic Volumes.** Less than 2,500 vehicles per day.

(C) **Limited Continuity.**

(D) **Safety.** Designed for the safety of pedestrians and bicyclists and the ease of access to adjacent parcels of land.

(E) **Traffic Control.** Stop signs, yield signs, or right-of-way rules for uncontrolled intersections. Traffic requirements in other than residential areas may require special design consideration by the applicant's engineer and the City's Transportation Engineer.

(F) **Function.** Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination with the neighborhood. Local streets are utilized in single family residential areas. ~~Utility line easements should be available.~~

(G) **Right-of-Way.** Sixty (60') with ~~detached~~ attached walk.

(H) **Number of Moving Lanes.** Two.

(I) **Access Conditions.** In accordance with Chapter 8 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

(J) **Planning Characteristics.** Local streets should not intersect major arterial streets.

(K) **Type of Curb and Gutter.** Four inch (4") combination curb, gutter and walk, with attached walk; six inch (6") vertical with ~~detached~~ attached walk.

(L) **Sidewalk Width.** Five foot (5') minimum, ~~detached~~ attached ~~from~~ with curb ~~with 6' tree line minimum~~. All variations pending City approval.

(M) **Cul-De-Sacs.** In accordance with Section 6.21.00 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

(N) **Street Widths.**

1. ~~Thirty-six~~Thirty-six foot (36') paved width ~~plus~~ with two (2) two foot (2') gutter pans.

6.13.00 COLLECTOR STREET

6.13.01 Minor Collector

A minor collector is a general term denoting a roadway designed or operating with the following characteristics:

(A) **Posted Speed Limit.** Minimum 25 to 30 miles per hour. ~~Posted or prima facia speeds for the various street classifications are normally five (5) to ten (10) miles per hour less than the design speed of that street.~~

(B) **Traffic Volumes.** Generally less than 7000 vehicles per day.

(C) **Continuous.** For less than two (2) miles.

(D) **Safety.** Designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

(E) **Traffic Control.** Regulation of traffic accomplished through the use of stop signs and channelization. Traffic signals normally used only at intersections with major collectors and arterial streets. Parking allowed.

(F) **Driveways.** ~~No~~ Limited back-out drives permitted.

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(G) **Function.** Collector streets collect and distribute traffic between arterial and local streets and serve as main connectors within communities, linking one neighborhood with another. Traffic carried by collector streets should have an origin or a destination within the community. ~~Utility easements should be available.~~

(H) **Right-of-Way Width.** ~~Eighty Seven~~Eighty-five feet (~~80'7~~85') minimum, ~~one hundred foot (100') average~~.

(I) **Number of Moving Lanes.** Two (2).

(J) **Access Conditions.** In accordance with Chapter 8 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

(K) **Planning Characteristics.** Collector streets should have continuity throughout a neighborhood but need not extend beyond the neighborhood intersections with collectors, major collectors, and arterial streets should be at least one-quarter (1/4) mile apart.

(L) **Type of Curb and Gutter.** Six (6) inch vertical.

(M) **Sidewalk Width.** ~~Six~~ Eight foot (~~6'~~8') minimum, detached from curb with 8' tree line minimum. All variations pending City approval.

(N) **Street Widths.** Minimum ~~thirty six~~thirty-six foot (36') paved with two (2) two-foot (2') gutter pans.

6.13.02 Major Collector

A major collector is a general term denoting a roadway designed or operating with the following characteristics:

(A) **Posted Speed Limit.** Between 30 and 45 miles per hour. ~~Posted or prima facie speeds for the various street classifications are normally five (5) to ten (10) miles per hour less than the design speed of that street.~~

(B) **Traffic Volumes.** Generally greater than 7000 vehicles per day and less than 12,000 vehicles per day, when the land which the collector serves is fully developed.

(C) **Continuous.** For two (2) or more miles.

(D) **Safety.** Designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

(E) **Traffic Control.** Regulation of traffic accomplished by signing and channelization. Traffic signals will normally be located only at intersections with streets of higher classification. Parking not allowed.

(F) **Driveways.** No back-out drives permitted.

(G) **Function.** Major collector streets permit relatively unimpeded traffic movement and are intended for use on those routes where two (2) moving lanes are required but where a larger classified street is not warranted. Utilized in industrial, commercial, multi-family and single family residential areas~~, where on street parking is required~~.

(H) **Right-of-Way Width.** Minimum ~~one hundred twenty~~eighty-five feet (~~120'~~85').

(I) **Number of Moving Lanes.** Four (4).

(J) **Access Conditions.** In accordance with Chapter 8 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

(K) **Planning Characteristics.**

1. Major collector streets should be employed where traffic demands are high and right-of-way acquisition costs are not prohibited.

2. Detached sidewalk required.

3. Design element (trees, open space, etc.).

(L) **Type of Curb and Gutter.** Six (6) inch vertical.

(M) **Sidewalk Width.** ~~Eight~~ Ten foot (~~8'~~10') minimum, detached from curb with 8' tree line minimum. All variation pending City approval.

(N) **Street Widths.** Four (4) eleven-foot (~~12'~~11') travel lanes, two (2) two-foot (2') gutter pans.

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6.14.00 ARTERIAL STREET

6.14.01 ~~Minor~~ Arterial

An arterial street is a general term denoting a roadway designated or operating with the following characteristics:

(A) **Posted Speed Limit.** Between 40 and 45 miles per hour. ~~Posted or prima facie speeds for the various street classifications are normally five (5) to ten (10) miles per hour less than the design speed of that street.~~

(B) **Traffic Volumes.** Twelve thousand (12,000) vehicles per day expected minimum traffic volume when the land which the arterial serves is fully developed.

(C) **Access.** In accordance with Chapter 8 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

(D) **Continuity.** Several miles, generally connecting with inter-city routes.

(E) **Traffic Control.** Regulation of traffic accomplished by signs and channelization. Traffic signals will normally be located only at intersections with streets of high classification. Parking should be prohibited.

(F) **Function.** Arterial routes permit relatively unimpeded traffic movement and are intended for use on these routes where four (4) moving lanes and one (1) left-turn lane are required but where a major arterial cross-section would not be warranted. No parking is allowed.

(G) **Right-of-Way Width.** One hundred and ~~thirty~~ ten feet (~~130'~~110') minimum.

(H) **Number of Moving Lanes.** Four (4).

(I) **Planning Characteristics.** Arterials should be spaced from one-half (1/2) to one (1) mile apart and should, where possible, be continuous. Arterials should act as boundaries between neighborhood areas. Arterial cross-section should be employed where traffic demands are high and right-of-way acquisition costs are prohibitive. Detached sidewalk required. Separate major land uses.

(J) **Type of Curb and Gutter.** Six (6) inch vertical.

(K) **Sidewalk Width.** Eight foot (8') minimum, detached from curb, with 12' tree line minimum. All variation pending City approval.

(L) **Street Widths.** Four (4) eleven-foot (~~12'~~11') travel lanes, one (1) ~~sixteen~~ten-foot (~~16'~~10') left-turn lane/striped or curbed median, and two (2) two-foot (2') gutter pans plus acceleration/deceleration lanes at intersections. Total street width shall be

~~sixty~~fifty-eight feet (~~68'~~58') flowline to flowline plus acceleration/deceleration lanes at intersections.

6.14.02 Major Arterial (4 Lane)

(A) Posted Speed Limit. **Greater than or equal to 40 miles per hour. Posted or prima facie speeds for the various street classifications are normally five (5) to ten (10) miles per hour less than the design speed of that street.**

(B) Traffic Volumes. **Nineteen thousand (19,000) vehicles per day expected minimum traffic volume when the land which the arterial serves is fully developed.**

(C) Access. **In accordance with Chapter 8 of these STANDARDS AND SPECIFICATIONS.**

(D) Continuity. **Several miles, generally connecting with inter-city routes.**

(E) Traffic Control. **Movement of traffic will be controlled by signals and channelization. Parking shall be prohibited. Roadways should have a raised median strip between them.**

(F) Function. **Major arterial streets permit rapid and relatively unimpeded traffic movement throughout the country, connecting major land use element, as well as communities with one another. No parking is allowed.**

(G) Right-of-Way Width. **One hundred forty feet (140') minimum.**

(H) Number of Moving Lanes. **Four (4).**

(I) Planning Characteristics. **Major arterial streets should be spaced approximately one (1) mile apart and should traverse the entire city. Major arterial streets should not bisect neighborhoods but should act as boundaries between them.**

(J) Type of Curb and Gutter. **Six (6) inch vertical with two foot (2') pan on outside of traveled way; six (6) inch vertical with one foot (1') pan on medians.**

(K) Sidewalk Width. **Ten foot (10') minimum, detached from curb, with 12' tree line minimum. All variation pending City approval.**

(L) Street Widths. **Four (4) eleven foot (12') travel lanes, from one (1) sixteen foot (16') raised median, two (2) one foot (1') median gutter pans, two (2) two foot (2') gutter pans plus necessary left turn and acceleration/deceleration lanes, and minimum four foot (4') raised median at intersections.**

6.14.03 Major Arterial (6 Lane)

(A) Posted Speed Limit. **Greater than or equal to 50 miles per hour. Posted or prima facie speeds for the various street classifications are normally five (5) to ten (10) miles per hour less than the design speed of that street.**

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~~(B) Traffic Volumes. Thirty thousand (30,000) vehicles per day expected minimum traffic volume when the land which the arterial serves is fully developed.~~

~~(C) Access. In accordance with Chapter 8 of these STANDARDS AND SPECIFICATIONS.~~

~~(D) Continuity. Several miles, generally connecting with inter-city routes.~~

~~(E) Traffic Control. Movement of traffic will be controlled by signals and channelization. Parking shall be prohibited. Roadways should have a 4 foot (4') minimum raised median strip between them.~~

~~(F) Function. Major arterial streets permit rapid and relatively unimpeded traffic movement throughout the City, connecting major land use elements, as well as communities with one another. Parking is not allowed.~~

~~(G) Right-of-Way Width. One hundred sixty foot (160') minimum.~~

~~(H) Number of Moving Lanes. Six (6).~~

~~(I) Planning Characteristics. Major arterial streets should be spaced approximately one (1) mile apart and should traverse the entire city. Major arterial streets should not bisect neighborhoods but should act as boundaries between them.~~

~~(J) Type of Curb and Gutter. Six (6) inch vertical with two foot (2') pan on outside of traveled way; six (6) inch vertical with one foot (1') pan on median.~~

~~(K) Sidewalk Width. Ten foot (10') minimum, detached from curb, with 12' tree line minimum. All variation pending City approval.~~

~~(L) Street Widths. Six (6) eleven foot (12') travel lanes, one (1) sixteen foot (16') median, two (2) one foot (1') median gutter pans, two (2) two foot (2') gutter pans and necessary double left turn lanes, acceleration/deceleration lanes, and four foot (4') raised median at intersections.~~

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6.15.00 Drainage

The minor and major storm drainage systems shall be designed in accordance with the City of Fort Lupton Storm Drainage ~~Design and Technical~~ Criteria Manual. Because safe and efficient movement of traffic is the primary function of roadways, the storm drainage function of roadways, (such as allowable gutter capacity and street overtopping), shall be designed to the limits set forth in the drainage criteria.

6.15.01 Crosspans

Crosspans shall be constructed in accordance with the detail drawing. Crosspans are not permitted across collector or arterial roadways, nor are they allowed on roadways with storm sewer systems. Double crosspans may be used parallel to collectors or arterial roadways to

convey storm runoff across residential roadways. The use of double crosspans elsewhere, or the use of any crosspan on roadways where the vertical grade exceeds four-and-one-half percent (4.5%) will be considered only after all alternatives have been exhausted.

6.15.02 Inlets

Inlets shall be located to intercept the curb flow at the point curb flow capacity is exceeded by storm runoff. Refer to the City of Fort Lupton's Storm Drainage ~~Design and Technical~~ Criteria Manual for curb capacity. Inlets shall also be installed to intercept cross-pavement flows at points of transition in superelevation. Due to the presence of handicap ramps, inlets shall not be allowed in the curb return but shall be located outside the tangent points of the curb returns. Gutter transition sections abutting inlets shall not be within the curb return.

6.15.03 Sidewalk Chases

Storm water from concentrated points of discharge shall not be allowed to flow over sidewalks but shall drain to the roadway or storm inlet by use of chase sections. Sidewalk chase sections shall not be located within a curb cut or driveway. Hydraulic design shall be in accordance with the Storm Drainage ~~Design and Technical~~ Criteria Manual. Sidewalk chase sections shall be constructed in accordance with the detail drawing.

6.15.04 Temporary Erosion Control

Temporary erosion control is required along and at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc., in accordance with Chapter 2 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

6.16.00 HORIZONTAL ALIGNMENT

6.16.01 Horizontal Curves

The minimum horizontal curves for roadway alignment shall be in accordance with Table 6.16.01 below.

TABLE 6.16.01

Horizontal Curves

Design Speed (MPH)	Average Running Speed (MPH)	Maximum Degree of Curvature	Minimum Curve Radius*(Feet)
20	20		57.3
		100	
25	24		32.7
		175	
30	28		22.9
		300	
35	32		14.3
		475	

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40	36	8.8
	650	
50**	44	6.0
	955	
55**	48	4.75
	1200	

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* AASHTO Figure 111-18 - for low speed urban street - normal crown.
** Requires Superelevation - 0.04 ft/ft maximum.

6.16.02 Curb Return Radius

Minimum return radius shall be as shown in Table 6.16.02 below.

TABLE 6.16.02
Curb Return Radii
(Measured Along Flowline)

	Intersecting Streets		
Through Street	Arterial	Collector	Local Service
Arterial	50 Feet	30 Feet	25 Feet
Collector	30 Feet	25 Feet	20 Feet
Local Service	25 Feet	20 Feet	15 Feet

6.16.03 Design Speed

Horizontal alignment design speed shall be consistent with the requirement for vertical alignment design speed. If no superelevation is required and normal crown section exists, the horizontal curve data as shown in Table 6.16.01 shall be used.

6.16.04 Spiral Curves

Spiral curves shall be used only on arterial roadways within the City of Fort Lupton and only upon written approval of the Public Works Director~~/City Engineer~~.

6.16.05 Small Deflection Angles

For small deflection angles, curves should be sufficiently long to avoid the appearance of a kink. Curves should be at least five hundred (500) feet long for a central angle of five degrees (5°), and the minimum length should be increased one hundred feet (100') for each one-degree (1°) decrease in the central angle. Horizontal curves should not be used when the central angle is fifty-nine minutes (59') or less. This criteria applies to arterial roadway design only.

6.16.06 Compound Curves

A compound curve on arterials should be avoided, particularly where a simple curve can be obtained at small extra cost. Where topography makes their use necessary, the radius of the

flatter curve should not be more than fifty percent (50%) greater than the radius of the sharper curve. When this is not feasible, an intermediate curve or spiral should be used to provide the necessary transitions. Spiral curves are only to be used upon written approval of the Public Works Director~~/City Engineer~~.

6.16.07 Reversing Curves

True reversing curves should not be used. In cases of reversing curves, a sufficient tangent should be maintained to avoid overlapping of the required superelevation runoff and tangent runout. The following is the minimum tangent lengths that shall be used for each roadway classification:

(A) Local -- not applicable.

(B) Collector -- Fifty feet (50') minimum.

(C) Arterial -- One hundred feet (100') minimum.

6.16.08 Broken-Back Curves

A broken-back curve consists of two (2) curves in the same direction joined by a short tangent, of length less than one thousand five hundred feet (1500'). Broken-back curves are undesirable. If the length of intervening tangent is less than one thousand five hundred feet (1500'), a simple curve, a compound curve, or spiral transitions should be used to provide some degree of continuous superelevation. Spiral curves are only to be used upon written approval of the Public Works Director~~/City Engineer~~.

6.16.09 Alignment at Bridges

Ending a curve on a bridge is undesirable and adds to the complication of design and construction. Likewise, curves beginning or ending near a bridge should be so placed that no part of the spiral or superelevation transitions extends onto the bridge. Compound curves on a bridge are equally undesirable. If curvature is unavoidable, every effort should be made to keep the bridge within the limits of the simple curve.

6.16.10 Coordination With Vertical Alignment

To avoid the possibility of introducing serious traffic hazards, coordination is required between horizontal and vertical alignment. Particular care must be exercised to maintain proper sight distance at all times. Sharp horizontal curves introduced at or near the top of pronounced crest or bottom of sag vertical curves should be avoided. Vertical curvature superimposed upon horizontal curves, or vice versa, generally results in a more pleasing facility.

6.17.00 VERTICAL ALIGNMENT

Vertical Alignment Control Table:

Design Controls for vertical alignment are shown on Table 6.17.00.

TABLE 6.17.00
Vertical Alignment Controls

Description	Minimum VCL Speed*	Design Grade**	Maximum K Value Crest	Sag	Ranges Crest	Sag
Local	35	8	40-50		30-50	
	50			50		
Minor Collector	40	7	60-80		60-70	
	50			50		
Major Collector	50	7	110-160		90-110	
	100			80		
Minor Arterial	50	6	110-160		90-110	
	100			80		
Major Arterial***	55	6	150-220		100-130	
	110			90		

* The design speed is a minimum of 5 miles per hour over the posted speed for each classification.

** The maximum grades indicated should only be used in extreme topographic conditions. The designer should strive to minimize the use of these grades for considerable lengths and on north-facing slopes.

*** K values exceeding 125 on curbed streets should be checked for drainage. Multiple inlets may be required within long sag on vertical curves, and where the longitudinal slope is less than 0.4 percent.

6.17.01 Permissible Roadway Grade

The minimum allowable grade for roadways is ~~one half~~three-quarters percent (0.75%). The minimum allowable grade for bubbles and cul-de-sacs within the bulb is one percent (1%). The maximum allowable grade for any roadway is shown in Table 6.17.00 above.

6.17.02 Permissible Intersection Grades (Public Rights-of-Way)

The maximum permissible grade at intersections shall be as shown in the detail drawing. These grades are maximum instantaneous flowline grades for the stated distances (each side of the street) for the minor (intersecting) street.

The intersection grade of the major (through) street at the intersection may be dictated by design considerations for the street. However, if the major street intersection grade exceeds three percent (3%), the type of access and access control will be as directed by the ~~Public Works Director/~~City Engineer.

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All private commercial driveways with curb return radii shall follow the standards set forth for a local street. The length of the maximum grade for the commercial driveway shall be a minimum of fifty feet (50') measured from the flowline intersection of the public roadway.

6.17.03 Changing Grades

The use of grade breaks in lieu of vertical curves is discouraged. However, if a grade break is necessary and the algebraic difference in grade does not exceed eight-tenths of a percent (0.008 ft./ft.) along the roadway, the grade break will be permitted. The maximum grade break allowed at the point of tangency at a curb return for local and collector roads shall be two percent (2%) and for arterial roadways a maximum of one percent (1%).

6.17.04 Vertical Curves

When the algebraic difference in grade (A) is at, or exceeds, eight-tenths of a percent, a vertical curve is to be used. Design criteria for vertical curves is found in Table 6.17.00 of this chapter. The minimum gradients into and out of a sag (sump) vertical curve is five-tenths of a percent (0.005 ft./ft.). Minimum length of a vertical curve is shown in Table 6.17.00 of this chapter. All vertical curves shall be labeled in the profile with length of curve (L), K=L/A values, VPC, VPT, VPI, and stationing and elevation of these components. In addition, the low point or high point of the vertical curve shall be shown.

6.17.05 Intersections

In addition, the following criteria shall apply at intersections.

(A) The grade of the "through" street shall take precedence at intersections. At the intersections of roadways with the same classification, the more important roadway, as determined by the Public Works Director~~/City Engineer~~, shall have this precedence. The design should warp side streets to match through streets with as short a transition as possible.

(B) The key criteria for determining the elevation of the curb return on the side street and the amount of warp needed on a side street transitioning to a through street are:

1. Permissible grade in the stop/start lane. See Section 6.17.02 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

2. Pavement cross slope at the PCR's on the side street and permissible warp in pavement cross slope (see Section 6.19.01(B)).

3. Normal vertical curve criteria.

4. Vertical controls within the curb return itself.

(C) The elevation at the PCR of the curb return on the through street is always set by the grade of the through street in conjunction with pavement cross slope.

(D) Carrying the crown at a side street into the through street is permitted only when drainage considerations warrant such a design.

(E) A more detailed review shall be performed for arterial-arterial intersections to maximize ~~driveability~~drivability. A few arterial intersections will have a uniform two percent (2%) cross-slope, the majority of them having one or more sides warped.

(F) Whenever possible, intersections shall be made at right angles or radial to a curve. No intersecting angle of less than seventy-five degrees (75°) will be allowed.

6.17.06 Curb Returns

Minimum fall around curb returns for flow along the curb line shall be as follows:

Table 6.17.06
Curb Returns

~~Radius~~ Radius	Minimum Fall
15 Feet	0.3 Feet
20 Feet	0.3 Feet
25 Feet	0.4 Feet
30 Feet	0.4 Feet
50 Feet	0.5 Feet
All Others	1.2 Percent Around the Return

6.17.07 Curb Return Profiles

Curb return profiles are required for radii equal to or greater than ~~twenty-five~~twenty-five (25') within the public right-of-way. A mid-point elevation along the arc length of the curb return shall be shown in plan view for radii equal to or greater than twenty-five feet (25'). Curb return design shall be set in accordance with the following design procedure. General standards for flowline control and profiles with the curb returns shall be as follows:

(A) The point of tangency at each curb return shall be determined by the projected tangent grade beginning at the point of intersection (PI) of the flowlines.

(B) The arc length and external distances of the curb return shall be computed and indicated on the drawing.

(C) Show the projected flowline (or top of curb) grade for each roadway beyond the PCR.

(D) Design the flowline of the curb return such that a maximum cross slope between the mid-point of the curve and the PICR (external distance) does not exceed five percent (5%). Grade breaks at the PCRs shall not exceed two percent (2%) for local and collector streets and one percent (1%) for arterials. The flowline design of the curb return shall be accomplished within the return without affecting street grades beyond the PCR. Maximum vertical curves will equal the arc length of the curb return. The elevation and location of the high or low point within the return, if applicable, is to be called out in the profile.

(E) Scale for the curb return profile to be one inch equals one foot (1"=1') vertically.

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6.17.08 Connection With Existing Roadways

(A) Connection with existing roadways shall be smooth transitions conforming to normal vertical curve criteria if the algebraic difference in grade between the existing and proposed grade exceeds eight-tenths (0.008 ft./ft.) of a percent. When a vertical curve is used to make this transition, it shall be fully accomplished prior to the connection with the existing improvements and shall also comply with the grade requirements at intersection approaches.

(B) Existing grade shall be shown for at least three hundred feet (300') with field verified as-builts showing stations and elevations at twenty-five-foot (25') intervals. In the case of connection with an existing intersection, these as-builts are to be shown within a three-hundred-foot (300') radius of the intersection. This information will be included in the plan and profile that shows that proposed roadway. Limits and characteristics of the proposed improvement are the primary concern in the plan view. Such characteristics include horizontal alignment, off-site intersections, limits of the improvement, etc.

(C) Previously approved designs for the proposed improvement are not an acceptable means of establishing existing grades. However, they are to be referenced on the construction plan where they occur.

(D) The basis of the as-built elevations shall be the design elevations (both flowline or both top of curbs, etc.) when possible.

6.18.00 SIGHT DISTANCES

6.18.01 General

The major considerations in alignment design are safety, grade, profile, road area, design speed, sight distance, topography, drainage, and performance of heavy-duty vehicles. The road alignment should provide for safe and continuous operation at a uniform design speed. New road layout shall bear a logical relationship to existing or platted roads in adjacent properties. Design for site distances shall be in accordance with the following:

Adequate intersection design necessitates the provision of safe ingress and egress from one street or driveway to the other, based in part on the ability of a driver to see oncoming vehicles or pedestrians. The following guidelines shall be used in the design of intersections, private driveways and public streets which intersect other traffic carrying facilities.

6.18.02 Sight Distance Triangle

At the intersection of two public streets or a private driveway and a public street, sight distance shall be evaluated across a “sight distance triangle” where obstructions are restricted according to the following criteria. Within the area of the triangle there must be no wall, fence, sign, foliage, berming or other structure which will obscure the driver’s view of traffic approaching that intersection. The structures or berms within the sight distance triangle can extend no higher than 24 inches above the curb elevation. Exceptions to this requirement exist for public

facilities such as fire hydrants, utility poles and traffic control devices. These facilities must be located to minimize visual obstruction.

The evaluation of sight distance shall be made on two different types of sight distance areas. The first is shown in Figure 6.18.01 for the intersection of two public streets. The sight distance triangle in this case is formed by the intersection of two lines plotted along the curb line of the intersecting streets using the specified lengths. The diagonal connects the other ends of those lines. Where one or the other of the intersecting streets/driveways has no curb, the lines are plotted along the edge of the traveled way.

The second sight distance triangle is shown in Figure 6.18.02, and is formed by lines plotted along the flowlines or edge of traveled way of both streets and the diagonal lines d_1 and d_2 as shown. Distance d_1 is measured to vehicles approaching from the left and d_2 is measured to those approaching from the right. The sight lines (d_1 and d_2) have their origin at the stopped driver's eye, located ten feet (10') behind the flowline of the street being entered.

Tables 6.18.01 through 6.18.04 show recommended sight distances d_1, and d_2 for passenger vehicles and semi-tractor trailer trucks for several different vehicle operating speeds and roadway configurations. The tables were developed according to the following general criteria:

1. Vehicles turning left or right can accelerate to the operating speed of the intersecting street without causing approaching vehicles to reduce speed by more than ten miles per hour.

2. Vehicles turning left can clear the near half of the street without conflicting with vehicles approaching from the left.

3. The distance requirements are based on the driver's eye being 3.5 feet above the roadway and an object height of 4.25 feet. For semi-tractor trailers, a ~~six-foot~~six-foot driver's eye height and a 4.25 feet object height are assumed.

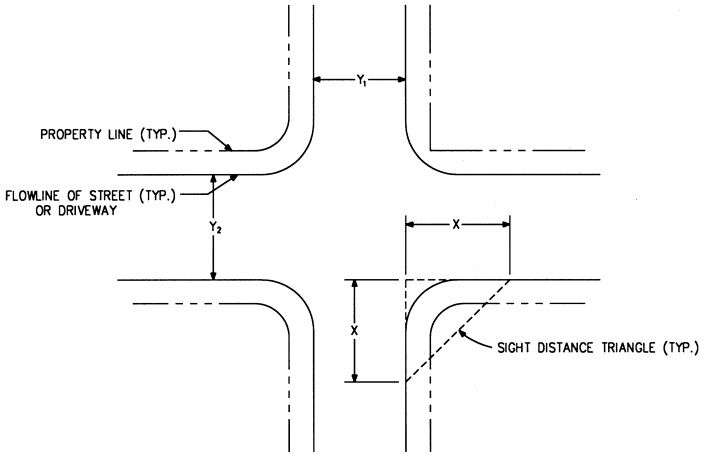
4. The operating speed on each approach is assumed to be (in the order of desirability):

   A. The 85th percentile speed;

   B. The speed limit, if based on a traffic engineering study;

   C. The design speed in the case of a new facility.

SIGHT DISTANCE TIANGLES



NOTE: IF $Y_1 \neq Y_2$ USE THE LARGER OF THE TWO TO DETERMINE THE "LEG LENGTH" OF THE SIGHT DISTANCE TRIANGLE

FLOWLINE TO FLOWLINE (Y)	LEG LENGTH (X)
≤ 36 FT.	35 FT.
≤ 44 FT.	45 FT.
>= 45 FT.	55 FT.

FIGURE 6.18.01

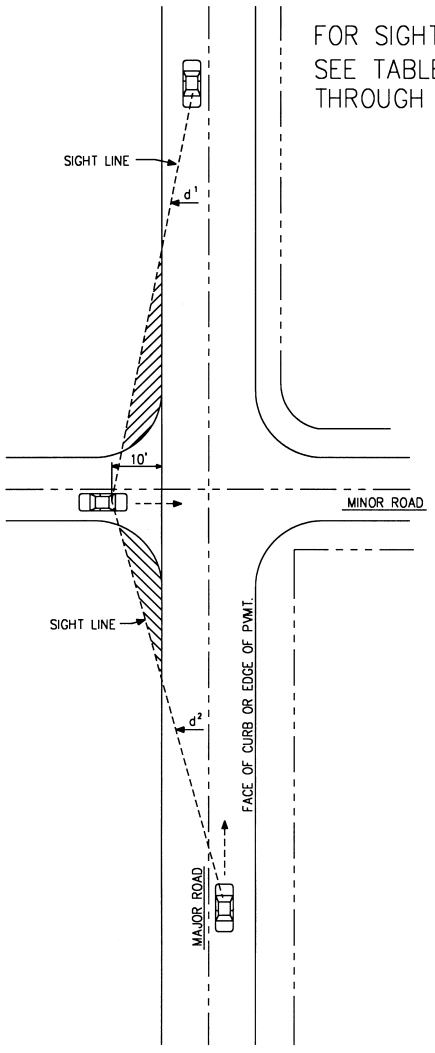


FIGURE 6.18.02

When the criteria for sight distance cannot be met, the City may prohibit certain turns by exiting vehicles to provide safe operating conditions. These standards apply to accesses on State Highways and City streets.

TABLE 6.18.01

Sight Distance (~~feet~~) for Passenger Cars Exiting from Private Accesses or Public Streets onto Two-Lane Roads

Speed (mph)	Safe Sight Distance - Left [1] d_2	Safe Sight Distance - Right [1] d_2
20	150	130
25	240	200
30	350	260
35	430	350
40	530	440
45	610	570
50	740	700
55	830	860
60	950	1,050

[1] Measured from the driver's eye ten feet back of the flowline or pavement edge.

TABLE 6.18.02

Sight Distance (~~feet~~) for Passenger Cars Exiting from Private Accesses or Public Streets onto Four and Six-Lane Roads

Speed (mph)	Safe Sight Distance - Left [1] d_2	Safe Sight Distance - Right [2] d_2
20	130	130
25	180	200
30	220	260
35	300	350
40	380	440
45	500	570
50	620	700
55	760	860
60	950	1,050

[1] Measured from the driver's eye ten feet back of the flowline or pavement edge to a vehicle in the outside lane.

[2] Measured from the driver's eye ten feet back of the flowline or pavement edge to a vehicle approaching in the median lane.

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TABLE 6.18.03

Sight Distance (~~fe~~et) for Semi-Trailers Exiting from Private Accesses or Public Streets onto Two-Lane Roads

Speed (mph)	Safe Sight Distance - Left [1] d_2	Safe Sight Distance - Right [2] d_2
20	300	200
25	400	320
30	680	400
35	850	640
40	1,160	850
45	1,600	1,160
50	2,000	1,600
55	2,500	2,000
60	950	2,500

[1] Measured from the driver's eye ten feet back of the flowline or pavement edge.

[2] Measured from the driver's eye ten feet back of the flowline or pavement edge to a vehicle approaching in the median lane.

TABLE 6.18.04

Sight Distance (~~fe~~et) for Semi-Trailers Exiting from Private Accesses or Public Streets onto Four and Six-Lane Roads

Speed (mph)	Safe Sight Distance - Left [1] d_2	Safe Sight Distance - Right [2] d_2
20	200	200
25	320	320
30	400	400
35	640	640
40	850	850
45	1,160	1,160
50	1,600	1,600
55	2,000	2,000
60	2,500	2,500

[1] Measured from the driver's eye ten feet back of the flowline or pavement edge.

[2] Measured from the driver's eye ten feet back of the flowline or pavement edge to a vehicle approaching in the median lane.

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The sight distance shown in Tables 6.18.05 and 6.18.06 are required for vehicles turning left ~~form~~ from a public street to allow them a clear view of oncoming vehicles and complete the maneuver safely.

TABLE 6.18.05

Sight distance (ft.) for Passenger Cars Entering Private Accesses or Public Streets by Left Turns from a Public Street

	Safe Sight Distance in Feet [1]		
Speed (mph)	2-Lane	4-Lane	6-Lane
20	150	160	170
25	190	200	220
30	230	250	270
35	300	320	340
40	370	390	420
45	450	470	500
50	520	550	580
55	600	630	670
60	700	740	780

[1] Measured from the point where a left turning vehicle stops to a vehicle approaching in the outside lane.

TABLE 6.18.06

Sight distance (ft.) for Semi-Trailers Entering Private Accesses or Public Streets by Left Turns from a Public Street

	Safe Sight Distance in Feet [1]		
Speed (mph)	2-Lane	4-Lane	6-Lane
20	260	280	300
25	330	360	380
30	400	440	480
35	480	540	580
40	570	620	670
45	680	730	800
50	810	880	950
55	910	990	1,060
60	1,000	1,100	1,200

[1] Measured from the point where a left turning vehicle stops to a vehicle approaching in the outside lane.

The sight distances in Tables 6.18.01 and 6.18.04 apply when highway grades are zero to 3.0% (either up or down). When grades are steeper than 3.0%, adjustments must be made to compensate for the different distances required to reach the speed of highway traffic. Adjustment factors are provided in Table 6.18.07.

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TABLE 6.18.07

Factors for the Effect of Grade on Sight Distance

Grade	Downgrade Factor [1]	Upgrade Factor [2]
0 - 3#	1.0	1.0
3.1 - 5%	0.6	1.4
5.1 - 8%	0.5	1.7

[1] When the highway in the section to be used for acceleration after leaving the access descends, sight distance in the direction of approaching descending highway traffic should be reduced by these factors.

[2] When the highway in the section to be used for acceleration after leaving the access ascends, then sight distance in the direction of approaching ascending should be increased by these factors.

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6.19.00 ROADWAY CROWN

6.19.01 Cross Slope

Except at intersections or where superelevation is required, roadways shall be level from top of curb to top of curb (or flowline to flowline) and shall have a minimum two percent (2%) crown. Within one-hundred-fifty feet (150') of an intersection, the maximum elevation difference between flowlines shall be dictated by the allowable intersection grade and the actual distance between flowlines.

(A) Parabolic or curved crowns are not allowed. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street.

(B) The rate of change in pavement cross slope when warping side streets at intersections shall not exceed one percent (1%) every twenty-five feet (25') horizontally on a local roadway, one percent (1%) every thirty-seven-and-one-half feet (37.5') horizontally on a collector roadway, or one percent (1%) every fifty-six-and-one-half feet (56.5') horizontally on arterial roadway.

(C) In the case of conflict caused by requirements of the Storm Drainage Design and Technical Criteria Manual, the drainage requirements shall govern.

6.19.02 Superelevation

Superelevation is required for curves on all arterial roadways and selected collector roadways. Horizontal curve radius on superelevation shall be in accordance with the recommendations of the AASHTO "A Policy on Geometric Design of Highways and Streets", latest edition (Green Book).

Superelevation shall not be used on local or other roadway classifications with a design speed of 40 miles per hour or less. The following procedure is an outline for the correct application of superelevation on roadways within the City of Fort Lupton.

(A) Definitions Regarding Superelevation:

Superelevation Runoff. That length of roadway needed to accomplish the change in cross slope from a section with the adverse crown removed (flat) to the fully superelevated section, or vice versa.

Transition Points. Beginning or ending of tangent run-out, superelevation runoff, or full superelevation.

Tangent Run-Out. That length of roadway needed to accomplish the change in cross slope from a normal (2 percent) crown section to a section with the adverse crown removed (flat), or vice versa.

(B) General:

One of the most important factors to consider in highway safety is the centrifugal force generated when a vehicle traverses a curve. Centrifugal force increases as the velocity of the vehicle and/or the degree of curvature increases. In order to overcome the effects of centrifugal force, curves should be superelevated. It is impossible to balance centrifugal force by superelevation alone because for any given curve radius a certain superelevation rate is exactly correct for only one driving speed. At all other speeds there will be a side thrust either outward or inward, relative to the curve center, which must be offset by side friction.

(C) Standards for Superelevation:

AASHTO's Green Book, Table 111-8 on superelevation give the required rates of superelevation for the various degree of curvature. Maximum superelevation rate of 0.04 foot per foot are commonly used on major streets.

(D) Urban Street Conditions:

Every effort should be made to maintain standard rates of superelevation. However, in urban areas street intersections, established street grades, curbs, and drainage conditions may require a reduction in the rate of superelevation or different rates for each half of the road bed. In warping areas for drainage, adverse superelevations should be avoided.

6.20.00 SIDEWALKS, CURB AND GUTTERS, RAMPS, AND DRIVEWAYS

(A) Roadway typical sections shall be as specified by these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

(B) Sidewalks or bicycle paths shall be constructed on both sides of all roadways unless specifically deleted by action of City of Fort Lupton Planning Department.

(C) All sidewalks used in conjunction with vertical curb and gutter shall have a minimum width of ~~four~~ five-feet (~~4~~5').

(D) Combination curb, gutter, and walk is approved for use on local roadways ~~and minor rural collectors~~ only. Vertical curb, gutter, and detached walk shall be used on all other roadways.

(E) State law requires that handicap ramps be installed at all intersections and at certain mid-block locations for all new construction of curb and sidewalk [CRS 43-2-107(2)]. Handicap ramps shall be constructed in accordance with the detail drawings in the~~se STANDARDS AND~~ CONSTRUCTION SPECIFICATIONS. Handicap ramps may be shown at all curb returns or called out by a general note on the development plans, but must be shown (located) on all "T" intersections. Whenever referencing a handicap ramp, call out the specific detail drawing to construct that ramp. Handicap ramps to be poured monolithic with the abutting curb and gutter. The ramp portion shall be constructed with "Truncated Domes/Detectable Warning Devices" colored "Pavestone River Red" in accordance with the detail drawings.

(F) Drainage structures shall not be placed in line with handicap ramps. Location of handicap ramps shall take precedence over location of the drainage structure.

(G) Curb cuts should not be used for commercial/industrial or high volume residential driveways. In general, when the number of parking spaces services by the driveway exceeds ten (10), radius returns should be used.

(H) Where curb cuts are allowed based on traffic considerations, concentrated storm water runoff must not be discharged across the sidewalk. These flows must be directed to a sidewalk chase section. If this is not possible due to grading restraints, radius returns and a crosspan shall be used.

(I) Curb cuts and driveways shall be constructed in accordance with the detail drawings in these ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS.

6.21.00 CUL-DE-SACS

The following criteria shall be used for cul-de-sac horizontal geometry.

(A) The minimum property line radius shall be fifty feet (~~50'~~55').

(B) The minimum flowline radius shall be forty feet (~~40'~~45'). See the detail drawing in this section.

(C) The maximum length of the cul-de-sac as measured along and between the radius point and the right-of-way line on the abutting street shall be five hundred feet (500') or a maximum of fifteen (15) residential dwelling units, whichever is greater.

(D) Vertical alignment shall be in accordance with Section 6.17.00 of these DESIGN STANDARDS~~STANDARDS AND SPECIFICATIONS~~.

6.22.00 DECELERATION LANES

The design of the arterial street system depends upon the proper control of access to developments. The location and design of access points must minimize traffic hazards and interference to through traffic movements. To ensure proper control, the following standards for deceleration lanes have been established. The need for deceleration lanes is established by the approved traffic study for the final plat or final development plan.

(A) Requests for exemption from the requirements for a deceleration lane shall be based upon a traffic engineering study that presents trip-generation data for the proposed development in terms of impacts upon through traffic flows. Such requests shall be reviewed by the City ~~Traffic~~ Engineer and may be approved, except that such an approval cannot be granted if through traffic would be impeded more than three percent (3%) of the total time, more than five percent (5%) of the time during peak traffic flow periods, or if other unique circumstances warrant special design considerations.

(B) Deceleration lanes may be required along segments of collector streets if the proposed development constitutes a potential for creating a traffic hazard or unnecessarily impedes through traffic movements.

(C) Deceleration lanes shall have a minimum paved width of eleven feet (11') unless otherwise approved at a lesser width by the Public Works Director/City Engineer.

(D) The vehicle storage length of the deceleration lane shall be based upon the peak hour turning volume for the development as follows:

TABLE 6.22.01
Deceleration Lanes

Peak Hour Volume	Minimum Length
35-50	40 Feet
51-60	50 Feet
61-100	100 Feet
101-200	175 Feet
201-300	250 Feet

Deviations from ~~this criteria~~this criterion shall be in accordance with AASHTO *"A Policy on Geometric Design of Highways and Streets"* (Green Book).

(E) The lead-in taper length plus additional deceleration length for the deceleration lane shall be based upon the posted speed limit along the street.

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TABLE 6.22.02
Deceleration Tapers

Speed Limit	Deceleration Length	Taper Ratio*
30 MPH & Under	160 Feet	8:1
35 MPH	250 Feet	12:1
40 MPH	370 Feet	12:1
45 MPH	425 Feet	15:1
50 MPH	500 Feet	15:1

* Taper length equals taper ratio times lane width.

(F) Deceleration lanes shall be provided for all exclusive right-turn access points (i.e., right-in/right-out driveways).

(G) The deceleration lane and the associated signage and pavement marking shall be installed as per the requirements established by the City ~~Traffic Engineer~~Engineer prior to the issuance of any Certificate of Occupancy within the development.

6.23.00 ACCELERATION LANES

At intersections, it is desirable to provide acceleration lanes for vehicles turning right onto the arterial from a cross street. The design elements of these acceleration lanes shall be in accordance with Tables 505.7B and 505.7C of the Colorado Department of Transportation Roadway Design Manual.

6.24.00 BUS PULL-OUT LANES - DELETED

~~If recommended by the Regional Transportation District or required by the City, bus pull-out lanes shall be designed and constructed by the adjacent subdivider.~~

~~(A) The design of the pull-out lanes shall be governed by dimensions shown in Table 6.24.01 and the detail drawing in this section; and shall be reviewed and approved according to procedures set forth in these design standards.~~

~~TABLE 6.24.01~~
~~Bus Pull-Out Lanes~~

~~Speed Limit~~	~~Lead-In Length~~	~~Lead-Out Length~~
~~35 MPH & Under~~	~~60 Feet~~	~~60 Feet~~
~~40 MPH~~	~~100 Feet~~	~~70 Feet~~
~~45 MPH~~	~~150 Feet~~	~~80 Feet~~
~~50 MPH~~	~~200 Feet~~	~~90 Feet~~
~~55 MPH~~	~~250 Feet~~	~~100 Feet~~

~~(B) The pavement design report shall consider the requirements of the pull-out lane separately from the adjacent roadway.~~

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~~(C) Bus pull-outs shall be constructed with no less than fifty feet (50') between an intersection curb return curve (PC) and the beginning of the lead-in taper.~~

6.25.00 OFF-SITE DESIGN

(A) The design grade, and existing ground at that design grade, of all roadways that dead end due to project phasing, subdivision boundaries, etc., shall be continued in the same plan and profile as the proposed design for at least three hundred feet (300') or to its intersection with an arterial roadway.

(B) If the off-site roadway adjacent to the proposed development is not fully improved, the developer is responsible for the design and construction of a transition for the safe conveyance of traffic from his improved section to the existing roadway. The following formula shall be applied to the taper of lane change necessary for this transition:

$L = WS^2/60$

Where:

L = Length of Transition in Feed
W = Width of Offset in Feet
S = Speed Limit or 85th Percentile Speed

(C) The City of Fort Lupton ~~Engineering Division~~Public Works Department should be contacted to establish unusual transition criteria. This contact is the responsibility of the applicant.

6.26.00 BARRICADES

Whenever roadways terminate due to project phasing, subdivision boundaries, etc., barricades are required. Design and construction shall comply with the requirements of the Manual of Uniform Traffic Control Devices, most recent edition. Details shall be shown on the construction drawings, and installation shall be provided by the developer.

6.30.00 PAVEMENT DESIGN AND TECHNICAL CRITERIA

6.31.00 GENERAL

This section provides the basic criteria and design procedures for roadway pavements. Recommended design methodologies for asphalt and Portland cement concrete are addressed and essentially follow the Colorado Department of Transportation methodology. Some standardization of criteria has been made in design procedures.

For all City land development approvals that involve a Public Improvements Agreement for roadway construction, the applicant shall provide a subgrade investigation and pavement design report that recommends typical pavement structural section based on the known site soil conditions and the valid traffic study. This pavement design serves as a justification of the roadway improvements agreement in addition to determining roadway structural requirements.

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6.32.00 SUBGRADE INVESTIGATION

All subgrade investigation shall be in accordance with the procedures outlined in the "Manual" With the more specific criteria as follows:

*The field investigation shall consist of borings or other suitable methods of sampling subgrade soils to a depth of at least three feet (3') below proposed subgrade elevation at spacings of not more than two hundred fifty feet (250') unless otherwise accepted by the Public Works Director/City Engineer. Samples shall be taken after grading is completed and the subgrade is rough cut.

*The treatment of expansive soils shall be in accordance with Section 2.3 of the "Manual" unless approved otherwise, in writing, by the Public Works Director/City Engineer.

*The "Subgrade Resilient Modulus"(Mg) shall be correlated the Resistance Value (R-value) using the formulas in the "Manual", If the Plasticity Index (PI) of the subgrade is more than 15 or the R-value of the soil is less than 10, then the subgrade shall be stabilized with one of the methods outlined in the "Manual".

6.33.00 PAVEMENT DESIGN CRITERIA

6.33.01 General

This section provides the parametric input data to be used for the design of pavements of various roadway classifications.

6.33.02 Equivalent (18 Kip) Single Axle Load Applications (ESAL)

The pavement design procedure in this section provides for a 20-year service life of pavement, given that normal maintenance is provided to keep roadway surface in an acceptable condition. ESAL and Design Traffic Number (DTN) are considered equivalent units based on 20-year design criteria and an 18 Kip axle loading. All data and design nomographs in this chapter use ESAL units for pavement loading repetitions. Minimum ESAL criteria for each City of Fort Lupton roadway classification are given in Table 6.33.02 and are to be used when a traffic study indicates lesser ESAL values.

TABLE 6.33.02
Minimum Equivalent (18 Kip) Single Axle Load Applications (ESAL)

Classification	Class Modifier	ESAL Values
Cul-de-Sac	Serving < 10 D.U.	14,600
Local	Serving < 80 D.U.	36,000
Minor Collector	Residential	219,000
	Commercial	365,000
Major Collector`	All	730,000
~~Minor~~ Arterial	All	1,460,000
~~Major Arterial~~	~~All~~	~~1,460,000~~

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(1) ESAL for major arterial roadways shall be set on a case-by-case basis; 1,460,000 is the recommended minimum for planning purposes.

6.33.03 Design Serviceability Loss (APSI)

The following criteria shall be used for all City of Fort Lupton roadways to be dedicated for public use: ASI is based on an initial serviceability index of 4.5 and is the value to use in the CDOT procedure.

TABLE 6.33.03
Serviceability Index and Loss

Roadway Classification	SI	ASI
Arterials (Minor, Major)	2.5	2.0
Collectors:		
Major	2.5	2.0
Minor Commercial	2.5	2.0
Minor Residential	2.5	2.0
Local and Private Parking Lots	2.0	2.5

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6.33.04 Reliability

Reliability is the probability that the pavement system will perform its intended function over its design life (or time) and under the conditions (or environment) encountered during operation.

TABLE 6.33.04
Reliability (Risk)

Functional Classification	Reliability
Principal Arterials	95
Minor Arterials	95
Collectors	90
Local	80

6.33.05 Minimum Pavement Section

This paragraph provides the minimum acceptable pavement sections for public roadways in the City of Fort Lupton. These pavement thicknesses may be used for preliminary planning purposes. Final pavement designs must be based on actual subgrade support test results. Table 6.33.04 lists these minimum thicknesses for each roadway classification.

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TABLE 6.33.05

Minimum Pavement Sections

Classification	Composite Section Asphalt Inches	Treated Subgrade	Full Depth Asphalt (Inches)	Portland Cement (2) Concrete (Inches)
Cul-de-Sac (1)	--	--	6.0	6.0
Local	4	8	5.0	5.0
Minor Collector				
(A) Residential	4	8	7.0	5.0
(B) Commercial	4	8	7.0	5.5
Major Collector	4	8	7.0	5.5
Minor Collector	5	8	7.0	6.0
Major Arterial	6	8	9.0	6.0

(1) All cul-de-sacs shall be the minimum full depth shown or the full depth determined by the subgrade support tests, whichever is greater.

(2) Concrete streets are only allowed with specific written approval of the City Engineer.

(3) "Full Depth Asphalt" is required on all "Public Streets". Composite sections will only be allowed ~~W~~when specifically approved by the City Engineer.

6.33.06 Flexible Pavement Strength Coefficients

Table 6.33.06 contains the standard design coefficients for various pavement materials. Non-standard design coefficients may be used only if approved in advance by the Public Works Director/City Engineer. In addition, design values shall be verified by predesign mix test data and supported by daily construction tests or redesign values shall be required; i.e., such as add one-half inch (1/2") to one inch (1") to the in-place surface course of final asphalt concrete.

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TABLE 6.33.06

Strength Coefficients

Pavement Structure Component*	Structural Layer Coefficients		(Limiting Test Criteria)
Conventional Materials:			
Hot Bituminous Pavement	0.44		
Exist Bituminous Pavement	0.30	(9-15 yr)	
	0.24	(> 15 yr)	
Aggregate Base Course	0.14	(R≥83)	
Aggregate Base Course	0.12	(77≤R-value<83)	
Aggregate Base Course	0.11	(69≤R-value<77)	
Aggregate Base Course	0.10	(R-value <69	
Treated Materials:			
Cement-Treated Aggregate Base	Refer to the "Manual"		
Lime-Treated Subgrade	Refer to the "Manual"		

*The combination or one or more of the following courses placed on a subgrade to support the traffic loading and distribute it to the road bed.

(A) Subbase. The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course, surface course, or both.

(B) Base Course. The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course.

(C) Surface Course. One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called "wearing course."

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6.34.00 PAVEMENT DESIGN PROCEDURE

6.34.01 Flexible Pavements

(A) The following procedure should be used in determining the structural number (SN) of the pavement being designed.

1. Determine roadway classification and corresponding ESAL (Traffic Study or Table 6.33.02 whichever is greater).

2. Determine the serviceability loss (ASI) of the roadway classification (Table 6.33.03).

3. M_R value of subgrade as determined by soils report from laboratory and/or correlation equation below:

   Convert Hveem "R" to Soil Support

   $S_1 = [(\text{"R"} - 5)/11.29] + 3$

   To Convert S_1 to M_R

   $M_R = 10^{[S_1 + 18.72]/6.24}$

4. Structural Layer Coefficients (Table 6.33.06)

5. Overall deviation, So, which is 0.44 for flexible pavement.

6. Reliability, R, (see Table 6.33.04)

7. Use nomograph (Table 6.34.01) or use the AASHTO pavement design software,DARWin™ to obtain the Structural Number (SN).

8. Once the structural number (SN) has been determined, the design thicknesses of the pavement structure can be determined by the general equation:

$SN = a_1 D_1 + a_2 D_2 + a_3 D_3 + \ldots$

Where:

a_1 = Hot Bituminous Pavement (HBP) strength coefficients

D_1 - Thickness of Hot Bituminous Pavement (HBP) (inches)

D_2, D_3, D_n - Thickness of Additional Pavement Component Sections (inches)

a_2, a_3, a_n - Strength coefficient for the corresponding pavement structure *

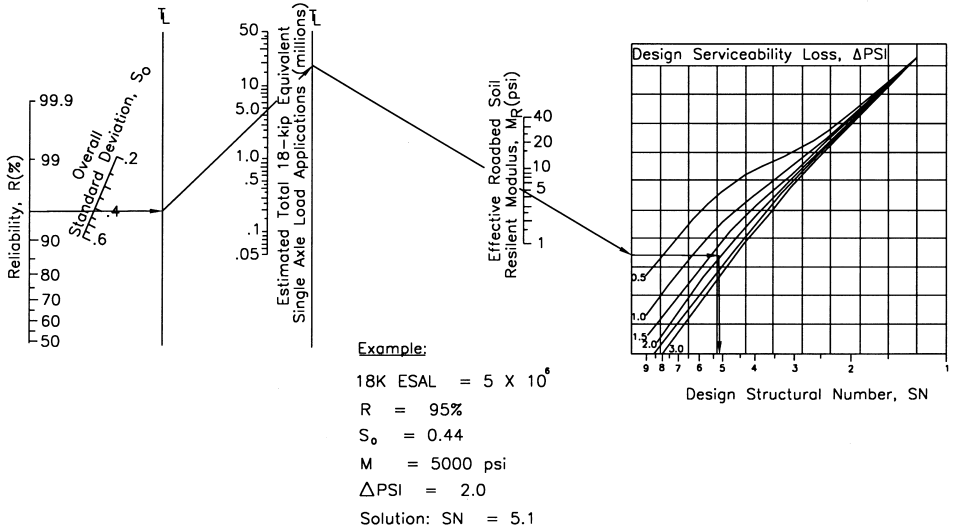
- The Strength coefficients for various components of the pavement structure are given in Table 6.33.06. The component thickness selected must meet two conditions:

a. Total HBP thickness selected cannot be less than the minimum specified in Table 6.33.05 for the roadway classification

b. The base course thickness cannot exceed 2.5 times the HBP thickness selected. If a base course section is allowed, in writing, by the ~~Public Works Director/~~City Engineer.

NOMOGRAPH SOLVES:

$$\log_{10}18^{K}\text{ESAL} = Z_R * S_o + 9.36*\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32*\log_{10}M_R - 8.07$$



Example:

18K ESAL = 5 X 10^6

R = 95%

S_o = 0.44

M = 5000 psi

ΔPSI = 2.0

Solution: SN = 5.1

TABLE 6.34.01

Flexible Pavement Design

6.34.02 Rigid Pavement

If rigid pavement is allowed by the City Engineer, the procedures in the "Manual" should be followed.

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6.35.00 SUBGRADE INVESTIGATION AND PAVEMENT DESIGN REPORT

The report shall be prepared by or under the supervision of and signed and sealed by a Professional Engineer registered in the State of Colorado and shall include the following information:

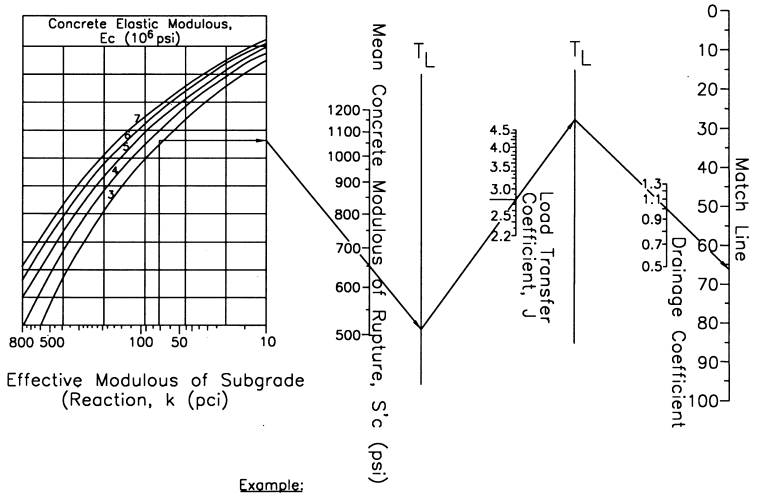
(A) Vicinity map to locate the investigated area.

(B) Scaled drawings showing the location of borings.

(C) Scaled drawings showing the estimated extent of subgrade soil types and EDLA for each street.

NOMOGRAPH SOLVES:

$$\log_{10}18^{K}ESAL = Z_R * S_o + 7.35*\log_{10}(D+1) - 0.06 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.5-1.5}\right]}{1+\frac{1.624*10^7}{(D+1)^{8.46}}} + (4.22-0.32p_t)*\log_{10}\left[\frac{S'c*Cd\left[D^{0.75}-1.132\right]}{215.63*J\left[D^{0.75}-\frac{18.42}{(Ec/k)^{0.25}}\right]}\right]$$



Example:

k = 72 pci
Ec = 3.4x10 psi
S'c = 650 psi
J = 2.8
Cd =1.0

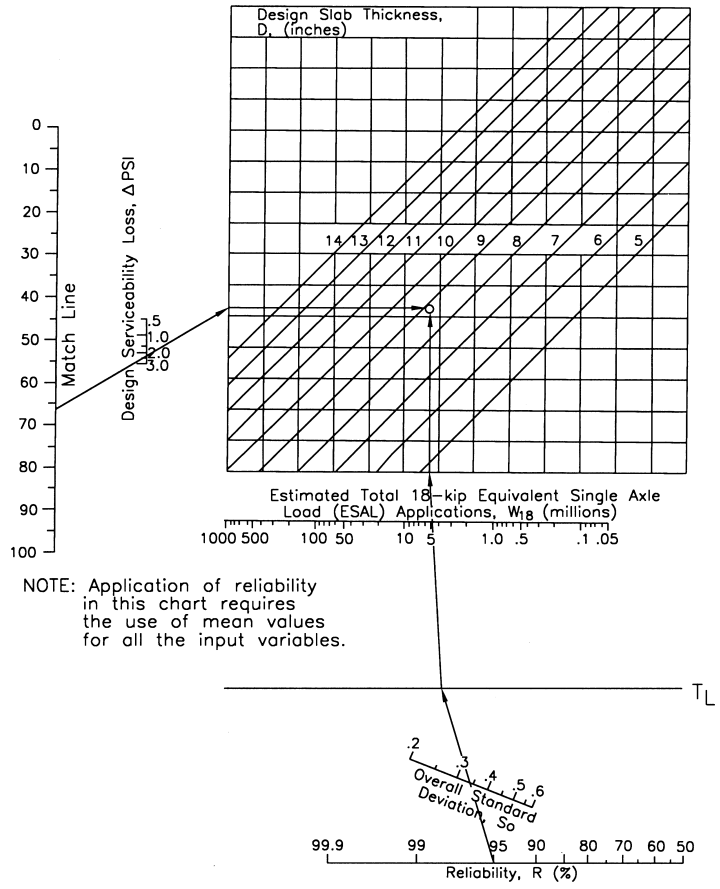
So =0.34
ΔPSI = 4.0−2.5=2.0
18K ESAL = 5.1 X 10^6
Solution: D=9.0 inches (nearest half−inch, from segment 2)

Design chart for rigid pavement based on using mean values for each input variable(Segment 1)

TABLE 6.34.02
Rigid Pavement 1of 2

TABLE 6.34.02

Rigid Pavement 2 of 2



Design chart for rigid pavements based on using mean values for each input variable (Segment 2).

(D) Pavement design alternatives for each street on a scaled drawing.

(E) Tabular listing of sample designation, sample depth, group number, liquid limit, plasticity index, percent passing the No. 200 sieve, AASHTO classification, group index, and soil description.

(F) CBR (R-value) test results of each soil type used in the design.

(G) Pavement design nomographs properly drawn to show soil support -- ESAL - SN.

(H) Design calculations.

(I) A discussion regarding potential subgrade soil problems including, but not limited to:

1. Heave or settlement-prone soil.

2. Frost-susceptible soils.

3. Ground water.

4. Drainage considerations (surface and subsurface).

5. Cold-weather construction (if appropriate).

6. Other factors or properties which could affect the design or performance of the pavement system.

(J) Recommendations to alleviate or mitigate the problems discussed in Items 1 through 6 above.

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CHAPTER 8
TRAFFIC CONTROL

8.00.00 INTRODUCTION

8.01.00 GENERAL

The standards contained in this chapter regulate all improvements and private work to be dedicated to the public and accepted by the City and all work within the public right-of-way. They are intended to provide for adequate, coordinated, modern development with required facilities to serve and protect the potential users of the various areas of the community.

The standards in this chapter apply to new developments which are not constrained by already existing improvements. This chapter is not to be applied without qualification to in-fill development. In-fill development in an urban area is often constrained by existing improvements. To the extent deemed possible by the City, in-fill developments shall be required to conform to these DESIGN STANDARDS ~~AND SPECIFICATIONS~~. The City may allow modification of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS when necessary to allow private and public construction which is compatible with surrounding in-place improvements.

8.02.00 GLOSSARY OF TERMS

AASHTO -- American Association of State Highway and Transportation Officials

Acceleration Lane -- A speed change lane, including tapered areas, for the purpose of enabling a vehicle entering a roadway to increase its speed to a rate at which it can more safely merge with through traffic.

Access -- Driveway or other point of access such as a street, road, or highway that connects to the general street system. Where two public roadways intersect, the secondary roadway shall be the access.

Approach -- The portion of an intersection leg which is used by traffic approaching the intersection.

Average Daily Traffic (ADT) -- The total bi-directional volume of traffic passing through a given point during a given time period, divided by the number of days in that time period.

Band Width -- The time in seconds or the percent of cycle between a pair of parallel lines which delineate progressive movement on a time-space diagram. It is a quantitative measurement of through traffic capacity provided by signal progression.

Capacity -- The maximum number of vehicles that have a reasonable expectation of passing over a given roadway or section of roadway in one direction during a given time period under prevailing roadway and traffic conditions.

Critical Volume -- A volume (or combination of volumes) for a given street which produces the greatest utilization of capacity for that street in terms of passenger cars or mixed vehicles per hour.

Cycle Time -- The time period in seconds required for one complete sequence of signal indications.

Deceleration Lane -- A speed change lane, including tapered areas, for the purpose of enabling a vehicle that is to make an exit turn from a roadway to slow to a safe turning speed after it has left the main stream of faster-moving traffic.

Delay -- Stopped time per approach vehicle in seconds per vehicle.

Design Hour Volume (DHV) -- Hourly traffic volume used for street design and capacity analysis, usually one or more peak hours during a twenty-four (24) hour period.

Design Speed -- Five to ten miles per hour (5-10 mph) above the proposed or desired speed limit of the facility under design.

Design Vehicle -- Developments intended for public use must be designed for the following types of vehicles:

Residential (excluding single-family or duplex)	SU30
Commercial Uses	WB40
Industrial Uses	WB50

For public streets, the following design vehicles must be used:

Commercial/Multi-Family Locals & Minor Collectors	SU30
Major Collectors	WB40
Arterials	WB50

Definitions for the above vehicle types are found in AASHTO Geometric Highway Design Standards.

Divided Highway -- A highway with separated roadways for traffic in opposite directions, such separation being indicated by depressed dividing strips, raised curbings, traffic islands, other physical separations, or by standard pavement markings and other traffic control devices.

Fire Trucks -- Must be considered as a WB40 truck with a minimum forty-five-foot (45') radius for design purposes.

Flowline -- The transition point between the gutter and the face of the curb. For a cross or valley pan, it is the center of the pan.

Grade -- Rate or percent of slope, either ascending or descending from or along the highway. It is usually measured along the centerline of the highway or access.

Green Time -- The length of a green phase plus its change interval, in seconds.

Hourly Volume -- The number of (mixed) vehicles that pass over a given section of a lane or roadway during a time period of one (1) hour.

Level of Service (LOS) -- A measure of the mobility characteristics of an intersection as determined by vehicle delay and a secondary factor, the volume/capacity ratio.

MUTCD -- Manual on Uniform Traffic Control Devices and the Colorado Supplement.

Sight Distance -- The length of roadway ahead visible to the driver. The minimum sight distance available should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

Signal Progression -- Progressive movement of traffic at a planned rate of speed through adjacent signalized locations within a traffic control system without stopping.

Speed Change Lane -- A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase (acceleration lane) or decrease (deceleration lane) its speed to a rate at which it can more safely merge or diverge with through traffic.

Stopping Sight Distance -- The distance traveled by the vehicle from the instant the driver of a vehicle sights an object necessitating a stop to the instant the brakes are applied and the distance required to stop the vehicle from the instant brake application begins.

Storage Lane -- Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during a critical period without interfering with the through lanes.

Time Space Diagram -- A chart on which the distance between signals and signal timing is plotted against time. The chart, when completed, indicates signal progression band widths and speed of traffic.

8.10.00 DESIGN STANDARDS

8.10.01 Responsibilities for Traffic Studies

Traffic studies may be required by the City in order to adequately assess the impacts of a development proposal on the existing and/or planned street system. The primary responsibility for assessing the traffic impacts associated with a proposed development shall rest with the developer, with the City serving in a review capacity.

Unless waived by the Public Works ~~Director/City Transportation Engineer~~Director, a written study meeting the criteria contained in this chapter shall be required for a development proposal when trip generation during the AM or PM peak hour is expected to exceed one hundred (100) vehicles, as determined by the ~~City Transportation Engineer~~City Engineer. This study shall be the responsibility of the applicant and shall be prepared by a Professional Engineer registered in the State of Colorado, with adequate experience in transportation engineering. Upon submission of a draft traffic study, the Public Works ~~Director/City Transportation Engineer~~Director will review the study data sources, methods, and findings. Comments shall be provided in a written form. The developer and the project engineer will then have an opportunity to incorporate necessary revisions prior to submitting a final report. All studies shall be approved by the Public Works ~~Director/City Transportation Engineer~~Director before acceptance. The following submittals will require traffic studies:

(A) A rezoning application or an application for annexation into the City.

(B) A preliminary map or final plat if the property has already been rezoned for the proposed use and no traffic study was required for the rezoning, or the land use assumptions at the time of platting will result in trip generation increasing by more than fifteen percent (15%) compared to trip generation estimates made for the traffic study at the time of rezoning.

(C) Prior to issuance of a building permit, if the property has already been zoned/platted and no previous traffic study less than two (2) years old exists.

(D) The applicant shall be required to submit a new traffic study if, after submitting the original traffic study for any of the above submittals, the land use intensity is increased by more than fifteen percent (15%), or the land use is changed so that trip generation is increased by more than fifteen percent (15%).

All previous traffic studies relating to the development that are more than two (2) years old shall be updated, unless the Public Works ~~Director/City Transportation Engineer~~Director determines that conditions have not changed significantly. Where access points are not defined or a site plan is not available at the time the traffic study is prepared, additional traffic analysis may be required when a site plan becomes available or the access points are defined.

The applicant will be notified at the pre-planning stage if a traffic study will be required, provided sufficient information is available for the City to determine whether the trip generation criterion has been met. If insufficient information is available but the property appears to involve a sufficiently intense land use, the applicant will be informed that a traffic study is required.

Transportation consultants are required to discuss projects with the Public Works ~~Director/City Transportation Engineer~~Director prior to starting the study. As a minimum, topics for possible discussion at such meeting shall include trip generation, directional distribution of traffic, trip assignment, definition of the study area, intersections requiring capacity/level of service analysis, and methods for projecting build-out volume. This will provide a firm base of cooperation and communication between the City, the owner or developer, and the project's consultants in forecasting future traffic characteristics which realistically define traffic movement associated with the proposed development. Specific requirements will vary depending on the site location.

8.10.02 Traffic Study Format

In order to provide consistency and to facilitate staff review of traffic studies, the following format shall be followed in the preparation of such studies by transportation consultants.

(A) Introduction:

The introduction portion of the report must contain the following:

1. A note stating the following: “We acknowledge that the City of Fort Lupton’s review of this study is only for general conformance with submittal requirements, current design criteria and standard engineering principles and practices. WE are also aware of the provisions of section 11-6-5(B)3 of the City Code of the City of Fort Lupton.

2. A brief description of the size of the land parcel, general terrain features, the location within the jurisdiction and the region shall be included in this section. In addition, the roadways that afford access to the site and are included in the study area shall be identified. The exact limits of the study area should be based on engineering judgment and an understanding of existing traffic conditions surrounding the site. In all instances, however, the study area limits shall be mutually agreed upon by the developer, his engineer, and the Public Works ~~Director/City Transportation Engineer~~Director. A vicinity map that shows the

site and the study area boundaries in relation to the surrounding transportation system shall be included.

3. The existing and proposed uses of the site shall be identified in terms of the various zoning categories of the City. In addition, the specific use for which the request is being made shall be identified, if known, since a number of uses may be permitted under the existing ordinances. It shall be the intent of the traffic study to evaluate the worst case traffic impacts for the proposed development allowed by the zoning. If several different uses are permitted by the zoning, the highest trip generation shall be assumed for the study.

4. A complete description (including a map) of the existing land uses in the study area, as well as their current zoning and use, shall be included. In addition, all vacant land within the study area and its assumed future uses shall be identified. This latter item is especially important where large tracts of undeveloped land are in the vicinity of the site and within the prescribed study area. Generally, much of this information can be obtained from the City's Planning Division staff.

5. Within the study area, the applicant shall describe and provide volumes for existing roadways and intersections, including geometrics and traffic signal control, as well as improvements contemplated by all affected government agencies. This would include the nature of the improvement project, its extent, implementation schedule, and the agency or funding source responsible. A map shall be provided showing the location of such facilities.

(B) Trip Generation and Design Hour Volumes:

A summary table listing each type of land use, the size involved, the average trip generation rates used (total daily traffic and a.m./p.m. peaks) and the resultant total trips generated shall be provided. Trip generation shall be calculated for the maximum uses allowed under the existing and proposed zoning based on the latest data contained within the Institute of Transportation Engineers (ITE) Trip Generation Manual; or other applicable sources. In the event that data is not available for the proposed land use, the City must approve estimated rates prior to acceptance. The calculation of design hour volumes used to determine study area impacts shall be based on:

1. Peak hour trip generation rates as published in the ITE Trip Generation Summary or other applicable sources.

2. Traffic volume counts for similar existing uses if no published rates are available.

3. Additional sources from other jurisdictions, if acceptable to the ~~City Transportation Engineer~~City Engineer.

Use of reduction factors to account for passerby traffic may be considered upon approval of the Public Works ~~Director/City Transportation Engineer~~Director. Internal trip reductions and modal split assumptions will require analytical support to demonstrate how the figures were derived and will require approval by the Public Works ~~Director/City Transportation Engineer~~Director.

(C) Trip Distribution:

The estimates of percentage distribution of trips from the proposed development to destinations in the metro region shall be clearly stated in the report using the north, south, east, and west compass points. Market studies and information concerning origin of trip attractions to the proposed development may be used to support these assumptions where available. A map showing the percentage of site traffic on each street shall be provided as part of the traffic study graphic material.

(D) Trip Assignment:

The direction of approach of site-generated traffic via the area's street system shall be presented in this section. The technical analysis steps, basic methods, and assumptions used in this work shall be clearly stated and agreed to by the Public Works ~~Director/City Transportation Engineer~~Director. The assumed trip distribution and assignment shall represent the most logically traveled routes for drivers accessing the proposed development. These routes can be determined by observation of travel patterns to existing land uses in the study area.

(E) Existing and Project Traffic Volumes:

Graphics shall be provided which show the following traffic impacts for private access points, public intersections, and public streets.

1. A.M. peak-hour site traffic (in and out), including turning movements.

2. P.M. peak-hour site traffic (in and out), including turning movements.

3. A.M. peak-hour total traffic (in and out), including site-generated traffic. These volumes must include through and turning movement volumes for current conditions and separate set of numbers that also include twenty (20) year projections or build-out, whichever is specified by the Public Works ~~Director/City Transportation Engineer~~Director.

4. P.M. peak-hour total traffic (in and out), including site-generated traffic. These volumes shall include through and turning movement volumes for current conditions and a separate set of numbers that also include twenty (20) year projections or build-out, whichever is specified by the Public Works ~~Director/City Transportation Engineer~~Director.

5. Any other peak hour which may be critical to site traffic and the street system in the study area should be included in the graphics and show the same information as is provided for the a.m./p.m. peak hours.

6. Actual counts of existing total daily traffic for the street system in the study area at the time the study is being prepared.

7. Projected total daily traffic for the street system in the study area based on traffic from the proposed development and counts of existing daily traffic obtained in Item 6 above. The component of the existing daily traffic attributable to the

existing uses shall be identified and the increase in total daily traffic from the proposed uses.

8. Projected total daily traffic for the street system in the study area based on traffic from the proposed development, counts of existing daily traffic obtained in Item 6 above, traffic projections based on build-out of land use within the study area, or a twenty (20) year projection, whichever is specified by the Public Works ~~Director/City Transportation Engineer~~Director.

All raw traffic count data, including average daily volumes and peak-hour turning movements, and analysis worksheets shall be provided in the appendices of the report. Computer techniques and the associated printouts may be used as part of the report. Volume projections for background traffic growth will be provided by the Public Works ~~Director/City Transportation Engineer~~Director or, alternatively, a method for determining these volumes will be recommended by the ~~City Transportation Engineer~~City Engineer. All total daily traffic counts shall be actual machine counts and not based on factored peak-hour sampling. Latest available machine counts from the Colorado Department of Transportation, the City, and other agencies may be acceptable if not more than two (2) years old.

(F) Level of Service:

Level of Service "C" shall be the design objective for all movements, and under no circumstances will less than level of Service "D" be accepted for site and non-site traffic, including existing traffic at build-out of the study area. The design year will be approximately twenty (20) years following construction and include volumes generated by build-out of the study area or a twenty (20) year projection in background traffic, whichever is specified by the Public Works ~~Director/City Transportation Engineer~~Director. The following interpretations of "Level of Service" have been provided:

Level of Service A. A condition of free flow with low-traffic density where no vehicle waits longer than one (1) signal cycle.

Level of Service B. A stable flow of traffic where only on a rare occasion do drivers wait through more than one (1) signal cycle.

Level of Service C. Still in the zone of stable flow but intermittently, drivers must wait through more than one (1) signal cycle and back-ups may develop behind left-turning vehicles.

Level of Service D. Approaching instability, drivers are restricted in their freedom to change lanes and delays for approaching vehicles may be substantial during peak hours.

Level of Service E. Traffic volumes are near or at the capacity of the arterial and long queues of vehicles may create lengthy delays, especially for left-turning vehicles.

Level of Service F. Congested condition of forced traffic flow where queued back-ups from locations downstream restrict or prevent movement of vehicles out of the approach creating a storage area during part or all of the peak hour.

(G) Capacity Analysis:

A capacity analysis shall be conducted for all public street intersections impacted by the proposed development and for all private property access points to streets adjacent to the proposed development and within the limits of the previously defined study area. The a.m., p.m., and any other possible peak period shall be tested to determine which peak hours need to be analyzed. Capacity calculations should also include an analysis for the twenty- (20) year projections or study area build-out conditions. The capacity analysis calculations should be based on the latest approved techniques as published in the latest update of TRB Special Report 209. All capacity analysis worksheets shall be included in the appendices of the report.

(H) Traffic Signals:

The need for new traffic signals shall be based on warrants contained in the Manual on Uniform Traffic Control Devices and any additional warrants established by the National Committee on Uniform Traffic Control Devices. In determining the location of a new signal, traffic progression is important. Generally, a spacing of one-half (1/2) mile for all signalized intersections should be maintained. This spacing is desirable to achieve good speed, capacity, and optimum signal progression. Pedestrian movements shall be considered in the evaluation and adequate pedestrian clearance provided in the signal cycle split assumptions.

To provide flexibility for existing conditions and ensure optimum two-way signal progression, an approved traffic engineering analysis shall be made to properly locate all proposed accesses that may require signalization. The section of roadway to be analyzed for signal progression will be determined by the City and will include all existing and possible future signalized intersections.

The progression pattern calculations shall use a cycle consistent with current signal-timing policies of the City. A desirable band width of fifty percent (50%) of the signal cycle shall be used where existing conditions allow. Where intersections have no signals presently but are expected to have signals, typically a sixty percent (60%) mainline, forty percent (40%) cross-street cycle split should be assumed. Cycle split assumptions shall relate to volume assumptions in the capacity analysis of individual intersections, and where computerized progression analysis techniques are used they shall be the type which utilize turning-movement volume data and pedestrian clearance times in the development of time/space diagrams. The green time allocated to the cross street shall be considered no less than the time which is required for a pedestrian to clear the main street using the Manual on Uniform Traffic Control Devices standards. Those intersections which would reduce the optimum ban width if a traffic signal were installed may be required by the City to remain unsignalized and have turning movements limited by access design or median islands.

(I) Traffic Accidents:

Traffic accident data for affected street corridors may be required for the study. The study period will normally be three (3) years. Such locations will be specified by the Public Works ~~Director/City Transportation Engineer~~Director. Where this is necessary, estimates of increased or decreased accident potential shall be evaluated for the development, particularly if the proposed development might impact existing traffic

safety problems in the study area, and safety improvements recommended where necessary.

(J) Noise Attenuation:

If a residential development is planned adjacent to a freeway or arterial roadway, the need for noise attenuation measures may be required as part of the impact analysis. It is recommended that the need for noise attenuation measures be determined using the methods outlined in Fundamentals and Abatement of Highway Traffic Noise Textbook, FHWA, September 1980.

(K) Recommendations:

In the event that analysis indicates unsatisfactory levels of service on study area roadways, a description of proposed improvements to remedy deficiencies shall be included. These proposals would include projects by the City or the Colorado Department of Transportation for which funds have been appropriated and obligated. The assumptions regarding all future roads and laneages in an analysis will require approval from the Public Works ~~Director/City Transportation Engineer~~Director. In general, the recommendation section should include:

1. Proposed Recommended Improvements. This section must describe the location, nature, and extent of proposed improvements to assure sufficient roadway capacity. A sketch of each improvement should be provided showing the length, width, and other pertinent geometric features of the proposed improvements.

2. Level of Service Capacity Analysis at Critical Points. Another iteration of the operational analysis shall be described which demonstrates the anticipated level of service as a result of making these improvements. This level of service must be "D" or better.

3. Traffic Volume Proportions. Percentages based on the traffic impact analysis may be required by the City to determine the proportion of traffic using various public improvements (both existing and proposed) from several developments within the study area.

(L) Conclusions:

This last section of the report must be a clear, concise description of the study findings explained in a manner that a citizen could understand as the language in this section will be inserted into the Planning Commission and City Council agenda memorandums. At minimum, the summary will include information pertaining to existing site generated traffic, impacts and mitigation measures and when they will be implemented.

(M) Revisions to Traffic Study:

Revisions to the traffic study shall be provided as required by the Public Works ~~Director/City Transportation Engineer~~Director. The need to require revisions will be based on the completeness of the traffic study, the thoroughness of the impact evaluation, and the compatibility of the study with the proposed access and development plan.

8.10.03 Summary of Typical Study Contents

(A) Introduction:

1. Land Use, Site, and Study Area Boundaries (provide map)
2. Existing and Proposed Site Uses
3. Existing and Proposed Uses in Vicinity of Site (provide map)
4. Existing and Proposed Roadway and Intersections (provide map)

(B) Trip Generation and Design Hour Volumes (provide table)

(C) Trip Distribution (provide figure)

(D) Trip Assignment (provide figure)

(E) Existing and Projected Traffic Volumes (provide figure for each item):

1. A.M. Peak Hour Site Traffic (including turning movements)
2. P.M. Peak Hour Site Traffic (including turning movements)
3. A.M. Peak Hour Total Traffic (including site-generated traffic and projected traffic)
4. P.M. Peak Hour Total Traffic (including site-generated traffic and projected traffic)
5. Any Other Peak Hour Necessary for Complete Analysis
6. Total Daily Existing Traffic for Street System in Study Area
7. Total Daily Existing Traffic for Street System in Study Area and New Site Traffic
8. Total Daily Existing Traffic for Street System in Study Area plus New Site Traffic and Projected Traffic from Build-Out of Study Area Land Uses

(F) Level of Service

(G) Capacity Analysis (provide analysis sheets in appendices)

(H) Traffic Signals (provide analysis sheets in appendices)

(I) Traffic Accidents (optional) (provide collision diagrams and accident rates)

(J) Noise Attenuation

(K) Conclusions

(L) Recommendations:

1. Proposed Recommended Improvements (provide sketches of improvements)

2. Volume/Capacity Analysis at Critical Points (provide analysis sheets in appendices

3. Traffic Volume Proportions

NOTE: Information required on figures may be combined provided that the information is clearly legible.

8.11.00 ACCESS REQUIREMENTS AND CRITERIA

8.11.01 General

New access to City streets and roadways is approved through one of the two mechanisms:

-- For new developments, access is granted through City Council approval of the Preliminary Development Plan; or

-- To obtain access to City streets from existing developed property, the mechanism is dependent upon zoning.

(A) For Planned Unit Developments, new or altered access shall be obtained through the City Preliminary or Official Development Plan amendment process. This involves applying through the Planning Division for an amendment to the appropriate development plan. The application should be accompanied by appropriate plans for the proposed access and technical justification, including justification for the extent of the improvements proposed at the access point.

(B) For property classified as a standard zoning district (other than Planned Unit Development), the application should be made to the Planning Division and accompanied by plans of the proposed access and technical justification for the access and associated public improvements.

The Community Development Staff is available to provide advice on the extent of technical justification required for any access request. It is recommended that this advice be sought prior to submitting any application.

8.11.02 State Highways

(A) Access to state highways is governed by the State Highway Access Code.

(B) The City of Fort Lupton has delegated its authority to administer the State Highway Access Code to the Colorado Department of Transportation who is, therefore, responsible for the review of issuance of access permits to State Highways in the City of Fort Lupton.

8.11.03 ~~Principal~~ Arterials

(A) A ~~publicway~~ ROW Access permit shall be obtained from the Public Works Director~~/City Engineering Division~~ for any public or private access constructed on an ~~major~~ arterial.

(B) Private, direct access to ~~major~~ arterials shall be permitted only:

-- When the property in question has no other reasonable access to the general street system; or

-- When denial of direct access to the ~~major~~ arterial and alternative direct access to another roadway would cause unacceptable traffic operation and safety problems to the overall traffic flow of the general street system.

When direct private access must be provided, the following shall be considered:

1. Such access shall continue only until such time that some other reasonable access to a lower function category street is available and permitted. The ~~publicway~~ ROW Access permit should specify the future reasonable access location(s), if known, and under what circumstances what changes will be required.

2. No more than one (1) access shall be provided to an individual parcel or to contiguous parcels under the same ownership unless it can be shown that allowing only one access conflicts with safety regulations (i.e.; fire access) or if additional access would significantly benefit safety and operation of the highway and is necessary to the safe and efficient use of the property.

3. An access shall be limited to right turns only unless it has the potential for signalization, left turns would not create unreasonable congestion or safety problems and lower the level of service, or if alternatives to the left turns would not cause unacceptable traffic operation and safety problems to the general street system.

(C) Public direct access to a major arterial where left turns are to be permitted shall meet the signal-spacing criteria under Section 8.11.03 of this chapter. Those that do not meet these requirements shall be limited to right turns only, unless they meet the requirements mentioned in Section 8.10.02 above. No local streets shall be permitted to intersect major arterials.

(D) Spacing and Signalization:

1. In general terms, full access to major arterials shall be limited to one-half (1/2) mile intervals, plus or minus approximately two hundred feet (200'), in order to achieve good speed, capacity, and optional signal progression.

2. To provide flexibility for both existing and future conditions, an approved engineering analysis of signal progression shall be made to properly locate any proposed access that may require signalization.

8.11.04 Minor Arterials

(A) A ~~publicway~~ROW Access permit shall be obtained from the Public Works Director/City Engineering Division for any public or private access constructed to a minor arterial.

(B) Private direct access onto a minor arterial will be permitted if it does not have the potential for signalization; if it does have the potential for signalization; and it meets the signal-spacing requirements for intersecting public streets stated below and does not interfere with the location, planning, and operation of the general street system and access to nearby properties.

(C) Public direct access to a minor arterial where left turns are to be permitted shall meet the following signal-spacing criteria. Those that do not meet these requirements shall be limited to right turns only, unless they meet the requirements of Section 8.11.02(B) above. No local streets shall be permitted to intersect minor arterials.

(D) Spacing and Signalization:

1. In general terms, full access to minor arterials shall be limited to one-half (1/2) mile intervals, plus or minus approximately one hundred feet (100'), in order to achieve good speed, capacity, and optional signal progression.

2. To provide flexibility for both existing and future conditions, an approved engineering analysis of signal progression shall be made to properly locate any proposed access that may require signalization.

8.11.05 Major and Minor Collectors

(A) Private access to collectors shall be governed by the following curb opening and driveway criteria. Single-family residence access to major collectors is not permitted. Limited access from single-family residences will be allowed on minor collectors

(B) Public streets shall intersect collectors not closer than three hundred and thirty feet (330') from each other (centerline to centerline).

8.11.06 Local Streets

(A) Private access to local streets shall be governed by the following curb opening and driveway criteria.

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(B) Public streets should not intersect local roadways closer than one hundred and fifty feet (150') from each other (centerline to centerline).

8.11.07 Basic Principles for Curb Openings and Driveways

(A) Certain control values for curb openings and driveways require minimum dimensions in some instances and maximum values for other dimensions. The design of curb openings and driveways within the range of these dimensions will provide for good service on the part of the motorist using the driveway while at the same time minimizing the interference to the traffic using the street. By controlling the location and width of openings of driveways along the street, it will be possible to avoid or eliminate long, open stretches where motorists can indiscriminately drive onto the street. The width of opening established in these STANDARDS AND SPECIFICATIONS are based on studies which indicate that the various width openings will accommodate vehicles of maximum size authorized on City streets.

(B) The opening or driveway width should be adequate to handle properly the anticipated traffic volume and character of traffic, as well as being within the limits specified for the type of property development. The controls established for curb openings and driveways shall apply to existing streets as well as new streets that may be developed in the future.

(C) To the greatest extent possible, all openings for driveways shall be located at the point of optimum sight distance along the street. For openings and driveways to commercial establishments and service stations, there shall be sufficient space reasonably cleared of any obstructions such that drivers entering the property will have sufficient sight distance to enable them to make proper and safe movements. The profile of a driveway approach and the grading of the adjacent area shall be such that when a vehicle is located on the driveway outside the traveled portion of street the driver can see a sufficient distance in both directions to enable him to enter the street without creating a hazardous traffic situation.

(D) Any adjustments which must be made to utility poles, street light standards, fire hydrants, catch basins or intakes, traffic signs and signals, or other public improvements or installations which are necessary as the result of the curb openings or driveways shall be accomplished without any cost to the City of Fort Lupton. Also, any curb opening or driveway which has been abandoned shall be restored by the property owner except where such abandonment has been made at the request of or for the convenience of the City.

(E) Driveway approaches, whereby the driveway is to serve as an entrance only or as an exit only, shall be appropriately signed by and at the expense of the property owner. The property owner will be required to provide some means of ensuring that the motorists will use the driveway either as an entrance only or an exit only, but not both.

8.11.08 <u>Definition of Terms</u>

Several terms are used herein which have a somewhat distinct meaning. For the purpose of clarity, the definition of some of these terms are listed below:

(A) Width of Curb Opening (W) -- The width of curb opening measured at the curb line.

(B) Edge Clearance (E) -- The distance measured along curb line from the nearest edge of the curb opening to a point where the property line extended intersects the curb line.

(C) Corner Clearance (C) -- At an intersecting street, the distance measured along the curb line from the projection of the intersection street right-of-way line to the nearest edge of the curb opening.

(D) Distance Between Double Drives (D) -- The distance measured along the curb line between the inside edges of two adjacent curb openings.

(E) Setback (S) -- The lateral distance measured perpendicular to the street right-of-way line and extending from the right-of-way line to the closest point on a structure.

(F) Frontage -- The distance along the street right-of-way line of a single property or development within the property lines. Corner property at an intersection would have a separate frontage along each street.

(G) Residential -- Property used primarily for residential purposes such as single-family, two-family, and multi-family units.

-- Single-Family (SF) Residential: Single, detached family dwelling units, double bungalows, or duplexes.

-- Multi-Family (MF) Residential: Three or more attached dwelling units including townhouses, condominiums, and apartments.

(H) Commercial -- Establishments where the buying and selling of commodities, entertainment, or services is carried on, excluding service stations. Included are such uses as office buildings, restaurants, hotels, motels, banks, grocery stores, theaters, parking lots, trailer courts, and public buildings.

(I) Service Station -- Any property where flammable liquids such as motor vehicle fuel are used, stored, and/or dispensed from fixed equipment into fuel tanks of motor vehicles.

(J) Industrial or Warehouse -- Any establishment that manufactures or stores an article or product.

8.11.09 General Requirements

(A) Number of Openings:

1. Single-Family Residential. In general, each single-family residential property shall be limited to one (1) access point.

2. Multi-Family Residential. In general, access shall be determined by information provided by the owner/developer in the traffic impact study and by comments generated during the Public Works ~~Director/City Transportation Engineer~~Director's review and acceptance of that study.

3. Commercial. In general, commercial property having less than one hundred and fifty feet (150') of frontage and located mid-block shall be limited to one (1) access point to the street. An exception to this rule may be where a building is constructed in the middle of a lot and parking is provided for on each side of the building. A second access point may be allowed for commercial property having more than one hundred fifty feet (150') of frontage. For commercial property located on a corner, one (1) access to each street may be permitted.

4. Service Stations. Where there is sufficient frontage to provide for minimum and maximum requirements, two (2) access points to a street may be permitted.

5. Industrial. Access shall be determined on a case-by-case basis. The City shall consider good traffic engineering practice and the information provided by the applicant in the traffic impact study accompanying the submittal.

(B) Amount of Curb Opening Permitted:

The total length of curb opening on a street for access to a commercial property or service station shall not exceed thirty-five feet (35'). This requirement does not apply to residential-type curb openings.

(C) Entrance Angle:

In general, the entrance angle for all driveway approaches shall be as near ninety degrees (90°) to the centerline of the street as possible. The minimum angle which will be permitted is sixty degrees (60°).

(D) Minimum Space Between Openings:

The minimum spacing between curb openings shall be thirty-five feet (35') measured at the curb line. This spacing shall apply to double drives that serve a single property, as well as the distance between drives serving adjoining properties. A fifty-foot (50') spacing applies to commercial openings.

(E) Joint Entrances:

Whenever possible and feasible, joint entrances shall be provided to serve two adjacent properties. Joint entrances are to be centered on the common property line.

8.11.10 Control Dimensions

To accomplish the objectives of the basic principles stated earlier, certain control dimensions are necessary. There are many variables which affect these control dimensions. Some of the variables are as follows: type of street classification, type of private property development, volume and type of traffic, and width of right-of-way.

(A) Width of Curb Opening (W):

The total width of curb opening for properties on various function street classifications shall be in conformance with the detail drawings in Chapter ~~5~~ 6 of these DESIGN STANDARDS ~~AND SPECIFICATIONS~~.

(B) Curb openings of thirty-five feet (35') or more shall be constructed as radius curb returns.

1. Residential. No edge clearance is required for residential access. However, the drive shall not extend beyond the property line extended.

2. Commercial.

Access onto an Arterial -- 75 Feet Minimum
Access onto a Local -- 75 Feet Minimum

NOTE: Joint access with adjoining property is encouraged. Joint access shall be the only justification for reducing the minimum edge clearance dimension.

3. Service Stations.

Access onto an Arterial -- 5 Feet Minimum
Access onto a Local -- 5 Feet Minimum

(C) Corner Clearance:

It is important to locate driveways away from major intersections. This constraint is as much for the ability to enter and leave the property as for the benefit of intersection safety and operations. Exiting a driveway during peak-hour conditions at traffic signals is difficult where the queue of standing or slow-moving vehicles never allows a sufficient gap for entry from the driveway. Corner clearness shall be in accordance with the Urban System Transportation Manual, Figure 7-12.

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(D) Sight Distance:

Sight distance for curb openings to private property shall be in accordance with Chapter ~~5~~ 6 of these STANDARDS AND SPECIFICATIONS.

8.12.00 STREET LIGHTING

8.12.01 Street Lighting Procedure

The developer shall submit a written request for street light design to ~~Public Service Company~~United Power Cooperative ~~of Colorado (P.S.CO)~~. The Public Works Director~~/City Transportation Engineer~~ will request, in writing, designs from ~~Public Service Company~~Unite Power. ~~Public Service Company~~United Power will submit the final design and cost estimates to the Public Works Director~~/City Transportation Engineer~~ for review and approval. Developer will pay ~~P.S.CO~~United Power the total costs of installation for all street lighting within the prescribed time period. Developer will be responsible for street lighting within the development as well as on side streets surrounding the development site.

Street lighting in residential areas shall be post-top luminaires of the modern style, 100-watt high-pressure sodium on vertical, fiberglass poles, as shown in the detail drawings. Any other post-top luminaire style shall have written approval of the Public Works Director~~/City Transportation Engineer~~ prior to installation. In areas other than residential, street lighting shall be steel standards of either the steel davit or mast arm variety, as shown on the detail drawing.

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8.12.02 Spacing and Illumination

The spacing and illumination which shall be used is contained in the following Table 8.12.02:

TABLE 8.12.02

Street Type	Foot Candles	Average Lamp Lumens	Pole Spacing
Local Residential	0.15	9,500	250 Feet ±
Business & Residential Collector	0.25	9,500-27,500	250 Feet ±
Arterial	0.59	27,500	250 Feet ±

8.13.00 PARKING

8.13.01 Regular Parking

Conventional parking layout dimensions are provided in Table 8.13.01 and the detail drawings in the Appendix. Other angled parking layouts meeting the approval of the Public Works Director/City Engineer will be permitted where possible.

TABLE 8.13.01

Minimum Parking Layout Dimensions (In Feet) for 9-Foot Regular Parking Stalls at Various Angles

Dimension	On Diagram	Angle 0	45	60	75	90
Stall Width, Parallel to Aisle	A	9.0	12.7	10.4	9.3	9.0
Stall Length of Line	B	24.0	24.5	21.5	19.5	18.0
Stall Depth to Wall	C	9.0	17.0	18.5	19.0	18.0
Aisle Width Between Stall Lines	D	12.0	12.0	16.0	22.0	24.0
Stall Depth, Interlock	E	9.0	14.8	17.0	18.3	18.0
Module, Wall to Interlock	F	30.0	43.8	51.5	59.3	60.0
Module, Interlocking	G	30.0	41.6	50.0	58.6	60.0
Module, Interlock to Curb Face	H	30.0	41.8	49.4	56.9	58.0
Bumper Overhang (Typical)	I	0.0	1.5	1.8	2.0	2.0
Offset	J	--	6.3	2.7	0.5	0.0
Setback	K	24.0	11.0	8.3	5.0	0.0
Cross Aisle, One-Way	L	18.0	18.0	18.0	18.0	18.0
Cross Aisle, Two-Way	-	24.0	24.0	24.0	24.0	24.0

8.13.02 Compact Parking

Stall Layout. For ninety-degree (90°) compact parking, the minimum stall width shall be eight feet (8') and the minimum stall length at least sixteen feet (16'). Layout dimensions are provided in Table 8.13.02 and the detail drawing in the Appendix. There will be no provision for bumper overhang for compact parking.

TABLE 8.13.02
Minimum Parking Layout Dimensions (In Feet) for 8-Foot Regular Parking Stalls at Various Angles

Dimension	On Diagram	Angle 0	45	60	75	90
Stall Width, Parallel to Aisle	A	8.0	11.3	9.2	8.3	8.0
Stall Length of Line	B	22.0	24.0	20.5	18.2	16.0
Stall Depth to Wall	C	8.0	17.0	17.8	17.6	16.0
Aisle Width Between Stall Lines	D	12.0	12.0	16.0	22.0	24.0
Stall Depth, Interlock	E	8.0	11.7	14.3	16.0	16.0
Module, Wall to Interlock	F	28.0	43.2	48.1	53.3	56.0
Module, Interlocking	G	28.0	35.4	44.6	54.0	56.0
Module, Interlock to Curb Face	H	28.0	43.2	48.1	53.3	56.0
Bumper Overhang (Typical)	I	0.0	0.0	0.0	0.0	0.0
Offset	J	0.0	5.7	2.3	0.6	0.0
Setback	K	22.0	11.3	8.0	4.1	0.0
Cross Aisle, One-Way	L	18.0	18.0	18.0	18.0	18.0
Cross Aisle, Two-Way	-	24.0	24.0	24.0	24.0	24.0

8.13.03 Signing

Compact parking spaces shall be designated as being for the exclusive use of compact cars with a raised identification sign. The sign for compact car stalls must comply with the following:

(A) The legend shall read "Compact Cars Only."

(B) The minimum size of the sign shall be twelve inches by eighteen inches (12" x 18").

(C) Height of the sign must be a minimum of seven feet (7'). A height of four feet (4') will be permitted in non-pedestrian areas.

(D) Signs shall be reflectorized.

8.13.04 Maximum Allowable Grades Permitted in Parking Lots

Maximum grades permitted in parking lots must not exceed eight percent (8%).

8.13.05 Handicapped Parking Posting

Each handicapped parking stall should be between twelve feet (12') and fourteen feet (14') in width, must have a stall depth of at least eighteen feet (18'), and be located near buildings and handicap ramps. A handicapped parking space will be required to be identified by an official "Handicapped Reserve Parking" (Manual on Uniform Traffic Control Devices, R7-8) sign with the handicapped person logo.

In order for handicapped parking spaces to function as intended, they will be required to be designed and signed in a uniform manner to allow for a clear understanding of the parking zone and to make enforcement possible. Signing of one, two, or three spaces for handicapped parking spaces must be done by using one sign for each space placed at the center of each end line.

8.13.06 Parking Structures

For design details and optimum layout of parking structures, reference to Parking Garage Planning and Operation, by the Eno Foundation for Transportation, Inc., Westport, 1978, or the Urban Land Institute Standards is recommended. The City will evaluate designs for such structures on an individual case basis.

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CHAPTER 9
TRENCHING, BACKFILLING AND COMPACTING

9.00.00 GENERAL

9.01.00 DESCRIPTION

(A) This section covers excavation and trenching including drainage, dewatering, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipe lines, service lines, and appurtenances.

(B) Reference detail drawing in the appropriate chapter of these STANDARDS AND SPECIFICATIONS.

9.02.00 QUALITY ASSURANCE

9.02.01 Compaction

Soil compaction tests shall be performed in accordance with:

(A) ASTM D 698, Standard Method of Test for Moisture Density Relations of Soils

(B) ASTM D 2049, Standard Method of Test for Relative Density of Cohesionless Soils

9.02.02 Construction Staking

(A) Construction staking shall be performed with qualified, competent personnel under the direction of a professional land surveyor registered in the State of Colorado.

(B) All survey notes and construction staking notes shall be entered into bound, hard cover field books.

(C) Staking of the work shall be at fifty-foot (50') stations (maximum).

(D) Offsets shall be staked so that vertical and horizontal alignment may be checked.

(E) All survey data which is developed by the contractor or the developer's surveyor in performing surveys which are required by the work shall be available to the City for examination throughout the construction period.

9.03.00 JOB CONDITIONS

9.03.01 Drainage and Groundwater

(A) All excavations and trenches shall be kept free from excess groundwater during construction.

(B) Any water which is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade to permit joints to be made in the dry and to prevent the entrance of water into the pipeline.

(C) Surface run-off shall be diverted as necessary to keep excavations and trenches free from water during construction.

(D) The excavation or trench shall be kept free from water until the structure or pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

(E) Water shall be prevented from entering into previously constructed pipe.

(F) Except for storm drains, the pipe under construction shall not be used for dewatering.

9.03.02 Sequencing

(A) Pipeline installation shall be performed within two hundred (200) linear feet of trench excavation. If construction is occurring in an open field, this distance may be increased at the Public Works Director/City Engineer's discretion.

(B) Initial trench backfill shall be performed within fifty (50) linear feet of pipeline installation. If construction is occurring in an open field, this distance may be increased at the Public Works Director/City Engineer's discretion.

(C) Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the duration of that opening is to be minimized. The contractor shall coordinate the amount and duration of road closures with the City's Public Works and Traffic Department.

9.03.03 Underground Obstructions

(A) The contractor/developer shall field verify all drawings of record information obtained from the City or other affected utility company.

(B) The contractor/developer shall notify each utility owner and request utilities to be field located by surface reference at least forty-eight (48) hours prior to trenching or excavation.

(C) In situations where conflicts may exist, the contractor shall expose and verify the size, location, and elevation of underground utilities and other obstructions sufficiently in advance of construction to permit changes to be made to the construction drawings.

(D) In the case of a conflict, the contractor shall notify the City and the affected utility company, the proposed work may then be modified by the Design Engineer and after the Public Works Director/City Engineer's approval.

(E) Existing improvements, adjacent property, utilities, trees, and plants that are not to be removed shall be protected from injury or damage resulting from the contractor's operations. If damage should occur, the contractor shall make repair such that damaged materials are restored in original or better condition, as directed by the Public Works Director/City Engineer, utility or property owner in question.

(F) If the contractor removes any underground obstructions, the following shall apply:

1. Drainage culverts may be salvaged, stored, and reused in the original location if approval is obtained from the City Engineer. All other underground obstructions shall be replaced with new materials.

2. The area in which the underground obstruction was located shall be restored to original or better condition.

9.04.00 MAINTENANCE AND CORRECTION

9.04.01 Trench Settlement

The contractor/developer shall maintain and repair all trench settlement and make necessary repairs to pavement, sidewalks, or other structures which may be damaged as a result of backfill settlement. Contractor shall warrant work for a period of one (1) year after final completion and acceptance of the work.

9.04.02 Subcontractors

The contractor/developer may perform such maintenance and repairs by subcontract. If the contractor chooses to subcontract the warranty work, he shall submit to the Public Works Director/City Engineer a copy of the subcontract or the work authorization as evidence of the contractor's faithful intention to perform any repairs which may become necessary during the one-(1) year warranty period.

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CHAPTER 10
ACCEPTANCE REQUIREMENTS

10.00.00 APPLICABILITY

Before the City will assume ownership and maintenance responsibility for public improvements, the public improvements shall be formally accepted by the Public Works Director/City Engineer. The developer is responsible for the proper installation of all improvements. Failure by the City's representatives to detect improper installations or defects during the construction of improvements or during subsequent inspections does not relieve the developer of the responsibility to correct such defects at a later date. There shall be no partial acceptances of public improvements within new developments.

10.01.00 ACCEPTANCE PROCEDURE

10.01.01 Written Request

At such time that the developer believes that the construction of all required public and private improvements have been completed, all improvements are accessible and visible for inspection and a written Release For Service (See Chapter 1) for water and sanitary sewer systems has been issued by the Public Works Director/City~~'s~~ Engineer~~ing Division~~, a written request for acceptance shall be submitted to the Public Works Director/City Engineer.

10.01.02 Record Drawings

A complete set of "blueline as-constructed" drawings of the public improvements shall accompany the request for acceptance. Upon approval by the City, the developer will be required to submit a certified set of 3 mil double matte mylar copies of the "as-constructed" drawings. These drawings shall be prepared on twenty-four-inch by thirty-six-inch (24" x 36") sheets, and lettering should be no smaller than one-eighth inch (1/8"). At a minimum, record drawings shall indicate the horizontal or vertical layout of all underground water, sanitary sewer, and storm sewer facilities (including distances between valves, fittings, manholes, etc.), profiles of streets, sanitary sewer mains and storm sewer mains, details of special or unusual installations, and detention pond volumes. If significant corrections to the improvements are noted during the acceptance inspection, the record drawings may be returned to the developer for revisions. The final submittal of record drawings shall include the mylar copy mentioned above along with a "blueline" copy with each sheet of the blueline signed and sealed by the Professional Engineer registered in the State of Colorado who is responsible for the preparation of the record drawings.

10.01.03 Certification of Storm Drainage Detention

A. Registered Land Surveyor: A land surveyor registered in the State of Colorado shall affirm the as-built detention pond volumes and surface areas at the design depths, outlet structure sizes and elevations, storm sewer sizes and invert elevations at inlets, manholes, and discharge location, and representative open channel cross-sections, and dimensions of all the drainage structures.

B. Registered Professional Engineer: The responsible design engineer shall state that "I have inspected the drainage facilities and to the best of my knowledge, belief, and opinion, the drainage facilities were constructed in accordance with the design intent of the approved drainage report and construction drawings."

10.01.04 Preparation of Corrections List

Upon receipt of the written request for acceptance, certification of storm drainage detention, and record drawings, the Public Works Director/City Engineer will instruct the appropriate Engineering Construction Inspector to schedule an inspection of the improvements. The developer or his representative will be invited to accompany the City's representative on all such inspections. The construction of public improvements will be inspected for conformance with the approved plans, the Official Development Plan, the Public Improvements Agreement, these STANDARDS AND SPECIFICATIONS, and City Code. If, due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the developer will be notified of the need to postpone these activities until the cause of the delay can be rectified. Deficiencies noted during the inspection will be compiled in a corrections list to be mailed to the developer.

10.01.05 Correction of Deficiencies

Correction list items shall be corrected within sixty (60) days of the date of the corrections list. If all of the noted deficiencies are not corrected within this time, the public improvements may be reinspected and any new defects may be added to the corrections list. Public improvements will not be accepted until all noted deficiencies are corrected within the proper time frame. The Public Works Director/Engineering Construction Inspector shall be notified before any corrective work commences and immediately upon the completion of the repairs.

10.01.06 Written Acceptance

Upon the completion of all items on the correction list and payment of all outstanding fees, reimbursements, and other items owed to the City, the Public Works Director/City Engineer will issue a written acceptance of the public improvements. The amount of the surety for the public improvements may then be reduced to fifteen percent (15%) of the original, estimated cost of the public improvements.

10.02.00 WARRANTY PERIOD

10.02.01 Duration

All public improvements shall be subject to a warranty period of at least ~~one~~ two (~~1~~2) years after the date of the letter of acceptance from the City Engineer.

10.02.02 Maintenance Responsibility

The developer shall be responsible for the maintenance of all public improvements during the warranty period. The Public Works Director/City Engineer will notify the developer of any maintenance that may be necessary during this time. Routine maintenance normally performed by the developer includes, but shall not be limited to, the cleaning of streets, patching of potholes, and removal of blockages from water, storm and sanitary sewer facilities. The cost of any routine maintenance not performed by the developer that must be performed by the City will be billed to the developer at cost plus fifteen percent (15%).

10.02.03 Emergency Repairs

In the event of a water main break, sanitary sewer main blockage, street or bridge failure, or other emergency that may occur during the warranty period, it may become necessary for the City to undertake immediate repairs to the facilities and/or make the area safe to residents, pedestrians, or motorists. The City will attempt to contact the developer in the event of such emergency. However, if the developer or his representative cannot be contacted quickly or if the developer is unable to take immediate action to relieve the urgent situation, the City may proceed with such action as deemed necessary by the Public Works Director/City Engineer, and the developer will be billed for all costs of these actions at cost plus fifteen percent (15%).

10.03.00 END OF WARRANTY PROCEDURE

10.03.01 Preparation of Corrections List

At approximately ~~nine~~ twenty-two (~~9~~22) months into the warranty period, the Engineering Construction Inspector will schedule and perform an inspection of the public improvements within the development. The developer or his representative will be invited to accompany the City's representative on all such inspections. The condition of the public improvements will be inspected for conformance with the approved plans, the Official Development Plan, the Public Improvements Agreement, these STANDARDS AND SPECIFICATIONS, and City Code. If due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the developer will be notified of the need to postpone these activities until the cause of the delay can be rectified. Deficiencies noted during the warranty inspection will be compiled in a corrections list to be mailed to the developer.

10.03.02 Correction of Deficiencies

Warranty correction list items should be corrected within 2 months of the date of the warranty correction list, and all corrections must be completed no later than ten (10) working days prior to the scheduled end of the warranty period. If all of the noted deficiencies are not corrected within this time, the public improvements may be reinspected, a revised correction list may be issued, and the end of the warranty period may be adjusted at the discretion of the Public Works Director/City Engineer to allow ample time for the completion of the corrections. The end of the warranty period will not be acknowledged until all noted deficiencies are corrected within the proper time frame. The appropriate Public Works Director/Engineering Construction Inspector shall be notified before any corrective work commences and immediately upon the completion of the repairs.

10.03.03 Written Acknowledgment of End of Warranty

Upon completion of the correction of all deficiencies noted in the warranty correction list, the city engineer will issue a written acknowledgment of the end of the warranty period for the public improvements. Surety for public improvements may be released in its entirety at this time.

10.04.00 ACCEPTANCE/WARRANTY INSPECTION CRITERIA

10.04.01 General

All public and private improvements shall be installed in conformance with the approved plans, the Official Development Plan, the Public Improvements Agreement, and these STANDARDS AND SPECIFICATIONS. The Public Works Director/City Engineer shall be the final authority in the determination of defects and required corrections to public and private improvements.

10.04.02 Grading and Seeding

Finished grades shall be in conformance with the approved plans and the Official Development Plan. Detention pond grading shall provide, at a minimum, the required volume as defined in the approved final drainage study. Unless otherwise approved, no slopes shall exceed a grade of four (horizontal) to one (vertical) (4:1). Seeding shall be performed and grass shall be established in conformance with Chapter 2 of these STANDARDS AND SPECIFICATIONS.

10.04.03 Water Systems

The required inspection and testing of water mains and appurtenances that shall be performed before systems can be released for service is outlined in Chapter 3 of these STANDARDS AND SPECIFICATIONS. At the time of acceptance and warranty inspections of all public and private improvements, additional aspects of water system construction that shall be inspected include, but shall not be limited to, the following:

(A) All valves, blow-off installations, and fire hydrants shall be operable.

(B) Valve box risers shall be vertical and shall be adjusted to within one-eighth inch (1/8") below grade in paved areas or one inch (1") above grade in landscaped areas.

(C) Valve operating nuts shall be accessible with a six-foot (6') valve key with between eighteen inches (18") and four feet (4') of clearance between the handle of the key and finished grade.

(D) Fire hydrants shall be vertical and shall be adjusted to a minimum of eighteen inches (18") from the center of the nozzle to finished grade.

(E) A minimum of five feet (5') of clearance for operation shall be provided around all fire hydrants and water valve risers.

(F) Manhole rims and covers for water valve vaults shall be adjusted to within one-eighth inch (1/4") below grade in paved areas or one inch (1") above grade in landscaped areas.

(G) The construction and operation of any required pumping systems shall be in conformance with the specifications issued and approved for that specific installation.

(H) All mains and manholes shall be free of construction debris, dirt, trash, and other foreign material.

(I) Manhole steps shall be properly spaced and aligned.

10.04.04 Sanitary Sewer System

The required inspection and testing of sanitary sewer mains and appurtenances that shall be performed before systems can be released is outlined in Chapter 4 of these STANDARDS AND SPECIFICATIONS. At the time of acceptance and warranty inspections of all public improvements, additional aspects of sanitary sewer system construction that shall be inspected include, but shall not be limited to, the following:

(A) All mains and manholes shall be free of construction debris, dirt, trash, and other foreign material.

(B) The City's TV inspection of all sanitary sewer mains shall be completed prior to the acceptance of public and private improvements.

(C) Manhole rims and covers shall be adjusted to within one-eighth inch (1/4") below grade in paved areas or one inch (1") above grade in landscaped areas.

(D) Manhole steps shall be properly spaced aligned.

(E) The construction and operation of any required sewage lift systems shall be in conformance with the specifications issued and approved for that specific installation.

10.04.05 Storm Sewer System

The required inspection and testing of storm sewer mains and appurtenances that shall be performed are outlined in Chapter 5 of these STANDARDS AND SPECIFICATIONS. At the times of acceptance and warranty inspections of all public improvements, additional aspects of storm sewer system construction that shall be inspected include, but shall not be limited to, the following;

(A) All pipes and manholes shall be free of construction debris, dirt, trash, and other foreign material.

(B) Manhole rims and covers shall be adjusted to within one-fourth inch (1/4") below grade in paved areas or one inch (1") above grade in landscaped areas.

(C) Manhole steps shall be properly spaced and aligned.

(D) Inlets shall be properly aligned to within one-eight inch (1/8") below grade next to sidewalk or curb and gutter.

10.04.06 Concrete

At the time of acceptance and warranty inspection of all public improvements the aspects of concrete construction that shall be inspected include, but shall not be limited to the following:

(A) Breakage or cracking greater than 1/32" at other than construction joints.

(B) Ponding of any size.

(C) Settlement affecting drainage, pedestrian or traffic safety.

(D) Surface spalling or deterioration.

(E) Longitudinal cracking.

10.04.07 Roadway

At the time of acceptance and warranty inspection of all public improvements, the aspects of roadway construction that shall be inspected include, but shall not be limited to, the following:

(A) Breakage or cracking greater than 1/8".

(B) Ponding of any size.

(C) Settlement affecting drainage, pedestrian or traffic safety.

(D) Surface segregation of fines or aggregate

(E) Hazardous conditions

(F) Alligatoring

(G) Improper grade or inverted crown.

FORT LUPTON STANDARD CONSTRUCTION NOTES

1. CONTRACTOR SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL HEALTH AND SAFETY RULES AND REGULATIONS.

2. THE CONTRACTOR IS RESPONSIBLE FOR ANY DEBRIS DROPPED INTO PUBLIC MANHOLES AND OTHER PUBLIC STRUCTURES. THE CONTRACTOR SHALL IMMEDIATELY REMOVE ALL DEBRIS IN AFFECTED STRUCTURES. IF IT IS DETERMINED THAT DEBRIS CAUSED A BACKUP, THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR DAMAGES.

3. THE CONTRACTOR SHALL PROVIDE ACCESS TO AND FROM ALL PRIVATE PROPERTY ADJACENT TO THE WORK THROUGHOUT THE PERIOD OF CONSTRUCTION.

4. "AS-BUILT" ELECTRONIC SUBMITTAL OR PRINTS ARE TO BE SUBMITTED TO CITY ENGINEER AT COMPLETION OF THE PROJECT. "AS-BUILT" DRAWINGS ARE TO BE REPRODUCIBLE COPIES (OR ORIGINALS) OF THE APPROVED CONSTRUCTION DRAWINGS. ANY FIELD CHANGES ARE TO BE NOTED. THE DRAWINGS WILL STATE "AS-BUILT" IN LARGE BLOCK LETTERS. THE "AS-BUILT" ELECTRONIC SUBMITTAL OR PRINTS ARE TO BE SIGNED, DATED AND STAMPED BY A COLORADO REGISTERED PROFESSIONAL ENGINEER.

5. NO WATER VALVE OR OTHER CONTROL DEVICE ON THE EXISTING PUBLIC SYSTEM WILL BE OPERATED FOR ANY PURPOSE BY ANYONE OTHER THAN THE CITY WITHOUT PRIOR WRITTEN AUTHORIZATION.

6. TO SCHEDULE AN INSPECTION DURING REGULAR BUSINESS HOURS, CONTACT PUBLIC WORKS DEPARTMENT AT 303-857-6694. FOR AFTER HOURS EMERGENCIES CALL POLICE DISPATCH AT 720-652-4222.

7. THE CONTRACTOR SHALL CONTACT ALL APPROPRIATE UTILITY COMPANIES AND THE CITY OF FORT LUPTON 48 HOURS PRIOR TO THE BEGINNING OF ANY CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ANY EXISTING UTILITY (INCLUDING DEPTHS) WHICH MAY CONFLICT WITH THE PROPOSED CONSTRUCTION. THE CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES FROM DAMAGE. DAMAGED UTILITIES SHALL BE REPAIRED BY THE CONTRACTOR, AT HIS EXPENSE.

8. PERMITTEE SHALL NOTIFY THE CITY INSPECTOR:

    - TWO WORKING DAYS BEFORE COMMENCING WORK ON R.O.W.;
    - WHEN SUSPENDING OPERATIONS FOR 5 OR MORE WORKING DAYS;
    - TWO WORKING DAYS BEFORE RESUMING SUSPENDED WORK;
    - UPON COMPLETION OF WORK.

9. CONTRACTOR SHALL MAINTAIN AT LEAST ONE COPY OF THE APPROVED PLANS, SPECIFICATIONS AND STANDARDS ON THE JOB SITE AT ALL TIMES.

10. CONTRACTOR IS RESPONSIBLE FOR BEING AWARE OF, NOTIFYING, COORDINATING AND SCHEDULING ALL INSPECTIONS REQUIRED FOR FINAL APPROVALS AND PROJECT ACCEPTANCE.

11. ALL WORK, INCLUDING CORRECTION WORK, IS SUBJECT TO NOTIFICATION AND INSPECTION REQUIREMENTS.

12. CONTRACTOR IS RESPONSIBLE FOR PROVIDING AND MAINTAINING ADEQUATE TRAFFIC CONTROL THROUGHOUT THE PROJECT, INCLUDING PROPER TRAFFIC CONTROL DEVICES AND/OR PERSONNEL AS REQUIRED. A TRAFFIC CONTROL PLAN (TCP) IS SUBJECT TO CITY OF FORT LUPTON AND/OR CDOT APPROVAL PRIOR TO COMMENCING WORK ON ROADWAY ROW. A COPY OF APPROVED TCPS MUST BE AVAILABLE ON SITE DURING WORK. TRAFFIC CONTROL TO BE IN ACCORDANCE WITH M.U.T.C.D., SECTION VI.

13. ALL WORK WILL BE PROPERLY BACKFILLED PRIOR TO THE END OF WORKDAY, NO OPEN HOLES ARE ALLOWED OVERNIGHT. ALL WORK IS TO BE IN ACCORDANCE WITH PERMIT REQUIREMENTS AND APPLICABLE STANDARDS.

14. WHEN AN EXISTING ASPHALT STREET IS CUT, THE STREET MUST BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN ITS ORIGINAL CONDITION. THE EXISTING STREET CONDITION SHALL BE DOCUMENTED BEFORE ANY CUTS ARE MADE, PATCHING SHALL BE DONE IN CONFORMANCE WITH THE PROJECT STANDARDS. THE FINISHED PATCH SHALL BLEND SMOOTHLY INTO THE EXISTING SURFACE. ALL LARGE PATCHES SHALL BE PAVED WITH AN ASPHALT LAY-DOWN MACHINE.

15. PATCH ASPHALT PAVING AS NECESSARY TO JOIN NEW GUTTERS WITH THE EXISTING PAVEMENT. REMOVAL AND REPLACEMENT OF ASPHALT SHALL BE PER THE LATEST CITY OF FORT LUPTON STANDARDS AND DETAILS.

16. WHERE CONSISTENT WITH SAFETY AND SPACE CONSIDERATIONS, EXCAVATED MATERIAL IS TO BE PLACED ON THE UPHILL SIDE OF TRENCHES.

17. PERMITTEE SHOULD REMOVE MATERIALS AND EQUIPMENT FROM THE ROADWAY R.O.W. AT THE CLOSE OF DAILY OPERATIONS. THE TCP MUST INCLUDE PROTECTIVE MEASURES WHERE MATERIALS AND EQUIPMENT MAY BE STORED ON R.O.W, BUT ENSURE FIVE FEET OF PEDESTRIAN CLEARANCE ON SIDEWALKS.

18. NO WORK SHALL BE PERMITTED AT NIGHT OR ON SATURDAYS, SUNDAYS, AND HOLIDAYS WITHOUT PRIOR AUTHORIZATIONS OR UNLESS OTHERWISE SPECIFIED IN THIS PERMIT. CITY MAY RESTRICT WORK ON R.O.W. DURING ADVERSE WEATHER CONDITIONS OR DURING PERIODS OF HIGH TRAFFIC VOLUME.

19. PRIOR TO FINAL ACCEPTANCE, ALL DISTURBED PORTIONS OF ROADWAY RIGHT OF WAY SHALL BE CLEANED UP AND RESTORED TO THEIR ORIGINAL CONDITION, SUBJECT TO CITY APPROVAL.

20. SEEDING, SODDING, AND PLANTING SHALL BE AS SPECIFIED OR OTHERWISE APPROVED BY CITY. CONSTRUCTION, MAINTENANCE, AND WATERING REQUIREMENTS SHALL CONFORM WITH THE CITY STANDARD SPECIFICATIONS. WHERE LANDSCAPE RESTORATION MUST BE DELAYED DUE TO SEASONAL REQUIREMENTS, SUCH WORK MAY BE AUTHORIZED BY A SEPARATE PERMIT.

GRADING AND EROSION CONTROL NOTES

1. ALL SITE GRADING (EXCAVATION, EMBANKMENT, AND COMPACTION) SHALL CONFORM TO THE RECOMMENDATIONS OF THE LATEST SOILS INVESTIGATION FOR THIS PROPERTY AND SHALL FURTHER BE IN CONFORMANCE WITH THE CITY OF FORT LUPTON'S "SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS," LATEST EDITION.

2. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION

OPERATION AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.

3. TOPSOIL SHALL BE STOCKPILED TO THE EXTENT PRACTICABLE ON THE SITE FOR USE ON AREAS TO BE REVEGETATED. ANY AND ALL STOCKPILES SHALL BE LOCATED AND PROTECTED FROM EROSIVE ELEMENTS.

4. TEMPORARY VEGETATION SHALL BE INSTALLED ON ALL DISTURBED AREAS WHERE PERMANENT SURFACE IMPROVEMENTS ARE NOT SCHEDULED FOR INSTALLATION WITHIN THREE MONTHS. VEGETATION SHALL BE A VIGOROUS, DROUGHT TOLERANT, NATIVE SPECIES MIX. (REFER TO SECTION 2.26.00 OF CITY CONSTRUCTION SPECIFICATIONS FOR SEEDING MIX.) PROJECT SCHEDULING SHOULD TAKE ADVANTAGE OF SPRING OR FALL PLANTING SEASONS FOR NATURAL GERMINATION, BUT SEEDED AREAS SHALL BE IRRIGATED, IF CONDITIONS SO MERIT.

5. AT ALL TIMES, THE PROPERTY SHALL BE MAINTAINED AND/OR WATERED TO PREVENT WIND CAUSED EROSION. EARTHWORK OPERATIONS SHALL BE DISCONTINUED WHEN FUGITIVE DUST SIGNIFICANTLY IMPACTS ADJACENT PROPERTY. IF EARTHWORK IS COMPLETE OR DISCONTINUED AND DUST FROM THE SITE CONTINUES TO CREATE PROBLEMS, THE OWNER/DEVELOPER SHALL IMMEDIATELY INSTITUTE MITIGATIVE MEASURES AND SHALL CORRECT DAMAGE TO ADJACENT PROPERTY.

6. TEMPORARY CUT/FILL SLOPES SHALL NOT EXCEED A STEEPNESS OF 2:1 (2H:1V). PERMANENT SLOPES SHALL NOT EXCEED 4:1 (4H:1V) IN AREAS TO BE SEEDED OR SODDED.

7. THE OWNER/DEVELOPER SHALL PROVIDE ANY ADDITIONAL DUST ABATEMENT AND EROSION CONTROL MEASURES DEEMED NECESSARY BY THE CITY, SHOULD CONDITIONS MERIT THEM.

8. TEMPORARY FENCES SHALL BE INSTALLED ALONG ALL BOUNDARIES OF THE CONSTRUCTION LIMITS OR PROPERTY LINES AS SHOWN ON THE APPROVED EROSION CONTROL PLAN, TO PREVENT GRADING ON PROPERTY NOT OWNED BY THE DEVELOPER. IN ADDITION, THE CITY MAY REQUIRE ADDITIONAL TEMPORARY FENCES IF FIELD CONDITIONS SO MERIT THEM.

9. IMPERVIOUS SURFACES WHICH ARE ADJACENT TO OR CONTAINED WITHIN CONSTRUCTION SITES WILL BE SWEPT ON A DAILY BASIS OR AS NEEDED DURING THE DAY WHEN SEDIMENT AND OTHER MATERIALS ARE TRACKED OR DISCHARGED ON TO

THEM. EITHER SWEEPING BY HAND OR USE OF STREET SWEEPERS IS ACCEPTABLE. STREET SWEEPERS USING WATER WHILE SWEEPING IS PREFERRED IN ORDER TO MINIMIZE DUST. FLUSHING OFF PAVED SURFACES WITH WATER IS PROHIBITED.

10. THE CONTRACTOR SHALL PROTECT ALL STORM SEWER FACILITIES ADJACENT TO ANY LOCATION WHERE PAVEMENT CUTTING OPERATIONS INVOLVING WHEEL CUTTING, SAW CUTTING, OR ABRASIVE WATER JET CUTTING ARE TO TAKE PLACE. THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL WASTE PRODUCTS GENERATED BY SAID CUTTING OPERATIONS ON A DAILY BASIS OR AS NEEDED THROUGHOUT THE WORK DAY. THE DISCHARGE OF ANY WATER CONTAMINATED BY WASTE PRODUCTS FROM CUTTING OPERATIONS TO THE STORM SEWER SYSTEM IS PROHIBITED.

11. THE DISCHARGE OF WATER CONTAINING WASTE CEMENT TO ADJACENT WATERWAYS, WETLANDS, OTHER PROPERTIES, ETC., IS PROHIBITED. THE CLEANING OF CEMENT TRUCK DELIVERY CHUTES, EXCEPT IN DESIGNATED CONCRETE WASHOUT AREAS, IS PROHIBITED AT THE JOB SITE.

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Construction Specifications

For Public Improvements

Adopted January 12, 2024
Resolution 24-??
AM 24 -???

Previously Adopted November 28, 2015
Ordinance 2015-992
AM 2015-136

Previously Adopted July 12, 1995
Resolution 95-030
AM 95-110

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CHAPTER 1
GENERAL REQUIREMENTS

1.00.00 AUTHORITY AND PURPOSE

1.01.00 TITLE

These regulations, together with all future amendments, shall be known as the City of Fort Lupton ~~STANDARDS AND~~ SPECIFICATIONS FOR ~~THE DESIGN AND~~ CONSTRUCTION OF PUBLIC IMPROVEMENTS, ~~2014~~ 2018 Edition, and may be cited as such and will be referred to herein as the ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS.

The companion document "The City of Fort Lupton DESIGN STANDARDS FOR PUBLIC IMPROVEMENTS, 2018 Edition will be cited as such and will be referred to herein as the DESIGN STANDARDS.

1.02.00 APPLICABILITY

These ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS shall apply to construction, enlargement, alteration, relocation, removal, conversion, demolition, repair, and excavation of any public improvements or private improvements of common ownership specifically regulated herein. The provision of these CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS applies to City contracts as well as to contracts made for the development of property in the City. In the case of City capital improvement contracts, the project specifications may supersede or modify these CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS. Alterations, additions or repairs to existing improvements shall comply with all requirements of these CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS unless specifically exempted, in writing, by the City. The City retains the right to require additional information, criteria, or requirements as conditions may warrant.

1.03.00 AUTHORITY

These CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS have been enacted pursuant of the Municipal Code of the City and Title 31 of Article 16 of the Colorado Revised Statutes and shall have the same force and effect as all other ordinances of the City.

1.04.00 PURPOSE

The purpose of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~is~~ are to provide MINIMUM standards to safeguard life, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use, location, and maintenance of all public improvements and private improvements of common ownership including, but not limited to, sanitary sewer systems, water supply systems, storm drainage systems, streets, open space, parking lots, and appurtenances thereto.

The purpose of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS are ~~STANDARDS AND SPECIFICATIONS is~~ also to insure that the City receives public facilities which are constructed with the care and materials such that the facility meets or exceeds the normal service life requirements for similar installations and to insure that when said facilities are transferred to the

City's ownership that they will be free from all defects and in suitable working order to provide the service capabilities anticipated with such a facility.

1.05.00 INTERPRETATION

In the interpretation of the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ the following shall govern:

(A) In its interpretation, the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ shall be regarded as the minimum requirements for the protection of the public health, safety, comfort, convenience, prosperity, and welfare of the residents of the CITY.

(B) Whenever a provision of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ or any provision in any law, ordinance, resolution, rule or regulation of any kind, contain any restrictions covering any of the same subject matter, whichever standards produce higher quality shall govern.

(C) These DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ shall not abrogate or annul any permits or approved drainage reports and construction plans issued or any easement or covenant granted before the effective date of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. However, if the review and approval of construction plans, specifications, and associated engineering reports by the City has occurred more than twelve (12) months prior to execution of the Public Improvements Agreement/or commencement of construction activities, the City shall have the right to require another review process for the plans, specifications, and reports to insure compliance with these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

1.06.00 ENFORCEMENT RESPONSIBILITY

It shall be the duty of the City Manager or his representative to enforce the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

1.07.00 VIOLATIONS

No person, firm, or corporation shall construct, enlarge, alter, repair, relocate, improve, remove, excavate, convert, or demolish any public improvements or private improvements in common ownership or permit the same to be done in violation of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. Whenever any work is being done contrary to the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~, the City Manager or his designee may order the work stopped by a written notice in accordance with Section 1.26.04 of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

1.08.00 VARIANCES

The provisions of these ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS are not intended to prevent the use of any material or method of construction not specifically prescribed by these standards, provided any alternate has been previously approved and its use authorized in writing by the City. Whenever there are practical difficulties involved in carrying out the provisions of these procedures, the City may grant a variance for individual cases, provided that the City shall first find that a unique reason makes these standards impractical and that the modification is in conformity with the intent and

purpose of these standards, and providing that such variance does not lessen any design requirements or any degree of structural or operational integrity. The City shall require that sufficient specifications, evidence, justification, and/or proof be submitted to substantiate any claims that may be made regarding the alternate material, detail, or technique. The City, in its sole discretion, will decide upon the acceptability of any proposed variance.

1.09.00 AMENDMENTS AND REVISIONS

These CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS may be amended as new technology is developed and/or if experience gained in the use of these DESIGN STANDARDS and CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS indicate a need for revision. The City shall have full power and authority to promulgate rules, regulations, or new standards of a technical nature, which rules, regulations, or standards shall be effective immediately upon their approval and certification by the City Manager or his designee. It is the responsibility of the Consultant/Contractor/Developer to obtain all revisions to these CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS.

1.10.00 SEVERABILITY

If any section or article of these CONSTRUCTION ~~STANDARDS OR~~ SPECIFICATIONS is found to be unconstitutional or illegal by any court, the said section or article shall have no bearing on the effectiveness of the rest of these CONSTRUCTION ~~STANDARDS OR~~ SPECIFICATIONS.

1.11.00 DEFINITIONS

CITY shall mean the City of Fort Lupton, in the State of Colorado, acting by and through the City Manager, Mayor, and City Council.

CITY CODE shall mean the official adopted City Code of Fort Lupton, Colorado.

CONTRACTOR shall mean a person, company, firm, or corporation licensed and bonded in the City in accordance with the City Code.

CITY REPRESENTATIVE shall mean the Public Works Director/City Engineer or the City's authorized representative acting on behalf of the City.

DEVELOPER shall mean a person, company, firm, or corporation that is seeking to develop a property within the City.

EXPRESSIONS Wherever the words "as directed", "as required", "as permitted", or words of like meaning are used, it shall be understood that the direction, requirements, or permission of the City Representative is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the City Representative.

Whenever the words "DESIGN STANDARDS" are used it shall be understood that reference is made to the "City of Fort Lupton, DESIGN STANDARDS FOR PUBLIC IMPROVEMENTS".

Whenever the words "CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS" are used it shall be understood that reference is made to the "City of Fort Lupton", ~~STANDARDS AND~~ SPECIFICATIONS FOR ~~THE DESIGN AND~~ CONSTRUCTION OF PUBLIC IMPROVEMENTS".

OWNER shall mean a person, company, firm, or corporation holding title to land that is being developed or modified within the City.

PUBLIC IMPROVEMENTS include: all work in the public right-of-way, City property, easements dedicated to the City, private property that will become City property or an easement to the City in the future, and projects or utilities that will become the City's responsibility to maintain.

DESIGNATED PRIVATE CONSTRUCTION WORK includes: private sewer systems, water and sewer service lines to buildings, grading, drainage structures, retaining walls, parking lots, private streets and walks, fire lanes, driveways, and associated construction.

SUBCONTRACTOR Any person, company, firm, or corporation licensed and bonded in the City in accordance with the City Code which has a direct or indirect contract with the Contractor or other Subcontractor and furnishes and/or performs on-site labor, and/or furnishes materials in connection with the performance of the work.

SURETY shall mean the entity which is bound with and for the Contractor for the performance of the work as described in these specifications. (Bonded)

TESTING AGENCY Any individual, partnership, or corporation which is qualified and licensed to perform the required sampling, analysis, testing, and professional recommendation service.

TRAFFIC ENGINEER shall mean the Traffic Engineer of the City.

1.12.00 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AASHTO	"Green" **A Policy on Geometric Design of Highways and Streets, Latest Edition.** American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association
ASA	American Standards Association
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
CDOT	Colorado Department of Transportation
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CUHP	Colorado Urban Hydrograph Procedure
CWCB	Colorado Water Conservation Board
DIP	Ductile Iron Pipe
DRCOG	Denver Regional Council of Governments
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
HERCP	Horizontal Elliptical Reinforced Concrete Pipe
IMSA	International Municipal Signal Association
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices

NEC	National Electric Code
NEMA	National Electric Manufacturers Association
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
ODP	Official Development Plan
OSHA	Occupational Safety and Health Association
PDP	Preliminary Development Plan
PSCO	Public Service Company of Colorado
PUD	Planned Unit Development
PVC	Polyvinyl Chloride
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SCS	Soil Conservation Service
SPP	Structural Plate Pipe
SPPA	Structural Plate Pipe Arch
UDFCD	Urban Drainage and Flood Control District
UNCC	Utility Notification Center of Colorado
USDCM	Urban Storm Drainage Criteria Manual (MANUAL)
USGS	United States Geological Survey

1.20.00 GENERAL CONDITIONS

1.21.00 RESPONSIBILITY FOR DESIGN AND CONSTRUCTION

The City shall have full authority to review and approve all submittals and construction for compliance with these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS. An approval or acceptance by the City does not relieve the owner, engineer, designer, or contractor from responsibility for ensuring that the calculations, plans, specifications, construction, and record drawings are in compliance with these CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS. Any approval or acceptance by the City shall not result in any liability to the City or its employees for any claim, suit, loss, damage, or injury resulting from the use or implementation of the approved documents. Nothing in these CONSTRUCTION ~~STANDARDS AND~~ SPECIFICATIONS shall be construed to circumvent any sections of the City of Fort Lupton Code or sub codes, pertaining to responsibility for reports, studies, designs, and construction.

1.22.00 PRE-CONSTRUCTION MEETINGS

In conjunction with the "Notice to Proceed" for a development, the contractor shall arrange a "pre-construction meeting" which shall be attended by the owner/developer, all of the owner/developer's engineer, contractors, subcontractors, affected utility companies and the appropriate City representatives. This meeting shall be held before any construction-related activities can commence on said development, and its purpose is to introduce all of the "parties" involved in the development as well as establish guidelines that the City feels are appropriate for the development.

1.23.00 WORK CONDITIONS

1.23.01 Emergency Work

When, in the opinion of the City, the contractor has not taken sufficient precautions for the safety of the public or the protection of the work to be constructed, or if adjacent structures or property which may be damaged by processes of construction on account of such neglect, and an emergency arises and immediate action is considered necessary in order to protect private or public interests, the City, WITH OR WITHOUT NOTICE to the contractor or the developer, may provide suitable protection by causing work to be done and material to be furnished and placed as the City may consider necessary and adequate. The cost and expense of such work and material so furnished will be borne by the contractor or developer and will be paid within 30 days of presentation of the bills. The City may also draw from the developer's surety to cover any non-payment, including accrued interest and applicable overhead costs. The performance or non-performance of such emergency work under the direction of the City will in no way relieve the contractor of responsibility for damages which may occur during or after such precaution has been taken.

1.23.02 Final Clean-Up

Upon completion of the work and prior to any inspection by the City, the contractor shall remove from the project area all surplus and discarded material, rubbish, and temporary structures and leave the project area in a neat and presentable condition. The contractor shall restore all work which has been damaged by his operations to general conformity with the specifications for the item(s) involved. The contractor shall inspect the interior of all manholes and catch basins within the construction limits for construction materials, dirt, stones, or other debris and remove same prior to any inspection by the City.

1.24.00 CONTROL OF WORK AND MATERIALS

1.24.01 Authority of City

The City will have the authority to stop work whenever such stoppage may be deemed necessary. The City Engineer will resolve all questions which arise as to the quality and acceptability of materials furnished, work performed, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS.

City inspectors are authorized to inspect all work and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector is not authorized to revoke, alter, or waive any requirements of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. They are authorized to call the attention of the contractor to any failure of the work or materials to conform to these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. The Inspector will have the authority to reject materials until any questions at issue can be resolved by the City.

The Inspector will, in no case, act as foreman or perform other duties for the contractor nor interfere with the management of the work done by the contractor. Any "advice" or "opinion" which the inspector may give the contractor will not be construed as binding upon the City Engineer or the City in any way or release the contractor from fulfilling all of the terms of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. The presence or absence of the inspector will not relieve, in any degree, the responsibility or the obligation of the contractor, owner or developer.

The City and its inspector will, at all times, have reasonable and safe access to the work as it progresses and the contractor will provide proper facilities for such access and inspection.

1.24.02 Responsibilities of the Contractor

In case of suspension of work for any cause, the contractor, before leaving the job site, will take such precautions as may be necessary to prevent damage to the project, provide for public safety, normal drainage, and erect any necessary barricades, signs, or other facilities at his expense as directed by the City and required by these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. The contractor is responsible for ensuring that all construction and construction activities and materials are in compliance with these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures. The contractor shall be responsible for the acts and omissions of his employees, subcontractors, and their agents and employees. The contractor shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating. City utility maps are intended to be used for general information only, and the location of any utilities or property lines as shown on the utility maps are not necessarily accurate.

1.24.03 Unauthorized and/or Unacceptable Work

Work which does not conform to the approved construction plans and these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ and results in an inferior or unsatisfactory product will be considered unacceptable work. Unacceptable work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause which is found to exist prior to the final acceptance of the work will be immediately removed and replaced or otherwise satisfactorily corrected by and at the expense of the developer or contractor. This expense includes total and complete restoration of any disturbed land or surface to original or better condition that existed before the repairs or replacement.

1.24.04 Samples and Tests

To ascertain that materials and procedures comply with contract requirements, testing will be taken at the source or at the job destination at the discretion of the City and as often as the City deems it advisable or necessary. Taking of samples will be in accordance with standard practices except where methods and procedures for sampling materials are otherwise set forth in these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

The contractor will furnish, without charge, all samples and test results required by the City and will afford such facilities as may be necessary for collecting and forwarding them. The contractor may be required to furnish, when requested by the City, a written statement giving the origin, composition, and process of manufacture of a material.

Whenever any of the provisions of these CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ or evidence that any material or construction does not conform to the requirements herein, the City may require that the contractor have tests performed, at his expense, which will be used as proof of compliance. Test methods will be as referenced by these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. If there

are no recognized and accepted test methods for the proposed alternate, the City will determine the test procedures. All tests will be made by an agency approved by the City. Reports and results of such tests will be retained by the City.

1.24.05 Storage of Materials

Materials will be stored so as to ensure the preservation of their quality and suitability for the work. Stored materials, even though approved prior to storage, will be subject to inspection prior to their use in the work and will meet all requirements of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ at the time they are used. Stored materials will be located so as to facilitate inspection. With the prior written approval of the City, portions of the right-of-way not required for public travel may be used for storage purposes and for the placing of the contractor's plants and equipment, but any additional space required will be provided by the contractor at his expense.

1.24.06 Defective Materials

Materials not in conformance with requirements of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ will be considered defective and will be rejected. Rejected materials will be removed from the work site at the contractor's expense, unless otherwise permitted by the City.

1.25.00 PROTECTION OF PUBLIC INTERESTS

1.25.01 Public Convenience and Safety

Unless otherwise specified, the contractor will give written notice, to the proper authorities in charge of streets; gas and water pipes; electric service, cable television, and other conduits; railroads; poles; manholes; catch basins; and all other property that may be affected by the contractor's operations at least 72 hours prior to any construction. The contractor will not hinder or interfere with any person in the protection of such property or with the operation of utilities at any time. The contractor must obtain all necessary information in regard to existing utilities, protect such utilities from injury, and avoid unnecessary exposure so that they will not cause injury to the public.

The contractor will obtain all necessary information in regard to the planned installation of new utilities and cables, conduits and transformers, make proper provision and give proper notification so that new utilities and appurtenances can be installed at the proper time and location without delay to the developer or contractor, nor cause unnecessary inconvenience to the owner or the public. New underground utilities and appurtenances will not be covered with pavement prior to the City's inspection of such facilities. When the work involves excavation adjacent to any building or wall along the work, the contractor will give property owners due and sufficient written notice thereof, with a copy to the City.

1.25.02 Protection of Property and Monuments

The developer and contractor will use every reasonable precaution to prevent the damage or destruction of public or private property such as, but not limited to, poles, trees, shrubbery, crops, fences, monuments and all overhead structures such as, but not limited to, wires or

cables which are either within or outside of the right-of-way. The contractor will protect and support all water, gas, sanitary sewer, storm sewer, electrical pipes, conduits, and all railway tracks, buildings, walls, fences, or other properties which are liable to be damaged during the execution of his work. The contractor will take all reasonable and proper precautions to protect persons, animals and vehicles from injury or damage and, wherever necessary or as directed by the City, will erect and maintain a fence or railing around any excavation and place a sufficient number of amber lights about the work and keep them operational from twilight until sunrise. The contractor will employ one or more watchmen as additional security whenever they are needed or required by the City. The contractor will not prevent the flow of water in the gutters of the street and will use proper means to permit the flow of surface water along the gutters while the work is in progress.

The contractor will protect and carefully preserve all land boundary and City survey control monuments until the owner's authorized registered land surveyor has referenced their location for replacement. All monuments disturbed or removed by the contractor through negligence or carelessness on his part or on the part of his employees or subcontractors will be replaced by a land surveyor registered in the State of Colorado, at the contractor's expense. The developer and contractor will be responsible for the repair of any damage or destruction of property resulting from neglect, misconduct, or omission in his manner or method of execution or non-execution of the work, defective work or the use of unsatisfactory materials. The contractor will restore such property to a condition equal to or better than that existing before such damage or injury was done by repairing, rebuilding, or replacing it as may be directed by the City, or they will otherwise make amends for damage or destruction in a manner acceptable to the City. The developer and contractor will be responsible for the repair of underground pipes, wires, or conduits damaged by them or their subcontractors.

The developer and contractor will be liable for all damage caused by storms and fire until the work is accepted into warranty.

1.25.03 Installation of Survey Monuments

Permanent survey monuments, and lot pins shall be set at locations approved by the City provided that such monuments shall be set not more than 1,400 feet apart along any straight boundary line; at all angle points; and at the beginning, end, and points of change of direction or change of radius of any curved boundary. In addition, 5/8-inch steel pins, or larger, shall be set at all lot corners. Affixed securely to the top of each monument shall be an aluminum cap marked with the Colorado registration number of the land surveyor responsible for the establishment of the monument.

The Professional Land Surveyor will assure that the monuments he establishes or re-establishes conform both in location and physical character with the specifications called for in Section 38-51-104, Colorado Revised Statutes. Each found monument verified in location shall be restored or rehabilitated as necessary so as to have it readily identifiable ad reasonably durable.

1.25.04 Explosives

When blasting is permitted and approved in writing by the City, the developer and contractor will use the utmost care to protect life and property. Signals warning persons of danger will be given before any blast. Excessive blasting or overshooting will not be permitted. The City will have authority to order any method of blasting discontinued which leads to overshooting, is dangerous to the public, or destructive to property, environment or natural features.

Before any blasting will be done by the contractor, a certificate of insurance indicating special blasting coverage in the following minimum amounts will be filed with the City:

Property Damage, each accident	$1,000,000
Public Liability, bodily Injury single limit or equivalent, each accident	$1,000,000

The City reserves the right to require additional insurance coverage if the circumstances warrant.

The City has the right to require detailed inspections by an independent consultant or by City inspectors on any structures or properties located in the vicinity of the blasting, both before and after the blasting activity. The cost for such inspections shall be the responsibility of the developer and contractor.

1.25.05 Protection of Streams, Lakes, and Reservoirs

The developer and contractor will take all necessary precautions to prevent pollution of streams, lakes, and reservoirs by sediment, fuels, oils, bitumens, calcium chloride, fertilizers, insecticides, or other harmful materials. They will conduct and schedule their operations to avoid or minimize siltation of streams, lakes, and reservoirs. A plan for erosion protection shall be submitted and approved by the City. All required erosion control measures shall be in place before starting work. All work must conform to all applicable local, state, and federal regulations.

1.26.00 WORK IN PUBLIC RIGHT-OF-WAY

1.26.01 Permit Required -- Right-of-Way Permit

It shall be unlawful for any person to perform work within a public way of the City of Fort Lupton without first obtaining permission from the City of Fort Lupton. If the work to be performed involves a City of Fort Lupton utility in a State of Colorado Highway right-of-way, both a right-of-way permit from the City and the appropriate permit from the Colorado Department of Transportation shall be required. An application for work done under a right-of-way permit shall be submitted to the City on a form provided by the City for each job. The application shall be submitted at least 48 hours prior to the planned start of work to allow for review and approval by the City. Permittees may be required to increase this time up to 10 days when the work consists of more than a single spot excavation. An application form (when approved) shall constitute a valid "right-of-way permit." Incomplete permit applications will not be reviewed or processed by the City.

The City may require submittal of plans and specifications. No work shall commence until the City has approved the plans and specifications and/or permit application, except in emergency conditions. A permit application shall be required for emergency conditions within 72 hours after the performance of the work and all conditions of a right-of-way permit shall apply.

1.26.02 Issuance of Permits

The City may grant permits to work in, construct, or excavate within the public way or to close traffic lanes or work in connection with a City utility system to any Class D public way

contractor filing an application as herein provided, which application shall pertain to work which shall comply with the requirements of this chapter. All permits shall be issued according to the provisions of the Official Code of the City of Fort Lupton for Class D public way contractors.

1.26.03 Liability for Damage

Any person who shall undertake work pursuant to a permit issued under the provisions of this chapter, perform work under contracts with the City, or perform work under the terms of a Public Improvements Agreement, or by virtue of permission obtained from the Council in accordance with the provisions adopted by the said Council, shall be answerable for any damage or injury to persons, animals, or property as a result of any circumstances of such work. Prior to any excavation within the public right-of-way, the contractor shall contact UNCC, the City of Fort Lupton's Public Works and Utilities Department and any other affected utility company for field location of any utility lines which may be in the vicinity of the work.

1.26.04 Suspension or Revocation of Permits -- Stop Work Order

(A) Any permit may be revoked or suspended by the City and a stop work order may be issued after notice to the permittee for:

1. Violations of any condition of the Public Improvements Agreement, or of the approved construction drawings or specifications; or

2. Violation of any provision of these STANDARDS AND SPECIFICATIONS; or

3. Violation of any other ordinance of the City, state law, or federal law pertaining to the work; or

4. Existence of any condition or the occurrence of any act which may constitute or cause a condition endangering health, life, or safety, or serious damage to property.

(B) A suspension or revocation by the City and stop work orders shall take effect immediately upon notice to the person performing the work in the field and shall remain in effect until such time as the City cancels the order in writing. A failure to abide by the terms of the suspension or revocation will be considered a violation of City code.

(C) Upon receipt of a stop work order, the contractor shall be responsible for taking such precautions as may be necessary to prevent damage to the project, prevent inconvenience or hazardous conditions for the general public, provide for normal drainage, and to erect any necessary barricades, signs, or other facilities which may be necessary or directed by the City.

1.26.05 Application Form

Application for a permit to work in the public way shall be made on an original form provided by the City and shall recite specifically and illustrate by sketch or plan the exact location, depth, extent, nature, and purpose of the excavation to be made and the duration of the time

required for the work. The application shall include the name of the applicant requesting the permit and the applicant's business address, registration number, business phone number, after business hours phone number, and contact person. The application will include other pertinent information such as application date, the start and finish dates of work within the public way, the completion date, the permit fee, a City contact phone number for inspection requests, a traffic control plan if required, and any other relevant information required by the terms of the right-of-way permit.

Applicants shall pay a fee to the City before issuance of such permit. The amount of that fee shall be established by the City and displayed on the permit.

1.26.06 Exhibition of Permit

All required permits shall be kept at the site of the excavation while the work is in progress and shall be exhibited upon request to any police officer or other authorized representative of the City. Failure to comply with this provision shall be grounds for a revocation of the permit and the issuance of a stop work order.

1.26.07 Guarantee

The permittee, by acceptance of the permit, expressly guarantees complete performance of the work therein described and guarantees all work done by him for a period of ~~one~~ two years after the date of completion as shown on the permit form. The permittee agrees upon demand to maintain and to make all necessary repairs during the ~~one~~two-year warranty/maintenance period, and to hold harmless the City of Fort Lupton for any and all claims arising from such work. This guarantee shall include all repairs and actions needed as a result of:

(A) Defects in workmanship or materials

(B) Settling of fills or excavations

(C) Failures caused by unknown reasons

(D) Any unauthorized deviations from the approved plans and specifications

(E) Failure to barricade

(F) Failure to clean up during and after performance of work

(G) Any other violation of these STANDARDS AND SPECIFICATIONS.

If repairs are required during the subsequent ~~one~~two-year warranty period, those repairs need only be guaranteed until the end of the initial ~~one~~two-year period starting with the date of initial completion. However, in the event the City deems that the repairs are severe enough to constitute a reconstruction it may require that a new ~~one~~two-year guarantee be provided for subsequent repairs after the completion of the reconstruction.

The permittee shall be responsible for providing materials and construction methods complying with these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. If the permittee defaults in completion or conformance with these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~, the City shall submit a letter to the permittee describing the default or non-conformance at least 10 days prior to authorizing City personnel to perform suitable repairs and reconstruction. City personnel shall be authorized to remove and replace non-conforming work and/or materials to a reasonable distance beyond the limits of the non-conforming work as required to produce a suitable repair. The permittee shall be responsible for all costs incurred by the City to accomplish the work in a safe and timely manner.

1.26.08 Performance

(A) **Inspection.**

There shall be a minimum of two inspections for each permit. The first shall occur upon notification by the contractor that the work is ready for inspection and the second inspection will be made 30 days prior to the expiration of the ~~one~~two-year warranty period. At any time prior to completion of the ~~one~~two-year warranty period, the City may notify the permittee of any needed repairs. Such repairs shall be completed within 24 hours if the defects are determined by the City to be an imminent danger to the public health, safety, and welfare. Non-emergency repairs shall be completed within 10 days after notice.

(B) **Barricading and Traffic Control.**

1. All work within a traveled public roadway area shall be protected at all times by safety devices as prescribed by the MUTCD and in such manner as to minimize the disruption of the flow of traffic in the vicinity of the work. Normally, only one side of a street may be closed at any given time. Traffic must be provided a minimum lane width of 10 feet in the construction area. Any plan for traffic control during construction must be approved by the Traffic Engineer prior to issuance of permit. Plans that indicate complete closures must show detour routes and must be approved by the Traffic Engineer at least one week prior to the issuance of the permit. The City reserves the right to require longer lead times if it deems necessary.

2. All work within the roadway shall take place between 8:30 a.m. and 3:30 p.m. unless otherwise stipulated on the right-of-way permit.

3. As directed by the City, street excavations must be backfilled prior to leaving the site at the end of the work day, even if the work has not been completed.

4. No person shall dig or cause to be dug any hole, drain, ditch, or any other excavation in any street, alley, sidewalk, or other public place within the City without providing sufficient amber lights to be placed with a suitable barricade or temporary fence around such hole, drain, or other excavation in order to prevent persons, animals, and vehicles from sustaining injury. During the daytime the barricades shall be maintained but warning lights are not required.

All barricades and lights shall be left in place until a permanent patch or temporary cold-mix patch can be made to the excavation.

(C) **Removal of Safety Devices or Barricades.**

No person shall damage, displace, remove, or interfere with any barricade warning light or any other safety device which is lawfully placed around or about any street, alley, sidewalk, or other excavations or construction work in the City.

1.27.00 OTHER PERMITS

This section discusses only those permits and agreements which may be required by the City of Fort Lupton as part of the construction of the public improvements or private improvements in areas of common ownership (for example; landscaping, parking lots, etc.). It does not address other City permits (for example; building permits, tap permits, etc.) or permits which may be required by other government entities (for example; CDOT, FEMA, EPA, etc.).

1.27.01 Land Disturbance Permit

The fee for this permit shall be as established by City Code. This permit is required if any owner/developer wishes to begin overlot grading within a particular development before the public improvements agreement is executed and good and sufficient surety is provided to the City. It should be noted that the City is under no obligation to issue a land disturbance permit prior to the execution of the public improvements agreement. However, if the City has approved the Official Development Plan, completed at least one review of the construction drawing package, and believes that the necessary revisions to that package are minor and that the review process is progressing in an acceptable manner, the City may issue a land disturbance permit. In addition, the owner/developer will be required to sign a letter acknowledging that he is doing the overlot grading at his own risk, and that any subsequent changes to that grading that may be required as a result of additional review comments will be his sole responsibility. Prior to the issuance of a land disturbance permit, all provisions of Section 1.28.02 of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS~~SPECIFICATIONS~~ shall be complied with.

1.27.02 Temporary Water Service Permit

All water used in the City for construction purposes is to be metered and charged to the user. The application for temporary water service shall be made at the City's Utility Division. The application and fee for each temporary meter shall be in accordance with Fort Lupton Municipal Code. A deposit must be made to the City when the application is made. The deposit will be refunded to the applicant, less water usage charges and any consequential damages to the City provided equipment, once certification of water usage has been made. In such cases where water usage charges and equipment damages exceed the deposited amount, additional charges will be billed to the applicant. Water usage rates are established by Title VIII, Water Rate Schedule, Multiple Units, Commercial and Public of the City Code. In the event a water metering device cannot be provided to the applicant by the City other means will be established by the City to estimate water usage.

~~1.28.00 IMPROVEMENTS AGREEMENT~~

~~1.28.01~~ ~~DEFINITION~~

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~~AN IMPROVEMENTS AGREEMENT IS A WRITTEN CONTRACT BETWEEN THE DEVELOPER/OWNER AND THE CITY OF FORT LUPTON FOR INSTALLATION OF ALL PUBLIC IMPROVEMENTS AND/OR PRIVATE IMPROVEMENTS IN AREAS OF COMMON OWNERSHIP, RELATED TO A PARTICULAR PROJECT. TWO AGREEMENTS ARE REQUIRED. ONE ADDRESSING "PUBLIC IMPROVEMENTS" AND ONE ADDRESSING "PRIVATE IMPROVEMENTS". THESE AGREEMENTS SPECIFY THE NATURE OF ALL PUBLIC AND/OR PRIVATE IMPROVEMENTS, THE TIME FRAME FOR CONSTRUCTION AND, IN STANDARD FORMAT, IDENTIFIES THE OBLIGATIONS OF THE DEVELOPER/OWNER AND THE CITY. THIS CONTRACT BINDS THE OWNERS OF PROPERTY BEING DEVELOPED AND ANY SUCCESSORS, ASSIGNEES WITH INTEREST TO THAT PROPERTY.~~

~~THE IMPROVEMENTS AGREEMENT IS A MANDATORY PART OF THE DEVELOPMENT PROCESS AND MUST BE EXECUTED BEFORE CONSTRUCTION ACTIVITIES CAN COMMENCE AND BEFORE A FINAL PLAT CAN BE RECORDED. THE AGREEMENT WILL BE PREPARED BY THE CITY WITH THE INFORMATION PROVIDED BY THE DEVELOPER/OWNER AFTER THE FINAL CONSTRUCTION PACKAGE HAS BEEN APPROVED AND WILL BE FORWARDED TO THE DEVELOPER/OWNER FOR THEIR SIGNATURES.~~

~~1.28.02~~ ~~SURETY~~

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~~THE IMPROVEMENTS AGREEMENT CANNOT BE EXECUTED NOR THE FINAL PLAT EXECUTED AND RECORDED UNTIL GOOD AND SUFFICIENT SURETY IS PROVIDED BY THE OWNER/DEVELOPER TO THE CITY. THE SURETY REPRESENTS 115 PERCENT OF THE TOTAL ESTIMATED COST OF ALL PUBLIC IMPROVEMENTS AND PRIVATE IMPROVEMENTS IN AREAS OF COMMON OWNERSHIP WITH RESPECT TO A SPECIFIC PROJECT. TWO SEPARATE SURETIES ARE REQUIRED, ONE FOR PUBLIC IMPROVEMENTS AND ONE FOR PRIVATE IMPROVEMENTS.~~

~~(A) TYPES OF SURETY.~~

~~THERE ARE FOUR TYPES OF SURETY THAT THE CITY WILL ACCEPT:~~

~~1. A LETTER OF CREDIT FROM A FINANCIAL INSTITUTION ACCEPTABLE TO THE CITY THAT GUARANTEES THE MONIES STATED IN THE LETTER OF CREDIT.~~

~~2. A PLAT RESTRICTION (FOR SINGLE-FAMILY DETACHED RESIDENTIAL DEVELOPMENTS ONLY).~~

~~4. CASH~~

~~(B) REDUCTION OF SURETY.~~

~~REQUESTS FOR REDUCTIONS IN SURETY MUST BE MADE IN WRITING TO THE CITY AND MUST INCLUDE AN ITEMIZED COST BREAKDOWN IN THE SAME FORMAT AS THAT INCLUDED IN THE EXHIBIT OF THE IMPROVEMENTS AGREEMENT. ONLY AFTER THE CITY HAS RESPONDED IN WRITING APPROVING SUCH A REDUCTION CAN THE REDUCTION BE MADE. AT NO TIME SHALL THE AMOUNT OF SURETY RETAINED BY THE CITY BE LESS THAN 15% OF THE TOTAL COST OF THE IMPROVEMENTS.~~

~~(C) EXPIRATION OF SURETY.~~

~~THE EXPIRATION DATE ON THE SURETY SHOULD COINCIDE WITH THE EXPIRATION DATE ON THE IMPROVEMENTS AGREEMENT. ONCE THE PROJECT IS ACCEPTED INTO THE WARRANTY PERIOD, THE SURETY SHALL BE AMENDED SO THAT THE EXPIRATION DATE COINCIDES WITH THE END OF WARRANTY PERIOD DATE.~~

~~AT LEAST FOURTEEN (14) CALENDAR DAYS PRIOR TO THE EXPIRATION DATE OF ANY SURETY, OWNER SHALL PROVIDE THE CITY AN AMENDED FORM OF SURETY WITH A TERM SUFFICIENT TO COVER THE TIME FOR COMPLETING ANY REMAINING OBLIGATIONS OF THE OWNER PURSUANT TO THIS AGREEMENT. THE OWNER'S FAILURE TO PROVIDE SUCH AN EXTENDED FORM OF SURETY PRIOR TO SAID FOURTEEN (14) DAY PERIOD SHALL CONSTITUTE A FAILURE TO PERFORM IN ACCORDANCE WITH AGREEMENT AND SHALL GIVE THE CITY THE RIGHT TO PROCEED IMMEDIATELY TO LIQUIDATE THE EXISTING SURETY.~~

~~1.29.00 CONSTRUCTION DRAWING SUBMITTAL REQUIREMENTS~~

~~CONSTRUCTION DRAWINGS SHALL CONTAIN THE INFORMATION AND BE IN THE FORMAT OUTLINED IN THE SEPARATE DOCUMENT TITLED "PLAN SUBMITTAL DOCUMENT GUIDELINES", AVAILABLE FROM THE PUBLIC WORKS DIRECTOR/ENGINEERING DIVISION OF THE CITY.~~

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CHAPTER 2
EARTHWORK, EROSION CONTROL, AND SEEDING

2.00.00 EARTHWORK AND GRADING

All earthwork operations shall be executed in a manner which will minimize dust, noise, excessive accumulation of debris, danger to the public, and interference with other construction. Positive drainage and adequate erosion control shall be provided at all times during the earthwork operations.

Earthwork operations shall be executed to provide compaction to a minimum 85-percent Standard Proctor density at ± 3 percent of optimum moisture in areas to be eventually turfed or planted and compaction to minimum 95 percent Standard Proctor density at ± 2 percent of optimum moisture under all walks, trails, streets, structures, and other site improvements. Testing, if required by the City to demonstrate compliance with this specification, shall be performed per AASHTO T-180 by a Professional Engineer registered in the State of Colorado and practicing in the field of soils mechanics. All costs for such testing shall be paid by the contractor/developer. Refer to the applicable section in these STANDARDS AND SPECIFICATIONS for compaction requirements within the public right-of-way.

Upon completion of earthwork operations, the contractor shall leave the site and soil clean to allow for proper installation of irrigation, plantings, and related site improvements. Completed grades shall be smoothly and uniformly sloped, properly compacted, and shall provide drainage away from site improvements. All banks or slopes constructed shall be maintained in a stable condition by approved methods to prevent slips, washouts, or erosion. No area to be seeded or sodded shall be steeper than a 4:1 maximum slope (4 horizontal: 1 vertical), nor flatter than a 2-percent minimum slope. Final grades shall conform to the final drainage study and grading plans.

2.10.00 EROSION CONTROL

The primary goal of all erosion control systems is to prevent unacceptable erosion and maintain water quality at acceptable levels. This shall be accomplished by analyzing pertinent environmental factors and applying technical procedures which result in a workable plan.

There are two major elements in developing an erosion and sedimentation control plan. The first is an investigation and analysis of the natural characteristics of a site (such as soil type, steepness of slopes, and available vegetation) that will help the developer anticipate where erosion problems might occur. Detailed information on soils, vegetation, topography, geologic, and hydrologic conditions shall be obtained for the site. The second element is use of effective control measures. Attention shall be given to identify and evaluate problems that may cause serious erosion during and after construction. Runoff from the site, as well as runoff from the watershed above, shall be controlled and discharged safely. Measures shall be taken to prevent erosion and sediment deposition on downstream properties.

2.10.01 Limitations

No person shall clear or grade land without implementing soil erosion and sediment controls in accordance with the requirements of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS, and the City of Fort Lupton's Municipal Code.

2.10.02 Exemptions

(A) Agricultural land management practices and construction of agricultural structures;

(B) Clearing or grading activities that disturb less than ~~2~~ 1 acre~~s~~ of land area and disturb less than 200 cubic yards of earth, provided the existing grades are less than 8 percent and the effected property does not abut public lands.

(C) Clearing or grading activities that are subject exclusively to State approval and enforcement under State law and regulations. A copy of the state approved SWMP shall be provided to the City Engineer.

2.11.00 EROSION AND SEDIMENT CONTROL PLANS

2.11.01 Review and Approval

(A) A person may not clear or grade land without first preparing an erosion and sediment control plan which has been approved by the City.

(B) The applicant shall submit an erosion and sediment control plan and any supporting computations to the City for review and approval. The erosion and sediment control plan shall contain sufficient information, drawings, and notes to describe how soil erosion and off-site sedimentation will be minimized. The City shall review the plan to determine compliance with these DESIGN STANDARDS ~~AND SPECIFICATIONS~~, and the City of Fort Lupton's Municipal Code prior to approval. The plan shall serve as a basis for all subsequent grading and stabilization.

(C) In approving the plan, the City may impose such conditions thereto as may be deemed necessary to ensure compliance with the provisions of these DESIGN STANDARDS and CONSTRUCTION SPECIFICATIONS, and the City of Fort Lupton's Municipal Code for the preservation of public health and safety.

(D) The erosion and sediment control plan shall not be considered approved without the inclusion of the signature and date of signature of the City Engineer.

(E) Approved plans may remain valid for one year from the date of approval unless renewed by the City.

(F) Approved plans will become an exhibit to the City's Land Disturbance Permit. In addition, the developer/contractor will be required to execute an improvements agreement and provide surety in a form outlined by City Code prior to beginning earthwork operations.

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2.11.02 Modifications to Approved Erosion and Sediment Control Plans

When inspection of the site indicates the approved erosion and sediment control plan needs modification, the modification shall be made in compliance with the erosion and sediment control criteria contained in these DESIGN STANDARDS ~~AND SPECIFICATIONS~~, and the City of Fort Lupton's Municipal Code.

(A) The permittee shall submit requests for major modifications to approved erosion and sediment control plans, such as the addition or deletion of a sediment basin, to the City to be processed appropriately. This processing includes modifications due to plan inadequacies at controlling erosion and sediment as revealed through inspection.

(B) The City may approve minor modifications to approved erosion and sediment control plans in the field if conditions so merit.

2.11.03 Grading and Erosion Control Notes

The following minimum grading and erosion control notes shall be stated on, as well as incorporated into the overlot grading and erosion control plan:

GRADING AND EROSION CONTROL NOTES

(A) All site grading (excavation, embankment, and compaction) shall conform to the recommendations of the latest soils investigation for this property and shall further be in conformance with the City of Fort Lupton's **"~~STANDARDS AND~~ SPECIFICATIONS FOR ~~THE DESIGN AND~~ CONSTRUCTION OF PUBLIC IMPROVEMENTS,"** latest edition.

(B) Natural vegetation shall be retained and protected wherever possible. Exposure of soil to erosion by removal or disturbance of vegetation shall be limited to the area required for immediate construction operation and for the shortest practical period of time.

(C) Topsoil shall be stockpiled to the extent practicable on the site for use on areas to be revegetated. Any and all stockpiles shall be located and protected from erosive elements.

(D) Temporary vegetation shall be installed on all disturbed areas where permanent surface improvements are not scheduled for installation within three months. Vegetation shall be a vigorous, drought tolerant, native species mix. (Refer to Section 2.26.00 of the~~se STANDARDS AND~~CONSTRUCTION SPECIFICATIONS for seeding mix.) Project scheduling should take advantage of spring or fall planting seasons for natural germination, but seeded areas shall be irrigated, if conditions so merit.

(E) At all times, the property shall be maintained and/or watered to prevent wind-caused erosion. Earthwork operations shall be discontinued when fugitive dust significantly impacts adjacent property. If earthwork is complete or discontinued and dust from the site continues to create problems, the owner/developer shall immediately institute mitigative measures and shall correct damage to adjacent property.

(F) Temporary cut/fill slopes shall not exceed a steepness of 2:1 (2H:1V). Permanent slopes shall not exceed 4:1 (4H:1V) in areas to be seeded or sodded.

(G) Utility construction is not approved under this plan.

(H) The owner/developer shall provide any additional dust abatement and erosion control measures deemed necessary by the City, should conditions merit them.

(I) Temporary fences shall be installed along all boundaries of the construction limits or property lines as shown on the approved erosion control plan, to prevent grading on property not owned ~~-~~by the developer. In addition, the City may require additional temporary fences if field conditions so merit them.

2.11.04 Standard Erosion Control Details

In the Appendix of these ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS are the standard erosion control details which are acceptable to the City of Fort Lupton.

2.20.00 LANDSCAPING

For the purpose of this chapter, the term "landscaping" refers to ground cover only. "Formal" landscaping requirements are specified in a separate document titled City of Fort Lupton Landscape Regulations. Final drawings, specifications, and details shall be submitted to the City for review and approval prior to construction.

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2.21.00 SOIL PREPARATION

2.21.01 Materials

Soil preparation shall be provided on all areas to be seeded, sodded, or otherwise planted. Organic matter for soil amendment shall be well aged dairy cattle manure, thoroughly composted organic material, and other organic matter as approved by the City, and shall contain a minimum of 60-percent organic matter. The mixture shall be free from clay subsoil, stones, lumps, plants or their roots, sticks, weed stolons and seeds, high salt content, and other materials harmful to plant life. The materials shall be coarsely ground and thoroughly mixed together to ~~insure~~ ensure an even composition. The mix shall have an acidity no greater than pH 7.5 and shall meet the following mechanical analysis:

	% PASSING	% RETAINED
1-1/2 Inch Screen	100	0
1-Inch Screen	90-100	0-10
1/2 Inch Screen	50-80	20-50
#100 Mesh Sieve	0-15	85-100

If testing is required, it shall be done by a Professional Engineer registered in the State of Colorado and practicing in the field of soil mechanics. Testing shall be at the contractor's/ developer's expense.

2.21.02 Placement

Upon establishment of approved grades, the soil surface shall be loosened by rototilling to a minimum of 8 inches, and all materials over 2 inches in diameter shall be removed. The organic matter shall be evenly spread over the entire surface at the rate of 5 cubic yards per 1,000 square feet and shall be mixed thoroughly into the soil surface to a depth of 8 inches by means of a rototiller, soil mixer or similar equipment. The surface shall then be finish-graded and compacted to the approved elevations. Prior to seeding or sodding, D1-ammonium phosphate (18-46-0) shall be spread evenly over the entire surface at the rate of 15 pounds per 1,000 square feet.

2.22.00 TOPSOILING

Topsoiling is not considered a portion of the ordinary soil preparation operations as described in these ~~STANDARDS AND~~CONSTRUCTION SPECIFICATIONS. However, the use of good topsoil is desirable, and may help in reducing water consumption and encouraging plant growth. When topsoil exists on the project site, the contractor shall strip and stockpile the topsoil and redistribute the topsoil over the open space areas after the overlot grading is complete. The City has the prerogative of deleting all or a portion of the soil preparation requirements when topsoil is provided, depending on topsoil quality and quantity.

2.2201 Material

Topsoil shall be fertile sandy loam topsoil, taken from a well-drained site and free from clay subsoil, stones, lumps, plants or their roots, sticks, weed stolons and seeds, high salt content, and other materials harmful to plant life. The topsoil shall have an acidity in the range of pH 5.5 to pH 8.5, and shall be screened and meet the following mechanical analysis:

	% PASSING	% RETAINED
1 Inch Screen	100	0
1/2 Inch Screen	97-100	0-3
#100 Mesh Sieve	60-40	40-60

If soil testing is required, it shall be by a Professional Engineer registered in the State of Colorado and practicing in the field of soil mechanics and in accordance with "Methods of Soils Analysis -- Agronomy No. 9" as published by the American Society of Agronomy. Testing shall be at the contractor's expense.

2.22.02 Placement

Upon establishment of the approved grade, the subsoil surface shall be loosened to a minimum depth of 8 inches by tilling and all objects over 2 inches in diameter shall be removed. The topsoil shall be spread over the area to a minimum of 6 inches compacted depth, and mixed lightly into the subsoil by means of a rototiller, soil mixer, or similar equipment. The surface layer shall then be finish graded and compacted to the approved elevations.

2.23.00 FERTILIZATION

A booster fertilizer with the chemical analysis of Nitrogen-12, Potash-12, Phosphorous-4 with 4 percent iron and 8 percent sulphur shall be applied on the prepared soil at the rate of 5 pounds per 1,000 square feet immediately prior to seeding. If a soil analysis indicates sufficient amounts of the above elements the City may, at its discretion, waive the requirement to fertilize.

2.24.00 MULCHING

A mulch may be needed to conserve moisture, prevent crusting, reduce runoff and erosion and help establish a plant cover. The need for mulch will be at the sole discretion of the City. Mulching material shall be applied immediately before or immediately after seeding. One of the mulching methods listed below will be acceptable:

(A) Application of hydro-mulch (wood fibers in a water slurry) -- minimum rate of 2,000 lbs/acre. Tackifier, fertilizer, etc. will be included in the hydro-mulch.

(B) Weed and seed grass hay or grain straw shall be used at an application rate of 4,000 lbs/acre of air dried material. At least 50-percent of the mulch by weight shall be 10 inches or more in length. Mulch shall be anchored immediately after distributing with a mulch crimper, and tackifier.

(C) Mulch netting shall be firmly held in place with pins spaced not more than ~~ten~~ 10 linear feet apart. In sandy or extremely loose soil, the pins shall be located not more than 5 linear feet apart.

(D) Jute netting, enkamat, and similar approved materials shall be installed according to the manufacturer's recommendations.

(E) Excelsior mat shall be installed according to the manufacturer's recommendations.

2.25.00 SEEDING - GENERAL

Seeding of grasses or ground cover plants is required for either of two purposes:

(A) Temporary erosion control.

(B) Permanent seeding for erosion control and appearance

Temporary seeding for erosion control shall be in accordance with Sections 2.11.03 and 2.26.00 of these STANDARDS AND SPECIFICATIONS.

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2.26.00 DRY LAND SEEDING

Prior to any seeding, a depth of tillage sufficient to establish a seed bed will be done based on specific site conditions.

Germination Standard

The minimum standard for any dryland grass is 5 seedlings of the seeded species per square foot. This count/inspection shall be taken four (4) weeks after germination by a qualified botanist. Any area not meeting the specifications on germination will be touch up seeded in one of the following methods:

Hand Broadcast and Incorporation
Mechanical Broadcast and Incorporation
Interseeding with Seed Drilling Equipment

Dry land seeding, sometimes referred to as "native" seeding, shall be accomplished with mechanical power-drawn drills which have depth bands set to maintain a planting depth of at least 1/4-inch and shall be set to space the rows not more than 7 inches apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application. When requested by the contractor and approved by the City, seeding may be accomplished by means of approved broadcast or hydraulic-type seeders. Seed shall not be drilled or sown during windy weather or when the ground is frozen or otherwise untillable.

All seed sown by broadcast-type seeders shall be "raked in" or otherwise covered with soil to a depth of at least 1/4-inch. Hand method of broadcasting seed will be permitted only on small areas not accessible to machine methods. Water shall be applied as necessary to establish the cover crop. Hydraulic seeding equipment and accessories shall conform to that described in Section 2.28.00 of these STANDARDS AND SPECIFICATIONS. If inspections indicate that strips wider than the specified space between the rows planted have been left or other areas skipped, the City may require immediate resowing of seed in such areas at the developer's expense. Dry land seed shall be applied at the following rate:

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Dry Land Seeding Rates

			Lbs. Per Acre PLS	
Species	C-W-N	Variety	Drilled	Broadcast
Western Wheatgrass	N	Barton	25	50
Blue Grama	N	Lovington	2.5	5
Buffalo Grass	N	Sharps Improved	20	40
Alkali Sacaton	N	**	2.5	5
Pubescent Wheatgrass	C	Lune	7.5	15
Kentucky Bluegrass	C	Merion	1.25	2.5

** = Seed source should come from within 150 miles of an area to be seeded.
PLS = Pure Live Seed is the amount of seed expected to grow based on the purity and germination rate of the bulk seed.
C = Cool season grass
W = Warm season grass
N = Native species

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CHAPTER 3
WATER SYSTEM

3.00.00 INTRODUCTION

All water distribution systems constructed within the City of Fort Lupton shall comply with the requirements of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ and may include additional special criteria established by the City for overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the City.

In the case of water mains larger than 16 inches, the owner or his representative shall submit construction specifications to the City for review and approval prior to the City's approval of the construction drawings.

3.01.00 INTERRUPTION OF SERVICE

The City's Public Works Division will operate all existing valves, hydrants, blow-offs and curb stops. **NO VALVE OR OTHER CONTROL DEVICE ON THE EXISTING PUBLIC SYSTEM WILL BE OPERATED FOR ANY PURPOSE BY ANYONE OTHER THAN THE CITY WITHOUT PRIOR WRITTEN AUTHORIZATION**. Twenty-four hours prior to the interruption of service, the contractor shall notify all users whose service will be interrupted in order for them to make provisions for necessary water storage. For water mains servicing commercial areas (i.e., restaurants) 48 hours prior notice shall be given, and work affecting the shut-down shall be coordinated with each business. No water line in service will be shutdown for more than a four-hour period at one time. Prior approval by the City is required for all shutdowns.

3.02.00 WATER BREAKS

If notification prior to shutdown is impossible, the contractor shall notify all users within one hour after the shutdown. Since prior notification was not possible, it will be the responsibility of the contractor to supply potable water to the users affected. The contractor shall also contact the City's Public Works Division and Fire Department in reference to this emergency shutdown within one hour.

3.03.00 METER SET INSTALLATION REINSPECTION FEE

Water tap fees provide for the initial inspection of the meter set only. Where additional inspections are made necessary by incomplete or faulty work, a fee in accordance with City Code will be charged for the second inspection and each subsequent inspection. This fee shall be charged to the holder of the permit and paid to the City before any additional inspections will be made.

TO SCHEDULE AN INSPECTION DURING REGULAR BUSINESS HOURS, CONTACT PUBLIC WORKS DEPARTMENT AT 303-857-6694. FOR AFTER HOURS EMERGENCIES CALL POLICE DISPATCH AT 720-652-4222.

~~3.10.00 DESIGN CRITERIA~~

~~3.11.00 SCOPE~~

~~IT IS THE INTENT OF THIS "DESIGN CRITERIA" SECTION TO PROVIDE SUFFICIENT DETAILED INFORMATION TO ENABLE THE ENGINEER FOR THE OWNER/DEVELOPER TO CORRECTLY AND EFFICIENTLY DESIGN THE OVERALL WATER SYSTEM FOR A PARTICULAR DEVELOPMENT. IF THERE IS A QUESTION OR A CONCERN REGARDING THE DESIGN OF ANY PORTION OF THE WATER SYSTEM THAT IS NOT ADEQUATELY ANSWERED WITHIN THIS CHAPTER, THE OWNER/DEVELOPER OR HIS REPRESENTATIVE SHALL CONTACT THE CITY TO GET ALL ISSUES RESOLVED PRIOR TO DESIGN. ANY DEVIATION FROM THESE STANDARDS AND SPECIFICATIONS MUST BE APPROVED IN WRITING BY THE CITY.~~

~~3.12.00 GENERAL~~

~~THE WATER SYSTEM SHALL BE DESIGNED BY OR UNDER THE DIRECT SUPERVISION OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO UTILIZING THE MOST CURRENT TECHNICAL STANDARDS ALONG WITH GOOD, SOUND ENGINEERING JUDGMENT THROUGHOUT THE DESIGN PROCESS. THE ENGINEER SHALL HAVE EXPERIENCE IN THE DESIGN AND CONSTRUCTION OF MUNICIPAL WATER DISTRIBUTION SYSTEMS. THE DEVELOPMENT APPROVAL PROCESS INCLUDES THE SUBMITTAL OF A PRELIMINARY DEVELOPMENT PLAN, AN OFFICIAL DEVELOPMENT PLAN, UTILITY STUDY AND CONSTRUCTION DRAWINGS FOR REVIEW AND APPROVAL BY THE CITY.~~

~~FOR DESIGN OF THE WATER SYSTEM, THE FIRE DEPARTMENT SHALL BE CONTACTED EARLY IN THE DESIGN PROCESS IN ORDER TO DETERMINE THE REQUIRED FIRE FLOWS FOR PROPOSED FACILITIES. FIRE FLOW REQUIREMENTS WILL LIKELY DICTATE THE SIZING AND LAYOUT OF THE WATER DISTRIBUTION SYSTEM.~~

~~3.12.01 WATER SYSTEM UTILITY STUDY REQUIREMENTS~~

~~THE UTILITY STUDY SHALL INCLUDE THE FOLLOWING INFORMATION AND SHALL BE BOUND IN AN 8 ½ X 11 INCH FOLDER:~~

~~A) CERTIFICATION STATEMENT - SHALL BE INCLUDED AT THE BEGINNING OF THE REPORT AND SHALL READ AS FOLLOWS: "THIS UTILITY REPORT FOR THE DESIGN OF THE _____ DEVELOPMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION IN ACCORDANCE WITH THE CITY OF FORT LUPTON'S STANDARDS AND SPECIFICATIONS AND ACCEPTABLE~~

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~~PROFESSIONAL PRACTICES OF THE INDUSTRY. WE ACKNOWLEDGE THAT THE CITY OF FORT LUPTON'S REVIEW OF THIS UTILITY STUDY IS ONLY FOR GENERAL CONFORMANCE WITH SUBMITTAL REQUIREMENTS, CURRENT DESIGN CRITERIA AND STANDARD ENGINEERING PRINCIPALS AND PRACTICES. WE ARE ALSO AWARE OF THE PROVISIONS OF THE CITY CODE OF THE CITY OF FORT LUPTON." THE SEAL AND SIGNATURE OF THE PROFESSIONAL ENGINEER RESPONSIBLE FOR PREPARING THE REPORT SHALL FOLLOW THIS STATEMENT.~~

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~~B) REPORT TEXT FOR THE WATER SYSTEM DESIGN SHALL INCLUDE THE FOLLOWING AT A MINIMUM:~~

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~~a) PROJECT LOCATION AND DESCRIPTION A DESCRIPTION OF THE BOUNDARY STREETS, PROJECT AREA AND TYPE OF DEVELOPMENT PROPOSED OR ANTICIPATED USE. INCLUDE A VICINITY MAP.~~

~~b) SYSTEM LAYOUT A DESCRIPTION OF THE EXISTING AND PROPOSED WATER INFRASTRUCTURE IN CONFORMANCE WITH THE CITY'S LATEST MASTER PLAN SHALL BE PROVIDED AND REFERENCE SHALL BE MADE TO A FIGURE IN THE BACK OF THE REPORT ILLUSTRATING THESE IMPROVEMENTS. THE DESCRIPTION SHALL INCLUDE THE SIZES AND TYPES OF EXISTING AND PROPOSED PIPES AND THE INFLUENCE OF THE IMPROVEMENTS ON THE PROJECT AND SURROUNDING AREA.~~

~~c) DESIGN FLOW REQUIREMENTS COMPLETE DESIGN FLOW CALCULATIONS AND A~~

~~DISCUSSION EXPLAINING THE CALCULATIONS AND ASSUMPTIONS SHALL BE PROVIDED. ITEMS SHALL INCLUDE TYPES OF FACILITIES TO BE SERVED, FIRE FLOW CALCULATIONS BASED ON BUILDING CONSTRUCTION TYPE AND FLOOR AREA, DEVELOPED LAND AREA, NUMBER OF UNITS BASED ON LAND USE, AND POPULATION DENSITIES. CALCULATIONS FOR AVERAGE DAY, MAX DAY AND PEAK HOUR DEMANDS SHALL BE PRESENTED. MAX DAY PLUS FIRE FLOW AND PEAK HOUR DEMAND SCENARIOS SHALL BE EVALUATED FOR WORST CASE AND SHALL INCLUDE DOMESTIC DEMANDS, BUILDING SPRINKLER FLOWS AND DOMESTIC IRRIGATION FLOWS. DATA SHALL BE PRESENTED IN TABLE FORMAT, IF POSSIBLE, FOR EASE OF READING. THE REPORT SHALL ACKNOWLEDGE THAT THE PUBLIC WORKS DEPARTMENT/FIRE DEPARTMENT HAS PROVIDED THE REQUIRED FIRE FLOWS AND THAT THEY APPROVE OF THE PROPOSED FIRE HYDRANT LOCATIONS.~~

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~~d) HYDRAULIC ANALYSIS A DETAILED DESCRIPTION OF MODELING ASSUMPTIONS AND RATIONALE SHALL BE PROVIDED IN THE REPORT TEXT SUCH THAT THE ANALYSIS IS CLEAR AND CAN BE CONFIRMED. RESULTS OF THE ANALYSIS AT A MINIMUM SHALL INCLUDE: MINIMUM AND MAXIMUM SYSTEM PRESSURES FOR THE VARIOUS SCENARIOS MODELED, CORRESPONDING NODE LOCATIONS, DISTRIBUTION OF FIRE FLOWS AMONG HYDRANTS, AND MAXIMUM PIPE VELOCITIES. DATA SHOULD BE PRESENTED IN TABLE FORMAT. REFERENCE SHALL BE MADE TO MODELING DATA IN THE APPENDIX AND A FIGURE OF THE PIPE AND NODE NETWORK PROVIDED.~~

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~~e) CONCLUSIONS A DESCRIPTION OF THE RESULTS AND HOW THEY FOLLOW THE CITY CRITERIA SHALL BE PROVIDED. ANY DEVIATIONS FROM THE CITY CRITERIA SHALL BE DESCRIBED AND APPLICABLE VARIANCES REQUESTED.~~

C) APPENDICES - PRINTED DATA OUTPUT FROM THE MODELING RESULTS SHALL BE PROVIDED IN THE APPENDIX AND SHALL CORRESPOND WITH A FIGURE OF THE PIPE AND NODE NETWORK. THE APPENDIX SHALL ALSO INCLUDE HYDRANT FLOW TEST RESULTS, HAND CALCULATIONS AND ANY OTHER PERTINENT DATA. A LARGE SIZE FIGURE (24" X 36") ILLUSTRATING THE EXISTING AND PROPOSED UTILITY IMPROVEMENTS SHALL BE PROVIDED AND SHALL CONFORM TO THE CITY'S LATEST MASTER PLAN. THE DRAWING SHALL INCLUDE PRESSURE ZONE BOUNDARIES, BUILDING FINISHED FLOOR ELEVATIONS, ELEVATION CONTOURS AND LOCATIONS OF PROPOSED AND EXISTING UTILITY EASEMENTS AND RIGHT-OF-WAY.

3.13.0 DESIGN DEMAND

THE DOMESTIC DEMANDS FOR A PARTICULAR DEVELOPMENT VARY DEPENDING ON THE TYPE OF DEVELOPMENT, LAND USE DENSITY, IRRIGATION DEMAND AND BUILDING FIRE SPRINKLER FLOW REQUIREMENTS. HOWEVER, THE DEMAND USED TO DESIGN A WATER SYSTEM IS LARGELY A FUNCTION OF THE REQUIRED FIRE FLOW FOR A PARTICULAR DEVELOPMENT.

THERE ARE TWO GENERAL CATEGORIES OF DEVELOPMENT FOR WHICH DOMESTIC FLOW RATES ARE DETERMINED: RESIDENTIAL AND COMMERCIAL/INDUSTRIAL. DOMESTIC DEMANDS FOR THESE DEVELOPMENTS ARE DETERMINED FROM TABLES 3.13.A, 3.13.B AND 3.13.C BELOW AND THEN PEAKING FACTORS ARE APPLIED TO DEVELOP THE MAXIMUM DAY DEMAND AND PEAK HOUR DEMAND AS FOLLOWS:

MAXIMUM DAY DEMAND = 2.5 X AVERAGE DAY DEMAND

PEAK HOUR DEMAND = 4.0 X AVERAGE DAY DEMAND

DOMESTIC DEMANDS FOR A DEVELOPMENT SHALL BE COMBINED WITH PEAK IRRIGATION DEMAND, BUILDING FIRE SPRINKLER DEMAND AND THE PROJECT FIRE FLOW. THE PEAK IRRIGATION DEMAND SHALL BE DETERMINED BY THE IRRIGATION DESIGNER AND THE FIRE SPRINKLER DEMAND SHALL BE DETERMINED BY THE FIRE SPRINKLER ENGINEER. THE FIRE FLOW FOR A PROJECT IS DETERMINED FROM THE 2006 INTERNATIONAL FIRE CODE AND REQUIRES THE APPROVAL OF THE CITY FIRE MARSHAL. FACTORS SUCH AS BUILDING AREA AND CONSTRUCTION TYPE ARE REQUIRED TO DETERMINE THE FIRE FLOW FOR A STRUCTURE.

THE DESIGN OF THE WATER DISTRIBUTION SYSTEM SHALL BE BASED ON THE HIGHER OF THE TWO DEMAND SCENARIOS:

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~~MAXIMUM DAY DEMAND + PROJECT FIRE FLOW + BUILDING FIRE SPRINKLER FLOW + PEAK IRRIGATION FLOW, OR~~

~~PEAK HOUR DEMAND + PEAK IRRIGATION FLOW.~~

~~THE CITY SHALL BE CONSULTED FOR DESIGN CRITERIA WITH REGARD TO NON-STANDARD DEVELOPMENTS, DESIGN OF MUNICIPAL INFRASTRUCTURE SUCH AS TRANSMISSION MAINS, PUMP STATIONS, ETC. AND FOR DEVELOPMENT WITH UNUSUALLY HIGH DEMANDS. THE PUBLIC WORKS DIRECTOR/CITY ENGINEER SHALL HAVE FINAL INPUT IN THESE INSTANCES.~~

~~RESIDENTIAL AVERAGE DAY DEMAND SHALL BE BASED ON DENSITY, AND ZONING AS DETERMINED BY THE PRELIMINARY DEVELOPMENT PLAN AND OFFICIAL DEVELOPMENT PLAN FOR THE PROJECT. A PER CAPITA DEMAND OF 200 GALLONS PER PERSON PER DAY SHALL BE APPLIED TOWARD THE PEOPLE PER UNIT SPECIFIED IN TABLE 3.13.A BELOW. FOR RESIDENTIAL PLANNING PURPOSES, AVERAGE DAY DEMAND CAN BE CALCULATED ON AN ACREAGE BASIS AS SPECIFIED IN TABLE3.13.A.~~

~~TABLE 3.13.A – RESIDENTIAL AVERAGE DAY DEMAND DATA.~~

~~ZONING~~	~~TYPE OF DEVELOPMENT~~	~~UNITS PER ACRE*~~	~~PEOPLE PER UNIT*~~	~~GALLONS PER ACRE-DAY**~~
~~R-1 TO R-5~~	~~SINGLE FAMILY DETACHED~~	~~UP TO 5~~	~~2.62~~	~~1650~~
~~R-8 TO R-18 AND DISTRICT CENTER~~	~~SINGLE FAMILY ATTACHED~~	~~UP TO 18~~	~~2.62~~	~~4150~~

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~~COMMERCIAL AND INDUSTRIAL AVERAGE DAY DEMANDS WILL VARY WIDELY DEPENDING ON THE TYPE OF DEVELOPMENT. THE FOLLOWING CRITERIA IN TABLE 3.13.B IS BASED ON HISTORIC INFORMATION FROM THE CITY'S WATER RECORDS AND CAN BE USED TO ESTIMATE THE WATER USAGE FOR THE VARIOUS DEVELOPMENTS LISTED. THE CITY OF FORT LUPTON WATER RESOURCES DIVISION SHOULD BE CONSULTED TO DETERMINE TAP FEES.~~

~~TABLE 3.13.B COMMERCIAL/INDUSTRIAL AVERAGE DAY DEMAND DATA (BASED ON BUILDING AREA)~~

~~TYPE OF DEVELOPMENT~~	~~UNIT~~	~~DESIGN DEMAND (GALLONS/UNIT-DAY)~~
~~AUTO SERVICE AND REPAIR~~	~~SF~~	~~0.12~~
~~CAR WASH~~	~~BAY~~	~~528~~
~~CHILDCARE~~	~~SF~~	~~0.32~~
~~CHURCH~~	~~SF~~	~~0.18~~
~~GROCERY STORE~~	~~SF~~	~~0.22~~
~~GAS STATION WITH CAR WASH~~	~~SF~~	~~8~~
~~GAS STATION WITHOUT CAR WASH~~	~~SF~~	~~1.32~~
~~HOSPITAL~~	~~SF~~	~~0.32~~
~~HOTEL/MOTEL~~	~~ROOM~~	~~130~~
~~MEDICAL OFFICE~~	~~SF~~	~~0.2~~
~~GENERAL OFFICES~~	~~SF~~	~~0.04~~
~~RESTAURANT~~	~~SF~~	~~1.1~~
~~RETAIL/SHOPPING CENTER~~	~~SF~~	~~0.16~~
~~SCHOOL~~	~~SF~~	~~0.06~~
~~WAREHOUSE/INDUSTRIAL~~	~~SF~~	~~0.04~~

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~~FOR COMMERCIAL AND INDUSTRIAL PLANNING PURPOSES, AVERAGE DAY DEMANDS CAN BE CALCULATED ON AN ACREAGE BASIS AS SPECIFIED IN TABLE 3.13.C.~~

~~TABLE 3.13.C – COMMERCIAL/INDUSTRIAL AVERAGE DAY DEMAND DATA (BASED ON ACREAGE)~~

~~TYPE OF DEVELOPMENT~~	~~GALLONS PER ACRE-DAY**~~
~~RETAIL COMMERCIAL~~	~~1400~~
~~OFFICE~~	~~1400~~
~~BUSINESS PARK~~	~~1400~~
~~DISTRICT CENTER (NON-RESIDENTIAL)~~	~~1400~~
~~INDUSTRIAL~~	~~220~~
~~SCHOOL/CHURCH~~	~~630~~

~~* FROM THE "2004 CITY OF FORT LUPTON COMPREHENSIVE LAND USE PLAN"~~

~~** FROM THE CITY OF FORT LUPTON "WATER AND SEWER INFRASTRUCTURE MASTER PLAN", URS, 2010.~~

~~3.14.00 HYDRAULIC DESIGN~~

~~A COMPUTER GENERATED HYDRAULIC ANALYSIS OF THE PROPOSED INFRASTRUCTURE, OR "MODEL", SHALL BE DEVELOPED USING STANDARD INDUSTRY SOFTWARE SUCH AS WATERCAD OR CITY APPROVED EQUAL. IN ORDER FOR THE MODEL TO PROPERLY CORRELATE WITH THE CITY'S DISTRIBUTION SYSTEM, A HYDRANT FLOW TEST NEEDS TO BE PERFORMED ON NEARBY~~

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~~HYDRANTS AND STATIC AND RESIDUAL PRESSURES OBTAINED AS A FUNCTION OF FLOW RATE. THIS DATA SHALL BE USED IN THE MODEL TO DEVELOP A WATER SOURCE CURVE, REPRESENTED BY A RESERVOIR AND PUMP, AND THIS WILL ALLOW MODELED PRESSURES TO VARY OVER A RANGE OF IMPOSED DEMANDS. THE WATER SOURCE CURVE FUNCTIONS AS A BOUNDARY CONDITION IN THE MODEL WHERE PROPOSED PIPING INTERFACES WITH THE EXISTING DISTRIBUTION SYSTEM AT THIS BOUNDARY.~~

~~THE OBJECTIVE DURING HYDRANT FLOW TESTING IS TO OBTAIN A FLOW RATE SIMILAR TO THE DESIGN DEMAND REQUIRED FOR THE PROPOSED DEVELOPMENT. THE HYDRANTS TO BE TESTED SHALL BE DETERMINED BY THE CITY AND DATA OBTAINED DURING THIS TEST SHALL BE VALID FOR UP TO ONE YEAR, UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY. DISTRIBUTION SYSTEM FACTORS MAY REQUIRE THAT A FIRE FLOW BE INCREASED FOR A PARTICULAR AREA OF THE SYSTEM, AS DETERMINED BY PUBLIC WORKS/CITY ENGINEERING STAFF. A HYDRANT FLOW TEST SHALL BE REQUESTED BY THE DESIGN ENGINEER FROM THE CITY PUBLIC WORKS/ENGINEERING DIVISION.~~

~~SPECIAL ANALYSIS MAY BE REQUIRED BY THE CITY FOR DEVELOPMENTS REQUIRING LARGE FLOW DEMANDS AND SHALL BE DISCUSSED WITH THE UTILITIES DIVISION. FUTURE CHANGES IN ZONE PRESSURES, IN CONFORMANCE WITH THE CITY'S LATEST MASTER PLAN, SHALL BE CONSIDERED IN THE HYDRAULIC ANALYSIS.~~

~~UPON APPROVAL BY THE CITY, EXCEPTIONS TO THE COMPUTER GENERATED HYDRAULIC ANALYSIS MAY BE MADE FOR THE FOLLOWING:~~

- ~~DEVELOPMENTS REQUIRING LOW DOMESTIC DEMANDS (LESS THAN 600 GPM) AND WITH NO FIRE FLOW REQUIREMENT; OR~~

- ~~DEVELOPMENTS PROPOSING LESS THAN 200 FEET OF WATER MAIN AND NO REQUIRED FIRE HYDRANTS.~~

~~FOR THE ABOVE CASES, HYDRAULIC CALCULATIONS SHOULD BE PROVIDED AS PART OF THE UTILITY REPORT AND SHALL DEMONSTRATE ACCEPTABLE SYSTEM PRESSURES AND VELOCITIES AS A RESULT OF REQUIRED FLOWS.~~

~~3.15.00 OPERATING PRESSURES WITHIN THE DISTRIBUTION SYSTEM~~

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~~MINIMUM RECOMMENDED PRESSURE WITHIN THE DISTRIBUTION SYSTEM SHALL BE 50 POUNDS PER SQUARE INCH DURING THE PEAK HOUR DEMAND AND THE MAXIMUM RECOMMENDED PRESSURE DURING THE AVERAGE DAY DEMAND SHALL BE 100 POUNDS PER SQUARE INCH.~~

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~~THE MAXIMUM PRESSURE FLUCTUATION AT ANY LOCATION IN THE DISTRIBUTION SYSTEM BETWEEN PEAK HOUR DEMAND AND AVERAGE DAY DEMAND SHALL NOT EXCEED 30 POUNDS PER SQUARE INCH.~~

~~THE MINIMUM PRESSURE INVOLVING A FIRE FLOW SCENARIO SHALL BE 20 POUNDS PER SQUARE INCH AS MEASURED AT THE HIGHEST LIVING SPACE IN THE BUILDING(S).~~

~~3.16.00 PRESSURE REGULATING STATIONS~~

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~~PRESSURE REDUCING VALVE (PRV) INSTALLATIONS ARE USED TO CONTROL PRESSURE BETWEEN DISTRIBUTION SYSTEM PRESSURE ZONES. WHEN MAIN EXTENSION PLANS ARE SUBMITTED FOR REVIEW, THE NEED FOR A PRESSURE REGULATING VALVE INSTALLATION SHALL BE DETERMINED JOINTLY BY THE DEVELOPER'S ENGINEER AND THE CITY. PLANS SHALL BE SUBMITTED AS PART OF THE UTILITY STUDY INDICATING SIZE, TYPE, AND LOCATION OF THE PRV INSTALLATION. ALL CALCULATIONS SHALL BE SUBMITTED TO THE CITY FOR REVIEW.~~

~~FOR INDIVIDUAL WATER SERVICES TO BUILDINGS, WATER PRESSURE REGULATORS WILL BE REQUIRED IF SYSTEM PRESSURES EXCEED 80 PSI OR AT THE DISCRETION OF THE BUILDING DIVISION.~~

~~3.17.00 SIZING OF MAINS~~

~~3.17.01 DISTRIBUTION MAINS~~

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~~ALL WATER MAINS SHALL BE SIZED LARGE ENOUGH TO PROVIDE FOR DOMESTIC, IRRIGATION, AND FIRE PROTECTION FLOWS TO THE AREA SERVICED. THE MAXIMUM ACCEPTABLE HEAD LOSS FOR SIX, EIGHT, TEN AND TWELVE INCH MAINS IS TWO FEET PER THOUSAND FEET OF MAIN FOR THE PEAK HOUR DEMAND SCENARIO. THIS ACCEPTABLE HEAD LOSS RATE SHALL NOT APPLY FOR FIRE FLOW SCENARIOS. THE MAXIMUM PIPE VELOCITY FOR NON-FIRE FLOW SCENARIOS SHALL BE 5 FEET PER SECOND AND FOR FIRE FLOW SCENARIOS SHALL BE 7 FEET PER SECOND. FINAL SIZE OF DISTRIBUTION MAINS SHALL BE APPROVED IN WRITING BY THE CITY. OVER SIZING OF MAINS MAY BE REQUIRED BY THE CITY, AND THE RECOVERY OF THE~~

~~COSTS OF SUCH OVER SIZING SHALL BE IN ACCORDANCE WITH THE CITY OF FORT LUPTON MUNICIPAL CODE.~~

~~THE MINIMUM DIAMETER FOR WATER MAINS IN RESIDENTIAL AREAS, INCLUDING CUL-DE-SACS, SHALL BE 6 INCHES. ALL SCHOOLS, SHOPPING CENTERS, BUSINESS PARKS, INDUSTRIAL PARKS, AND HIGH-DENSITY RESIDENTIAL AREAS SHALL BE LOOPED WITH MAINS AT LEAST 8 INCHES IN DIAMETER. ALL WATERLINES SHALL BE LOOPED. NO DEAD-END MAINS, EXCEPT LINES EXTENDING INTO CUL-DE-SACS SERVING NOT MORE THAN 6 SINGLE-FAMILY RESIDENTIAL UNITS, NOR MAINS EXTENDING MORE THAN 150 FEET FROM THE LATERAL CONNECTION, WILL BE PERMITTED. ALL STUBS AND DEAD END MAINS SHALL HAVE A BLOW-OFF INSTALLED. WITH THE EXCEPTION OF FIRE HYDRANT LATERALS, ONLY POLYVINYL CHLORIDE (PVC) PIPE IS APPROVED FOR WATER MAIN INSTALLATIONS 12 INCHES IN DIAMETER AND SMALLER. ANY OTHER MATERIAL PROPOSED MUST BE APPROVED IN WRITING BY THE CITY PRIOR TO CONSTRUCTION. A HAZEN-WILLIAMS "C" COEFFICIENT OF 130 SHALL BE USED WHEN MODELING PVC AND DIP PIPE.~~

~~3.17.02 TRANSMISSION MAINS~~

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~~ALL TRANSMISSION MAINS SHALL BE SIZED IN COMPLIANCE WITH THE CITY'S "WATER DISTRIBUTION SYSTEM STUDY," LATEST EDITION, OR AS OTHERWISE APPROVED IN WRITING BY THE CITY. SEE SECTION 3.22.00 FOR FURTHER DETAILS.~~

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~~3.18.00 SYSTEM LAYOUT – CONSTRUCTION PLAN CRITERIA~~

~~3.18.01 GENERAL~~

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~~ALL WATER MAINS SHALL BE INSTALLED IN DEDICATED RIGHTS-OF-WAY OR PUBLIC EASEMENTS. WATER MAIN INSTALLATION IN EASEMENTS BETWEEN SINGLE-FAMILY RESIDENTIAL LOTS WILL ONLY BE ALLOWED FOR THE PURPOSE OF LOOPING A WATER MAIN AT THE END OF A CUL-DE-SAC. WATERLINES SHOULD NOT BE INSTALLED PARALLEL TO AND DIRECTLY BELOW ANY CONCRETE SUCH AS SIDEWALKS, CURBS, OR GUTTERS. LINES SHALL NORMALLY BE LOCATED 5 FEET NORTH OR WEST OF STREET CENTERLINE, OR 5 FEET NORTH OR WEST OF A CURBED MEDIAN, UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY.~~

~~THE MINIMUM DEPTH OF COVER FOR WATER MAINS FROM THE FINAL APPROVED GRADE OF THE SURFACE TO THE TOP OF THE WATER MAIN SHALL BE 5 FEET. WHERE FINAL GRADES HAVE NOT BEEN ESTABLISHED, MAINS SHALL BE INSTALLED TO A DEPTH GREAT ENOUGH TO~~

~~INSURE 5 FEET OF COVER BELOW THE APPROVED FUTURE GRADE BUT IN NO EVENT LESS THAN 5 FEET OF COVER FROM THE TEMPORARY GRADE. THE MAXIMUM DEPTH OF COVER FOR WATER MAINS SHALL BE 8 FEET BELOW THE FINAL APPROVED GRADE OF THE SURFACE UNLESS APPROVED OTHERWISE, IN WRITING, BY THE CITY.~~

~~PLAN AND PROFILE SHALL BE REQUIRED FOR ALL WATER MAIN DESIGNS. UTILITY CROSSINGS SHALL BE IDENTIFIED IN THE PROFILE VIEWS FOR ALL KNOWN OR PLANNED UTILITIES. THE VERTICAL ALIGNMENT OF WATER MAINS SHALL BE DESIGNED SUCH THAT UNNECESSARY HIGH POINTS ARE AVOIDED. IF A HIGH POINT IN THE MAIN CANNOT BE AVOIDED, A CONTROLLED HIGH POINT SHALL BE LOCATED AT A FIRE HYDRANT TEE WHERE TRAPPED AIR IN THE SYSTEM CAN BE BLED. FOR CONTROLLED HIGH POINTS IN TRANSMISSION MAINS (16 INCH AND LARGER), COMBINATION AIR VALVES SHALL BE PROVIDED. HIGH POINTS AT A WATER MAIN LOWERING SHOULD BE AVOIDED BY DEFLECTING THE MAIN ON BOTH SIDES OF THE LOWERING SUCH THAT POSITIVE PIPE GRADES ARE MAINTAINED TO CONTROLLED HIGH POINTS IN THE SYSTEM. TO MAINTAIN POSITIVE PIPE GRADES TO CONTROLLED HIGH POINTS, THE MAXIMUM DEPTH OF COVER TO THE MAIN CAN INCREASE TO 8 FEET, IF APPROVED IN WRITING BY THE CITY. REFER TO SECTIONS 3.18.02 AND 3.18.06 FOR THE ALIGNMENT OF WATER LINES WITH SEWER LINES. REFER TO SECTION 3.18.07 FOR THE DESIGN OF COMBINATION AIR VALVES.~~

~~WATER MAINS SHALL BE LAID A MINIMUM OF TEN FEET, HORIZONTALLY AND EDGE TO EDGE, FROM ANY EXISTING OR PROPOSED UTILITY. UPON WRITTEN APPROVAL BY THE CITY, A WATER MAIN MAY BE LAID CLOSER THAN TEN FEET TO A PARALLEL SEWER MAIN IF IT IS LAID IN A SEPARATE TRENCH AND IF THE ELEVATION OF THE INVERT OF THE WATER MAIN IS AT LEAST 18 INCHES ABOVE THE CROWN OF THE SEWER MAIN AND, IN ADDITION, PVC C-900 IS USED FOR THE SEWER MAIN.~~

~~WATER MAINS SHALL BE DESIGNED SUCH THAT THEY EXTEND THE ENTIRE FRONTAGE OF THE PROPERTY TO BE SERVED OR AS OTHERWISE APPROVED IN WRITING BY THE CITY.~~

~~WHEN THE WATER MAIN PASSES UNDER A HIGHWAY, RAILROAD, OR WATERWAY, THERE SHALL BE A MINIMUM OF FIVE FEET OF COVER AND A STEEL CASING SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER. THE STEEL CASING SHALL EXTEND THE ENTIRE WIDTH OF THE RIGHT-OF-WAY OR EASEMENT OF THE CROSSING STRUCTURE OR AS DIRECTED BY THE CITY. IN ALL CASES, VALVES SHALL BE LOCATED SUCH THAT THE WATER MAIN AT SUCH CROSSINGS CAN BE COMPLETELY ISOLATED WITHOUT INTERRUPTION OF ANY SERVICES.~~

~~3.18.02~~ ~~WATERLINE CROSSING OVER A SANITARY SEWER LINE~~

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~~WHEN THERE IS LESS THAN 18 INCHES OF VERTICAL CLEARANCE BETWEEN THE WATER MAIN AND THE SANITARY SEWER, THE SANITARY SEWER SHALL BE ENCASED IN CONCRETE A MINIMUM OF NINE FEET ON EACH SIDE OF THE CENTERLINE OF THE CROSSING~~ OR ~~POLYVINYL CHLORIDE PRESSURE PIPE IN ACCORDANCE WITH AMERICAN WATER WORKS ASSOCIATION C900, PRESSURE CLASS 305 PSI MAY BE USED FOR THE SANITARY SEWER.~~

~~3.18.03~~ ~~WATERLINE CROSSING OVER A STORM SEWER LINE~~

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~~WHEN THERE IS LESS THAN 18 INCHES OF VERTICAL CLEARANCE BETWEEN THE WATER MAIN AND THE STORM SEWER, EACH JOINT OF THE STORM SEWER WITHIN NINE FEET OF THE CENTERLINE OF THE CROSSING SHALL BE ENCASED IN CONCRETE.~~

~~FREEZE POTENTIAL OF A WATER MAIN SHALL BE EVALUATED WHEN CROSSING STORM SEWERS OR OTHER EXPOSURES TO THE ELEMENTS. IF A WATER MAIN CROSSES A STORM SEWER WITH 3 FEET OR LESS OF VERTICAL CLEARANCE, A 12" THICK LAYER OF EXTRUDED POLYSTYRENE INSULATING FOAM, ALSO REFERRED TO AS "XPS" SHALL BE PROVIDED ALL AROUND THE WATER MAIN FOR A MINIMUM OF 5 FEET ON EACH SIDE OF THE STORM SEWER. THE SHEETS OF "XPS" SHALL BE THICK ENOUGH TO ALLOW SHAPING OF THE MATERIAL SO IT FITS SNUGLY AROUND ALL SIDES OF THE PIPE LEAVING A MINIMUM 12" THICKNESS AROUND ALL SIDES OF THE PIPE. BONDING OF INDIVIDUAL SHEETS OF "XPS" SHALL BE IN ACCORDANCE WITH SECTION 3.61.03 OF THESE STANDARDS AND SPECIFICATIONS. CROSSINGS OF DEAD END WATER MAINS AND STORM SEWER WITH LESS THAN 18 INCHES OF VERTICAL CLEARANCE SHALL BE PROHIBITED.~~

~~3.18.04~~ ~~SANITARY SEWER LINE CROSSING OVER A WATERLINE~~

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~~IN ALL CASES, REGARDLESS OF VERTICAL CLEARANCE, THE SANITARY SEWER SHALL BE ENCASED IN CONCRETE A MINIMUM OF NINE FEET ON EACH SIDE OF THE CENTERLINE OF THE CROSSING~~ OR ~~POLYVINYL CHLORIDE PRESSURE PIPE IN ACCORDANCE WITH AMERICAN WATER WORKS ASSOCIATION C900, PRESSURE CLASS 305 PSI MAY BE USED.~~

~~3.18.05~~ ~~STORM SEWER LINE CROSSING OVER A WATERLINE~~

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~~IN ALL CASES, REGARDLESS OF VERTICAL CLEARANCE, THE JOINTS OF THE STORM SEWER SHALL BE ENCASED IN CONCRETE A MINIMUM OF NINE FEET ON EACH SIDE OF THE CENTERLINE OF THE CROSSING.~~

~~FREEZE POTENTIAL OF A WATER MAIN SHALL BE EVALUATED WHEN CROSSING STORM SEWERS OR OTHER EXPOSURES TO THE ELEMENTS. IF A WATER MAIN CROSSES A STORM SEWER WITH 3 FEET OR LESS OF VERTICAL CLEARANCE, A 12" THICK LAYER OF EXTRUDED POLYSTYRENE INSULATING FOAM, ALSO REFERRED TO AS "XPS" SHALL BE PROVIDED ALL AROUND THE WATER MAIN FOR A MINIMUM OF 5 FEET ON EACH SIDE OF THE STORM SEWER. THE SHEETS OF "XPS" SHALL BE THICK ENOUGH TO ALLOW SHAPING OF THE MATERIAL SO IT FITS SNUGLY AROUND ALL SIDES OF THE PIPE LEAVING A MINIMUM 12" THICKNESS AROUND ALL SIDES OF THE PIPE. BONDING OF INDIVIDUAL SHEETS OF "XPS" SHALL BE IN ACCORDANCE WITH SECTION 3.61.03 OF THESE STANDARDS AND SPECIFICATIONS. CROSSINGS OF DEAD END WATER MAINS AND STORM SEWER WITH LESS THAN 18 INCHES OF VERTICAL CLEARANCE SHALL BE PROHIBITED.~~

~~3.18.06~~ ~~LIMITS ON VERTICAL SEPARATION~~

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~~UNDER NO CIRCUMSTANCES SHALL THE VERTICAL CLEARANCE BETWEEN ANY WATERLINE AND SANITARY SEWER OR STORM SEWER BE LESS THAN 18 INCHES WITHOUT WRITTEN APPROVAL FROM THE CITY.~~

~~3.18.07~~ ~~COMBINATION AIR VALVES~~

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~~COMBINATION AIR VALVES ARE NECESSARY TO SERVE SEVERAL FUNCTIONS: THEY EXHAUST LARGE VOLUMES OF AIR FROM THE SYSTEM DURING START-UP, THEY OPEN DURING DRAINING OR IF A NEGATIVE PRESSURE OCCURS AND THEY RELEASE ACCUMULATED AIR FROM THE SYSTEM DURING OPERATION. THE VERTICAL ALIGNMENT OF WATER MAINS SHALL BE DESIGNED SUCH THAT UNNECESSARY HIGH POINTS ARE AVOIDED AS DESCRIBED IN SECTION 3.18.01 OF THESE STANDARDS AND SPECIFICATIONS. IF A HIGH POINT IN A DISTRIBUTION WATER MAIN CANNOT BE AVOIDED, A CONTROLLED HIGH POINT SHALL DESIRABLY BE LOCATED AT A FIRE HYDRANT TEE WHERE TRAPPED AIR IN THE SYSTEM CAN BE BLED THROUGH THE FIRE HYDRANT. IF THIS IS NOT POSSIBLE DUE TO LEGITIMATE DESIGN CONSTRAINTS, AN AIR VALVE SHALL BE LOCATED AT THE HIGH POINT AND WITHIN A MANHOLE. FOR CONTROLLED HIGH POINTS IN TRANSMISSION MAINS (16 INCH AND LARGER), COMBINATION AIR VALVES SHALL BE PROVIDED (REFER TO THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER).~~

~~COMBINATION AIR VALVES FOR DISTRIBUTION MAINS AND TRANSMISSION MAINS SHALL BE SIZED BY THE ENGINEER IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND APPROVED BY THE PUBLIC WORKS DIRECTOR/CITY ENGINEER.~~

~~3.19.00 EASEMENTS~~

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~~ALL WATER MAINS SHALL BE IN AN EASEMENT WHICH HAS A HORIZONTAL WIDTH OF AT LEAST TWO TIMES THE DEPTH TO THE PIPE INVERT. THE MINIMUM EASEMENT SHALL BE 20~~

~~FEET IN WIDTH FOR ONE UTILITY, 30 FEET IN WIDTH FOR TWO UTILITIES, AND 40 FEET IN WIDTH FOR THREE UTILITIES. SITE SPECIFIC CIRCUMSTANCES MAY DICTATE THE NEED FOR WIDER EASEMENTS. FOR NORMAL DEPTHS, THE MAIN SHALL BE LOCATED A MINIMUM OF 10 FEET FROM AND PARALLEL TO THE EDGE OF THE EASEMENT. METERS AND FIRE HYDRANTS NOT INSTALLED WITHIN THE RIGHT-OF-WAY WILL REQUIRE AN EASEMENT DEDICATION TEN FEET WIDE AND EXTENDING FIVE FEET BEHIND THE METER OR FIRE HYDRANT. IF A FIRE HYDRANT LATERAL OR WATER METER EXTENDS BEHIND THE CURB MORE THAN TEN FEET, THEN THE WIDTH OF THE EASEMENT SHALL BE A MINIMUM OF 15 FEET. ALL EASEMENTS SHALL BE FOR THE EXCLUSIVE USE OF THE CITY OF FORT LUPTON. NEITHER LANDSCAPING (EXCEPT GRASS AND PRIVATE IRRIGATION SYSTEMS) NOR PERMANENT STRUCTURES (SHEDS, BUILDINGS, ETC.) SHALL BE PLACED IN THE EASEMENT.~~

~~THE EASEMENT AGREEMENT, PROVIDED BY THE CITY, SHALL STATE THAT ANY TEMPORARY STRUCTURES (INCLUDING PAVING AND FENCING) PLACED IN THE EASEMENT SHALL BE REMOVED AND REPLACED BY THE OWNER OF THE LAND WHEN REQUESTED BY THE CITY SO THAT MAINTENANCE CAN BE PERFORMED. THE OWNER OF THE LAND SHALL AGREE TO HOLD THE CITY OF FORT LUPTON HARMLESS FOR ANY REPLACEMENT OF STRUCTURES REMOVED FROM THE EASEMENT.~~

~~THE FOLLOWING STATEMENT SHALL APPEAR ON ALL OFFICIAL DEVELOPMENT PLANS AND ALL FINAL PLATS.~~

~~UTILITY MAINTENANCE STATEMENT~~

~~ALL PUBLIC WATER, STORM SEWER AND SANITARY SEWER MAINS AND APPURTENANCES LOCATED IN PUBLIC ROW SHALL BE MAINTAINED BY THE CITY OF FORT LUPTON PUBLIC WORKS DEPARTMENT. ALL PUBLIC WATER, STORM SEWER, SANITARY SEWER MAINS AND APPURTENANCES UNDER PRIVATE DRIVES ARE LOCATED IN UTILITY EASEMENTS. CITY IS RESPONSIBLE FOR MAINTENANCE OF THESE WATER, STORM AND SANITARY SEWER FACILITIES. CITY IS NOT RESPONSIBLE FOR REPAIR OR REPLACEMENT OF PRIVATE DRIVE, CURB AND GUTTER OR LANDSCAPING DAMAGED DURING UTILITY REPAIR OR MAINTENANCE.~~

~~3.20.00 FUTURE CONNECTIONS~~

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~~A BLOW-OFF IS REQUIRED AT THE END OF ANY WATER MAIN WHICH TERMINATES AND IS ANTICIPATED TO BE EXTENDED IN THE FUTURE. REFER TO THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER. WHEN A FUTURE MAIN EXTENSION IS ANTICIPATED, THE MAIN SHALL INCLUDE VALVES SO THAT ONLY ONE VALVE WILL HAVE TO BE CLOSED WHEN THE MAIN IS EXTENDED. THE VALVE SHALL BE RESTRAINED SO WHEN THE ONE VALVE IS CLOSED AND THE LINE TO BE EXTENDED IS EXPOSED, THE VALVE WILL NOT BLOW OFF. RESTRAINT~~

~~SHALL BE MADE BY THE USE OF A MECHANICAL JOINT ANCHORING TEE (SWIVEL TEE), SWIVEL CROSS, AND BY INSTALLING A MINIMUM OF TWO FULL LENGTHS OF PIPE ON THE EXTENSION SIDE OF THE VALVE (8 INCH PIPE AND SMALLER). NO SERVICE TAPS SHALL BE ALLOWED ON A MAIN WHICH CAN BE EXTENDED IN THE FUTURE BETWEEN THE SINGLE VALVE TO BE CLOSED AND THE DEAD END.~~

~~3.21.00 SERVICES~~

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~~CALCULATIONS FOR METER AND SERVICE LINE SIZES SHALL BE PREPARED USING THE "PLUMBING DATA SHEET" AVAILABLE FROM THE BUILDING DIVISION. THE APPLICANT SHALL PREPARE BUILDING PLANS AND CALCULATIONS AND SUBMIT THEM TO THE BUILDING DIVISION FOR REVIEW AND APPROVAL. THE BUILDING DIVISION MUST APPROVE ALL METER AND SERVICE LINE SIZES (BEFORE AND AFTER THE METER) PRIOR TO BEGINNING CONSTRUCTION. THE SERVICE LINES, TAP AND METER SHALL BE THE SAME SIZE, UNLESS OTHERWISE APPROVED AND/OR REQUIRED BY THE CITY. IF THE TAP AND METER ARE OF DIFFERENT SIZES, THE FEE SHALL BE PAID BASED ON THE LARGER SIZE, UNLESS A LARGER TAP IS APPROVED AND/OR REQUIRED BY THE CITY IN WHICH CASE THE FEE FOR THE METER SIZE SHALL BE PAID.~~

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~~EACH SEPARATED STRUCTURE SHALL BE SERVED BY A SEPARATE SERVICE LINE AND METER. ALL NON-RESIDENTIAL DEVELOPMENTS WITH ANY IRRIGATED AREAS ARE REQUIRED TO HAVE SEPARATE IRRIGATION TAPS AND METERS FROM THE WATER MAIN IN ACCORDANCE WITH THE FORT LUPTON CITY CODE. UTILITY EASEMENTS SHALL BE REQUIRED FOR SERVICE LINES UP TO AND INCLUDING THE METER PIT.~~

~~NO PRESSURE BOOSTER FACILITY OF ANY KIND SHALL BE ALLOWED ON ANY SERVICE LINE BETWEEN THE PUBLIC MAIN AND THE METER. ALL SERVICE LINE PRESSURE BOOSTER FACILITIES SHALL BE PRIVATELY OWNED AND MAINTAINED.~~

~~WATER SERVICE LINES SHALL BE LOCATED A MINIMUM OF 10 FEET AWAY FROM ALL SEWER SERVICES AND A MINIMUM OF 5 FEET AWAY FROM ALL FIRE PROTECTION SERVICE LINES (MEASURED HORIZONTALLY). ALL SERVICE LINES SHALL BE CONSTRUCTED PERPENDICULAR TO THE FRONT PROPERTY LINE OF THE PROPERTY THEY ARE GOING TO SERVE AND NOT LESS THAN 5 FEET FROM THE SIDE OF A FRONT PROPERTY LINE. SERVICE LINES THROUGH PRIVATE PROPERTY TO SERVE A SEPARATE PROPERTY ARE PROHIBITED.~~

~~SIZE CHANGES, IF ALLOWED BETWEEN THE SERVICE LINE AND THE METER, SHALL BE ACCOMPLISHED BY PROVIDING A FULL SIZED METER VAULT AND SETTER FOR THE LINE SIZE INSTALLED AND USING INDUSTRY STANDARD ADAPTERS TO INSTALL A REDUCED SIZE METER IN THE FULL SIZE LINE.~~

~~WATER TAPS CANNOT BE ISSUED PRIOR TO A BUILDING AND/OR TAP ENTITLEMENT APPROVAL. EXCEPTIONS MUST BE APPROVED BY THE CITY MANAGER; FOR EXAMPLE, CONVERSION FROM WELL WATER TO THE CITY WATER SYSTEM.~~

~~ALL SERVICE LINES 3/4 INCH THROUGH 2 INCH SHALL BE COPPER AND SHALL BE INSTALLED CONTINUOUS WITHOUT JOINTS BETWEEN THE CORPORATION STOP AT THE WATER MAIN AND THE METER OR CURB STOP. SERVICES SHALL BE TAPPED AT THE MAIN WITH A 45 DEGREE ANGLE FROM HORIZONTAL AND SHALL HAVE A MINIMUM OF 5 FEET OF COVER AND BE LAID AS SHOWN ON THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER. THE MINOR EXCEPTION TO THIS IS ALLOWED FOR THE "SLACK" SECTION IN THE SERVICE LINE NEAR THE TAP WHICH MAY HAVE SLIGHTLY LESS THAN 5 FEET OF COVER.~~

~~SERVICE CONNECTIONS REQUIRING A FLOW GREATER THAN CAN BE DELIVERED THROUGH A 2 INCH CORPORATION AND SERVICE LINE SHALL BE 4 INCH, 6 INCH, OR 8 INCH CONNECTIONS AND SHALL BE POLYVINYL CHLORIDE PIPE IN ACCORDANCE WITH SECTION 3.52.02 OF THESE STANDARDS AND SPECIFICATIONS. SERVICE CONNECTIONS (4 INCH, 6 INCH, OR 8 INCH) TO NEW LINES SHALL BE MADE WITH MECHANICAL JOINT ANCHORING TEES (SWIVEL TEES) OR REDUCING MECHANICAL JOINT ANCHORING TEES (SWIVEL TEES) IF INSTALLED AT THE TIME OF MAIN LINE CONSTRUCTION. LATER CONNECTIONS, IF INSTALLED, MAY ALSO BE MADE WITH TAPPING SLEEVES AND TAPPING VALVES AND AT THE DEVELOPER'S EXPENSE.~~

~~3.22.00 TRANSMISSION MAINS~~

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~~ALL WATER MAINS LARGER THAN 12 INCH IN DIAMETER SHALL BE CLASSIFIED AS "TRANSMISSION MAINS."~~

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~~ALL TRANSMISSION MAINS SHALL HAVE COMBINATION AIR VALVES INSTALLED AT ALL HIGH POINTS ON THE LINE AND ON EACH SIDE OF BUTTERFLY VALVES IN ACCORDANCE WITH THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER.~~

~~ALL TRANSMISSION MAINS SHALL HAVE BLOW-OFF ASSEMBLIES INSTALLED AT ALL LOW POINTS ON THE LINE AND CONSTRUCTED IN ACCORDANCE WITH THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER.~~

~~WITH THE EXCEPTION OF FIRE HYDRANT LATERALS, ONLY POLYVINYL CHLORIDE (PVC) PIPE IS APPROVED FOR WATER MAIN INSTALLATIONS 12 INCHES IN DIAMETER AND SMALLER. ANY OTHER PIPE MATERIAL MUST BE APPROVED IN WRITING BY THE CITY. LINES 20 INCHES IN DIAMETER AND LARGER MAY BE DUCTILE IRON PIPE OR STEEL PIPE, AS APPROVED IN WRITING BY THE CITY. A HAZEN WILLIAMS C COEFFICIENT OF 130 SHALL BE USED WHEN MODELING PVC AND DIP PIPE AND SHALL BE 100 FOR STEEL PIPE, UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY.~~

~~THE DESIGN OF DUCTILE IRON AND STEEL TRANSMISSION MAINS AND OTHER CRITICAL DIRECT BURY APPURTENANCES SUCH AS VALVES, SHALL REQUIRE CATHODIC PROTECTION. CATHODIC PROTECTION SHALL BE DESIGNED BY A QUALIFIED CATHODIC PROTECTION ENGINEER, REGISTERED IN THE STATE OF COLORADO AND SHALL CONFORM TO NACE STANDARD RP-01-69, LATEST REVISION. AS A MINIMUM, THE CATHODIC PROTECTION SYSTEM SHALL INCLUDE MAGNESIUM ANODES; TEST STATION THERMAL BOARD AND SHUNTS; EXOTHERMIC WELD CAPS AND COATING; CONDUCTOR, TEST STATIONS, JOINT BOND WIRES; WIRE SPLICE KITS; EXOTHERMIC WELD EQUIPMENT AND MATERIALS; WIRE AND CABLE MARKER TAGS; AND ONE-PIECE INSULATING SLEEVES AND WASHERS, ALL IN CONFORMANCE WITH SECTION 3.62.00 OF THESE Standards and Specifications. ALL OF THE DATA FOR THESE MATERIALS SHALL BE SUBMITTED TO THE CITY FOR APPROVAL PRIOR TO INSTALLATION. TEST STATIONS SHALL BE SHOWN ON DESIGN DRAWINGS AND AS-BUILT DRAWINGS. CATHODICALLY PROTECTED PIPE, EXCEPT STEEL CASING PIPE, SHALL ALSO REQUIRE POLYETHYLENE WRAP AS DESCRIBED IN SECTION 3.61.02.~~

~~NO SERVICE LINE TAPS OR ANY TAPS LESS THAN SIX INCHES IN DIAMETER SHALL BE MADE TO TRANSMISSION MAINS. EXCEPTIONS TO THIS WILL BE FOR COMBINATION AIR VALVES ONLY.~~

~~VALVES ON TRANSMISSION MAINS SHALL BE PLACED NO MORE THAN 1,200 FEET APART. WHERE THERE ARE CONNECTIONS TO TRANSMISSION MAINS, ALL CONNECTING MAINS SHALL INCLUDE VALVES AT THE CONNECTION. THERE SHALL BE A MINIMUM OF TWO VALVES AT A TEE CONNECTION AND THREE VALVES AT A CROSS CONNECTION.~~

~~3.23.0 UNLAWFUL CONNECTION~~

~~NO INSTALLATION OF POTABLE WATER SUPPLY PIPING OR PART THEREOF SHALL BE MADE IN SUCH A MANNER THAT IT WILL BE POSSIBLE FOR USED, UNCLEAN, POLLUTED, OR CONTAMINATED WATER, MIXTURES, OR SUBSTANCES TO ENTER ANY PORTION OF SUCH PIPING FROM ANY TANK, RECEPTACLE, EQUIPMENT, OR PLUMBING FIXTURE BY REASON OF BACK SIPHONAGE, SUCTION, BACK PRESSURE, OR ANY OTHER CAUSE, EITHER DURING NORMAL USE AND OPERATION OR WHEN ANY SUCH TANK RECEPTACLE, EQUIPMENT, OR PLUMBING FIXTURE IS FLOODED, OR SUBJECT TO PRESSURE IN EXCESS OF THE MAIN LINE OPERATING PRESSURE. NO PERSON SHALL MAKE A CONNECTION OR ALLOW ONE TO EXIST BETWEEN PIPES OR CONDUITS CARRYING DOMESTIC WATER SUPPLIED BY THE CITY AND ANY PIPES,~~

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~~CONDUITS, OR FIXTURES CONTAINING OR CARRYING WATER, CHEMICALS, LIQUIDS, GASES, OR ANY OTHER SUBSTANCES FROM ANY OTHER SOURCE. REFER TO SECTION 3.24.08, BACKFLOW PREVENTION ASSEMBLIES FOR FURTHER REQUIREMENTS.~~

~~3.24.00 APPURTENANCES~~

~~3.24.01~~ VALVES

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~~RESIDENTIAL DISTRIBUTION SYSTEMS SHALL INCLUDE VALVES TO ENSURE THAT NO MORE THAN 600 FEET OF MAIN OR 18 RESIDENTIAL UNITS AND 1 FIRE HYDRANT WILL BE OUT OF SERVICE IN THE EVENT OF A SINGLE WATER MAIN BREAK. VALVE PLACEMENT SHALL BE SUCH THAT THERE ARE AT LEAST TWO VALVES AT EVERY TEE AND THREE VALVES AT EVERY CROSS.~~

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~~VALVES 16 INCH OR LARGER SHALL BE BUTTERFLY VALVES. MAIN LINE VALVES SHALL BE LOCATED AT A TEE, CROSS OR ELBOW IF POSSIBLE. UNDER NO CIRCUMSTANCES SHALL A VALVE BE LOCATED IN CONCRETE AREAS, SUCH AS SIDEWALKS, CROSSPANS, APRONS, CURBS, OR GUTTERS. BUTTERFLY VALVE OPERATORS SHALL BE LOCATED ON THE NORTH OR EAST SIDE OF THE WATER MAIN. ANY VALVE LOCATED IN A GREENBELT AREA SHALL HAVE AN 18 INCH WIDE BY 6 INCH THICK CONCRETE COLLAR AROUND THE VALVE BOX.~~

~~3.24.02~~ FIRE HYDRANTS

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~~THE MAXIMUM DISTANCE, AS MEASURED ALONG THE CENTERLINE OF THE STREET, BETWEEN FIRE HYDRANTS SHALL BE 500 FEET IN RESIDENTIAL AREAS AND 300 FEET IN BUSINESS AND OTHER HIGH VALUE AREAS UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY. ONE FIRE HYDRANT WILL BE ALLOWED ON DEAD-END LINE PROVIDED THAT THE LINE IS AN 8" LINE. THE NUMBER AND LOCATION OF FIRE HYDRANTS IN A GIVEN AREA SHALL BE APPROVED IN WRITING BY THE FIRE DEPARTMENT. IF HYDRANTS ARE TO BE INSTALLED AT LOCATIONS OTHER THAN STREET INTERSECTIONS, THEY SHALL BE LOCATED ON THE EXTENSION OF PROPERTY SIDE LOT LINES. IN NO CASE SHALL A HYDRANT BE LOCATED CLOSER THAN 5 FEET TO OBSTRUCTIONS, DRIVEWAYS, ETC. THE FIRE HYDRANT SHALL BE LOCATED WITHIN THE RIGHT-OF-WAY OR POCKET UTILITY EASEMENT AND ON THE SAME SIDE OF THE STREET AS THE WATER MAIN UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY. FENCES, LANDSCAPING, ETC., SHALL IN NO WAY HINDER THE OPERATION OF THE FIRE HYDRANT. IN ADDITION, CLEAR DISTANCES TO THE FIRE HYDRANT SHALL BE IN ACCORDANCE WITH SECTION 3.19.00 OF THESE STANDARDS AND SPECIFICATIONS.~~

~~THE FIRE HYDRANT LATERAL LINES SHALL BE SET AT 90 DEGREES TO MAINS. THE LENGTH OF THE FIRE HYDRANT LATERAL LINE SHALL BE MINIMIZED AND SHALL BE NO MORE THAN 70 FEET LONG. NO HORIZONTAL BENDS OR OFFSETS SHALL BE USED IN FIRE HYDRANT LATERAL LINES. UNDER NO CIRCUMSTANCES SHALL ANY TAP BE MADE ON A FIRE HYDRANT LATERAL LINE.~~

~~3.24.03~~ ~~THRUST BLOCKS AND JOINT RESTRAINT DEVICES~~

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~~ALL BENDS, TEES, PLUGS, DEAD-ENDS, WET TAPS (IN CERTAIN CASES), HYDRANTS, AND BLOW-OFFS SHALL BE DESIGNED AND CONSTRUCTED WITH CONCRETE THRUST BLOCKS. IF THE SOIL-BEARING STRENGTH IS UNKNOWN, THE SOIL-BEARING CAPACITY USED IN DESIGN SHALL BE 2,000 POUNDS/SQUARE FOOT. REFER TO THE DETAIL DRAWINGS IN THE APPENDIX OF THIS CHAPTER.~~

~~JOINT RESTRAINT DEVICES SHALL BE USED ON BOTH SIDES OF VALVES AND FITTINGS FOR PIPE SIZES 12 INCHES IN DIAMETER AND SMALLER AND IN ADDITION TO THRUST BLOCKS. FOR TRANSMISSION MAINS, 16 INCHES IN DIAMETER AND LARGER, JOINT RESTRAINTS SHALL BE USED FOR A SPECIFIED DISTANCE AS RECOMMENDED USING THE LATEST EDITION OF THE PIPE RESTRAINT CALCULATOR PROVIDED BY EBAA IRON, OR EQUIVALENT~~

~~(WWW.RCP.EBAA.COM). THRUST BLOCKS WILL BE REQUIRED TO BE USED IN ADDITION TO JOINT RESTRAINT DEVICES ON TRANSMISSION MAINS. VERTICAL BENDS IN ALL PIPE SIZES SHALL BE RESTRAINED USING JOINT RESTRAINT DEVICES AND SHALL BE RESTRAINED FOR A SPECIFIED DISTANCE AS RECOMMENDED USING THE LATEST EDITION OF THE PIPE RESTRAINT CALCULATOR PROVIDED BY EBAA IRON, OR EQUIVALENT (WWW.RCP.EBAA.COM).~~

~~HARNESS RODS, OR "RODDING", ARE NOT AN ACCEPTABLE MEANS FOR RESTRAINING PIPE AND FITTINGS UNLESS IT IS SPECIFIED INSIDE VAULTS AS SHOWN ON THE DETAIL DRAWINGS IN THE APPENDIX OF THIS CHAPTER. UNDER NO CIRCUMSTANCE SHALL STEEL HARNESS RODS BE ALLOWED TO BE IN CONTACT WITH SOILS.~~

~~3.24.04~~ ~~METERS~~

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~~CALCULATIONS FOR METER AND SERVICE LINE SIZES (BEFORE AND AFTER THE METER) SHALL BE PREPARED USING THE "PLUMBING DATA SHEET" AVAILABLE FROM THE PLANNING DIVISION AT THE CITY. THE APPLICANT SHALL PREPARE BUILDING PLANS AND WATER DEMAND CALCULATIONS AND SUBMIT THEM TO THE BUILDING DIVISION FOR REVIEW AND APPROVAL. THE PLANNING DIVISION/PUBLIC WORKS DEPARTMENT MUST APPROVE ALL METER AND SERVICE LINE SIZES PRIOR TO BEGINNING CONSTRUCTION. THE SERVICE LINES,~~

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~~TAP AND METER SHALL BE THE SAME SIZE, UNLESS OTHERWISE APPROVED AND/OR REQUIRED BY THE CITY. IF THE TAP AND METER ARE OF DIFFERENT SIZES, THE FEE SHALL BE PAID FOR THE LARGER, UNLESS A LARGER TAP IS APPROVED AND/OR REQUIRED BY THE CITY IN WHICH CASE THE FEE FOR THE METER SIZE SHALL BE PAID.~~

~~WATER TAPS CANNOT BE ISSUED PRIOR TO A BUILDING AND/OR TAP ENTITLEMENT APPROVAL. EXCEPTIONS MUST BE APPROVED BY THE CITY MANAGER; FOR EXAMPLE, CONVERSION FROM WELL WATER TO THE CITY WATER SYSTEM.~~

~~PUBLIC WATER METER INSTALLATIONS INSIDE ANY BUILDINGS ARE PROHIBITED UNLESS OTHERWISE APPROVED, IN WRITING, BY THE CITY. METERS SHALL BE LOCATED WITHIN PUBLICLY OWNED RIGHTS OF WAY OR EASEMENTS. METER PITS SHALL NOT BE LOCATED WITHIN CONCRETE AREAS OR AREAS EXPOSED TO VEHICLE TRAFFIC, UNLESS OTHERWISE APPROVED IN WRITING BY THE CITY. IF THE CITY APPROVES OF LOCATING A METER PIT IN A CONCRETE AREA OR AN AREA EXPOSED TO LIGHT VEHICLE TRAFFIC, THEN A HEAVY DUTY METER PIT DESIGN SHALL BE USED IN ACCORDANCE WITH THE DESIGN DETAIL IN THE APPENDIX OF THIS CHAPTER.~~

~~ALL WATER METERS CONNECTED TO THE CITY OF FORT LUPTON'S UTILITY SYSTEM SHALL BE THE PROPERTY OF THE CITY. UNDER NO CIRCUMSTANCES SHALL ANYONE OTHER THAN CITY PERSONNEL REMOVE A WATER METER ONCE THE PIT OR VAULT HAS BEEN INSPECTED AND APPROVED. NO CONNECTIONS SHALL BE MADE IN THE METER PIT, FOR IRRIGATION OR OTHERWISE, BY ANYONE OTHER THAN AUTHORIZED CITY PERSONNEL. IRRIGATION SYSTEM CONNECTIONS SHALL BE MADE DOWNSTREAM FROM THE METER AND A MINIMUM OF FIVE FEET FROM THE METER PIT OR VAULT.~~

~~FOR ANY INSTALLATION WHERE SPECIAL OR UNUSUAL CONDITIONS MIGHT EXIST, DETAILED DRAWINGS, ACCOMPANIED BY A LETTER OF EXPLANATION, SHALL BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL.~~

~~FOR ANY WATER METER INSTALLATION OVER 2 INCHES IN SIZE, DETAILED DRAWINGS OF THE PROPOSED INSTALLATION SHALL BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.~~

~~THERE SHALL BE NO ELECTRICAL WIRING ALLOWED IN ANY WATER METER PIT OR VAULT UNLESS AUTHORIZED, IN WRITING, BY THE CITY.~~

~~INSPECTIONS OF ALL RESIDENTIAL PITS AND COMMERCIAL PITS OR VAULTS SHALL BE CONDUCTED BY THE CITY. LOCATIONS AND DETAILS FOR COMMERCIAL PITS OR VAULTS SHALL BE REVIEWED AND APPROVED IN WRITING BY THE CITY.~~

~~3.24.05 FIRE PROTECTION SERVICE LINE~~

~~VALVES ON NEWLY CONSTRUCTED FIRE LINES SHALL BE LOCATED ON THE TEE AT THE MAIN LINE. THE OWNER SHALL MAINTAIN ALL PRIVATE FIRE LINES BEGINNING AT AND INCLUDING THIS VALVE. ALL FIRE SPRINKLER TAPS SHALL BE INSTALLED WITH AN APPROVED BACKFLOW PREVENTION DEVICE AS DEFINED BY THE FORT LUPTON CITY CODE 8-7-27 AND A FLOW SWITCH WHICH WILL INDICATE WHEN WATER HAS FLOWED THROUGH THE LINE. A PROPERTY REQUIRING A DOMESTIC SERVICE LINE AND A FIRE PROTECTION SERVICE LINE WILL HAVE SEPARATE TAPS FOR EACH. FIRE PROTECTION SERVICE LINES SHALL BE CONSTRUCTED OF PVC FROM THE FIRE LINE VALVE TO THE 90 DEGREE BEND FOR THE BUILDING STANDPIPE. THE 90 DEGREE BEND AND STANDPIPE SHALL BE DUCTILE IRON PIPE IN CONFORMANCE WITH THE INTERNATIONAL FIRE CODE AS ADOPTED BY THE BUILDING DIVISION. FIRE LINE VALVES SHALL HAVE A FLANGE CONNECTION AND SHALL BOLT DIRECTLY TO A MECHANICAL JOINT ANCHORING TEE (SWIVEL TEE) AT THE MAIN.~~

~~3.24.06 VALVE VAULTS~~

~~ALL VALVES LARGER THAN 12 INCHES SHALL BE INSTALLED IN A VAULT IN ACCORDANCE WITH THE DETAIL DRAWINGS IN THE APPENDIX OF THIS CHAPTER. ALL VALVE VAULTS SHALL BE CAPABLE OF WITHSTANDING AASHTO H-20 HIGHWAY LOADING. THE VAULT SHALL ALSO HAVE LIFT HOOKS IN THE ROOF FOR VALVE REMOVAL INSIDE THE VAULT.~~

~~VAULTS SHALL BE MADE WATER PROOF AFTER CONSTRUCTION BY USE OF SEALANTS, EPOXIES OR OTHER APPROVED METHODS. ALL VAULTS SHALL BE DESIGNED WITH WALL SLEEVES AND LINK SEAL AND BE CAPABLE OF HANDLING THRUSTS CAUSED BY REMOVING VALVES. ALL VENT PIPES FOR VAULTS SHALL BE INSTALLED IN CONFORMANCE WITH THE DETAIL DRAWINGS IN THE APPENDIX OF THIS CHAPTER.~~

~~3.24.07 MANHOLES~~

~~MANHOLES SHALL BE INSTALLED ON ALL PRESSURE REGULATING VALVES, PERMANENT BLOW-OFF INSTALLATIONS, AND AIR RELEASE VALVES IN ACCORDANCE WITH THE DETAIL DRAWING IN THE APPENDIX OF THIS CHAPTER.~~

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~~3.24. BACKFLOW PREVENTION ASSEMBLIES~~

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~~TO PREVENT BACKFLOW CONTAMINATION OF THE CITY OF FORT LUPTON'S POTABLE WATER SYSTEM, A REDUCED PRESSURE ZONE (RPZ) BACKFLOW PREVENTION DEVICE SHALL BE INSTALLED INSIDE THE STRUCTURE AFTER THE MAIN SHUT OFF VALVE ON ALL NON-RESIDENTIAL WATER SERVICE LINES OR WHERE ANY CONDITION MIGHT EXIST THAT WOULD RESULT IN A HIGHER PRESSURE DOWNSTREAM OF THE WATER METER THAN EXISTS IN THE MAIN LINE AND THAT COULD ALLOW BACKFLOW OR BACK SIPHONAGE OF POLLUTED OR CONTAMINATED WATER OR OTHER SUBSTANCES FROM THE WATER USER'S SYSTEM. THE ASSEMBLY SHALL BE INSTALLED PER COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT GUIDELINES AND CODE TO ALLOW FOR PROPER OPERATION AND EASY ACCESS FOR ANNUAL TESTING AND MAINTENANCE.~~

~~A REDUCED PRESSURE ZONE BACKFLOW PREVENTION DEVICE SHALL BE USED FOR ALL NON-RESIDENTIAL IRRIGATION SERVICES. THIS SHALL BE REQUIRED FOR BOTH DOMESTIC AND RECLAIMED WATER SOURCES. THE ASSEMBLY SHALL BE LOCATED A MINIMUM OF FIVE FEET DOWNSTREAM OF THE WATER METER AND INSTALLED PER COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT GUIDELINES AND CODE TO ALLOW FOR PROPER OPERATION AND EASY ACCESS FOR ANNUAL TESTING AND MAINTENANCE.~~

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3.30.00 CONSTRUCTION SPECIFICATIONS

3.31.00 TRENCHING, BACKFILLING AND COMPACTION

Trenching, backfilling and compaction shall be done in accordance with Chapter 9 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

3.32.00 BEDDING

In the event unstable trench conditions are found at pipeline grade, a minimum of one and one-half inch uniformly graded, washed rock shall be used for trench stabilization. Depth of the stabilization shall be as approved in writing by the City.

Granular bedding material shall meet the requirements of Chapter 9 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. Bedding shall be placed to six inches below the bottom of the pipe and shall be placed around the sides of the pipe and to a minimum of 12 inches above the top of the pipe and in accordance with the detail drawing in the Appendix of this chapter.

3.33.00 PIPELINE INSTALLATION

3.33.01 General

The City shall be notified at least 48 hours in advance of any pipe installation. No pipes shall be backfilled until they have been inspected by the City. Alignment and grade of the pipe and the location of fittings, valves, and hydrants shall be staked in accordance with the approved construction plans under the supervision of a professional surveyor registered in the State of Colorado.

Proper implements, tools, and facilities shall be provided and used by the contractor for the safe and convenient execution of the work. All pipe fittings, valves, and hydrants shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable tools or equipment to prevent damage to water main materials and protective coatings and linings. Chains or cables shall not be used for handling pipe with protective coatings. Under no circumstances shall water main materials be dropped or dumped into the trench.

All pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the City. All foreign matter or dirt shall be removed from the interior and ends of pipe and accessories before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

3.33.02 Pipe

Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. After installation of the polyethylene protective wrap, if required, the pipe shall be secured in place by installation of bedding material and backfill, in accordance with Chapter 9 and the detailed drawings in the Appendix of this chapter.

Deflection from a straight line or grade, as required by horizontal or vertical alignments or offsets, shall not exceed the maximum allowable limits set by the manufacturer's specifications. If the alignment requires deflection in excess of the allowable deflection per joint, special bends, or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limits set forth, as approved, in writing, by the City.

All ductile iron pipe, fittings, and appurtenances shall be protected with minimum 8 mil polyethylene film wrap in accordance with section 3.61.02 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. Miscellaneous steel or other

ferrous pipe for temporary blow-offs, etc., shall be similarly protected. Methods for applying the wrap shall conform to the detail drawing in the Appendix of this chapter.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the City, will not be permitted for installation.

All PVC waterline installations shall include the installation of a single, 12-gauge, insulated copper tracing wire taped to the top of the pipe. The tracing wire shall be installed in a continuous run between fire hydrants and the ends of the tracer wire shall be brought to the surface in a cathodic protection box next to the fire hydrant in accordance with the detail drawing in the Appendix of this chapter. Wire splices shall be accomplished in accordance with the detail in the appendix of this chapter. Tracer wire shall be tested by the City, or by the contractor and observed by the City, for continuity prior to acceptance.

During the backfilling of all PVC waterline trenches, a continuous 2-inch-wide metallic-coated, detectable tape labeled "Waterline Buried Below" shall be placed in the trench backfill 2 feet above and directly over the pipe. Detectable tape shall be manufactured by Pro-Line, or City approved equal.

Following backfill and compaction of the water mains, cathodic protection test stations, shall be tested for effectiveness by the contractor and the results of the continuity test shall be submitted to the City. If cathodic protection of the pipe is determined not to meet industry standards, then corrections shall be made until it meets industry standards and is accepted by the City.

3.33.03 Fittings

Pipes shall be connected to valves and fittings by mechanical joints unless specified differently in the approved drawings. For approved slip-on joints, the joint shall be assembled with a ratchet jack or other approved method in a manner that does not cause any damage to the pipe. Both the spigot and bell must be thoroughly clean and free from tar or other coatings and rust.

For mechanical joint pipe, the last 8 inches of the outside of the spigot end of the pipe and the inside of the bell of all fittings and gate valves shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter from the joint and then a thin film of gasket lubricant shall be applied. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the bell of the fitting. Gasket lubricant shall be applied to the rubber gasket and placed on the spigot end of the pipe with the thick edge towards the gland.

After the spigot end of the pipe is placed into the bell and fully inserted the gasket shall be pressed into place within the bell so it is even around the entire joint. After the gland is positioned behind the gasket, the contractor shall install all bolts and nuts and tighten them with a torque wrench in accordance with manufacturer's recommendations. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

Jointing shall be done in accordance with AWWA Specification C-111-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings, for all mechanical joint fittings.

3.34.00 VALVE AND VALVE BOX INSTALLATIONS

In addition to the jointing requirements mentioned in Section 3.33.03 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~, the additional requirements of this section shall apply. Valves and valve boxes shall be installed where shown on the approved drawings and as directed by the City. Valve boxes shall be firmly supported, centered, and plumbed over the operating nut of the valve with the box cover at or minus 1/4-inch within the surface of the finished pavement or at such other elevation as may be directed by the City. Extensions to within 4 feet of the finished grade shall be provided for valves installed with more than 5 feet of cover. All extensions shall be pinned to the valve operating nut. Earth fill shall be carefully tamped around each valve box to a minimum distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valves shall have the interiors cleaned of all foreign matter before and after installation.

Gear cases shall be tightened and the valve shall be inspected in opened and closed positions to insure that all parts are in working condition prior to installation. The cases shall be supported by concrete blocks to prevent any shock or stress being transmitted to the valve.

3.35.00 THRUST BLOCKS

The contractor shall excavate as required to ensure that the thrust blocks are placed against undisturbed soil and shall form the sides of the thrust block to provide the size and shape as required in the detail drawing in the Appendix of these Standards and Specifications. When it is impossible, because of over excavation or other causes, to pour a thrust block against undisturbed earth, harness rods shall be used to anchor the fittings to the main in addition to the thrust block and as required by the City. After the concrete has been placed and has set, the contractor shall remove all forming materials prior to backfilling around the thrust block. Concrete for the thrust blocks shall comply with provisions set forth in Chapter 7 of these CONSTRUCTION SPECIFICATIONS.~~STANDARDS AND SPECIFICATIONS~~

The blocking shall be placed so that the pipe and fitting joints will be accessible for repair. A bond breaker shall be placed between the fittings and the thrust block. Backfill may be placed over the thrust blocks once the surface has set sufficiently to resist the weight of the backfill. However, no tamping or compacting shall be allowed above the thrust block for a minimum of 24 hours after placement. Concrete must set a minimum of 48 hours prior to the initial filling of the line.

3.36.00 CONNECTION TO EXISTING MAINS

At locations where connections to existing water mains are to be installed, the contractor shall locate the existing mains, both vertically and horizontally, and shall verify their exact size in advance of the

time scheduled for making the connections. The contractor shall notify and schedule the connection with the City.

Prior to connecting to existing water mains, the contractor shall have all men, materials, and equipment ready to connect the fitting to the existing main to keep the shut-off time to a minimum. As soon as possible after making the connections, the contractor shall flush the connection to prevent any contamination of the existing facilities. The contractor shall take every precaution necessary to prevent dirt or debris from entering the main.

3.37.00 FIRE HYDRANT INSTALLATION

Before installation of a hydrant, the following operations shall be performed:

(A) The hydrant shall be thoroughly inspected for any defects or damage.

(B) The hydrant interior shall be thoroughly cleaned.

(C) The hydrant shall be opened and closed as many times as necessary to determine that all parts are in proper working order, valves are seating properly and the drain valve is operating freely.

(D) The hydrant shall be aligned so that the nozzles are rotated to face the accessible route by the Fire Department.

(E) The hydrant bury depth from the shoe to the finished grade shall be verified and the appropriate hydrant installed (see below). Extension kits will not be allowed on new hydrant installations without the prior written approval of the Public Works Director/City Engineer.

Following the installation of fire hydrants and before inspection by the City, the contractor shall ensure the following:

(A) The nozzle caps are removed, cleaned and greased with a food grade anti-seize compound such as those manufactured by Loctite, CRC, Assured Flow or USA Bluebook

(B) Reservoir oil is checked and filled as required.

(C) The operating nut is in new condition.

(D) The hydrant is re-painted in accordance with the requirements of Section 3.55.00.

Hydrants shall be set so that a minimum of 5 feet of cover is provided for the lateral line and the nozzles are a minimum of 18 inches above finished grade. Each hydrant shall be set on a concrete foundation at least 18 inches by 18-inches and 6 inches thick. Each hydrant shall be blocked against the end of the trench with a concrete thrust block. If the trench is unstable then the hydrant shall be mechanically restrained from the tee at the main to the hydrant in addition to the thrust block.

Hydrants shall have weep drain holes in the hydrant shoe and shall be surrounded with 1-1/2-inch washed rock. A sheet of 8-mil polyethylene shall be placed over the washed rock to prevent dirt from filling the rock. All hydrants shall stand plumb and shall be connected to the street main by a minimum 6-inch ductile iron lateral line. The lateral line, hydrant and fittings shall be wrapped in polyethylene. For new construction, the hydrant barrel from the flange to the shoe shall be ordered to meet the required field dimension so that the proper depth is achieved without the use of extensions. The fire

hydrant bottom flange shall be adjusted to not more than 8 inches or less than 2 inches above the approved finished grade. For grade adjustments to existing hydrants, the maximum allowable height of extensions shall be 12 inches.

Depending upon hydrant location, the use of steel posts filled with concrete may be required for protection, as specified by the City. Hydrant gate valves shall have a restrained connection directly to the tee at the main (swivel tee). In areas where the hydrant bottom is installed below ground water, the drain shall be plugged and the hydrant marked with a metal tag to indicate the requirements to pump the hydrant after use. All other requirements shall be as shown on the detail drawing in the Appendix of this chapter.

3.38.00 TAPS

~~The size of tap and the tapping method for a given type and size of waterline shall be as follows~~All service taps to the water main will be with a tapping saddle. Transmission mains (16 inch pipes and larger) should not be tapped unless otherwise approved in writing by the City.

~~Host Pipe Size~~	~~Tap Size (DIP or PVC)~~ ¾"	1"	1 1/2"	2"
~~6"~~	~~DT~~	~~DT/S~~	~~S~~	~~S~~
~~8"~~	~~DT~~	~~DT~~	~~S~~	~~S~~
~~10"~~	~~DT~~	~~DT~~	~~S~~	~~S~~
~~12"~~	~~DT~~	~~DT~~	~~S~~	~~S~~

~~S Tapping saddle required. All saddles shall have the AWWA taper on its threads.~~
~~DT Direct tap permitted.~~
~~S/DT Either a tapping saddle or a direct tap may be permitted depending on the situation.~~

All existing AC waterlines shall be tapped using a saddle.

All taps into the water main shall be at an angle of not more than 45 degrees from the horizontal, and corporation stops shall be installed.

Taps shall not be made on a water main until the main has passed the pressure tests and clear water tests and a "Release for Service" letter has been issued by the City. Care shall be taken to properly install water service lines so that a minimum of 12 inches of slack is in the service line at the main to protect against pull-out. Tapping mains may require digging out bedding material and cutting or removing part of the corrosion protective wrapping. After the taps are made, the wrap shall be repaired or replaced by the contractor to protect both the service line and the main.

Service taps shall have a minimum separation of 24 inches and be no closer than 24 inches to a main line joint.

All service taps shall be performed by the Contractor. All necessary materials for said taps, including corporations stops, copper line, meter pits, copper setters, curb stops, etc., shall be supplied by the Contractor. Said materials shall conform to these Standards and Specifications. The City will inspect each tap prior to backfilling.

Taps to PVC mains shall be accomplished with the mainline valves either side of the tap in the closed position.

Taps to PVC mains shall only be made when the air temperature is 32°F or higher.

3.39.00 METER INSTALLATION

All meter installations shall be in accordance with the detail drawings in the Appendix of this chapter.

No connections shall be made in the meter pit other than those related to the meter and bypass. Sprinkler system or backflow preventer connections shall be made no closer than five (5) feet from the meter pit or vault on the downstream side of the meter. The City will own and maintain the service line and fittings up to, and including the meter.

~~Residential 3/4" x ¾"~~All meters with transponders shall be provided and installed by the City upon the contractor's request for a final meter inspection. ~~All other meters and associated transponders shall be purchased by the contractor and then provided to the City for testing prior to installation. The contractor shall contact the City's Public Works Department prior to purchasing meters and transponders to verify the type and brands that are required. The contractor shall also contact the City's Public Works Department to make an appointment for delivery of said meter(s) to the Shop for testing. The location of installation and manufacturers information shall accompany the meter when delivered by the contractor to the City. The meter will be tested and a schedule set for picking up the meter within two working days by the contractor.~~ In addition, the following specific criteria shall apply:

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3.39.01 3/4-Inch and 1-Inch Meter Installations

The ¾" and 1" meter sets shall be installed in accordance with these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ and the detail drawing in the Appendix of this Chapter. The meter shall be located a minimum of ~~18~~ 18 inches from the back of walk to the edge of the meter lid. Where no sidewalk exists, the meter shall be placed a maximum of ~~6~~ 6 feet behind the back edge of the curb. In detached walk areas the meter shall be placed ~~6~~ 6 feet behind the back edge of curb but no closer than 18 inches from the front edge of the walk to the edge of the meter lid. In all cases, the meter shall be installed within rights-of-way or public easements.

The dome or meter lid shall be level and ~~2~~ 2 inches above the approved final grade. The copper setter shall be a minimum of ~~15~~ 15 inches and a maximum of ~~17~~ 17 inches below the meter pit lid. A variance of more than 2 inches vertically in installing the copper setter will not be accepted.

No meters shall be set in streets, sidewalks, driveway alignments, or concrete areas without specific design and prior approval of the City. Meter pits shall be constructed of modified hi-density polyethylene. The size shall be as specified in the detail drawing in the appendix of this Chapter. Grade adjustment shall be made at the top of the pit using concrete rings. The trench floor under the concrete rings shall be compacted earth. The concrete pit shall not bear on the service pipe. Lids shall be a 12" cast iron lid and bonnet and shall have a 2" diameter hole in the center to accommodate the transponder.

Final inspections of the meter pit will be made at the time the meter is actually set. The building permit applicant is responsible for any required adjustments to the copper setter or meter lid at that time.

3.39.02 1-1/2-Inch and 2-Inch Meter Installations

The 1 ½" and 2" meter sets shall be installed in accordance with these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ and the detail drawing in the appendix of this Chapter. Meter manhole lids shall be a maximum of 2 inches above the approved final grade.

The meter manhole shall be located a minimum of 3 feet behind sidewalk and in no case shall the manhole lid be located more than 25 feet from the back edge of curb. Where no sidewalk exists, the meter shall be placed a maximum of 6 feet behind the back of curb. In detached walk areas the meter shall be placed 6 feet behind the back edge of curb but no closer than 18 inches from the front edge of the walk to the edge of the meter lid. A curb stop is required on the service line behind the back of curb and outside of the manhole. In all cases, the meter manhole shall be installed within the right-of-way or public Utility Easements. No meter manholes shall be set in streets, concrete areas, driveway alignments, or other traffic area without specific design and prior approval of the City.

Meter manholes shall use a 24-inch aluminum ring and cover and the outside of the aluminum ring shall have 8 mils of tar applied. Once the tar is set then a 12" wide by 6" thick concrete collar shall be placed around the manhole ring. The manhole cover shall have a 2-inch diameter recessed hole in the center of the cover for the transponder and the cover shall have the lettering "Water Meter" cast into the lid. Meter manholes in traffic areas are only allowed at the discretion of the City. If allowed, the manhole shall use a 24 inch cast iron ring and cover and shall be designed to accommodate and protect the transponder. Approval by the City of this design will be on a project specific basis.

3.39.03 3-Inch and Larger Meter Installations

The 3" and larger meter sets shall be installed in accordance with these CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ and the detail drawing in the Appendix of this Chapter. The entry hole through the roof of the vault shall be aligned perpendicular to the service line and adjacent to the water meter. Vaults shall be sealed at all joints and made watertight. Meter vault lids shall be a maximum of 2 inches above the approved final grade.

The meter vault shall be located a minimum of 5 feet behind sidewalk or back of curb and no more than 25 feet from the back of curb. Where no sidewalk exists, the meter shall be placed a maximum of 6 feet behind the back of curb. In detached walk areas the meter shall be placed 6 feet behind the back edge of curb but no closer than 18 inches from the front edge of the walk to the edge of the meter lid. A curb stop is required on the service line behind the back of curb and outside of the vault. In all cases, the meter vault shall be installed within the right-of-way or public Utility Easements. No meter vaults shall be set in streets, concrete areas, driveway alignments, or other traffic area without prior approval of the City.

Meter vaults shall use a ~~24 inch~~24-inch aluminum cover and shall have the lettering "Water Meter" cast into the lid. A 24" x 36" aluminum cover adaptor and ring shall be used to enlarge the access opening and the adaptor shall have a ~~2 inch~~2-inch diameter hole for the transponder.

The outside of the aluminum ring shall have 8 mils of tar applied. Once the tar is set then a 12" wide by 6" thick concrete collar shall be placed around the manhole ring. Meter manholes in traffic areas are only allowed at the discretion of the City. If allowed, the manhole shall use a

~~24 inch~~24-inch cast iron ring and cover and shall be designed to accommodate and protect the transponder. Approval by the City of this design will be on a project specific basis.

PVC pipe shall be used on the service line outside the vault, except where the PVC pipe stubs through the vault walls. DIP shall be used inside the vault. For all ~~3~~ 3-inch and ~~4~~ 4-inch meter settings, ~~4 inch~~4-inch service pipe will be required on the City side of the meter. A reducer will be required before the meter and on the bypass for ~~3 inch~~3-inch settings. Insulators shall be provided between connections of dissimilar metals. Meter installations larger than ~~4~~ 4-inch shall require shop drawing submittals for approval.

Final inspections of the meter manhole will be made at the time the meter is set.

3.40.00 TESTS

3.40.01 General

The contractor shall disinfect and test all mains and fire lines regardless of existing conditions. This may include repairing existing facilities that must be included in the test and are not capable of holding test pressures. All thrust blocks or other bracing facilities shall be in place at least 48 hours before the initial filling of the line. All tests will be ~~administered~~ witnessed by the City.

3.40.02 Filling and Venting Lines

All existing valves will be operated by the City. The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken so that all available hydrants (including hydrant gate valves), air valves, and other vents are open during the filling of the line. Where hydrants or other vents are not available in the line, the contractor shall make whatever taps are required for venting purposes. These taps shall be abandoned after pressure and disinfection tests have passed and the line has been completely flushed as required by the City. Following testing, the taps shall be removed back to the main and the main repaired by the use of a stainless steel repair clamp. The rate of filling the line shall not exceed the venting capacity of the vent.

3.40.03 Disinfection

The contractor will be required to disinfect all new water piping (mains, services, hydrant laterals, etc.), connections to the existing water system and water main breaks in accordance with AWWA C651-05, Disinfecting Water Mains. Disinfection of the water system shall be performed after all field placed concrete has fully cured, in accordance with Section 3.35.00 of these Standards, and following backfill of the water system. The City shall be notified at least 48 hours prior to disinfection or flushing is performed.

The tablet method (AWWA C651-05, Section 5.1.2) consists of placing calcium hypochlorite granules of tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. During construction, 5 g calcium hypochlorite tablets shall be placed in each section of pipe. Tablets shall be placed in each hydrant, hydrant branch, and similar appurtenances. The minimum number of 5 g tablets required for each pipe section shall be 0.0012 d^2L rounded to the next higher integer, where d is the inside pipe

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diameter in inches and L is the length of the pipe section in feet. Regardless of the number of tablets calculated by this formula for use, the contractor shall achieve a minimum dosage of chlorine of 50 ppm (50 mg/liter).

The tablets shall be attached by a food-grade adhesive, such as Permatex Form-A-Gasket No. 2 and Permatex Clear RTV Silicone Adhesive Sealant manufactured by Loctite Corp. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. Tablets shall be attached before the pipe section is placed in the trench and their position shall be marked on the pipe so that the pipe can be installed with the tablets in the proper position.

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When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s. Precautions shall be taken to ensure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. Heavily chlorinated water should not remain in the pipe for prolonged periods to prevent damage to the pipe lining and fittings.

If a connection or repair is made to an existing water main with an equivalent length equal to or less than 18 feet of pipe, the new pipe, fittings and valves required for the connection shall be spray-disinfected or swabbed with a minimum 1 percent solution of chlorine just prior to being installed in accordance with AWWA C651-05, Section 10. If possible, flushing from both directions toward the work area shall be performed immediately following repairs.

3.40.04 Flushing the Main

The entire line shall be flushed after the specified disinfection time as required in Section 3.40.03. Such flushing shall continue until the water is clear and meets the chlorine content of the existing line. The entire line, including hydrant leads, branch lines, and dead-end mains shall be flushed. The discharge of flushed water shall be accomplished such that no erosion will occur and with no harm to fish, animals, or plants in accordance with Federal and State regulatory agencies. The Water Quality Control Division of The Colorado Department of Public Health and Environment (CDPHE) requires all water line contractors to possess a current Discharge Permit for discharges of chlorinated and process waters associated with the installation of new mains or conduits. Contact CDPHE Water Quality Control Division at 303-692-3539 for information on obtaining the required permit. Procedures for discharge will be subject to the review of the City.

3.40.05 Pressure Test

After the pipe and appurtenances have been laid, the line has been backfilled, disinfection and flushing of the system has occurred and all field-place concrete has cured in accordance with Section 3.35.00 of these STANDARDS AND SPECIFICATIONS each valved section, unless otherwise directed by the CITY, shall be subjected to a hydrostatic pressure of not less than 150 psi. However, in all cases the test pressure shall be 50 percent over existing main pressure in the test area as measured at the lowest elevation of the water main. The test duration shall be a minimum of one hour. If the test pressure drops more than 5 p.s.i. during the test, measured water shall be added to the test section to bring the section up to the specified test pressure. Water added to maintain the pressure shall be per AWWA C600-05 and AWWA C605-05. Allowable leakage shall be calculated according to the following formula:

Ductile Iron and PVC Pipe:

$$L = \frac{N \times D \times SQRT(P)}{74{,}000}$$

L = Allowable Leakage in gallons per hour
N = Total length of pipe being tested in feet
D = Nominal diameter of pipe in inches
P = The average test pressure in psi

When testing against existing closed valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size may be allowed at the discretion of the City.

Each test section of pipe shall be slowly filled with water and the specified test pressure (measured at the lowest point of elevation) shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus and labor shall be furnished by the contractor. Gauges and measuring devices shall be approved by the City. Before applying the specified test pressure all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, valves, or hydrants discovered in the pressure test shall be removed and replaced by the contractor with sound material including any existing pipe or appurtenances that are leaking and were included in the test section. After all visible leaks have been repaired; the pressure test shall be conducted again. Should testing show a leakage rate in excess of the rates calculated from the formula above, the pipeline shall not be accepted. The pipeline shall be repaired, rechlorinated to meet the criteria in Section 3.40.03 of these STANDARDS AND SPECIFICATIONS and retested as described in this section until it meets the test requirements and is accepted by the City.

3.40.06 Bacteriological and Turbidity Test

Water from all new water mains and appurtenances must successfully pass a bacteriological and turbidity test before the main is placed in service. After final flushing, an acceptable sample shall be collected from the new mains and appurtenances. A sample shall be collected for every 1200 ft of new pipe.

All sampling shall be performed by the City. A minimum 24 hours is required to receive bacteriological test results and may take as long as 72 hours. No bacteriological tests will be taken on Fridays.

If unsatisfactory results are obtained from bacteriological tests, the water system shall be rechlorinated by the continuous-feed or slug method of chlorination in accordance with AWWA C651-05, Section 8, until satisfactory results are obtained. Rechlorination shall be done by the contractor, at his expense and under the City's supervision.

3.40.07 Cathodic Protection System Testing

Following construction of water mains and other appurtenances requiring cathodic protection, the following tests shall be performed:

1. Test the pipe-to-soil voltage potential by comparing to a copper sulfate half-cell. One lead of the volt meter is connected to the pipe lead and the other is connected to the copper sulfate half cell buried in moist in-situ soil near the pipe installation. The

potential shall read 0.85 volt or higher. A value of 0.80 volts or less means the pipe is corroding.

2. Check the continuity of the pipe. Prior to completely backfilling the pipe an ohmmeter shall be connected between each end of the installed pipe to measure an ohm reading. Next, test between the test box lead wire and the pipe. A reading of 3 ohms or less shall be achieved for both tests.

3. Test the voltage output of the anode. As in test one above, connect the voltmeter to the anode lead wire and the other lead to the copper sulfate half cell. The voltage reading shall be between 1.4 and 1.6 volts.

4. Measure the current flow from the anode to the pipe. The volt meter is connected to the anode test lead and the other voltmeter lead is connected to the pipe test lead in the test box. The reading shall be between 0.005 amp and 0.3 amp. If the current is more than 1.3 times the design needs, a resistance shall be added to the circuit to extend the life of the anodes.

3.41.00 WORKING WITH ASBESTOS CEMENT PIPE

Approximately one-third of the City's distribution system is asbestos-cement (AC) pipe, commonly known as "Transite". When working with AC pipe by tapping, removing portions of the pipe, attaching fittings or disposing of the pipe, certain precautions need to be taken. It will be the responsibility of the contractors working within the City to follow State and Federal regulations (such as Colorado Department of Public Health and Environment, Regulation 8 Part B) as they apply to asbestos materials.

3.42.00 ABANDONMENT PROCEDURES

Abandonment of City water facilities shall follow these procedures. The City shall approve of facilities to be abandoned and the method and materials used for the abandonment.

Water Services:

- Expose the tap at the main line connection.
- Disconnect the service line from the corporation stop and pull the service line away from the main.
- Remove the corporation stop and install an approved repair clamp on the main.
- Rewrap Cast Iron or Ductile Iron Pipe with polyethylene and tape.
- After inspection, backfill and compact the excavation.
- Remove the meter and yoke from the meter pit and return the meter to the City.
- Remove the meter pit cover.
- Backfill the meter pit and compact the excavation to finished grade

Water Lines:

- Shut down the main and remove a section of pipe.
- Any main and fittings that will remain in service shall be disinfected in accordance with Section 3.40.03.
- Plug the pipe or fitting and rewrap Cast Iron or Ductile Iron Pipe with polyethylene and tape.

- Install required thrust block.
- Pressure grout the abandoned water line.

Water Valve Boxes:

- Notify City prior to abandoning the water valve and whether the valve will be abandoned in an open or closed position.
- Remove the top section of the valve box and lid.
- Fill the valve box with squeegee and patch the top 8" of the hole with the same type of material as the area surrounding the valve box.

3.50.00 MATERIALS

3.51.00 GENERAL

With the exception of fire hydrant laterals, only polyvinyl chloride (PVC) pipe is approved for water distribution main installations. Any other material proposed must be approved by the City in writing, prior to construction. All materials furnished shall be new and undamaged. Transmission mains, 16 inches in diameter and larger, may be ductile iron pipe or steel pipe at the discretion of the City.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Developer of the responsibility for furnishing materials meeting the requirements of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. The City reserves the right to direct or deny the use of certain types of materials in specific circumstances. All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality for the work. The presence of any defects in any materials may constitute sufficient cause for rejection of the pipe or appurtenances. Rejected materials shall be removed from the work site unless otherwise permitted by the City.

All references cited in these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ as the Denver Water Board Specifications shall mean the latest edition of the Engineering Standards of the Board of Water Commissioners of Denver, Colorado.

3.52.00 PIPE

3.52.01 Ductile Iron Pipe (DIP)

All ductile iron pipe shall be manufactured in accordance with AWWA Standard C-151-02, Ductile Iron Pipe Centrifugally Cast for Water. Pipe furnished under this specification shall conform to pressure class 350.

Ductile iron pipe shall be approved for fire hydrant laterals, pipe stubs through walls (as required) and other applications as approved by the City in writing. Pipe materials for transmission mains, 16" in diameter and larger, shall be as approved by the City in writing.

The joint type shall be "push-on, single-gasket" type conforming with applicable requirements of AWWA Standard C-111-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Joint types other than "push-on, single-gasket" are acceptable only if specifically approved by the City in writing.

Pipe shall have normal laying length of either 18 feet or 20 feet. Random lengths are not acceptable.

Iron used in the manufacture of pipe shall have 60/42/10 physicals in accordance with AWWA C-151-02.

Pipe shall have standard thickness cement mortar linings in accordance with AWWA Standard C-104-08, Cement Mortar Lining for Ductile Iron Pipe and Fittings. Pipe shall have a standard asphaltic coating on the exterior

The weight, pressure class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or

"Ductile" shall be cast or stamped on the pipe.

3.52.02 Polyvinyl Chloride Pipe (PVC)

All PVC pipe shall meet the requirements of AWWA Specification C-900-07, Polyvinyl Chloride Pressure Pipe and Fabricated Fittings (4" - 12"), and shall be Pressure Class 305 psi (DR 14), or AWWA C-905-08, Polyvinyl Chloride Pressure Pipe and Fabricated Fittings (14" - 48"), and shall be Pressure Class 235 psi (DR 18).

All pipe shall be suitable for use as a pressure conduit. Provisions must be made for expansion and contraction at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of AWWA Specification C-900-07.

Potable water main PVC pipe shall be blue color. No-potable water main PVC pipe shall be purple.

Standard laying lengths shall be twenty feet (20') for all sizes. Random lengths shall not be acceptable.

Each length of pipe shall bear the date manufactured, type, grade, length, manufacturer's name, and NSF seal of approval.

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.

Solvent cement joints are strictly prohibited.

The manufacturer shall furnish a certified statement that all of the specified tests and inspections have been made and the results thereof comply with the requirements of the applicable standard(s) herein specified. A copy of the certification shall be sent to the City upon request.

The following test station box has been approved by the City for use with tracer wire installations:

Valvco, Terminal Box #NM (5" ID) without locking lid

Others as approved in writing.

3.52.03 Steel Pipe

Upon approval by the City, the use of steel pipe may be allowed for transmission mains 16 inches in diameter or larger. The pipe shall meet Standard AWWA C-200-05, Steel Water Pipe 6 inch and Larger, and installed accordingly. Detailed specifications shall be as approved by the City on a case-by-case basis.

Steel mains larger than 12" shall require cathodic protection and shall be designed by a qualified cathodic protection engineer, registered in the State of Colorado. Cathodically protected pipe shall also require polyethylene wrap as described in section 3.61.02.

3.53.00 FITTINGS

All mechanical joint fittings shall be manufactured in accordance with AWWA C110-08, Ductile Iron and Gray Iron Fittings, or AWWA C153-06, Ductile Iron Compact Fittings. Fittings shall be furnished with rubber gasket joints in accordance with AWWA C111-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

All fittings shall be 350 PSI pressure rating and shall conform to the dimensions and weights shown in the tables of the above referenced AWWA Standards. All fittings shall be made from gray iron or ductile iron. The manufacturer shall prepare a certified statement that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the applicable Standard(s) herein specified. A copy of the certification shall be sent to the City upon request.

All ductile iron flanged fittings shall be manufactured in accordance with AWWA C110-08 for integrally cast flange fittings or AWWA C115, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges, for threaded flange fittings. Typical ductile iron flanged fittings shall be rated for 250 psi working pressure. A working pressure of 350 psi may be achieved with the use of special gaskets.

The following are additional requirements or exceptions to the standards mentioned above:

All fittings 4" through 16" shall be furnished with a fusion bonded epoxy inside and out, with a standard thickness as defined in AWWA C116-03, Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings. The requirement for fusion bonded epoxy on fittings may be waived by the City if specific fittings are not available.

All fittings shall be furnished complete with tee-head mechanical joint bolts and hexagon nuts and shall be fabricated from a high strength, low alloy steel known in the industry as "Cor-Ten" or approved equal.

Mechanical joint anchoring fittings (swivel) as approved by the City, in writing, may also be used.

3.54.00 VALVES

3.54.01 General

All valves shall open left (counterclockwise). Valves shall have a 2-inch-square operating nut. Extension stems shall be pinned to the operating nut for a secure connection. Set screw type connections will not be allowed.

All buried valves shall be installed with a valve box meeting the material specifications of Section 3.54.04 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

3.54.02 Gate Valves

Gate valves shall be required for 4 inch through ~~12 inch~~12-inch valve sizes, unless approved otherwise by the City in writing. Gate valves shall be iron body, resilient-seated gate valves with non-rising bronze stems with design, construction, and pressure ratings conforming to AWWA Specifications C-509-01, Resilient Seated Gate Valves, or C515-01, Reduced Wall Resilient
Seated Gate Valves, and with modifications specified herein. Stem seals shall be triple "O" ring seals designed so that the seals above the stem collar can be replaced with the valve under pressure and in full open position.

Gate valves approved by the City shall be one of the following types:

American Flow Control, Series 2500 (C515 only)
Mueller, Series 2360 (C509 only)
~~American AVK, Series 45~~
CLOW Valves, Models 2639 and 2640

With the exception of tapping valves and valves in vaults, gate valves shall have mechanical joint ends.

Gate valves requiring flanged ends shall have dimensions and drilled holes that conform to ANSI B16.1, Class 125. Flange faces shall be machined to a flat surface with a serrated finish in accordance with AWWA C207-07, Steel Pipe Flanges (4 in. through 144 in). Tapping valves and valves in water vaults for 3" and larger meters shall have a flange connection on one side of the valve and a mechanical joint on the other side (refer to section 3.60.04 for approved tapping valves).

All ferrous internal and external surfaces of the valves shall be epoxy coated in conformance with AWWA C116-03, Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings, and C550-05, Protective Interior Coatings for Valves and Hydrants. The coating shall be a two-part thermosetting epoxy suitable for field over coating and for touch-up with the same coating material without special surface preparation. The supplier shall furnish detailed performance tests of adhesion, hardness and abrasion resistance of the furnished coatings when requested by the City. The coating shall have a successful record of performance in valves, pipe or other fittings for a minimum of ten years.

The resilient seat gate valve stem shall have external break-off capabilities for over-torquing and positive stop to prevent over compression.

All external bolts, nuts and washers used in conjunction with valves shall be stainless steel and tee-bolts shall be "Cor-Ten". Valves shall be delivered complete with bolts, glands and rubber

gaskets in conformance with AWWA C111-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

3.54.03 Butterfly Valves

Butterfly valves shall be required for 16 inch and larger valves, unless approved otherwise by the City in writing. All butterfly valves shall be installed in a vault in accordance with the detail drawings in the Appendix of this chapter. Butterfly valves shall have a combination air and vacuum valve installed on both sides of the valve.

Butterfly valves approved by the City shall be one of the following types:

Mueller, Lineseal III and XPII (sizes up to 48")
Pratt, Triton XR-70 (sizes 24" to 72"),
K-Flo, 500 Series (sizes up to 20")

Butterfly valves shall be geared and designed for underground service and shall conform to AWWA Specification C-504-06, Rubber Seated Butterfly Valves, Class 150-B. Valves shall be tight closing rubber seat type with the rubber seats bonded to the valve body. No metal to metal sealing surfaces will be permitted. Valves shall be bubble tight to 150 PSI minimum rated pressure with flow in either direction. Valve discs shall rotate 90 degrees from the full open position to the shut-tight position. Valve bearings shall be sleeve-type corrosion-resistant, and self-lubricating with the load not to exceed 2,500 PSI.

All butterfly valves shall be furnished with flanged ends. Dimensions and drilling shall conform to ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207-07, Steel Pipe Flanges (4 in through 144 in). The flanges shall have full-sized bolt holes through the flanges, except that drilled and tapped holes will be acceptable only in the areas where the shaft passes through the body. Flanges with all holes tapped will not be allowed.

All ferrous internal and external surfaces of the valves shall be epoxy coated in conformance with AWWA C116-03, Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings, and C550-05, Protective Interior Coatings for Valves and Hydrants.

All external bolts, nuts and washers used in conjunction with valves shall be stainless steel and tee-bolts shall be "Cor-Ten".

3.54.04 Valve Boxes

Valve box risers for standard bury depths shall be two-piece with a 5-1/4-inch diameter screw-type shaft that is adjustable from 45 inches to 60 inches in height. Extensions shall be required for pipes with greater bury depth and the number of extensions shall be minimized. Valve boxes shall be made of gray cast-iron with a large oval base and conform with ASTM A48 Class 30A. Valve boxes shall be considered integral units and shall have at least 6 inches adjustment above and below the specified depth of cover over the pipe. Valve box lids shall be marked with the word "WATER," and shall have a lip or flange extending into the valve box shaft. No slip-type boxes will be allowed.

Valve boxes for buried gate valves shall be one of the following types as approved by the City:

Tyler, series 6860 (with No. 160 base)
Olympic Foundry Inc., Model No. 450VB
Castings Inc., Series 6850
East Jordan Iron Works, Series 8560

3.55.00 FIRE HYDRANTS

Preferred h~~ H~~ydrant~~s~~ will be Mueller Super Centurion, or approved equal ~~Waterous, Pacer Model WB-67-250~~ with the following options:

-- Bronze to bronze seating.
-- Oil cup reservoir.
-- Bronze "safety sleeve" stem coupling.
-- Bronze operating nut.
-- Epoxy-coated upper and lower washer assembly.
-- Fire hydrants shall open left (counterclockwise).

Hydrants shall have a 5-1/4-inch main opening with a 6-inch mechanical joint end. Each hydrant shall be equipped with one 4-1/2-inch pumper nozzle and two 2-1/2-inch hose nozzles with national standard threads. A traffic break-away feature shall be incorporated into the barrel of the hydrant at the ground line.

Hydrants shall be thoroughly cleaned at the factory and then painted with a prime coat of synthetic red primer, Type IV-TTP-86f, followed by one shop coat of fire engine red industrial enamel (Rust-oleum 7407 masstone tint base #1210, or approved equal). Fire hydrant paint shall not be lead based. Care shall be taken when handling hydrants to protect the paint. The installation contractor shall repaint all hydrants after installation with Rustoleum brand High Performance Protective Enamel (7564 Safety Red), as determined by the City.

The operating nut shall be National Standard pentagon measuring 1-1/2 inches from point to opposite flat. Nozzle covers shall have the same size and shape nut as the operating nut and shall be attached by chain to the hydrant body.

Any product that must be modified to meet these CONSTRUCTION SPECIFICATIONS ~~STANDARDS AND SPECIFICATIONS~~ shall be accompanied by a certification signed by a company officer that states that these changes have been incorporated into the product furnished and, in addition, the hydrant shall be tagged by the manufacturer to assure that all the above options were included.

3.56.00 BLOW-OFFS

For host pipes less than 16” in diameter, blow-offs shall consist of a 2” tap, a 2” blow-off pipe and a blow-off assembly as manufactured by Kupferle Foundry Company (model TF500) or City approved equal. Refer to the detail drawing in the appendix of this chapter. The main tap shall consist of a corporation stop and the blow-off pipe shall have a curb stop installed between the tap and blow-off assembly and shall have a 2-inch square operating nut with a valve box. The freeze-proof blow-off assembly shall empty through a drain hole into drain rock below the valve box.

The standard required blow-off for 16-inch and larger mains shall be a 6-inch or larger pipe with a gate valve meeting the material requirements of Section 3.54.02 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATION~~ and a manhole meeting the material

requirements of Section 3.57.00 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. This blow-off shall also conform to the detail drawing in the Appendix of these Standards and Specifications.

3.57.00 MANHOLES AND VAULTS

3.57.01 General

Manholes, Vaults and associated components (i.e. manhole sections, lids, walls and base slabs) shall be designed in accordance with ASTM C 857 and ASTM C 858 to handle applicable loads, including earth, thrust and live loads. Concrete shall have a minimum 28 day mix design of 5,000 psi. All concrete structures shall be designed for HS-20 loading in accordance with AASHTO Standards. Concrete structures shall be manufactured by facilities certified by the National Precast Concrete

Association (NPCA). Concentric reducing sections for manholes shall not be used.

Vaults shall be cast with a separate roof slab for removal and shall be 8 inches minimum thickness. Vault walls shall be cast in one continuous placement and corners shall have added reinforcement as shown in the standard detail in the appendix of these Standards and Specifications. Minimum wall thickness shall be 6 inches and reinforcement shall be at least one inch from the face of the vault. Shop drawings for vault designs shall be submitted to the City and shall be signed and sealed by a Registered Professional Engineer in the State of Colorado.

Steps shall be ½" minimum diameter steel reinforcing bar with a polypropylene plastic covering. Steps shall be placed 12 inches on center and 18 inches maximum from the top of the ring to the first step. Steps shall align with one another in a straight vertical line. Steps shall be PS2-PF manufactured by M.A. Industries, Inc., or City approved equal.

3.57.02 Rings and Covers

All gray iron manhole rings and covers shall conform to the requirements of AASHTO M 105 Class 35B or ASTM A48 Class 35B. Ductile Iron castings shall conform to the requirements of ASTM A536 Grade 80-55-06. Aluminum castings shall conform to the requirements of ASTM B 26 Alloy 356 or 319. All castings shall conform to Federal Specification RR-F-621E, for shape and dimension required and shall have a minimum traffic load rating of AASHTO H20-44.

Each casting shall have markings by the foundry showing: name of foundry, country of manufacture, AASHTO or ASTM designation number, Class number and letter and cast date. Lids shall have lettering, and City logo if required, as shown in the detail drawings in the appendix of this chapter.

Castings shall be free from plugging, sand, blowholes, shrinkage, cracks, and other cold shuts and be well cleaned by shot blasting. Runners, risers, fins, and other cast-on pieces shall be removed from the castings and ground smooth. Bearing surfaces between manhole rings and covers shall be cast or machined with such precision that a uniform bearing surface shall be provided throughout the perimeter area of contact.

Covers shall be 23-7/8" in diameter and frame or ring height shall be 8" tall in accordance with the standard detail in the appendix of these Standards, or as otherwise approved in writing.

Concrete extension collars shall be used to adjust the manhole ring and cover to approved street or ground surface.

Gray iron ring and covers shall be the following type or City approved equal:

East Jordan Iron Works, No. 00240568 (cover); No. 00242011 (ring)

Water meter vaults for 3" and larger services and butterfly valve vaults shall have a 24" x 36" cover adaptor ring to enlarge the access opening as shown on the detail drawings in the appendix of this chapter. Adaptor rings shall have a 2-inch diameter machined hole and there shall be a 3-1/2-inch diameter recessed area above the hole so that the transponder can be installed flush with the surface pattern of the lid.

Gray iron 24" x 36" adaptor rings shall be the following type or City approved equal:

East Jordan Iron Works, No. 2455E (adaptor); No. 2455Z (ring)
D & L Foundry, No. A-1425 (adaptor and ring)

Water meter manholes for 1-1/2" and 2" services shall have aluminum rings and covers. The center of the covers shall have a 2-inch diameter machined hole and there shall be a 3-1/2-inch diameter recessed area above the hole so that the transponder can be installed flush with the surface pattern of the lid. Aluminum rings and covers shall not be allowed in traffic areas however.

Aluminum rings and covers shall be the following type or City approved equal:

Castings Inc., Model MH-100-24 AL

All manholes and vaults installed in "field conditions" or in areas prone to tampering shall have locking covers and shall have gaskets for a water tight seal to prevent inflow. Locking lids shall be ductile iron. Bolt down type locking covers will not be accepted.

Locking type rings and covers shall be the following type or City approved equal:

Certainteed Pamrex Cover .

3.57.03 Base Slabs and Base Beams

When required, manhole base beams shall be precast, reinforced concrete. The beams shall be 12 inches wide by 9 inches deep by 8 feet long. The reinforcement shall consist of three No. 5 bars longitudinally and No. 4 bars at 12-inch centers transversely.

Base slabs may be poured in place or precast. The slab shall be designed to uniformly support AASHTO H-20 traffic loading and any earth loading. The minimum slab thickness shall be 6 inches. The minimum reinforcement in the base slab shall conform to the detail drawings in the Appendix of this chapter.

3.57.04 Joint Material

Joint material used to join all sections shall be a flexible butyl resin joint sealing compound meeting Federal specifications SS-S-210-A and AASHTO M-198-B. Joint material shall be Conseal CS-102 manufactured by Concrete Sealants, Inc., or City approved equal.

3.57.05 Mortar

Mortar used in repair of precast sections and for grouting joints shall be composed of one part Portland cement and not more than three nor less than two parts of fine aggregate. Hydrated lime or masonry cement shall not be used. Portland cement shall meet the requirements of ASTM C-250, Type II. Fine aggregate shall consist of well-graded natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95 percent passing a No. 4 sieve and a maximum of 7 percent passing a No. 100 sieve.

3.58.00 VAULT ELECTRICAL AND MECHANICAL

SECTION NOT USED

3.59.00 VENT PIPES

For typical above ground vent pipe installations, vent pipes shall be 3-feet tall and 8-inch diameter seamless aluminum pipe in accordance with the details in the appendix of these Standards and Specifications. Vent pipes that are located in a "field" condition or areas that may require a more visible installation shall be 8 ft tall and 6-inch diameter galvanized schedule 40 steel pipe which conforms to ASTM Standard Designation A-53. The vent screen shall be a 3/4-inch, No. 9-11 flattened, expanded galvanized metal screen.

Below-ground, vent pipes shall be 6-inch diameter, SDR 35 or Schedule 40 PVC with glued joints in accordance with the details in the appendix of these Standards and Specifications. For galvanized steel vent pipe installations, a PVC glued joint by standard pipe thread female adapter shall be used to connect the steel pipe to the PVC pipe at ground level.

3.60.00 SERVICE CONNECTIONS

3.60.01 Pipe

Acceptable material for ¾" through 2" service lines is seamless copper tube and for 4" and larger service lines polyvinyl chloride (PVC) pipe shall be used. All service pipes shall conform to one of the following specifications.

Acceptable service line material for non-potable water services is purple PE-RT tubing .

(A) ~~(A)~~ Seamless copper tube designated as "Type K" (soft) in the industry shall be used for ¾", 1", 1-1/2" and 2" service lines. Service pipe and fittings 1-1/4" in diameter are prohibited.

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(B) PE-RT tubing for municipal water service is required to meet the requirements of AWWA C901-17 Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. (19 mm) Through 3 In. (76 mm), for Water Service. AWWA C901-17 requires PE-RT tubing to have a material designation code of PE4710.

(B) Polyvinyl chloride pipe conforming to Section 3.52.02 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~ shall be used for 4-inch and larger service lines. Three-inch service pipe is not readily available and service pipe specified as 3-inch shall be upsized to 4-inch from the main connection to the meter pit.

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3.60.02 Saddles

For ¾" to 2" taps requiring saddles, the saddles shall be AWWA taper thread (CC thread) and shall be manufactured in accordance with AWWA C-800-05, Underground Service Line Valves and Fittings. Cast saddle top and nuts shall be constructed of 85-5-5-5 ASTM B62 brass and straps shall be silicon bronze.

The following saddles have been approved for use with ductile iron, cast iron, AC or PVC host pipes, 6" through 12":

	¾"	1	1½"	2"
Mueller	---------- BR2B Series ----------			
McDonald	---------- 3825 Series ----------			

3.60.03 Curb Stop Valves and Curb Stop Boxes

All curb stops shall be manufactured in accordance with AWWA C800-05, Underground Service Line Valves and Fittings, and shall be constructed of brass in accordance with ASTM-B62 (common trade name 85-5-5-5). Curb stop valves shall be ball type with a maximum working pressure of 300 psi and shall have compression fittings.

Curb stop valves for use with copper service pipe shall be the following type or City approved equal:

	¾"	1	1½"	2"
Mueller	n/a	n/a	B-25209	B-25209
McDonald	n/a	n/a	6100Q	6100Q

Curb stop boxes shall be cast iron and shall have an inside diameter of 4-1/4" with a large bottom section and pipe cut outs for the service line. Curb stop boxes shall be the following type or City approved equal:

Tyler Series 145R
Castings Inc. CI 145R

3.60.04 Tapping Sleeve and Valve

Tapping sleeves shall be required on existing host pipe for all taps larger than 2 inch, unless a tee is provided.

Cast or Ductile Iron Host Pipe

Full body Mechanical Joint (MJ) cast or ductile iron tapping sleeves are required.

Tapping sleeves for Cast Iron or Ductile Iron shall be the following type or City approved equal:

Mueller H-615
Waterous Series 1004 or 2800
US Pipe T-9
Tyler/Union Compact (up to 12")

PVC or AC Host Pipe

Fabricated stainless steel triangular sidebar style with stainless steel flange tapping sleeves are required. No coated carbon steel saddles will be allowed. A flange insulator kit between the valve and sleeve is required. Stainless steel bolts will be required on the tapping sleeve side of the valve. Tapping sleeve shall be rated for 250 PSI minimum operating pressure (sizes 4"-12") and 200 PSI minimum operating pressure for larger sizes.

Tapping sleeves for PVC or AC host pipes shall be the following type or City approved equal:

JCM 432 or 452
Mueller H-304
Ford FTSS
Romac SST III or STS 420
Smith Blair 665

Steel Host Pipe
Weld on Saddles shall be required. These taps are application specific and require approval by the City Engineer.

Tapping valves shall be resilient seat, cast iron or ductile iron body, fully bronze mounted with non-rising stem and shall be in conformance with section 3.54.02 of these Standards and Specifications. Tapping valves shall have a flange connection on one side meeting the requirements of ANSI B16.1 Class 125 and a mechanical joint on the other side meeting AWWA C111-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Valves shall be delivered complete with bolts and gaskets.

Tapping sleeves for Steel host pipes shall be the following type or City approved equal:

Mueller, Series 2360 (sizes 4" – 12")
American AVK, Series 45 (sizes 4" – 12")

3.60.05 Corporation Stops

All corporation stops and threaded brass fittings shall be manufactured in accordance with AWWA C800-05, Underground Service Line Valves and Fittings, and shall be constructed of brass in accordance with ASTM-B62 (common trade name 85-5-5-5). All corporation stops shall be tested at the factory and shall meet the following minimum physical requirements:

Tensile strength	30,000 PSI minimum
Yield Strength	14,000 PSI minimum
Elongation in 2 inches	20 percent minimum

Corporation stops shall be ball valve type designed for a maximum working pressure of 300 psi. The inlet side shall have AWWA taper thread (CC thread) and the outlet side shall have a compression fitting.

Corporation stops shall be the following type or City approved equal:

	¾"	1	1½"	2"
Mueller	---------- B-25008 ----------			
McDonald	---------- 4701BQ ----------			

3.60.06 Stop and Waste

Stop and waste valves will not be allowed for domestic potable connections. Nonpotable connections~~.~~

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3.60.07 Compression Couplings

Only compression fittings will be allowed on copper service pipe. All compression couplings shall be manufactured in accordance with AWWA C800-05, Underground Service Line Valves and Fittings, and shall be constructed of brass in accordance with ASTM-B62 (common trade name 85-5-5-5).

Compression couplings shall be the following type or City approved equal:

Ford: C44-G Series (Grip Joint Connection)
McDonald: 4758-Q
Mueller: H-15403

Upsizing of service lines after the meter shall be in accordance with the detail drawing of this chapter. Compression couplings for upsizing shall be the following type or City approved equal:

	¾" to 1"	1" to 1-1/2"	1½" to 2"	2" to 3"
Mueller	H-15403	H-15403	n/a	n/a
McDonald	4758Q	4758Q	n/a	n/a

3.61.00 ENCASEMENT

3.61.01 Concrete

All concrete shall be a minimum of Class A and shall conform to City standards for Portland cement concrete as specified in Chapter 7 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. All concrete encasements shall

be a minimum of 6 inches thick from outside of pipe to outside of encasement. Reinforcement for pipe encasements shall include #4 "hoop" reinforcement steel on 12" centers transverse and longitudinal #4 reinforcement placement shall conform with detail W27 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~. Material properties for reinforcing steel shall conform with Section 3.67.00 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

3.61.02 Polyethylene Encasement

Polyethylene encasement material shall be a minimum of 8 mils thick and shall be a high density, cross-laminated polyethylene film. All polyethylene encasement material shall be manufactured in accordance with ANSI/AWWA Standard C-105/A21.5-05, Polyethylene Encasement for Ductile Iron Pressure Pipe and Fittings. The raw materials used to manufacture polyethylene film shall be Type I, Class A, Grade E-1 in accordance with ASTM Standard Designations D-1250.

3.61.03 Extruded Polystyrene Insulating Foam

"Extruded Polystyrene Insulating Foam" or "Rigid, Cellular Polystyrene Thermal Insulation" also referred to as "XPS" shall be manufactured in accordance with ASTM C 578-08b. Bonding sheets of "XPS" together shall be accomplished by using "3M 78 Polystyrene Foam Insulation Spray Adhesive" or City approved equal.

3.62.00 CATHODIC PROTECTION

3.62.01 General

Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice. All materials and equipment shall conform to the respective specifications and other requirements specified herein.

3.62.02 Sacrificial Anodes

Dimensions of the magnesium anodes shall conform to the dimensions for standard sizes of anodes and of the weights specified. All magnesium anodes shall be cast around a galvanized steel core (flat strap or spring) and be made of high potential magnesium alloy conforming to the following compositions by weight:

Aluminum	0.01% Max.
Manganese	0.50% Min. to 1.30% Max.
Zinc	0.005% Max.
Copper	0.02% Max.
Nickel	0.001% Max.
Iron	0.03% Max.
Other Impurities	0.05% Each Max.
Other Impurities	0.30% Total Max.
Magnesium	Balance

Contractor shall furnish spectrographic analyses or a letter of compliance on samples from each heat or batch of anodes used on the project.

Sacrificial anodes shall be provided with specific backfill in a permeable cloth sack. Anodes shall be centered in the backfill material and shall be buried to a depth as specified by the design engineer. The weight and nominal dimensions of the packaged anode shall be as follows:

48 lb. bare anode (5.50" X 5" X 31") = approx. 100 lb. packaged (8" Dia. X 38"L)

The anode backfill material shall consist of 75 percent gypsum, 20 percent bentonite, and 5 percent sodium sulfate, and shall be of the quick wetting type.

All anodes shall be shipped and stored in waterproof bags or wrapping and shall be AMAX "MaxMag", Dow "Galvomag" or City approved equal.

Sacrificial anode lead wires shall consist of #12 AWG Type RHW or USE, black insulated stranded copper wire. Lead wires shall be a minimum of 25 feet in length. The lead wires shall be connected to the galvanized steel core of the anode by silver soldering and this connection shall be sealed with a waterproof epoxy or electrical potting compound.

3.62.03 Wire Conductors

Test station wires shall be #12 AWG and #8 AWG single conductor, stranded copper Type RHW. Wire color coding shall be as shown on the design drawings.

Joint bond wires shall be #4 AWG single conductors, stranded copper with Type HMWPE insulation.

3.62.04 Wire Splice Connections

All splices of buried test station or anode wires shall be made using a mechanical connector and soldered then sealed with an epoxy type material. Splice kits shall be Royston "MINI SPLICE-RIGHT" with a "Crimpit" type or City approved equal**.**

3.62.05 Exothermic Welds

All electrical cable connections to the buried piping shall be made by an exothermic weld. Exothermic type weld materials including the proper size and type of weld cartridges and welder molds for use on steel or ductile iron pipe shall be by Erico Products Inc. "CADWELD" or Burndy "THERMOWELD" or City approved equal.

Copper sleeves specifically designed for the purpose shall be crimped on all bare wire ends of all stranded cables prior to exothermic welding to improve mechanical strength and thermal capacity.

3.62.06 Exothermic Weld Coating

For ductile iron pipe, exothermic weld coatings shall be a cold applied compound such as Koppers "Bitumastic 50", Royston "Roskote A51", or City approved equal.

For steel pipe, exothermic weld coatings shall be a mastic filled plastic weld cap such as Royston "Handicap" or City approved equal.

3.62.07 Test Stations

Flush mount cathodic protection test stations shall be those made specifically for the purpose and shall consist of test station enclosure, cast iron lid, terminal block with studs, and shunt.

Test station enclosures in shall be composed of concrete and shall be Brooks Products Inc. Model" No. 1-RT" or Christy Mfg. Model "G3" or "G5" with the lid inscribed with the words "CP TEST". Test station enclosures within vehicle traffic areas shall be cast iron in accordance with Section 3.54.04 of these Standards and Specifications.

A separate terminal board manufactured from a minimum 3/16 inch thick plastic or glass reinforced laminate with minimum dimensions of 3 inches by 4 inches shall be provided to terminate the test station and anode wires. Terminal boards shall be CP Test Services Model NM-5 terminal board or City approved equal.

Terminal board hardware shall be nickel plated brass and consist of a minimum of five 1/4 inch studs with double nuts, flat washers, and lock washers. The layout of the hardware shall be as shown on the City approved design drawings.

Each test station shall also be furnished with a Colt Mfg. Co. calibrated 0.01 ohm - 8 ampere color code yellow) test station shunt or City approved equal. Exception: the shunt is not required at test stations designated as insulating fitting or test stations with no anodes type test stations.

3.62.08 Insulating Flange Kits

Dielectric flange kit materials shall consist of full faced gaskets, bolt sleeves, non-metallic washers, and steel backing washers.

Gaskets shall be "Type E") (full face) phenolic with a Buna-N o-ring type sealing element**.** Insulating bolt sleeves shall be the single one-piece sleeve and washer type made of Minion or acetyl resin plastic, shall fit within the bolt facing of the flange, and shall allow the standard size bolt or stud for the flange to be inserted. This subparagraph shall also apply to harness rods or tie bolts where insulating sleeves and washers are specified.

The steel backing washers shall be 1/8" thick; cadmium plated, hot rolled steel and shall fit within the bolt facing on the flange.

3.63.00 METERS

3.63.01 General

All water meters shall be Badger E-Series ultrasonic meters and use Badger Beacon AMA, Orion cellular endpoint. Meters and endpoints will be supplied and installed by the City in accordance with Section 3.39.00 of these CONSTRUCTION SPECIFICATIONS.

~~All water meters shall be Badger and use Orion transponders, unless approved otherwise. Approval of the meter by size, type and brand shall be obtained from the City prior to purchasing the meter. All meters, other than residential 5/8" x ¾", shall be purchased by the contractor and delivered to the City Meter Shop to be pre tested prior to installing the meter in the meter setting in accordance with Section 3.39.00 of these CONSTRUCTION SPECIFICATIONSSTANDARDS AND SPECIFICATIONS.~~

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3.63.02 Magnetic Drive Displacement-Type Water Meters

All magnetic drive displacement-type meters shall conform to AWWA C700-02, Cold Water Meters Displacement Type Bronze Main Case, and AWWA C710-02, Cold Water Meters Displacement Type Plastic Main Case.

3.63.03 Compound and Turbine Meters

Compound meters shall conform to AWWA 702-01, Cold Water Meters Compound Type, and AWWA 701-07, Cold Water Meters Turbine Type, and C703-96 (reaffirmed 2004) Cold Water Meters Fire Service Type. Strainers shall be provided upstream of all compound meters. Turbine meters shall be supplied with integral strainers.

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3.63.04 Mastered Meters

Every "Master Metered" system to which fire hydrants or fire protection lines will be connected shall have a UL/FM approved "Fire Service Protection Water Meter" in accordance with AWWA C703-96(R04), Cold Water Meters – Fire Service Type. The City Utility Department shall be contacted prior to design for meter requirements.

3.63.05 Meter Bypass Line

Bypass lines shall be required on all 1-1/2" and larger domestic water meter installations and shall contain an independent control valve. The bypass shall not contain tees, plugs, or other outlets through which water could be withdrawn. Bypass valves shall have locking devices.

3.63.06 Meter Check Valves

For 1-1/2" and 2" meter installations, single check valves shall be installed inline with the service pipe and downstream of the meter setter in accordance with the standard details of this Chapter. Single check valves shall be manufactured in accordance with AWWA C800-05, Underground Service Line Valves and Fittings, and castings shall be constructed of brass in accordance with ASTM-B62 (common trade name 85-5-5-5).

Single check valves for 1-1/2" and 2" meter installations shall be the following type or City approved equal:

Ford HS11-666 (1-1/2"); HS11-777 (2")

For 3" and larger meter installations, swing check valves shall be installed downstream and adjacent to the meter as well as on the bypass. Swing-check valves shall be manufactured in accordance with AWWA Standard C-508-01, Swing-Check Valves for Waterworks Service (2 in through 24 in) and shall have interior epoxy coating in accordance with AWWA Standard C-550-05, Protective Interior Coatings for Valves and Hydrants. Swing check valves shall have an outside lever and weight and shall have metal seats. Swing check valves shall be iron body bronze mounted with flanged ends in accordance with ANSI B16.1.

Swing check valves for 3" and larger meter installations shall be the following type or City approved equal:

American Flow Control, Series 50-SC and 600
AVK, 41 Series
Mueller, A-2600-6-01
Kennedy, Style 106

3.63.07 Meter Valves

Meter valves for ¾" through 2" services shall be manufactured in conjunction with the setter. Valve shall be an angle lock wing type ball valve and shall be on the inlet side of the setter for ¾" and 1" setters and on the inlet and outlet sides for 1-1/2" and 2" setters.

For valves 4" and larger, gate valves shall be used and shall conform to Section 3.54.02 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

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3.63.08 Meter Yokes (Setters)

All meter setters shall be manufactured in accordance with AWWA C800-05, underground Service Line Valves and Fittings, and all castings shall be constructed of brass in accordance with ASTM-B62 (common trade name 85-5-5-5). Meter setters shall be designed in accordance with the detail drawings in the appendix of this chapter.

The following meter setters: shall be the following type or City approved equal:

	¾"*	1**	1½"***	2"***
Mueller	B-2474	B-2474	B-2423	B-2423
A.Y. McDonald	31-309WXTT33	31-410WXTT44	20-B618WWFF665	20-B718WWFF775

* 9" setter height
** 10" setter height. Requires bypass piping.
*** 18" setter height. Requires bypass piping.

For installation of a smaller meter on an existing setter, size changes shall be accomplished by providing a full sized meter vault and setter for the line size installed and using industry standard adapters to install a reduced size meter in the full size line. Adapters: shall be the following type or City approved equal:

1 ½" meter on 2" line	- 1 pair Ford A67 adapters
1" meter on 2" line	- 1 pair Ford A47 adapters
1" meter on 1 ½" line	- 1 pair Ford A46 adapters
5/8" X ¾" meter on 1" line	- 1 pair Ford A24 adapters
Other sizes	- Contact Utilities/Meter Shop

3.63.09 Valve and Meter Supports

Meter supports shall be fabricated of concrete and valve supports shall be fabricated of steel in conformance with detail W13 of these CONSTRUCTION SPECIFICATIONS~~STANDARDS AND SPECIFICATIONS~~.

3.63.10 Meter Pits (3/4" and 1" service lines)

Meter pits for ¾" and 1" service lines shall be constructed of modified high density polyethylene with a minimum nominal wall thickness of 0.50", shall have protective UV degradation with a low temperature brittleness which exceeds -76ºF, a thermal transfer rate of .40, smooth walled (inside and out) and shall have a vertical crush rating which exceeds 20,000 pounds. No meter pits shall be set in streets, concrete areas, driveway alignments, or other areas of vehicle traffic.

Meter pits shall be the following type or City approved equal:

Mid-States Plastics Inc. B-Series (20" dia. for ¾" services and 24" dia. for 1" services)

A concrete meter pit is available as an alternate to the plastic meter pit upon approval in writing by the City. Note that this meter pit is not intended for installation in areas of vehicle traffic. Concrete meter pits: shall be the following type or City approved equal:

Copeland Enterprises, Inc., 24" Water Meter Pit.

Meter pit covers shall be airtight and shall have a 13" diameter cast iron cap-type top lid and bonnet with a locking screw forged pentagon bolt. Lids shall have a 2" diameter hole centered in the lid for the transponder. A deep dish plastic inner lid shall be provided below the top lid. Meter risers shall not be allowed on new meter pit installations.

13" diameter meter pit covers shall be the following type or City approved equal:

Castings Inc. Model M70

3.64.00 PRESSURE-REDUCING VALVE

All pressure-reducing valves shall be Cla-Val model 90-01, or approved equal. The valve shall be designed to reduce a high upstream pressure to a constant downstream pressure by way of a pilot control system. The pilot system shall control the main valve which shall be single-seated, hydraulically-operated, diaphragm, globe-valve type. The typical valve seats shall be bronze (Note that the manufacturer recommends stainless steel seats when subjected to sustained high velocities through the valve). An indicator rod or flow tube shall be furnished as an integral part of the valve to show the position of the valve.

3.65.00 COMBINATION AIR VALVES

Air release valves shall be in conformance with AWWA C512-07, Air Release, Air/Vacuum and Combination Air Valves.

Single body combination air valves shall be the following type or City approved equal:
Note that inflow preventers shall be required on all vault installations:

Val-Matic Series 200
APCO Series 140C
ARI D-040

Combination air valves 2" and smaller shall have threaded NPT type inlets and outlets. For 3" and larger combination air valves, inlets shall be flanged.

Inflow preventers shall be the following type or City approved equal for combination air valves installed in vaults that could potentially flood with groundwater:

Val-Matic, Flood Safe

Inflow preventers shall be the following type or City approved equal for combination air valve installations that are not prone to groundwater flooding:

Wager Company, Model 2100

3.66.00 RESTRAINING SYSTEMS

3.66.01 <u>Harness Rods</u>

Harness rods and nuts shall be SAE type 304 stainless steel

3.66.02 Joint Restraint Devices

Joint restraint devices shall be manufactured of ductile iron conforming to ASTM A 536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C111/A21.11-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings, and ANSI/AWWA C153/A21.53-06, Ductile Iron Compact Fittings. Twist-off nuts, sized the same as the tee-head bolts, shall be used to insure that the proper torque is applied to the bolts. In no case shall the twist-off bolts be torqued beyond the manufacturers' recommendations.

Mechanical joint restraint device shall have a working pressure of at least 350 psi for pipe sizes 4-16 inch and 250 psi for pipe sizes 18-48 inches, with a minimum safety factor of 2:1. Mechanical joint restraint devices shall be the following type or City approved equal:

EBAA Iron, Mega-lug, Series 1100 (DIP), Series 2000 (PVC)
Star, Series 3000, 3000S and 3000OS (DIP), Series 4000 (PVC)
Uniflange, Series 1400

Push on joint bell restraint harnesses shall have working pressures for PVC pipe of at least 200 psi for sizes 12 inches and smaller, 235 psi for pipe sizes 14 to 16 inches and working pressures for ductile iron pipe of at least 350 psi for pipe sizes up to 16 inches. Bell restraint harnesses shall be the following type or City approved equal: (bell restraint harnesses are not recommended for pipe sizes above 16 inches):

EBAA Iron, Mega-lug, Series 1700 (DIP), Series 1500, 1600 and 2800 (PVC)
Star Pipe Products, Series 3100P (for DIP only)
Smith-Blair, Series 165 (for PVC only)

3.67.00 CONCRETE REINFORCEMENT

All deformed reinforcing bars shall conform to ASTM Standards A-615, Grade 40 or 60, or ASTM Standard A-671, Grade 40 or 60. All welded wire steel fabric shall conform to ASTM Standard A-185.

3.68.00 BACKFLOW PREVENTION DEVICE

Backflow prevention devices shall conform to the requirements of AWWA C510-07, Double Check Valve Backflow Prevention Assembly, and C511-07, Reduced Pressure Principle Backflow Prevention Assembly. Backflow devices shall also meet the application requirements in section 3.24.08 of these Standards and Specifications and the City of Fort Lupton Municipal Code.

3.69.00 REPAIR CLAMPS

Repair clamps shall be entirely 18-8 Type 304 stainless steel including bands, lugs, nuts, and bolts. Gaskets shall be gridded virgin GPR compounded for water service and meeting the requirements of ASTM D 2000-90M 4AA607. Repair clamps shall be single or double panel as required to fit the pipe and shall have a minimum working pressure rating of 150 psi. Repair clamp length shall be greater than or equal to the host pipe diameter.

Repair clamps approved by the City shall be one of the following types:

PowerSeal, Model 3121AS or 3122AS

Ford, Style FS1 or FS2
Smith-Blair, Models 261 and 262
Romac, Style SS1 or SS2

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CHAPTER 4
SANITARY SEWER SYSTEM

4.00.00 INTRODUCTION

All sanitary sewer systems shall comply with the requirements of these STANDARDS AND SPECIFICATIONS and may include special criteria established by the City for overall hydraulics of the sanitary sewer system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the City.

4.01.00 USE OF SANITARY SEWER

The use of sanitary sewers within the City of Fort Lupton shall be in accordance with the Fort Lupton Municipal Code.

~~4.10.00 DESIGN CRITERIA~~

~~4.11.00 SCOPE~~

~~It is the intent of this "design criteria" section to provide sufficient detailed information to enable the Engineer for the Owner/Developer to correctly and efficiently design the overall sanitary sewer system for a particular development. If there is a question or a concern regarding the design of any portion of the sanitary sewer system that is not adequately answered within this chapter, the Owner/Developer or his representative shall contact the City to get all issues resolved prior to design. Any deviation from these STANDARDS AND SPECIFICATIONS must be approved in writing by the City.~~

~~Outfall sewers, pumping stations, interceptors and appurtenances are included under the definition of "Sewage Treatment Works" in the State Water Quality Control Act. Section 2.2.4(1) of the State Water Quality Control Act states: "No person shall commence construction or expansion of any domestic wastewater treatment works with a design capacity of more than two thousand gallons per day unless site location and design for the construction or expansion have been approved by the Division or the Commission if the matter is appealed. Therefore, all plans falling under this criteria shall be submitted to the State Water Quality Control Division for approval prior to construction.~~

~~4.12.00 GENERAL~~

~~The sanitary sewer system shall be design by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The design process includes the submittal of a utility study and construction drawings for review and approval by the City. The following note shall be incorporated into the utility study:~~

~~**"We acknowledge that the City of Fort Lupton's review of this study is only for general conformance with submittal requirements, current design criteria and standard engineering principles and practices. We are also aware of the provisions of the City Code of the City of Fort Lupton."**~~

4.12.01 Study

The study shall include, as a minimum, the following information and shall be typed and bound in an 8-1/2-inch x 11-inch folder:

(A) Text, which addresses, a minimum of project location and description, project concept, discussion of any information that would affect the City's ability to serve the new area, and any recommendations and conclusions of the analysis.

(B) The area, in acres, which could be served by gravity by the new sewer, shown on a topographic map which delineates the basin boundaries as stated in (G) below.

(C) The estimated population densities and total population based on land use projections to be served by the new sewer.

(D) The estimated quantity and quality of any industrial wastes to be discharged to the system.

(E) Design flow rates, minimum and maximum flow velocities, minimum and maximum pipe slopes, and infiltration allowances.

(F) The impact of the additional flows on the existing sanitary sewer system at all critical points between the proposed site and the major interceptor.

(G) A utility map which includes, a minimum of, the following information:

Location of all proposed and existing easements and/or rights-of-way.

Existing and proposed sanitary sewer lines and appurtenances with sizes and slopes shown.

Basin delineation

All other existing and proposed utilities.

4.13.00 DESIGN FLOW

The flows used to design the sanitary sewer system for a particular development vary depending on the type of development. There are three general categories of development for which flow rates are given: residential development, commercial development and industrial development. Once the specific type of development is determined, the peak flows are calculated based on average demand, peak factor and infiltration/inflow amounts.

The following is a list of the criteria to be used in the preparation of all sanitary sewer system analyses:

Utility Study Criteria
Assume 2.90 People/Unit for all single family residential units *

Assume 1.80 People/Unit for all multi family units, including apartments.
Average Use: Residential – 70 Gallons/Capita/Day **

Commercial – 1000 Gallons/Acre/Day **
Industrial – 1000 Gallons/Acre/Day **
School – 25 Gallons/Capita/Day ***

Peak Factor = 3.0 **

Infiltration and Inflow Rate for all uses – 1000 Gallons/Acre/Day **

Sanitary sewers shall be designed to convey the peak daily flow plus Infiltration and Inflow. If an industry uses more than the average allowance, then the sewer must be designed to handle that industry's peak daily flow.

Flow rates downstream of lift stations shall take into account the flow generated at the maximum pumping rate plus peak daily flow plus Infiltration and Inflow.

* From "1988 Population and Household Estimates," published by the Denver Regional Council of Governments with revisions by City of Fort Lupton planning staff.

** From "1986 Sewer System Master Plan - City of Fort Lupton," Brown and Caldwell

*** From "WPCF Manual of Practice No. 9, fifth printing," American Society of Civil Engineers and the Water Pollution Control Federation.

4.14.00 HYDRAULIC DESIGN/SIZING OF SEWER LINES

4.14.01 General

Sanitary sewer shall be designed to carry the discharge calculated in accordance with Section 4.23.00 and to transport suspended material such that deposits in the sewer are precluded

The minimum diameter for sanitary sewer mains shall be 8 inches.

Oversizing of mains may be required by the City, and the recovery of the costs of such oversizing shall be in accordance with the Municipal Code.

The minimum diameter for sanitary sewer service lines shall be 4 inches.

4.14.02 Sanitary Sewer Mains

(A) The following table gives the minimum and maximum allowable slopes for sanitary sewer mains:

TABLE 4.14.01
Sanitary Sewer Main Slope Criteria

Diameter (Inches)	Minimum Slope (Feet/Feet)	Maximum Slope (Feet/Feet)
8	0.00500	0.190
10	0.00500	0.140
12	0.00220	0.110
15	0.00150	0.082
18	0.00120	0.064
21 or larger as approved by City		

(B) The sewer must be designed at a slope great enough to produce a flow velocity of two feet (2') per second at the peak design flow using the Manning equation and n = 0.015 but not less than the minimum slope given above.

Hydraulic design of pressure sanitary sewers shall be in accordance with chapter 3 of these standard specifications.

4.14.03 Sanitary Sewer Service Lines

The following table shows the minimum and maximum allowable slopes for sanitary sewer service lines:

TABLE 4.14.04
Sanitary Sewer Service Slope Criteria

Diameter (Inches)	Minimum Slope (Feet/Feet)	Maximum Slope (Feet/Feet)
4	.0208	.0800
6	.0104	.0600

4.15.00 SYSTEM LAYOUT

4.15.01 General

All mains shall be installed in dedicated rights of way or public easements. Under no circumstances should sanitary sewer mains be installed parallel to and directly below any concrete such as sidewalks, curbs or gutters. Lines shall normally be located five feet south or east of street centerline, unless otherwise approved, in writing, by the City. Sanitary sewer mains shall be straight between manholes, both in horizontal and vertical alignment.

Sewer mains will ordinarily have a minimum of eight feet of cover to finished ground surface. Where this will provide less than nine feet of elevation difference between the finished lot grade at building line and the top of the sewer main, it will be indicated on the plans that the lot is served by a "shallow sewer" and appropriate elevation information will be given.

Sewer mains will be extended at least ten feet uphill from the lowest lot corner of the uppermost lot to be served adjacent to the sewer main. Sewer mains will terminate in a manhole.

Sanitary sewer mains shall be laid a minimum of ten feet horizontally from any existing or proposed utility. Upon written approval by the City, a sanitary sewer main may be laid closer than ten feet to a parallel water main if it is laid in a separate trench and if the elevation of the invert of the water main is at least eighteen inches above the crown of the sewer main and, in addition, polyvinyl chloride pressure pipe is used for the sewer main.

When the sanitary sewer main passes under a highway, railroad or drainage or irrigation ditch, there shall be a minimum of 3 1/2 feet of cover and steel casing shall be installed in accordance with the detail drawing in the Appendix of this chapter. The steel casing shall extend the entire width of the right of way or easement of the crossing structure or as directed by the City.

4.15.02 Waterline Crossing Over A Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer, the sanitary sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 Class 200 may be used.

4.15.03 Sanitary Sewer Line Crossing Over Water Line

In all cases, regardless of vertical clearance, the sanitary sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 Class 200 may be used.

4.15.04 Storm Sewer Line Crossing Over Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the sanitary sewer line and the storm sewer line, the sanitary sewer line shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 may be used.

4.15.05 Sanitary Sewer Line Crossing Over A Storm Sewer Line

The sanitary sewer line shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with American Water Works Association C900 may be used. In addition, each joint of the storm sewer within nine feet of the centerline of the crossing shall be encased in concrete.

4.15.06 Limits On Vertical Separation

Under no circumstances shall the vertical clearance between any lines involving a waterline, sanitary sewerline, or storm sewer be less than 12 inches without prior written approval from the City.

4.16.00 EASEMENTS

All sanitary sewer mains shall be in an easement which has a width of at least two times the depth to the pipe invert. The minimum easement shall be 20 feet in width for one utility, 30 feet in width for two utilities and 40 feet in width for three utilities. Site specific circumstances may dictate the need for wider easements. The main shall be located a minimum of ten feet from and parallel to the edge of the easement. All easements shall be for the exclusive use of the City of Fort Lupton. No landscaping (except grass and private irrigation systems) nor permanent structures (i.e., mailboxes, sheds, buildings, etc.) shall be placed in the easement.

The easement agreement shall state that any structures placed in the easement shall be removed and replaced by the owner of the land when requested by the City so that maintenance can be performed. The owner of the land shall agree to hold the City of Fort Lupton harmless for any replacement of structures removed from the easement. The following statement shall appear on all Official Development Plans and all Final Plats:

"All public water, storm sewer and sanitary sewer mains and appurtenances located in public right-of-way shall be maintained by the City of Fort Lupton Public Works Department. All public water, storm sewer, sanitary sewer mains and appurtenances under private drives are located in utility easements. City is responsible for maintenance of these water, storm and sanitary sewer facilities. City is not responsible for repair or replacement of private drive, curb and gutter or landscaping damaged during utility repair or maintenance."

4.17.00 FUTURE CONNECTIONS

Manholes shall have pipes stubbed out which are sized to accommodate flows from the upstream basin whenever a future extension of the sanitary sewer main is anticipated. The main line stub out shall be capped and sealed.

4.18.00 SERVICES

Each structure shall be served by a separate service line. Sanitary sewer service lines shall be located a minimum of ten feet away from all water services (measured horizontally). All service lines shall be constructed perpendicular to the property line of the property they are going to serve and not less than five feet from the side property line. Typical installations should locate the sanitary sewer service line five feet downstream of the centerline of the lot. Six inch service lines and larger shall require connection to the main with a manhole. Any service line tying into a main line larger than 8" shall also be made in a manhole.

The City shall not be responsible for locating sewer service lateral stub outs for future connections.

4.19.00 TAPS

All sanitary sewer service connections to the sanitary sewer main shall be made using "wye" fittings, unless otherwise approved by the City.

4.20.00 UNLAWFUL CONNECTIONS

It shall be unlawful to discharge roof drainage, foundation drainage, sump pumps, surface drainage or any other non-acceptable wastes to the sanitary sewer which would violate any of the provisions of the Municipal Code.

4.21.00 SANITARY SEWER PRE-TREATMENT

Any new building to be constructed in an industrially zoned area with a floor space greater than five thousand square feet, or with a water meter size greater than three quarter inch or if otherwise required by the City shall install a sewer monitoring facility in accordance with the Detail Drawing in the Appendix of this chapter prior to final building inspection approval. The monitoring facility shall be situated outside of the building on the user's premises. If the industrial user's service line ties into an existing City manhole and such manhole allows for safe sampling and isolation of the industrial user's discharge, the City may allow said manhole to serve as the industrial user's monitoring facility.

4.22.00 APPURTENANCES

4.22.01 Manholes

The maximum spacing between manholes shall be four hundred feet. Manholes shall not be located in areas which are subject to flooding from surface runoff. Manholes shall be located in areas which allow direct access by maintenance vehicles when it is not feasible to locate the manhole in the public street.

If the possibility of surface runoff cannot be avoided, an internal watertight insert shall be installed to prevent inflow. All manholes located outside dedicated street rights of way shall be designed and constructed with locking type cover and the manhole ring shall be bolted to the manhole cone and steel marker posts.

At the termination of a force main or other locations at which hydrogen sulfide gases (H_2S) is deemed to be a problem, a chemical and or gas resistant manhole lining will be required.

4.22.02 Outside Drop Manholes

Drop manholes will only be allowed when the design engineer proves that alternates are not feasible and when approved, in writing, by the City. Outside drop manholes will be required whenever a sewer entering a manhole is at an elevation twenty four inches or more above the manhole invert. Outside drop manholes shall be in accordance with the Detail Drawing in the Appendix of this chapter.

~~4.22.03 Underdrains~~

~~Where underdrains are to be constructed under sewer mains, separate clean outs shall be provided next to each manhole in accordance with the Detail Drawing in the Appendix of this chapter. Further, all underdrain service lines originating from within lots shall meet these requirements including size, marking tape and sock.~~

4.30.00 CONSTRUCTION SPECIFICATIONS

4.31.00 EXCAVATION AND TRENCHING

Excavation, trenching and backfilling shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.32.00 BEDDING

4.32.01 General

In the event unstable trench conditions are found at pipeline grade, a minimum of one and one-half inch uniformly graded, washed rock shall be used for trench stabilization. Depth of stabilization shall be as approved by the City. Pipe bedding shall be done in accordance with Sections 4.42.02 or 4.42.03 of these STANDARDS AND SPECIFICATIONS and the Detail Drawing in the Appendix of this chapter.

4.32.02 Class A Bedding

Class A bedding is defined as that method of bedding in which the lower half of the pipe is set in a reinforced concrete cradle. The minimum thickness of concrete under the lowest part of the conduit shall be one-fourth of the outside pipe diameter but not less than four inches. The concrete shall extend around the pipe to the spring line of the pipe barrel. The width of the concrete cradle shall be at least equal to the outside pipe diameter plus eight inches.

4.32.03 Class B Bedding (Granular II)

Class B bedding is defined as that method of bedding in which the pipe is set on granular material meeting the requirements of Chapter 9 in these STANDARDS AND SPECIFICATIONS. Bedding shall be placed to a depth below the bottom of the pipe equal to one-fourth of the outside pipe diameter but not less than four inches. In rock excavation this minimum depth shall be six inches. Granular material shall be placed around the sides of the pipe and to a minimum of nine inches above the top of pipe.

4.33.00 PIPELINE INSTALLATION

4.33.01 General

The City shall be notified at least 48 hours in advance of any pipe installation. No pipes shall be backfilled until they have been inspected by the City. Alignment and grade of the pipe and the location of fittings, and manholes shall be staked under the supervision of a professional surveyor registered in the State of Colorado.

Proper implements, tools and facilities shall be provided and used by the contractor for the safe and convenient execution of the work. All pipe fittings, and manhole sections shall be carefully lowered into the trench by means of a derrick, ropes or other suitable tools or equipment to prevent damage to sanitary sewer line material. Under no circumstances shall sanitary sewer line materials be dropped or dumped into the trench.

All pipe fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the City. All foreign matter or dirt shall be removed from the interior and ends of the pipe before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

4.33.02 Pipe

Pipe shall be laid from downstream to upstream with spigot ends pointing downstream. All pipe shall be placed true to line and grade and carefully centered and with a smooth invert at the joint. The joint shall be made in a workmanlike manner and shall be watertight. Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. The pipe shall then be secured in place by installation of bedding material and backfill, in accordance with Chapter 9 and the detailed drawings in the Appendix of this chapter.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored

outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the City, will not be permitted for installation.

No pipe or appurtenant structure shall be installed upon a foundation in which frost has penetrated or at any time when the City deems there is a danger of ice formation or frost penetrations at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

4.34.00 MANHOLE CONSTRUCTION

4.34.01 Cast-in-Place Base

Manhole bases shall be constructed with Class A concrete, placed on undisturbed ground and in conformance with the detail drawing in the Appendix of this chapter. Changes in direction of flow through the manhole shall be made with a smooth curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. The floor of the manhole outside of the channel shall be finished to a brushed surface.

Concrete bases shall extend at least eight inches below the invert of the pipe and shall be benched to at least two inches over the top of the pipe. The manhole floor between the sewer pipe and the outer portions of the bench shall be flush with the top edges at the pipe spring line and shall slope upward at least two inches per foot. Wherever grade and alignment permit, the sewer shall be laid continuously through the manhole and the manhole built later. In such cases, the foundation shall be placed as mentioned above and once the manhole is constructed, the upper half of the pipe shall be sawed out and the rough edges smoothed with cement mortar. Breaking out the top of the pipe is not permitted

Where it is not practicable to use split pipe through manholes due to breaks in alignment, grade, or elevation of intersecting sewers, the sewer invert shall be made of concrete deposited between forms. The shape of the invert shall conform to the lower half of the pipe it connects. Side branches shall be constructed with as large a radius of curvature as possible. Inverts shall be plastered with cement mortar and left smooth and clean. Where called for on the plans, a pipe bell shall be stubbed out and plugged. The bell shall be placed as close to the manhole wall as possible, unless showing otherwise on the approved plans.

Reinforcement will be required in the manhole base when the distance from the pipe invert to the top of the manhole cover exceeds 15 feet. Reinforcement shall be approved by the City prior to installation.

4.34.02 Pre-Cast Base/Inverts

Pre-cast bases will be allowed by the City and shall be in conformance with this section.

The ground surface below the precast concrete base shall be excavated three inches below the elevation of the bottom of the base and backfilled with three quarter inch gravel. The gravel shall be carefully leveled and smoothed to give uniform support to the precast base over its entire area. The precast base shall be set at the proper location to center the manhole over the sewer main.

The precast base shall also conform to the requirements of Section 4.43.01 of these STANDARDS AND SPECIFICATIONS.

4.34.03 Pre-Cast Barrel

Precast manhole sections shall not be placed on the foundation until it has reached sufficient strength to provide support without damage. The joint between the manhole base and the barrel section shall be made with a flexible butyl resin joint sealing compound. Each succeeding precast section shall be joined in a similar manner and smoothly finished, inside and out.

In the event that the distance between the manhole invert and the ring and cover exceeds seventeen feet (17'), a precast concrete platform shall be installed. The platform shall conform with section 4.55.01, and detail SS5 of these STANDARDS AND SPECIFICATIONS.

4.34.04 Manhole Grouting Treatment

The horizontal joints between precast manhole sections shall be plastered and troweled smooth, inside and out, with cement mortar. The mortar shall be not less than five eighths inch in thickness over the joint and shall extend at least four inches on either side of the joint.

All smooth surface pipes, such as PVC or VCP shall have a manhole water-stop gasket, to be furnished by the contractor, firmly attached to the pipe prior to grouting into the manhole. The opening in the manhole wall where a pipe enters or leaves shall be sealed and patched in a neat workmanlike manner, both inside and out with cement mortar. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar.

4.34.05 Adjustment Rings

Precast concrete adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade. The maximum depth of the adjustment rings shall be twelve inches, and the maximum depth from top of cone to final grade shall be eighteen inches.

The top elevation of the manhole shall be adjusted to match final street grade. If manholes are located in open fields, they shall be left at least eighteen inches above grade and a locking ring and cover shall be installed. In cultivated areas, manholes shall be properly marked by a steel post painted red on the top six inches and located five feet from the centerline of the manhole cover.

4.34.06 Cleanouts

Cleanouts shall be installed next to the manhole base in conformance with the detail drawing in the Appendix of this chapter where an underdrain is installed with the sanitary sewer system.

4.35.00 CONNECTIONS TO EXISTING MANHOLES

Sewer pipe connections to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the requirements specified for new manhole construction. The contractor shall break out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be chipped to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. Where practical, the downstream invert shall be plugged during construction to prevent storm and non-sewage flow from entering the system. The contractor shall pump out and clean the manhole before removing the plug. Cement mortar shall be used to smoothly finish the new invert and to seal the new line, both inside and outside, so the junction is watertight.

4.36.00 UNDERDRAINS

4.36.01 General

Where excessive ground water is encountered, the City will require construction of a piped underdrain, to reduce infiltration. Underdrains shall be daylighted to the nearest suitable point as approved by the City.

Underdrain main construction shall be done in accordance with engineered construction plans for the work prepared under the direction of a registered professional engineer and approved by the City.

Soil samples are a prerequisite to the underdrain system. A written proposal on the underdrain system must be presented to the City of Fort Lupton before the Public Improvements Agreement is approved.

4.36.02 System Layout

Underdrain shall be placed in its own trench approximately 1-1.5 feet below sanitary sewer main, unless otherwise approved by Public Works Director/City Engineer.

All underdrain cleanouts should be located in either a storm sewer vault or in its own valve box. Underdrain cleanouts will not be permitted in sanitary sewer manholes.

Homeowners' and Homeowners' Associations will be responsible for the underdrain service. This includes perforated and non-perforated pipes around any building foundation running to the underdrain mainline.

4.36.03 Materials

All underdrains shall be constructed in perforated and/or non-perforated SDR-35 PVC pipe, with a tracer wire attached for locating purposes.

A minimum of 6 inch PVC pipe shall be used for all underdrain mains and services.

Underdrains shall be lined in filter fabric prior to installation only if perforated.

4.36.04 Mapping

As-builts mapping and address plats should be provided to the City prior to date of acceptance. All maps must provide adequate details of the underdrain prior to being accepted by the City.

4.36.05 Inspections

Underdrain mains will be thoroughly inspected by a City Inspector or City appointed representative prior to backfill.

Underdrain cleanouts must be located outside of sanitary sewer manholes, as detailed in the Construction Drawings.

Underdrain daylights shall be free from being covered by dirt. An engineering drawing of all proposed daylights shall be submitted prior to City approval.

City Inspectors or an appointed City representative shall have the authority to halt construction when these specifications or standard construction practices are not adhered to. Whenever any portion of these specifications is violated, the City may order further construction to cease until all deficiencies are corrected.

4.36.06 Bedding

Granular bedding material shall be installed a minimum of 12 inches above the top of the pipe. (Granular bedding material will be the equivalent of squeegee.)

Backfill must be placed in lifts not exceeding 12 inches.

4.36.07 Compacting Ordinary Backfill

All trenching, backfilling and compaction of underdrain shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.37.00 PRESSURE SEWERS

All requirements of Chapter 3 of these STANDARDS AND SPECIFICATIONS shall apply to the installation of pressure sanitary sewer lines with the exception of modifications noted in Section 4.64.04 of these STANDARDS AND SPECIFICATIONS. All pressure sanitary sewers shall be installed using PVC C-900 per AWWA.

A green plastic identification strip, a minimum of a six-inch wide, continuously labeled "Caution Sewer Line Below" shall be installed directly above the pressure sewer, the full length of the sewer, and shall be buried midway between the top of the pipe and the finished ground surface elevation.

4.38.00 SANITARY SEWER SERVICE LINE CONSTRUCTION

All sanitary sewer service lines which connect to the City of Fort Lupton sanitary sewer system shall comply with these STANDARDS AND SPECIFICATIONS.

The contractor shall place wyes, stubs, and risers where required by the approved plans. Wyes shall be angled upwards so that the upper invert of a one-eighth bend connected to the fitting will have an elevation equal to or higher than the inside crown of the sewer main. Riser connections shall be installed where the elevation of the top of the branch is more than twelve feet below the approved finished grade. Riser connections will ordinarily reach to a grade ten feet below the finished ground surface. Water-tight plugs shall be installed in each branch pipe or stub. As-built measurements shall be made by the contractor or his representative to reference the wye or riser connection to the nearest manhole before backfill. Said measurements shall be carefully and accurately made and recorded and shall be shown on the as-built plans furnished to the City prior to acceptance.

All installation work shall conform to applicable portions of ASTM C-12 and to the pipe manufacturer's installation instructions. The grooves shall be cleaned free of all foreign materials prior to assembling the joint. The pipe shall be laid with the spigot end pointing in the direction of the flow.

Trenches shall be kept free of water during laying and jointing. Lines longer than fifty feet shall be laid with batter boards, a laser, or other means approved by the City.

Clean-outs are required at a minimum interval of one hundred feet or at all bends or changes in grade. The area around a clean-out shall be graded so water runs away from the clean-out. No clean-outs, other than those installed as part of the sewer main underdrain system, shall be installed in publicly owned rights-of-way or easements.

Service stub-ins shall be extended at least 10' into the property and be plugged with a compression stop.

Backfilling shall be in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.39.00 TAPPING EXISTING SANITARY SEWERS

Where tees have not been installed in the sewer main, the main shall be tapped by machine drilling a hole sized to fit the saddle for the service line. The drilling machine and method of drilling and the saddle shall be approved by the City. The saddle shall be sealed when attached to the main and held in place with metal straps or other approved methods. The saddle and sewer main shall be encased in concrete.

4.40.00 TESTS

4.41.00 GENERAL

All sanitary sewer mains and appurtenances shall be cleaned and tested after backfill operations have been completed and compaction test results have been submitted to and approved by the City. Should the City find that the completed line or any portion thereof fails any of the specified tests, the City will not accept the new sewer line until such time as the sewer line meets the test specifications. Once the sewer line is completed and before a "Release for Service" letter is issued, the contractor shall perform an air test and the City shall perform a television inspection of the completed line. The use of alternate testing methods may be allowed or required in addition to those stated herein and as determined necessary by the City. Alternate testing methods include water infiltration test, deflection test and additional television inspection.

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The contractor shall furnish all labor, materials, tools and equipment necessary to clean the pipe and appurtenances, make the tests and perform all work incidental thereto with the exception of a television inspection which the City will perform. Any damages to the pipeline caused by cleaning or testing operations shall be repaired or replaced by the contractor at his expense.

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4.41.01 Air Tests

The contractor shall perform these tests with suitable equipment specifically designed for air testing sewers. The pipe, or sections of concrete pipe to be tested, may be wetted before the air test. The line shall be plugged at each manhole with pneumatic balls. All service plugs shall be secured in place to prevent displacement during testing operations. Low pressure air shall be introduced into the plugged lines until the internal air pressure reaches 4.0 psi plus 0.4 psi per foot of water table above the pipe invert, if any. At least two minutes shall be allowed for the air temperatures to stabilize before readings are taken and the timing started.

The portion being tested shall pass if it does not lose air at a rate to cause the pressure to drop from 3.5 to 3.0 psi (plus any adjustments for water table pressure as mentioned previously) in less time than listed below:

Pipe Diameter In Inches	Minimum Allowable Minutes 3.5 to 3.0 psi Pressure
4	3.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.0
18	9.0
21	10.5
24	12.0

If the installation fails this test, the testing equipment may be used to determine the location of the pipe leak.

4.41.02 Deflection Test:

The maximum vertical deflection allowed for PVC pipe is five percent. The City may require the contractor to perform deflection tests of the pipe before acceptance. Optional devices for testing include calibrated television, photography, properly sized go-no-go mandrel, sewer ball, or deflectometer. The method used shall be approved by the City. To insure accurate testing, the line shall be thoroughly cleaned prior to testing. Testing shall be done no sooner than 30 days after the pipe has been backfilled.

The contractor shall schedule the test with the City 48 hours prior to the test and the City shall be present during the test and shall verify the accuracy of the equipment used. The City may require the contractor to perform another deflection test prior to the end of the warranty period.

4.41.03 Lamping Test

DELETED

4.41.04 Pressure Test for Pressure Sewers

After the pipe has been laid, including fittings, thrust blocks, and backfill in accordance with the specifications, it shall be subjected to a hydrostatic pressure of not less than 150 P.S.I. for one hour. The allowable leakage shall not exceed the following formula:

$$L = \frac{ND / P}{7400}$$

L = Allowable Leakage in Gallons Per Hour
N = Number of Joints in Length of Pipeline Tested
D = Nominal Diameter of Pipe in Inches
P = Average Test pressure during the Test, PSIG

Each valved section or the entire line if there are no valves, shall be slowly filled with water and the specified test pressure, measured at the highest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the contractor. Gauges and measuring devices shall be approved by the City and the necessary taps made as required by the contractor. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made at the highest elevations of the test section and plugged with brass plugs once the pipeline has passed the test.

Any cracked or defective pipes, fittings, or valves, discovered in the pressure test shall be removed and replaced by the contractor with sound material. The test shall be repeated until the pipeline passes the pressure test and is accepted by the City.

4.41.05 Manhole Leakage Test

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Manholes shall be tested for leakage separately from the pipe when required. The sewer pipe in the manhole shall be plugged. If the ground water table is below the invert, the manhole shall be filled with water to a depth five feet above the invert. If the ground water table is above the invert of the manhole, then the manhole shall be filled to a level at least three feet above the ground water table or to the top of the uppermost precast manhole section, whichever is less, but not less than five feet above the invert. After soaking for one hour, the manhole shall be filled to the original level. It shall then be tested for two hours. The allowable drop in the water level shall be one-quarter inch. No manhole shall be accepted that has any visible infiltration when empty. Any manhole whose test is unsatisfactory shall be repaired at the contractor's expense and retested until satisfactory results are obtained.

4.41.06 TV Inspection

The City will perform TV inspections of all new sewer lines and all defects that have been repaired prior to acceptance.

In order to be considered for inspection, the improvements shall have been completed, accessible and cleaned sufficient to allow for detailed inspection by the City. When requested by the City, the Owner shall provide personnel and equipment to assist in the inspection process. When the City uses private consultants or contractors to conduct specialized television inspections of sewer lines or similar projects, Owner shall be responsible for assuring that the lines are clean so that adequate television inspections can be done. If the private consultant or contractor is required to return to the site because lines are not clean or accessible, the Owner shall reimburse the City for any fees due to reinspection.

4.41.07 Cleaning Prior To Inspections

Sewer cleaning shall be by high-pressure jet cleaning to remove foreign materials from lines. The jet cleaning machine shall be capable of removing stones, grit, grease, sludge and other debris from the sanitary lines by the flushing action of high pressure water. **Dumping of large volumes of water from hydrants or tankers is expressly prohibited.**

The jet cleaning machine must be capable of providing a continuous flow of water at a minimum of 40GPM and 2000 PSI. At a minimum, the cleaner shall use a 90% interior pipe diameter proofer skid at all times. Cleaning shall begin at the upper end of the system and proceed downstream to the outfall. The hose should be brought back at a proper yet steady speed for

appropriate and satisfactory cleaning. If necessary, repeat the process to remove all debris. All debris shall be captured and prevented from entering the downstream portion of the existing collection system.

Sewers found to be improperly cleaned shall be cleaned and reinspected at the contractor's expense.

4.50.00 MATERIAL SPECIFICATIONS

4.51.00 GENERAL

Only those pipeline materials described in this section are approved for sanitary sewer installations. Any other material proposed as an equal shall be approved by the City prior to construction. All pipe materials to be incorporated in the construction of sanitary sewers shall conform to the requirements specified herein or as modified elsewhere in these STANDARDS AND SPECIFICATIONS. All materials furnished shall be new and undamaged. Everything necessary to complete all installations shall be furnished and installed whether shown on the approved drawings or not, and all installations shall be completed and fully operational. Acceptance of materials or the waiving of inspection thereof shall in no way relieve the developer of the responsibility for furnishing materials meeting the requirements of these STANDARDS AND SPECIFICATIONS.

All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality and fitness for the work.

4.52.00 DEFECTS

The presence of any of the following defects in an individual pipe, or in a shipment of pipe, may constitute sufficient cause for rejection of the pipe. Rejected materials shall be removed from the work site within 24 hours unless otherwise permitted by the City.

- Pipe length varying more than two inches from the specified length. Pipe shall not be ordered in random lengths.
- Pipe having a deviation from straight which exceeds the following:

  $$\frac{\text{Length of Pipe in Feet}}{32} = \text{Maximum Deviation in Inches}$$

- Porous areas on either the inside or the outside surface of a concrete pipe having an area of more than five square inches and a depth of more than one-half inch.
- Pipe which has been patched or repaired without written approval of the City.
- Exposure of the reinforcement.
- Pipe damaged during shipment or construction.
- Any deficiencies noted in applicable ASTM Specifications

4.53.00 CERTIFICATION

A manufacturer's certification that material was manufactured and tested in accordance with applicable ASTM designations, together with a report of all test results, may be required by the City prior to final acceptance of the work.

4.54.00 PIPE

4.54.01 Polyvinyl Chloride Pipe (PVC)

All pipe materials and fittings shall meet the minimum requirements of ASTM D-3034, SDR-35, latest revision. Pipe shall be subjected to drop-impact tests in accordance with ASTM D-2444. The pipe shall have bell and spigot joints with gasketed joint. The spigot end shall be marked so the installer and the inspector can determine when the pipe is properly inserted into the bell. The maximum pipe length shall be twenty feet.

Minimum wall thickness shall be:

Pipe Diameter (Inches)	4	6	8	10	12	15	18
Wall Thickness (Inches)	.125	.180	.240	.300	.360	.437	.536

All fittings and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations compatible with that of the pipe.

PVC pipe and all fittings shall conform to Sections 3.52.02 and 3.53.0 of these STANDARDS AND SPECIFICATIONS.

Pipe stiffness for all pipe sizes shall be tested in accordance with ASTM D-2412. Joint tightness shall be tested in accordance with ASTM D-3212.

4.54.02 Reinforced Concrete Pipe (RCP)

Reinforced concrete pipe in sizes twenty-one inches or larger shall conform to the requirements of the standard specifications for reinforced concrete sewer pipe, ASTM Designation C-76 for Classes II, III, IV, and V and as modified in this Section.

All RCP shall be constructed with Type II modified cement. The absorption of the pipe shall not exceed 5.5 percent of volume.

All concrete pipe fittings, wyes, tees, and bends shall be cast as an integral part of the pipe to which they are attached and shall be the same pipe classification.

The following shall be clearly marked on the exterior surface of all pipe with waterproof paint.

- ASTM Specification.
- Class and Size.
- Date of Manufacture.
- Name or Trademark of Manufacturer.

-

4.55.00 MANHOLES

4.55.01 General

Manholes, reducing sections, ladder rungs and traffic lids shall be precast and conform to ASTM Standard Designation C-478. All traffic lids shall be designed for AASHTO H-20 traffic loading. All ladder rungs or manhole steps shall be cast into the manhole barrel when the manhole barrel is poured unless approved otherwise, in writing, by the City. Concrete reducing sections shall not be used. Concrete extension collars shall be used to bring the manhole ring and cover up to approved street or ground surface elevation. All manholes not within the right-of-way shall have cast-iron locking lids.

Concrete used in the manufacturing or construction of manholes shall be a minimum of Class A concrete in accordance with Chapter of these STANDARDS AND SPECIFICATIONS.

Precast manhole risers and cones shall be manufactured in conformity with ASTM Designation C-478.

4.55.02 Manhole Rings and Covers

All cast iron manhole rings and covers and other iron castings shall conform to the requirements of AASHTO M105/ASTM A48 Class 35B. Ductile Iron castings shall conform to the requirements of ASTM A536. All castings shall conform to Federal Specification RR-F-621E, for shape and dimension required. Castings shall be free from sand, blowholes, shrinkage, cracks, and other cold shuts and be well cleaned by shot blasting. Runners, risers, fins, and other cast-on pieces shall be removed from the castings and ground smooth. Bearing surfaces between manhole rings and covers shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

Manhole frame or ring dimensions shall be 24” diameter, 8” tall or as otherwise approved.

Cast iron ring and covers shall have a combined weight of not less than 365 pounds.

Fittings shall be hot dipped, factory applied, water base, asphalt paint to form a firm and tenacious coating.

Aluminum covers may be used for meter vaults where approved, and must have a recessed cut out for a transponder. Aluminum rings may not be used.

Acceptable product is East Jordan Iron Works #2405A, Product #240561 (sanitary vault only).

4.55.03 Manhole Base Slabs

Manhole base slaps may be poured in place or precast. The slab shall be designed to uniformly support AASHTO H-20 traffic loading and any earth loading. The minimum slab thickness shall be eight inches below bottom of the pipe and 2-inches above the top of the pipe. The minimum

reinforcement when required in the base slab shall conform to the detail drawings in the Appendix of this chapter.

4.55.04 Joint Material

Joint material used to set barrel sections shall be a flexible buytl resin joint sealing compound meeting Federal Specifications SS-S-00210(210-A) and AASHTO M 198-B.

4.55.05 Mortar

Mortar used in repair of precast sections shall be composed of one part Portland Cement and not more than three nor less than two parts of fine aggregate. Hydrated lime or masonry cement shall not be used. Portland cement shall meet the requirements of ~~ASTM C~~ASTM C-250, Type II. Fine aggregate shall consist of well-graded natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95 percent passing a No. 4 sieve and a maximum of seven percent passing a No. 100 sieve.

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CHAPTER 5
STORM SEWER SYSTEM

5.00.00 INTRODUCTION

All storm sewer systems shall comply with the requirements of the "Drainage Criteria Manual" and these STANDARDS AND SPECIFICATIONS. Special criteria shall be outlined at pre-design meetings and in the approved construction plans, as determined necessary by the City.

5.01.00 USE OF STORM SEWER

The use of storm sewers within the City of Fort Lupton shall be in accordance with the Fort Lupton Municipal Code.

~~5.10.00 DESIGN CRITERIA~~

~~The City of Fort Lupton's "Drainage Criteria Manual" shall be the design criteria for the analysis and design of storm drainage facilities within the City of Fort Lupton. All subdivisions, resubdivisions, planned unit development, or any other proposed construction submitted for approval under the provisions of the City of Fort Lupton Municipal Code shall include adequate storm drainage system analysis and appropriate drainage system plans in conformance with the requirements of the City of Fort Lupton's "Drainage Criteria Manual."~~

5.20.00 CONSTRUCTION SPECIFICATIONS

5.21.00 EXCAVATION AND TRENCHING

Excavation, trenching and backfilling shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

5.22.00 BEDDING

5.22.01 General

In the event unstable trench conditions are found at pipeline grade, a minimum of one and one-half inch uniformly graded, washed rock shall be used for trench stabilization. Depth of stabilization shall be as approved by the City. Pipe bedding shall be done in accordance with Sections 5.22.02 or 5.22.03 of these STANDARDS AND SPECIFICATIONS and the detail drawing in the Appendix of this chapter.

5.22.02 Class A Bedding

Class A bedding is defined as that method of bedding in which the lower half of the pipe is set in a reinforced concrete cradle. The minimum thickness of concrete under the lowest part of the conduit shall be one-fourth of the outside pipe diameter but not less than four inches. The concrete shall extend around the pipe to the spring line of the pipe barrel. The width of the concrete cradle shall be at least equal to the outside pipe diameter plus eight inches.

5.22.03 Class B Bedding (Granular II)

Class B bedding is defined as that method of bedding in which the pipe is set on granular material meeting the requirements of Chapter 9 in these STANDARDS AND SPECIFICATIONS. Bedding shall be placed to a depth below the bottom of the pipe equal to one-fourth of the outside pipe diameter but not less than four inches. In rock excavation this minimum depth shall be six inches. Granular material shall be placed around the sides of the pipe to a depth of 9 inches over the top of the pipe.

5.23.00 PIPELINE INSTALLATION

5.23.01 General

The City shall be notified at least 48 hours in advance of any pipe installation. No pipes shall be backfilled until they have been inspected by the City. Alignment and grade of the pipe and the location of fittings, manholes and inlets shall be staked under the supervision of a professional surveyor registered in the State of Colorado.

Proper implements, tools and facilities shall be provided and used by the contractor for the safe and convenient execution of the work. All pipe sections, pre-cast manholes and inlets sections, shall be carefully lowered into the trench by means of a derrick, ropes or other suitable tools or equipment to prevent damage to storm sewer line material. Under no circumstances shall storm sewer line materials be dropped or dumped into the trench.

All pipe fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the City. All foreign matter or dirt shall be removed from the interior and ends of the pipe before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

5.23.02 Pipe

Pipe shall be laid from downstream to upstream with spigot ends pointing downstream. All pipe shall be placed true to line and grade and carefully centered and with a smooth invert at the joint. The joint shall be made in a workmanlike manner and shall be watertight. Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. All lifting holes shall be filled with cement mortar prior to backfilling. The pipe shall be secured in place by installation of bedding material and backfill, in accordance with Chapter 9 and the detailed drawings in the Appendix of this chapter.

Cutting of pipe for inserting closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe.

No pipe or appurtenant structure shall be installed upon a foundation in which frost has penetrated or at any time when the City deems there is a danger of ice formation or frost penetrations at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

5.24.00 MANHOLE CONSTRUCTION

5.24.01 Cast-in-Place Base

Manhole bases shall be constructed with Class A concrete, placed on undisturbed ground and in conformance with the detail drawing in the Appendix of this chapter. Changes in direction of flow through the manhole shall be made with a smooth curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. The floor of the manhole outside of the channel shall be finished to a brushed surface.

Concrete bases shall extend at least eight inches below the invert of the pipe and shall be benched to at least two inches over the top of the pipe. The manhole floor between the sewer pipe and the outer portions of the bench shall be flush with the top edges at the pipe spring line and shall slope upward at least two inches per foot. Wherever grade and alignment permit, the sewer shall be laid continuously through the manhole and the manhole built later. In such cases, the foundation shall be placed as mentioned above and once the manhole is constructed, the upper half of the pipe shall be sawed out and the rough edges smoothed with cement mortar. Breaking out the top of the pipe is not permitted

Where it is not practicable to use split pipe through manholes due to breaks in alignment, grade, or elevation of intersecting sewers, the sewer invert shall be made of concrete deposited between forms. The shape of the invert shall conform to the lower half of the pipe it connects. Side branches shall be constructed with as large a radius of curvature as possible. Inverts shall be plastered with cement mortar and left smooth and clean. Where called for on the plans, a pipe bell shall be stubbed out and plugged. The bell shall be placed as close to the manhole wall as possible, unless shown otherwise on the approved plans.

Reinforcement will be required in the manhole base when the distance from the pipe invert to the top of the manhole cover exceeds 15 feet. Reinforcement shall be approved by the City prior to installation.

5.24.02 Pre-Cast Base/Inverts

Pre-cast bases will be allowed by the City and shall be in conformance with this section.

The ground surface below the precast concrete base shall be excavated six inches below the elevation of the bottom of the base and backfilled with three quarter inch gravel meeting the requirements of Chapter 9, Section 20. The gravel shall be carefully leveled and smoothed to give uniform support to the precast base over its entire area. The precast base shall be set at the proper

location to center the manhole over the storm sewer main. The precast base shall also conform to the requirements of Section 5.24.01 of these STANDARDS AND SPECIFICATIONS.

5.24.03 Pre-Cast Barrel

Precast manhole sections shall not be placed on the foundation until it has reached sufficient strength to provide support without damage. The joint between the manhole base and the barrel section shall be made with a flexible butyl resin joint sealing compound. Each succeeding precast section shall be joined in a similar manner and smoothly finished, inside and out.

5.24.04 Inlets

Inlets shall be constructed with Class A concrete, placed on undisturbed ground and in conformance with the detail drawings in the Appendix of this chapter. The top portion of inlets shall be constructed concurrently with the adjacent curb and gutter to ensure proper alignment of grades unless otherwise permitted in writing by the City Engineer.

5.24.05 Manhole/Inlet Grouting Treatment

The horizontal joints between precast manhole sections shall be plastered and troweled smooth, inside and out, with cement mortar in conformance with 5.64.05. The mortar shall be not less than five eighths inch in thickness over the joint and shall extend at least four inches on either side of the joint. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar.

5.24.06 Adjustment Rings

Precast concrete adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade. The maximum depth of the adjustment rings shall be twelve inches, and the maximum depth from top of cone in final grade shall be twenty inches.

5.25.00 CONNECTIONS TO EXISTING MANHOLES

Storm Sewer pipe connections to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the requirements specified for new manhole construction. The contractor shall break out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be shaped to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. The downstream invert shall be plugged during construction to prevent storm and non-sewage flow from entering the system. The contractor shall pump out and clean the manhole before removing the plug. Cement mortar shall be used to smoothly finish the new invert and to seal the new line, both inside and outside, so the junction is watertight.

5.30.00 TESTS

5.31.00 GENERAL

All storm sewer mains and appurtenances shall be cleaned and tested after backfill operations have been completed and compaction test results have been submitted to and approved by the City. Should the City find that the completed line or any portion thereof fails any of the specified tests, the City will not accept the new storm sewer line until such time as the sewer line meets the test specifications. Once the sewer line is completed and before a "Release for Service" letter is issued, the contractor shall perform an air test and lamp test on the completed line. The use of alternate testing methods may be allowed or required in addition to those stated herein and determined necessary by the City. Alternate testing methods include water exfiltration test, infiltration test, deflection test, and television inspection.

The contractor shall furnish all labor, materials, tools and equipment necessary to clean the pipe and appurtenances, make the tests and perform all work incidental thereto with the exception of a television inspection which the City will perform. Any damages to the pipeline caused by cleaning or testing operations shall be repaired or replaced by the contractor at his expense.

5.31.01 Lamping Test

Prior to acceptance into the one-year warranty period of the pipeline installation, the City shall perform a lamp test to verify the alignment and condition of the pipe. The lamp test shall be performed only after the contractor has completely cleaned the line to the satisfaction of the City. Should the lamp test indicate an alignment problem, the City shall be the sole judge of the need for replacement. Unsatisfactory alignment may be the cause for rejection. The contractor shall furnish the light source to be used in the lamp test and the labor necessary for the City to perform the test.

5.31.02 Manhole Leakage Test

Manholes shall be tested for leakage separately from the pipe when required. The sewer pipe in the manhole shall be plugged. If the ground water table is below the invert, the manhole shall be filled with water to a depth five feet above the invert. If the ground water table is above the invert of the manhole, then the manhole shall be filled to a level at least three feet above the ground water table or to the top of the uppermost precast manhole section, whichever is less, but not less than five feet above the invert. After soaking for one hour, the manhole shall be filled to the original level. It shall then be tested for two hours. The allowable drop in the water level shall be one-quarter inch. No manhole shall be accepted that has any visible infiltration when empty. Any manhole whose test is unsatisfactory shall be repaired at the contractor's expense and retested until satisfactory results are obtained.

5.31.03 TV Inspection

The City may perform TV inspections of all new sewer lines and all defects that have been repaired prior to acceptance.

5.40.00 MATERIAL SPECIFICATIONS

5.41.00 GENERAL

Only those pipeline materials described in this section are approved for storm sewer installations. Any other material proposed as an equal shall be approved by the City prior to construction. All pipe materials to be incorporated in the construction of storm sewers shall conform to the requirements specified herein or as modified elsewhere in these STANDARDS AND SPECIFICATIONS. All materials furnished shall be new and undamaged. Everything necessary to complete all installations shall be furnished and installed whether shown on the approved drawings or not, and all installations shall be completed and fully operational. Acceptance of materials or the waiving of inspection thereof shall in no way relieve the developer of the responsibility for furnishing materials meeting the requirements of these STANDARDS AND SPECIFICATIONS.

All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality and fitness for the work.

5.42.00 DEFECTS

The presence of any of the following defects in an individual pipe, or in a shipment of pipe, may constitute sufficient cause for rejection of the pipe. Rejected materials shall be removed from the work site within 24 hours unless otherwise permitted by the City.

- Pipe length varying more than two inches from the specified length. Pipe shall not be ordered in random lengths.

- Pipe having a deviation from straight which exceeds the following:

  $$\frac{\text{Length of Pipe in Feet}}{32} = \text{Maximum Deviation in Inches}$$

- Porous areas on either the inside or the outside surface of a pipe having an area of more than five square inches and a depth of more than one-half inch.

- Pipe which has been patched or repaired without written approval of the City.

- Exposure of the reinforcement.

- Pipe damaged during shipment or construction.

- Any deficiencies noted in applicable ASTM Specifications.

5.43.00 CERTIFICATION

A manufacturer's certification that material was manufactured and tested in accordance with applicable ASTM designations, together with a report of all test results, may be required by the City prior to final acceptance of the work.

5.44.00 PIPE

5.44.01 Reinforced Concrete Pipe (RCP)

All Reinforced Concrete Pipe used in the construction of a storm sewer system within the right-of-way in The City of Fort Lupton shall conform to the following specifications:

Pipe – ASTM C76 – Reinforced Concrete Culvert, Storm Drainage and Sewer Pipe for Class II, III, IV, and V.

Joints – ASTM C443 – Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.

O-Ring/Profile Rubber Gaskets – AASHTO M198

Maximum depths for each size and class of pipe shall be as shown in Table 5.44.01 of these Standards and Specifications

All RCP shall be constructed with Type II modified cement. The absorption of the pipe shall not exceed 5.5 percent.

All concrete pipe fittings, wyes, tees, and bends shall be cast as an integral part of the pipe to which they are attached and shall be the same pipe classification.

The following shall be clearly marked on the exterior surface of all pipe with waterproof paint.

- ASTM Specification.
- Class and Size.
- Date of Manufacture.
- Name or Trademark of Manufacturer.

5.45.00 MANHOLES

5.45.01 General

Manholes, reducing sections, ladder rungs and traffic lids shall be precast and conform to ASTM Standard Designation C-578. All traffic lids shall be designed for AASHTO H-20 traffic loading. All ladder rungs or manhole steps shall be cast into the manhole barrel when the manhole barrel is poured unless approved otherwise, in writing, by the City. Concrete reducing sections shall not be used. Concrete extension collars shall be used to bring the manhole ring and cover up to approved street or ground surface elevation. All manholes not within the right-of-way shall have cast-iron locking lids.

Concrete used in the manufacturing or construction of manholes shall be a minimum of Class A concrete in accordance with Chapter 7 of these STANDARDS AND SPECIFICATIONS.

Precast manhole risers and cone sections shall be manufactured in conformity with ASTM Designation C-578.

Concentric cones are not allowed.

5.45.02 Manhole Rings and Covers

All cast iron manhole rings and covers and other iron castings shall conform to the requirements of AASHTO M105/ASTM A48 Class 35B. Ductile Iron castings shall conform to the requirements of ASTM A536. All castings shall conform to Federal Specification RR-F-621E, for shape and dimension required. Castings shall be free from sand, blowholes, shrinkage, cracks, and other cold shuts and be well cleaned by shot blasting. Runners, risers, fins, and other cast-on pieces shall be removed from the castings and ground smooth. Bearing surfaces between manhole rings and covers shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

Manhole frame or ring dimensions shall be 24" diameter, 8" tall or as otherwise approved.

Cast iron ring and covers shall have a combined weight of not less than 365 pounds.

Fittings shall be hot dipped, factory applied, water base, asphalt paint to form a firm and tenacious coating.

Aluminum covers may be used for meter vaults where approved, and must have a recessed cut out for a transponder. Aluminum rings may not be used.

Acceptable product is East Jordan Iron Works #2405A, Product #240562 (storm vault only).

5.45.03 Manhole Base Slabs

Manhole base slaps may be poured in place or precast. The slab shall be designed to uniformly support AASHTO H-20 traffic loading and any earth loading. The minimum slab thickness shall be eight inches. The minimum reinforcement in the base slab shall conform to the detail drawings in the Appendix of this chapter.

5.45.04 Joint Material

Joint material used to set barrel sections shall be a flexible buytl resin joint sealing compound meeting Federal Specifications SS-S-00210(210-A) and AASHTO M 198-B.

5.45.05 Mortar

Mortar used in repair of precast sections shall be composed of one part Portland Cement and not more than three nor less than two parts of find aggregate. Hydrated lime or masonry cement shall not be used. Portland cement shall meet the requirements of ASTM C-250, Type II. Fine aggregate shall consist of well-graded natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95 percent passing a No. 5 sieve and a maximum of seven percent passing a No. 100 sieve.

TABLE 5.44.01

Maximum Fill Heights for Reinforced Concrete Pipe
In Clay Soils with Class B Bedding

PIPE SIZE (INCHES)	CLASS II		CLASS III		CLASS IV		CLASS V
	MAXIMUM COVER (FEET)						
18	>		11		16		25+
21	>		11		16		25+
24	>		11		17		25+
30	>		11		17		25+
36	>		11		17		26+
42	8		11		17		27+
48	9		12		17		27+
54	9		12		17		27+
60	9		12		17		27+
66	9		12		17		27+
72	10		12		18		28+
78	10		12		18		28+
84	10		13		18		28+
90	10		13		18		28+
96	10		13		18		28+
102	10		13		18		28+
108	10		13		18		28+
114	10		13		18		28+
120	10		13		18		28+
144	10		13		18		28+

For Greater fill depths, consult Concrete Pipe Design Manual

***** MINIMUM COVER FOR ALL CLASSES OF PIPE SHALL BE 12”**

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CHAPTER 6

ROADWAY

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CHAPTER 6
ROADWAY

6.00.00 GENERAL PROVISIONS

6.01.00 APPLICABILITY

This chapter contains minimum criteria to be met on all streets and parking lots designed and constructed in the City, both by private land developers and by the City.

6.02.00 VARIANCES

Where any particular minimum requirements contained in this chapter can be shown to be inappropriate when applied to an "out-of-the-ordinary" situation, variances to said minimum requirements will be considered and may be authorized by the Public Works Director/City Engineer where the proposed variance in minimum requirements will result in a level of safety, service, and quality equal to or greater than that intended by the application of the minimum requirements.

6.40.00 STREET CONSTRUCTION STANDARDS

6.41.00 GENERAL

The purpose of this section is to set forth the criteria to be used in the construction of all streets and appurtenances within the City of Fort Lupton.

6.42.00 COMPACTION IN UTILITY TRENCHES

Before street construction will be permitted, the top four feet (4') of all utility trenches within the street right-of-way (including service lines) shall be compacted to ninety-five percent (95%) of maximum standard density and the balance of the trench compacted to ninety percent (90%) of maximum density, as determined by ASTM D 698-78 or as specified in the approved soils report. This compaction shall extend to the street right-of-way lines as a minimum. Water settlement of trenches shall not be permitted. All water and sewer services, including water and sewer main stub-outs, shall be installed prior to street construction except that curb and gutter and sidewalk shall be installed prior to water service line installation.

6.43.00 EXCAVATION AND EMBANKMENT

6.43.01 General

The intent of this section is to specify methods and standards to be used in the construction of embankments or excavations for City streets or for other purposes, as indicated on the approved drawings or contract documents. The work will include excavation, embankment, grading; compacting; clearing and grubbing; removal of topsoil, trees, stumps, or other vegetation; removal and/or resetting of minor obstructions; subgrade preparations; and any other work incidental for the construction of excavations and embankments. All workmanship and materials shall be in accordance with the requirements of these STANDARDS AND SPECIFICATIONS and

in conformity with the lines, grades, quantities, and the typical cross-section shown on the plans or as directed by the Public Works Director/City Engineer.

6.43.02 Clearing and Grubbing

Work shall consist of clearing, grubbing, removing and disposing of all vegetation and debris within the limits of the project, and such other areas as may be indicated on the approved plans or required by the work except such objects as are designated to remain or are to be removed in accordance with other sections of these STANDARDS AND SPECIFICATIONS. All surface objects and trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and/or grubbed as required except non-perishable solid objects which shall be a minimum of two feet (2') below subgrade.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted in accordance with these STANDARDS AND SPECIFICATIONS. Materials and debris shall be disposed of in a manner acceptable to the Public Works Director/City Engineer. Burning shall not be permitted without prior written approval of the Public Works Director/City Engineer, Fire Marshal and the county health department.

The contractor shall make all necessary arrangements for obtaining suitable disposal locations. If disposal will be at other than established dump sites, the Public Works Director/City Engineer may require the contractor to furnish written permission from the property owner on whose property the materials and debris will be placed. Branches on trees or shrubs shall be removed as directed. Branches of trees extending over the road bed shall be trimmed to give a clear height of twenty feet (20') above the road bed surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

The contractor shall scalp areas where excavation or embankment is to be made, except that mowed sod need not be removed where the embankment to be constructed is four feet (4') or more in height below subgrade elevation. Scalping shall include the removal of material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and other vegetable matter from the surface of the ground. Hedges shall be pulled or grubbed in such a manner as to assure complete and permanent removal. Sod not required to be removed will be thoroughly disked before construction of embankment.

6.43.03 Removal of Existing Structures

(A) The contractor shall raze, remove, and dispose of all foundations, signs, structures, fences, old pavements, abandoned pipe lines, traffic signal materials, and other obstructions which are within the project limits except for utilities and for those items which other provisions have been made for removal. Traffic signals and related materials will include all attachment hardware and other incidental materials such as, but not limited to, mast arms and span wire. Concrete adhering to sign posts shall be removed, and pedestals and bases shall be removed to one foot (1') below the surrounding ground or subgrade.

Where portions of structures are to be removed, the remaining portions shall be prepared to fit new construction. The work shall be done in accordance with plan details and in such a manner that materials to be left in place will be protected from damage. All damage to portions of structures which are to remain in place shall be repaired by the contractor at his expense. Reinforcing steel, projecting from the remaining structure, shall be cleaned and aligned to provide bond with new extension. Dowels shall be securely grouted with approved grout.

Removal of sign panel shall include all work necessary to remove the panel and its attachment hardware from the existing installation. Where culverts or sewers are to be left in place and plugged, the ends shall be filled with concrete. In addition, the entire length of pipe to be left in place shall be blown full of sand. Materials used in detour structures and supplied by the contractor shall be the property of the contractor. After the detour is abandoned, the contractor shall completely remove the detour structures and shall dispose of materials according to these STANDARDS AND SPECIFICATIONS.

(B) Bridges, culverts, and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic. Unless otherwise directed, the substructures of existing structures shall be removed to one foot (1') below natural stream bottom or ground surface. Where such portions of existing structures lie wholly or in part within the limits of a new structure, it shall be removed as necessary to accommodate the construction of the proposed structure. Steel, precast concrete, and wood bridges shall be carefully dismantled without unnecessary damage. Steel members to be salvaged shall be match-marked with waterproof paint.

(C) Unless otherwise provided, all pipe shall be carefully removed and cleaned. Every precaution shall be taken to avoid breaking or damaging the pipe. Pipes to be relaid shall be removed and stored, when necessary, so that there will be no loss or damage before relaying. When removing manholes, catch basins, and inlets, any live sewer connected to these items shall be properly reconnected and satisfactory bypass service shall be maintained during such operation.

(D) Concrete or asphalt concrete that is to remain shall be cut in a straight, true line with a vertical face. The contractor shall be responsible for the cost of removal and replacement of all overbreak. Sawing shall be done carefully, and all damages to concrete or asphalt to remain in place, which are caused by the contractor's operations, shall be repaired by the contractor at his expense. The minimum depth of saw cuts in concrete shall be two inches (2"). If the removed portion falls within five feet (5') of an existing joint or edge, the concrete shall be removed to that joint or edge.

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6.43.04 Salvage

All salvageable material shown on the plans shall be removed without unnecessary damage in sections or pieces which may be readily transported and shall be stored by the contractor in locations approved by the Public Works Director/City Engineer. The contractor shall be required to replace any materials lost from improper storage methods or damaged by negligence.

6.43.05 Disposal

The contractor shall make all necessary arrangements for obtaining suitable disposal locations, and the cost involved shall be included in the work. If disposal will be at other than established dump sites, the Public Works Director/City Engineer may require the contractor to furnish written permission from the property owner on whose property the materials will be placed.

6.43.06 Excavation and Embankment

Excavation of whatever substances that are encountered within the limits of the project shall be performed to the lines and grades indicated on approved plans. All excavated areas shall be graded in a manner that will permit adequate drainage. Whenever practicable, all suitable material removed from the excavations shall be used in the formation of embankments, for backfilling, and for other approved purposes. Where material encountered within the limits of the work is considered unsuitable, such material shall be excavated below the grade shown on the approved drawings or as directed by the City Engineer and replaced with suitable material. All unsuitable excavated materials and any surplus or excavated material which is not required for embankments shall be disposed of by the contractor.

Before any embankment is placed, clearing, tree removal, sod and topsoil removal over the entire area shall be performed in accordance with these STANDARDS AND SPECIFICATIONS. The base of fill areas shall be scarified to a depth of not less than six inches (6") prior to placement of embankment material. Each layer shall be wetted or aerated, if necessary. No embankment material shall be placed upon organic, spongy, or frozen material or other material unsuitable for the placement thereof in the opinion of the Public Works Director/City Engineer. When an embankment is to be placed on slopes, it shall be continuously benched in horizontal layers to key to the existing slopes.

The construction of embankments by deposition, placing, and compacting materials of acceptable quality above the natural ground or other surface shall be in accordance with the lines, grades, and cross-sections shown on the approved plans and/or as required by the City Engineer. Each lift of the embankment material shall not exceed eight inches (8") in loose depth. The contractor shall thoroughly mix the different materials to secure a uniform moisture content and to insure uniform density and proper compaction. Each layer shall be thoroughly compacted by roller or vibratory equipment which is suitable for the type of embankment material to the densities specified below:

TABLE 6.43.06 *

AASHTO M145 Soil Classification	AASHTO T99 Minimum Relative Compaction (Percent)	AASHTO T180 Minimum Relative Compaction (Percent)
A-1	100	95
A-3	100	95
A-2-4	100	95
A-2-5	100	95
All Others	95	90

* Table 6.43.06 taken from Colorado Department of Transportation Specifications Section 203.07

Class I structural backfill shall be used on all bridges, box culverts, or where otherwise specified. All other backfill shall be developed on site.

6.43.07 Embankment

Embankment construction shall include preparation of the areas upon which embankments are to be placed, construction of dikes, placing and compacting of approved material within roadway areas including holes, pits, and other depressions within the roadway area. Only approved materials shall be used in the construction of embankments and fills.

Free running water shall be drained from the material before the material is placed on the roadway.

When embankment is placed on a slope that is steeper than four-to-one (4:1), as measured in the steepest direction, the embankment shall be continuously benched as the work is brought up in layers. Benching shall be well keyed and, where practical, a minimum of eight (8) feet wide. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous bench. Excavation from benching shall be compacted along with the new embankment material at the Contractor's expense.

Where embankment is to be placed and compacted and end dumping is permitted, the slopes of the original ground or embankment shall be deeply plowed or cut into before starting end dumping.

Where the base of embankment is within four (4) feet of the subgrade, all sod, and vegetable and other organic matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of six (6) inches, and compacted to the specified embankment density. Sod not requiring removal shall be thoroughly disked prior to embankment construction.

When embankments are constructed using claystone or soil-like non-durable shale as identified in the plans or by the Engineer, the material shall be pulverized to a maximum dimension of twelve (12) inches in diameter, placed in a maximum layer thickness of twelve (12) inches and watered to promote slaking and breakdown of the nondurable material in conformance with *Chapter 9, Trenching, Backfilling and Compaction*.

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Excavated material containing particles greater than six (6) inches in greatest dimension shall not be used as embankment material unless designated in the Project Manual or approved by the Engineer. When the excavated material consists predominately of rock too large to be placed in eight (8) inch layers, the Engineer may permit the material to be placed in thicknesses up to the average rock dimension, not to exceed three (3) feet. Placing of occasional boulders of sizes larger than the maximum layer thickness may be authorized by the Engineer. Each layer shall be leveled and smoothed by distribution of finer material or approved embankment material. If the use of leveling equipment is not practicable the Engineer may permit rock fill material to be cast or end dumped. In such cases sufficient hand or machine work will be required to construct a compact, stable fill and to finish the slopes to a neat and smooth appearance. Each layer shall be compacted as specified in *Chapter 9, Trenching, Backfilling and Compaction*.

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Rock fill, or claystone or soil-like non-durable shale, or both shall not be constructed above an elevation two (2) feet below the finished subgrade. The top two (2) feet of the embankment shall be placed in layers not to exceed eight (8) inches loose thickness and compacted in accordance with *Chapter 9, Trenching, Backfilling and Compaction*.

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When a rock fill is placed over any structure, the structure shall be covered with a minimum of two (2) feet of compacted embankment material or other approved material before the rock is placed.

During the construction of the roadway, the roadbed shall be maintained so that it is well drained at all times.

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6.43.~~0~~708 Select Borrow Material

In the event the material found on site is unsatisfactory for constructing subgrade, embankments, or filling excavations, the contractor shall provide material from off-site. The selected borrow material shall be a well-graded mixture of sound mineral aggregate particles containing sufficient quality bonding material to secure a firm stable foundation when placed and compacted on the roadway. The R-value of the borrow shall be equal to or greater than the design R-value required for the street. The R-value of the borrow shall be provided to the Public Works Director/City Engineer prior to placing borrow. If tests reveal that material being placed is not of suitable quality and structural value, the contractor shall provide other material as approved by the Public Works Director/City Engineer.

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6.44.00 SUBGRADE PREPARATION AND GRADING

6.44.01 General

The work covered by this section concerns the furnishing of all labor, equipment, supplies, and materials needed to perform preparation of subgrade within the public right-of-way. The bottom of the excavation for the pavement, or top of the fill, will be known as the pavement subgrade and shall conform to the lines, grades, and cross-sections shown on the approved plans. Prior to the street being excavated, all service cuts shall be checked to see if the backfill meets density requirements. If deficient, they shall be recompacted and brought up to the density as specified in Chapter 9, Trenching, Backfilling and Compaction.

6.44.02 Subgrade Stabilization

Embankment and subgrade soils shall be compacted to ninety-five percent (95%) of maximum standard density at plus or minus two percent ($\pm$2%) optimum moisture or as recommended in the approved soils report. Maximum density shall be determined by ASTM D 698-78. Soft and yielding material and other portions of the subgrade which will not compact when rolled or tamped shall be removed as directed by the Public Works Director/City Engineer and replaced with suitable material.

Subgrade surfaces below excavated areas such as cut areas and undisturbed areas shall require additional preparation. Said subgrade shall be scarified to a minimum depth of twelve inches (12"), wetted or aerated as needed, and compacted until the required density is obtained, unless otherwise approved by the Public Works Director/City Engineer. No paving, subbase, or base shall be placed on soft, spongy, or frozen unstable subgrade which is considered unsuitable by the Public Works Director/City Engineer.

The contractor shall, when requested by the Public Works Director/City Engineer, furnish the necessary equipment to proof roll, even though density tests may indicate compliance. Heavy construction equipment or loaded trucks acceptable to the City shall be driven over the finished subgrade and deflections noted. Soft and yielding material and portions of the subgrade which show deflection shall be scarified and re-rolled or shall be removed and replaced with subgrade course material and then placed and compacted as specified herein. Subgrade shall not be approved for base course construction or paving until it is uniformly stable and unyielding.

6.44.03 Lime and Cement Treated Subgrade

When recommended by the approved soils report and/or pavement design, the surface of the road bed shall be bladed to the established lines, grades, and cross-sections as shown on the approved plans. The prepared road bed shall be scarified to the depth and width required for the subgrade stabilization. The material thus obtained shall be pulverized. Application, mixing, and finishing shall be in accordance with Colorado Department of Transportation Specifications, 1991 Edition, Section 307.04 through 307.07. Hydrated lime shall conform to the requirements of ASTM C 107-79, Type N.

6.44.04 Subgrade Surface Tolerance

The excavation and embankments for the street, intersections, and driveways shall be finished to a reasonably smooth and uniform surface. Variations from the subgrade shall not be more than one-half inch (1/2") in solid nor more than one inch (1") above or six inches (6") below in rock.

6.44.04 Proof Rolling

Proof rolling with pneumatic tire equipment shall be performed using a minimum axle load of eighteen (18) kips per axle. A weigh ticket from an approved scale shall be furnished by the Contractor to substantiate this weight.

The subgrade shall be proof rolled after the required compaction has been obtained and the subgrade has been shaped to the required cross section. The proof roller shall be operated in a systematic manner so that a record may be readily kept of the area tested and the working time required for the testing. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Engineer, shall be ripped, scarified, dried or wetted as necessary and recompacted to the requirements for density and moisture at the Contractor's expense. After recompaction, these areas shall be proof rolled again and all failures again corrected at the Contractor's expense.

Upon approval of the proof rolling, the sub base, base course, or initial pavement course shall be placed within forty-eight (48) hours. If the Contractor fails to place the sub base, base course, or initial pavement course within forty-eight (48) hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction shall be performed again at the Contractor's expense.

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6.45.00 SUBBASE CONSTRUCTION

6.45.01 General

The subbase shall consist of a foundation course composed of granular material constructed on the prepared subgrade in accordance with these STANDARDS AND SPECIFICATIONS and in reasonable conformity to the lines and grades and typical cross-sections as shown on the approved plans.

6.45.02 Placement and Compaction

Each layer of subbase material shall be placed in layers not to exceed six inches (6") in compacted depth. Each layer shall be wetted or aerated, if necessary, and compacted to ninety-five percent (95%) maximum density at plus or minus two percent (±2%) of optimum moisture as determined by ASTM D 698-78. No subbase material shall be placed upon a soft, spongy, or frozen subgrade or other subgrade, the stability of which is unsuitable for the placement thereof.

6.45.03 Subbase Surface Tolerance

The prepared surface of the subbase shall not vary from the approved grade by more than a half inch (1/2").

6.46.00 BASE CONSTRUCTION

6.46.01 General

The intent of this section is to specify methods to be used for the construction, overlaying, sealcoating, and pavement rejuvenating of streets, parking lots, walks, drainageways, and other miscellaneous work requiring the use of aggregates. The work covered shall include general requirements that are applicable to aggregate base course, bituminous base, and pavements of the plant-mix type, bituminous prime coat, bituminous tack coat, rejuvenating applications, and asphalt concrete overly. All workmanship and material shall be in accordance with requirements of these STANDARDS AND SPECIFICATIONS and in conformity with the lines, grades, depths, quantity requirements, and the typical cross-section shown on the approved plans or as directed by the Public Works Director/City Engineer.

6.46.02 Base Course

This item shall consist of a foundation course composed of crushed gravel or crushed stone and filler, constructed on the prepared subgrade or subbase course. Construction shall be in accordance with the requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 304 and the approved pavement design. The composite base course material shall be free from vegetation and lumps or balls of clay.

6.46.03 Placement and Compaction

The base course material shall be deposited and spread in a uniform layer without segregation of size to a compacted depth not to exceed six inches (6"). The material shall be compacted to a minimum ninety-five percent (95%) density as determined by ASTM D 698-78. No base course material shall be placed upon a soft, spongy, or frozen subgrade or subbase with an unsuitable stability. Base material shall not be placed on a dry or dusty foundation where the existing condition would cause rapid dissipation of moisture from the base material and hinder or preclude its proper compaction. Such dry foundations shall have water applied and shall be reworked and recompacted.

Rolling shall be continuous until the base material has been compacted thoroughly in accordance with these STANDARDS AND SPECIFICATIONS. Water shall be uniformly applied as needed during compaction to obtain optimum moisture content and to aid in consolidation. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates are firmly placed.

6.46.04 Base Surface Tolerance

The prepared surface of the base shall not vary from the approved grade by more than one-half inch (1/2").

6.47.00 BITUMINOUS CONSTRUCTION

6.47.01 Hot Bituminous Pavement

All pavement shall be hot bituminous pavement of the plant mix type unless otherwise approved in writing by the Public Works Director/City Engineer. Construction shall be in accordance with the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 403, and the following requirements:

(A) The asphalt cement shall be in accordance with Section 6.73.02 (A) of these STANDARDS AND SPECIFICATIONS.

(B) The gradation of the mineral aggregate shall be in accordance with Section 6.73.02 (B) of these STANDARDS AND SPECIFICATIONS.

***Based on Colorado Department of Transportation's 2017 Specifications Division 400 (https://www.codot.gov/business/designsupport/cdot-construction-specifications/2017-construction-standard-specs/2017-specs-book/division-400-2017-final.pdf/view)**

6.47.02 Seal Coat

DESCRIPTION

This work consists of furnishing and applying asphalt emulsion and cover coat material on an existing surface, in accordance with these specifications and in conformity with the lines shown on the plans or established. When rejuvenating agent or emulsified asphalt is used as a fog seal, cover coat material will not be required.

MATERIALS

Asphalt Emulsion. Emulsified asphalt shall be polymerized or latex modified, and shall be rapid set or medium set conforming to the requirements of subsection 6.73.03(b).

Rejuvenating agent shall conform to the requirements of subsection 6.73 – 05.

Cover Coat Material. Cover coat material shall meet the requirements of subsection 6.73 – 07 for the type specified. The material will be accepted at the spreader.

CONSTRUCTION REQUIREMENTS

Weather Limitations. Asphalt emulsion shall not be applied on a damp surface, when either the air or pavement surface temperature is below 70 °F, or when weather conditions would prevent the proper construction of the chip seal.

Equipment. The following equipment or its equivalent shall be used:

(1) Asphalt distributor and equipment shall be capable of uniformly distributing asphalt emulsion at even temperature and uniform pressure on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard. The allowable variation from any specified rate shall not exceed plus or minus 0.02 gallon per square yard. The distributor's spreading capabilities shall be computer controlled or it shall be calibrated to conform to the distributor manufacturer's procedure prior to applying the emulsified asphalt. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically. Distributors shall be equipped with an automatic heater capable of maintaining the asphalt emulsion at the manufacturer's recommended application temperature or at 140 °F, whichever is higher.

(2) A rotary power broom.

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(3) A minimum of two pneumatic tire rollers that weigh at least 10 tons each.

(4) One self-propelled aggregate spreader of approved design supported by at least four wheels equipped with pneumatic tires on two axles. The aggregate spreader shall be capable of applying the larger cover coat material to the surface ahead of the smaller cover coat material and shall have positive controls so the required quantity of material is deposited uniformly over the full width of the asphalt emulsion. Other types of aggregate spreaders may be used provided they accomplish equivalent results and are approved.

Preparation of Surface. The entire surface that is to receive a chip seal shall be cleaned of loose sand, dust, rock, mud, and all other debris that could prevent proper adhesion of the asphalt coating. The cleaning shall be accomplished by power broom, scraping, blading, or other approved measures. Chip sealing operations shall not be started until the surface is approved.

Applying Asphalt Emulsion. Asphalt emulsion shall be applied by a pressure distributor in a uniform, continuous spread and within the temperature range specified. The distributor's spreading capability shall be computer controlled or calibrated to conform to the distributor manufacturer's procedure prior to applying the emulsified asphalt. If streaking occurs, the distributor operation shall be stopped immediately until the cause is determined and corrected. Streaking is alternating, narrow, longitudinal areas of excessive and then insufficient quantities of asphalt emulsion. The quantity of asphalt emulsion per square yard may vary from the rate shown in the Contract, as directed. A strip of building paper, at least 3 feet in width and with a length equal to that of the spray bar of the distributor plus 1 foot shall be used at the beginning of each spread. If the distributor does not have a positive cut-off, the paper shall be used at the end of each spread. The paper shall be removed and disposed of in a satisfactory manner. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. Skipped areas and deficiencies shall be corrected. Junctions of spreads shall be carefully made to assure a smooth riding surface.

The length of spread of asphalt emulsion shall not be in excess of the area that trucks loaded with cover coat material can immediately cover.

The spread of asphalt emulsion shall not be more than 6 inches wider than the width covered by the cover coat material from the spreading device. Under no circumstances shall operations proceed so asphalt emulsion will be allowed to chill, set up, dry, or otherwise impair retention of the cover coat.

The distributor shall be parked so that asphalt emulsion will not drip on the surface of the traveled way.

Application of Cover Coat Material. Immediately following the application of the asphalt emulsion, cover coat material shall be spread in quantities as designated. The spreading rate may vary from the rate shown in the Contract when approved. Spreading shall be accomplished so the tires of the trucks or aggregate spreader do not contact the uncovered and newly applied asphalt emulsion.

The cover coat material shall be moistened with a sufficient amount of water to reduce the dust coating of the aggregate prior to spreading. The cover coat material shall not contain free moisture as evidenced by drain down in the delivery truck bed.

Immediately after the cover coat material is spread, deficient areas shall be covered with additional material. Rolling shall begin immediately behind the spreader and shall continue until three complete coverages are obtained. Rolling shall be completed the same day the asphalt emulsion and cover coat materials are applied.

The completed roadway surface shall be lightly broomed the following morning to remove any excess material, without removing any imbedded material. The Contractor shall conduct additional brooming if so directed.

A fog seal shall be applied to the surface of the completed chip seal at the rate of

0.11 ± 0.04 gallon per square yard of diluted emulsion when directed. The fog seal shall have a 3:2 emulsion to water dilution rate. The application rate and the dilution rate may be changed by the Engineer.

METHOD OF MEASUREMENT

Chip seal will be measured by the number of tons, cubic yards, or square yards of the designated type of cover coat aggregate.

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BASIS OF PAYMENT

The accepted quantities of chip seal will be paid for at the contract price per ton, cubic yard, or square yard for cover coat material.

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Payment will be made under:

Pay Item	Pay Unit
Cover Coat Material (Type___)	Ton
Cover Coat Material (Type___) (Lightweight)	Cubic Yard
Cover Coat Material (Type___)	Square Yard

Asphalt emulsion, including the asphalt emulsion used for fog seal, will be measured and paid for in accordance with Section 6.47.07.

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6.47.03 Rejuvenating Agent/Tack Coat

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DESCRIPTION

This work consists of preparing and treating an existing surface with asphalt material, and blotter material if required, in accordance with these specifications and in conformity with the lines shown on the plans or established.

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MATERIALS

Asphalt Material. The type and grade of asphalt material for prime and tack coating will be specified in the Contract.

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The asphalt material for all coatings shall meet the applicable requirements of Section 6.73. The asphalt material for prime and tack coating may be conditionally accepted at the source. The rejuvenating agent shall be accepted before loading into the distributor.

Blotter Material. Blotter material for prime coating shall consist of aggregate base course conforming to the requirements specified for base course aggregate on the project.

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Blotter material for rejuvenating agent shall consist of dry, gritty sand conforming to the fine aggregate gradation of CDOT's Standards and Specifications Table 703-2, or as approved.

Blotter material may be accepted in the stockpile at the source or at the roadway prior to placement.

CONSTRUCTION REQUIREMENTS

Weather Limitations. Prime coat and tack coat shall not be applied under the following conditions:

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(A.) When the surface is wet.

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(B.) When weather conditions would prevent the proper construction of the prime or tack coat.

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Equipment. The Contractor shall provide equipment for heating and uniformly applying asphalt material and blotter material.

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The distributor and equipment shall be capable of uniformly distributing asphalt material at even temperature and uniform pressure on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard. The allowable variation from any specified rate shall not exceed plus or minus 0.02 gallon per square yard. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for

measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

The distributor for rejuvenating agent shall also be equipped with the following:

(A.) Heating facilities with controls to reach a temperature of 130 °F.

(B.) Circulating system to maintain proper mixture of the rejuvenating agent.

Preparation of Surface. Preparation of the surface to be treated shall include all work necessary to provide a smooth, dry, uniform surface. The work shall include patching, brooming, shaping to required grade and section, compaction, and removal of unstable corrugated areas.

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The edges of existing pavements which are to be adjacent to new pavement shall be cleaned to permit the adhesion of asphalt materials.

Application of Asphalt Material. Asphalt material shall be applied by a pressure distributor in a uniform and continuous spread. When traffic is maintained, not more than ½ of the width of the section shall be treated in one application, or sufficient width shall be left to adequately handle traffic. Care shall be taken so the application of asphalt material at the junctions of spreads is not in excess of the specified quantity. Excess asphalt material shall be removed or distributed as directed. Skipped areas or deficiencies shall be corrected. Asphalt material shall not be placed on any surface where traffic will travel on the freshly applied material.

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The rate of application, temperatures, and areas to be treated shall be approved prior to application of the coating.

Application of Blotter Material. If, after the application of the prime coat or rejuvenating agent the asphalt material fails to penetrate and the roadway must be used by traffic, blotter material shall be spread in the quantity required to absorb excess asphalt material.

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METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Asphalt material will be measured and paid for in accordance with Section 6.47.07.

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Blotter material will not be measured and paid for separately but shall be included in the work.

Payment for patching will be made at the contract unit price for the various items used for patching.

6.47.04 Asphalt Materials

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DESCRIPTION

This work consists of furnishing asphalt materials of all types and the application of these materials in accordance with these specifications and details shown on the plans.

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MATERIALS

All asphalt materials shall conform to the requirements of Section 6.73.

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The type and grade of asphalt material will be specified in the Contract.

Emulsion used for seal coat will be identified as rapid setting or medium setting emulsion, and conform to the requirements of subsection 6.73.02.

CONSTRUCTION REQUIREMENTS

Asphalt materials shall be fortified when required by the Contract with an additive of an approved type. Additive shall be uniformly blended with asphalt materials at the refinery, or through an approved in-line blender as specified in the Contract.

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Asphaltic application methods which result in the discoloration of concrete structures, concrete curbs, and concrete gutters will not be permitted. Coatings shall be applied so as to cause the least inconvenience to traffic and to permit one- way traffic. Traffic will be permitted to travel on fresh asphalt material when it can be accomplished without pickup or tracking of the asphalt material.

Asphaltic materials used as fuel or lubricant shall be stored separately.

Emulsified asphalt for tack coat shall be diluted before use as shown in the Contract or as directed.

METHOD OF MEASUREMENT

Asphalt cement will be measured by the ton by one of the following methods as determined by the Engineer:

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(1) The pay quantity of asphalt cement will be determined by multiplying the total accepted tons of paving mix by the weighted average of all asphalt content percentages obtained from the field acceptance tests for that item, or

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(2) The pay quantity of asphalt cement will be determined from the invoices for the asphalt cement delivered to the job corrected by tank stabs.

Emulsified asphalt and liquid asphaltic materials will be measured by the gallon.

The pay quantity for emulsified asphalt shall be the number of gallons before dilution with water.

Concentrated asphalt rejuvenating agent will be measured by the gallon before any water is added.

Emulsified asphalt used for seal coat will be measured by the actual number of tons placed and accepted. The pay quantity of emulsified asphalt will be determined from the invoices of emulsified asphalt delivered to the project, corrected by any weight of remaining emulsion in the distributor truck or tanker at the conclusion of the project. The Engineer may elect to calculate the remaining weight in a distributor by use of the average specific gravity of materials delivered, or by tank stabs. The average specific gravity for this calculation will be as determined by Central Laboratory Testing. If tank stabs are to be utilized for this measurement, the Contractor's Process Control Plan shall include appropriate information for calculations on the distributor used on the project. This calculation will be limited to less than 4000 gallons of material. All other material shall require weigh back for proper calculation of payment. The weight shall be determined by certified scales in accordance with CDOT's Standards and Specifications Section 109. This will also be monitored and documented by daily distributor gauge readings and yield calculations. All proposed methods of weighing materials, calibrating distributor rates and monitoring the yields shall be included in the Process Control Plan in accordance with Section 6.47.03.

Diluted emulsified asphalt used for fog seal on chip seals will be measured by the actual number of tons of asphalt prior to dilution with water. Correction for the final diluted emulsion at the conclusion of a project will assume a 3:2 emulsion to water dilution rate, and the water subtracted from the weight of the remaining product unless otherwise approved.

BASIS OF PAYMENT

The accepted quantities, measured as provided above, will be paid for at the contract unit price per ton or gallon as the case may be, for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

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Pay Item	Pay Unit
Asphalt Cement (___)	Ton
Emulsified Asphalt (___)	Gallon
Emulsified Asphalt (Rapid – Setting)(Polymerized)	Ton
Emulsified Asphalt (Medium – Setting)(Polymerized)	Ton
Liquid Asphaltic Material (___)	Gallon
Asphalt Rejuvenating Agent	Gallon
Recycling Agent	Gallon

High float emulsified asphalt (polymerized) or emulsified recycling agent used in Item 6.47.08, Cold Asphalt Pavement (Recycle) will be paid for by the gallon under the pay item Recycling Agent.

Water used to dilute emulsified asphalt or asphalt rejuvenating agent will not be paid for separately but shall be included in the work.

6.47.05 Cold Asphalt Pavement (Recycle)

DESCRIPTION

This work consists of pulverizing the existing asphalt surfacing to the depth shown on the plans, mixing a recycling agent and water, if required, with the pulverized material, then spreading and compacting the mixed material.

MATERIALS

The recycling agent shall be either a high float emulsified asphalt (polymerized) or emulsified recycling agent meeting the requirements of subsection 6.73.08.

The pulverized material shall meet the following gradation requirements:

Sieve Size	Percent Passing
31.5 mm (1 ¼ inch)	100
25.0 mm (1 inch)	90 – 100

The sealing emulsion shall be high float emulsion (diluted), emulsified asphalt (SS), or approved equal.

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CONSTRUCTION REQUIREMENTS

Weather Limitations. Daily recycling operations shall not begin until the atmospheric temperature is 55 ºF and rising. Recycling operations shall be discontinued when the temperature is 60 ºF and falling. Recycling operations shall not be performed when the weather is foggy or rainy, or when weather conditions are such that the proper mixing, spreading, compacting, and curing of the recycled material cannot be accomplished. Cold recycled pavement damaged by precipitation shall be reprocessed or repaired by methods approved by the Engineer, at the Contractor's expense.

The construction of cold recycled pavement will not be allowed from September 16 through May 14 unless otherwise approved. The Contractor's Progress Schedule shall show the methods to be used to comply with this requirement.

Milling. The existing asphalt surfacing shall be cold recycled in a manner that does not disturb the underlying material in the existing roadway.

Adjacent recycling passes shall overlap at the longitudinal joint a minimum of 4 inches.

The beginning of each day's recycling operation shall overlap the end of the preceding recycling operation a minimum of 100 feet unless otherwise directed.

Any fillet of fine, pulverized material which forms adjacent to a vertical face shall be removed prior to spreading the mixed material, except that such fillet adjacent to existing pavement which will be removed by a subsequent overlapping milling operation need not be removed. Vertical cuts in the roadway shall not be left overnight.

Mixing. When commencing recycling operations, the recycling agent shall be applied to the pulverized material at the initial design rate determined by the Materials Laboratory, based on samples obtained by the Department prior to construction. The exact application rate of the recycling agent will be determined and may be varied as required by existing pavement conditions. An allowable tolerance of plus or minus 0.2 percent of the initial design rate or directed rate of application shall be maintained at all times.

A representative of the recycling agent supplier shall be present on the project during recycling operations until an acceptable production sequence is established as determined by the Engineer.

The Contractor may add water to the pulverized material to facilitate uniform mixing with the recycling agent. Water may be added prior to or concurrently with the recycling agent, provided that this water does not adversely affect the recycling agent.

Spreading. Recycling and placing recycled material shall be at a rate sufficient to provide continuous operation of the paving machine. If paving operations result in being excessively behind or in excessive stopping of the paving machine, as determined by the Engineer, recycling operations shall be suspended. Recycling may resume when the Contractor can synchronize the rate of recycling with the capacity of the paving machine.

If segregation occurs behind the paver, the Contractor shall make changes in equipment, operations, or both to eliminate the segregation.

Compacting and Finishing. After the recycled material has been spread, traffic, including Contractor's equipment, shall not be allowed on the recycled material until it starts its initial

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break as determined by the Engineer. However, if precipitation is imminent, compaction may proceed to seal the surface from additional moisture.

Initial rolling shall be performed with one or more pneumatic tire rollers and be continued until no displacement is observed. Final rolling to eliminate pneumatic tire marks and achieve the required density shall be done by steel wheel rollers either in static or vibratory mode. The use of vibratory rollers shall be approved by the Engineer. If rollers are used in the vibratory mode, vibration shall be at low amplitudes to prevent transverse cracks.

The recycled material shall be compacted to a minimum of 100 percent of the density of a laboratory specimen compacted in accordance with CP 53. If the area tested fails to meet the required density, the area shall be reworked until it attains 100 percent compaction. The frequency of density testing for project acceptance will be one per 5000 square yards. The Engineer will perform one CP 53 for calculation of the percent relative compaction with each field density taken.

Rollers shall not be started or stopped on uncompacted recycled material. Rolling shall be accomplished so that starting and stopping will be on previously compacted cold recycled pavement or existing pavement.

Any type of rolling that results in cracking, movement, or other types of pavement distress shall be discontinued until the problem is resolved.

After the recycled material has been compacted, traffic, including the Contractor's equipment, shall not be permitted on the cold recycled pavement for at least two hours, unless otherwise approved.

Before placing the sealing emulsion or hot mix asphalt overlay, the cold recycled pavement shall be allowed to cure until the free moisture is reduced to 1 percent free moisture or less, by total weight of mix. Free moisture will be measured according to CP 57. After the free moisture content of the cold recycled pavement has reached the acceptable level, the hot mix asphalt overlay or sealing emulsion, if required, shall be placed. However, unless otherwise approved by the Engineer, the cold recycled pavement shall be covered with a minimum thickness of 2 inches of hot mix asphalt within ten calendar days after it is laid and compacted. The sealing emulsion, if required, shall be applied to the surface at an approximate rate of 0.025 to 0.10 gallons per square yard. The sealing emulsion shall be applied when the Engineer determines that it is necessary to prevent raveling (progressive separation of aggregate particles).

Damage caused by the Contractor to the cold recycled pavement shall be repaired at Contractor's expense, as directed, prior to placing any hot asphalt surfacing.

Soft areas that are not caused by the Contractor or weather shall also be repaired prior to placing the hot mix asphalt.

Recycling Train. The Contractor shall furnish a self-propelled machine capable of pulverizing the existing asphalt surfacing to the depth shown on the plans, in one pass. The machine shall have a minimum rotor cutting width of 12 feet. The rotor cutting width selected for the project shall allow for the longitudinal joint to be offset from the longitudinal joint of the layer placed above by at least 6 inches. The longitudinal joint shall not fall in the wheel path. The machine shall have standard automatic depth controls, and maintain a constant cutting depth. The machine shall also have screening and crushing capabilities to reduce or remove oversize particles prior to mixing with recycling agent. Oversize particles shall be reduced to size by crushing.

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The machine shall perform continuous weight measurement of the pulverized material interlocked with the recycling agent metering device so the required recycling agent content

will be maintained. Positive means shall be provided for calibrating the weight measurement device and the recycling agent metering device.

A positive displacement pump, capable of accurately metering the required quantity of recycling agent at rates as low as 4 gallons per minute, shall be used to apply the recycling agent. The interlock system shall allow addition of the recycling agent only when pulverized material is present in the mixing chamber. Each mixing machine shall be equipped with a meter capable of registering the rate of flow and the total amount of recycling agent introduced into the mixed material.

The recycling agent shall be applied through a separate mixing machine capable of mixing the pulverized material and the recycling agent to a homogeneous mixture, and placing the mixture in a windrow. The mixture shall be placed in a windrow in a manner that prevents segregation.

Paver. The recycled material shall be placed with a self-propelled asphalt paver meeting the requirements of CDOT's Standards and Specifications subsection 401.10, except that the screed shall not be heated. The mixed material shall be spread in one continuous pass, without segregation, to the lines and grades established on the plans.

When a pick-up machine is used to feed the windrow into the paver hopper, the pick-up machine shall be capable of picking up the entire windrow to the underlying materials.

Compactors. Rollers shall be steel wheel, pneumatic tire, vibratory or combination of these types. The number and weight of rollers shall be sufficient to obtain the required compaction while the recycled material is in a workable condition, except that each pneumatic tire roller shall be 30 tons minimum weight.

Smoothness. The longitudinal surface smoothness of the roadway prior to and after cold recycling shall be tested by the Contractor in accordance with CDOT's Standards and Specifications subsection 105.07.

METHOD OF MEASUREMENT

In-place cold recycled pavement will be measured by the square yard of paved surface actually recycled, complete in place and accepted.

Repair of cold recycled pavement will be measured by the square yard of paved surface repaired and accepted.

BASIS OF PAYMENT

The accepted quantity of in-place cold recycled pavement will be paid for at the contract unit price per square yard.

Payment will be made under:

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Pay Item	Pay Unit
Cold Asphalt Pavement (Recycle)	Square Yard Repair of Cold Asphalt
Pavement (Recycle)	Square Yard

Asphalt materials will be measured and paid for in accordance with Section 6.47.07.

Water will not be measured and paid for separately, but shall be included in the work.

Repair of cold recycled pavement damaged by the Contractor or by weather will not be measured and paid for separately, but shall be included in the work.

Overlaps of preceding recycling operations will not be measured and paid for separately, but shall be included in the work.

6.47.06 Stockpile Patching Material Detailed Specifications – Cold Patch

1 DESCRIPTION:

Stockpile patching material is a mixture composed of aggregate and bituminous material. The material shall be capable of storage in a stockpile and remain uniform, workable and have satisfactory setting properties at the time of delivery.

2 MATERIALS REQUIREMENTS:

A. Aggregates

Aggregates shall conform to Section 6.73. Crushed stone, crushed gravel, or approved crushed slag may be used.

B. Bituminous Material

The bituminous material shall conform to the requirements of Section 6.73, Bituminous Materials.

For any bituminous material not listed in Section 6.73, the Producer shall provide specifications for the alternative material to the Materials Bureau.

C. Anti-Stripping Mixtures

An anti-stripping agent, approved by the Director, Materials Bureau, or agency authorized representative, shall be used as needed to meet the stripping test requirements. This may be incorporated with the bituminous material at the terminal or at the mixing plant.

3 COMPOSITION OF MIXTURES:

The aggregate gradation and bituminous material quantities shall meet the requirements noted in Table 1 (see below). The Producer shall submit a Job Mix Formula to the Department's Regional Materials Engineer, or agency authorized representative, who has jurisdiction over the plant in which the material is to be produced. An approved Job Mix Formula must be received

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by the Producer prior to production. The following information shall be provided with the Job Mix Formula submission:

1. Aggregate gradation band and aggregate types.
2. Bituminous Material - amount and type.
3. Description and quantities of additives.
4. Temperature ranges for material preparation

TABLE 1 - STOCKPILE PATCHING MATERIAL

GENERAL LIMITS AND JOB MIX FORMULA TOLERANCES

Sieve Size	Coarse Mix		Intermediate Mix		Fine Mix	
	% Passing	Tolerance (1)	% Passing	Tolerance (1)	% Passing	Tolerance (1)
1 inch	100	-				
1/2 inch	95-100	-	100	-	100	-
1/4 inch	55-75	±5	90-100	-	90-100	-
1/8 inch	15-40	±6	12-40	±6	35-60	±6
No. 80	0-5	±2	0-5	±2	2-10	±3
No. 200	-	-	-	-	0-5	±2
Bituminous Material %(2)	4.0 – 7.5	±0.4	4.0 – 8.0	±0.4	5.5 – 8.0	±0.4

(1) All aggregate percentages are based on the total weight of the aggregate.

(2) Bituminous Material (asphalt residue) percentage is based on the total weight of the mix and shall include any additives

4 PREPARATION OF MIXTURES:

Stockpile patching material shall be produced using one of the following methods:

A. Hot Mix Asphalt Batch Plant

Material shall be provided in accordance with the specifications for Section 401 - Plant Production of the New York State Department of Transportation, Standard Specifications, except as modified herein.

Aggregate shall be introduced into the pugmill at a temperature which eliminates free moisture on the aggregate surface. The mixture temperature shall be no greater than 212°F. Automatic batch proportioning and recording equipment is not required.

B. Portable Pugmill

Material shall be provided in accordance with the specifications for Section 302 – Bituminous Stabilized Course of the New York State Department of Transportation, Standard Specifications, except as modified herein.

The moisture content requirement shall be waived.

5 INSPECTION, TESTING & ACCEPTANCE:

The Producer shall contact the Regional Materials Engineer, or agency authorized representative, to arrange for inspection of the preparation of mixtures. If inspection is not

performed at the time of mixture preparation, samples from the stockpile will be tested by the Department, or agency authorized representative, to determine the acceptability of the mixture prior to use for patching.

The following stripping test shall be conducted on the plant mixed material:

A. Stripping Test

A suitable size sample of the stockpile patching material shall be permitted to cure at normal laboratory temperature for at least 24 hours after which it shall be placed in a glass jar, fitted with a tight cover, and completely covered with distilled water. The jar and contents shall then be allowed to stand for a period of 24 hours at normal laboratory temperature (approximately 70ºF). The sample shall then be shaken vigorously for a period of 15 minutes. The water shall then be poured from the jar and the sample removed to a flat surface and be permitted to air dry after which it shall be visually examined for stripping of the bituminous film from the aggregate. The aggregate surface shall be at least 90 percent coated with the bituminous film.

The initial approval of a mixture or the initial acceptance of material shall in no way preclude further examination and testing if unsatisfactory results are achieved. The acceptance at any time shall not bar its future rejection.

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~~6.47.02 Tack Coat~~

~~When tack coat is specified on the approved plans or required by the Public Works Director/City Engineer, all construction shall be in accordance with the requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 407. Bituminous material shall be applied at the rate of five one-hundredths (0.05) to fifteen one-hundredths (0.15) gallons per square yard.~~

~~6.47.03 Seal Coat~~

~~When seal coat is required, all construction shall be in accordance with the requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 409. The type of bituminous material, cover aggregate, and rate of application shall be as shown on the approved construction plans.~~

~~6.47.04 Rejuvenating Agent~~

~~When a rejuvenating agent is specified on the approved construction plans or required by the Public Works Director/City Engineer, all materials and construction shall be in accordance with the requirements of the Colorado Department of Highways' Standard Specifications for Road and Bridge Construction, Section 407. The rejuvenating agent shall be as shown on the approved construction plans or as specified by the Public Works Director/City Engineer.~~

~~6.47.05 Heating and Scarifying~~

~~When heating and scarifying treatment is specified on the approved construction plans or required by the Public Works Director/City Engineer, all materials and construction shall be in accordance with requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 405.~~

6.47.0~~6~~7 Grinding

Grinding shall consist of milling, grinding, or cold planing the existing pavement surface to establish a new surface profile and cross-section in preparation for a bituminous overlay. After grinding, the surface shall have a grooved or ridged finish, uniform, and resistant to raveling or traffic displacement. This textured surface shall have grooves of one-quarter inch (1/4") plus or minus one-eighth inch (±1/8).

Wedge cut grinding shall consist of grinding the existing pavement surface a minimum of four feet (4') wide at the existing concrete gutter. The edge of the gutter end of the finished wedge cut shall be one-and-one-half inches (1-1/2") below the edge of the existing concrete gutter. The centerline of the street edge of the wedge cut will be cut one-eighth inch (1/8"). The depth of cut shall be determined by measuring to the top of the ridges by placing a five-foot (5') straight edge perpendicular to the grooving pattern. Full-width grinding shall consist of grinding the existing pavement surface from edge of gutter to edge of gutter to a minimum depth of two inches (2") unless otherwise directed by the Public Works Director/City Engineer.

In grinding around utility castings, the contractor may choose to remove the entire existing bituminous pavement around the castings where grinding is not completed and replace it with bituminous surface course placed and compacted in three-inch (3") lifts. The contractor shall vertically cut the limits of the area to be patched, mechanically compact the existing base course, and prime the bottom and vertical edges before backfilling. The contractor shall remove the cuttings immediately behind the grind machine by belt loader, end loader, power sweeper, and/or by hand. The removed material shall be disposed of as approved by the Public Works Director/City Engineer.

The grinding machine shall be a power-operated, self-propelled machine having a cutting drum with lacing patterns that will attain a grooved surface and produce grinding chips of less than one inch (1") in size. The grinding machine shall be equipped with a pressurized watering system for dust control. The equipment shall be a type that has successfully performed similar work.

The cleaning equipment shall be a type which will efficiently remove all loosened material and load into trucks for hauling and spreading. Because of the nature of the streets to be ground and the traffic restrictions, a belt loader followed by a power sweeper and manual sweeper is the most desirable method. Flushing into the City's storm sewer system as a means of clean-up will not be allowed.

6.48.00 PORTLAND CEMENT CONCRETE PAVEMENT

6.48.01 General

Work covered by this section consists of furnishing all tools, transportation, labor, equipment, accessories, services and material, and in performing all operations in constructing a single course of air-entrained Portland cement concrete pavement constructed on a prepared subgrade in accordance with these STANDARDS AND SPECIFICATIONS and in conformity with the lines, grades, thickness, and typical cross-sections as shown on the contract documents. **Portland Cement Concrete Pavements will only be allowed if approved in writing by the Public Works Director/City Engineer.**

6.48.02 Method

Construction may be of either of the following methods:

(A) **Standard Concrete Pavement:**

Standard concrete pavement shall consist of concrete of the type and thickness in the other contract documents, placed within fixed forms, and consolidated and finished by equipment operating on forms. This method is only to be used with written permission of the Public Works Director/City Engineer.

(B) **Slip-Form Pavement:**

Slip-form pavement shall consist of concrete of the type and thickness specified in the other contract documents placed, consolidated, and finished without the use of fixed forms. Unless specifically permitted in the contract documents, the use of slip-form type paving equipment shall be by permission of the Public Works Director/City Engineer only.

6.48.03 Setting Forms

(A) **Base Support:**

The foundation under the forms shall be hard and true to grade so that the form, when set, will be firmly in contact for its whole length and at the specified grade. Any grade which at the form line is found below established grade shall be filled to grade with granular material in lifts of one-half inch (1/2") or less for a distance of eighteen inches (18") on each side of the base of the form and thoroughly compacted. The granular material shall meet the ASTM D 4253 specification (<10 percent passing the No. 200 sieve). Imperfections or variations above grade shall be corrected by tamping or by cutting as necessary.

(B) **Form Setting:**

Forms shall be set sufficiently in advance of the point where concrete is being placed. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than three pins for each ten-foot (10') section. A pin shall be placed at each side of every joint. Form sections shall be tightly locked, free from play or movements in any direction. The forms shall not deviate from true line by more than one-quarter inch (1/4") at any point. Curb forms shall remain in place at least six hours after curb is placed. The curb form shall extend the vertical plane one-eighth inch (1/8"). No excessive settlement or springing of forms under the finishing machine will be tolerated. Forms shall be cleaned and oiled prior to the placing of concrete.

(C) **Grade and Alignment:**

The alignment and grade elevations of the forms shall be checked and corrections made by the contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked by the contractor.

6.48.04 <u>Subgrade Planing</u>

(A) After the setting of forms has been approved, the subgrade shall be fine graded with a subgrade planer or electronically controlled trimmer to correct the crown and elevation. Any excess material, as indicated by this template, shall be removed. To bring low areas up to the correct elevation, approved material shall be furnished. The existing subgrade in low areas shall be tamped or rolled in place until thoroughly compacted. Use of a rubber-tired roller is encouraged. Any ruts and depressions which develop shall be filled and consolidated.

(B) Equipment of such weight or used in such a way as to cause ruts in the finished subgrade two inches (2") or more in depth shall be removed from the work or the rutting otherwise prevented.

(C) Unless waterproof subgrade or base course cover material is specified, the subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the subgrade or base course shall be sprinkled but the method of sprinkling shall not be such as to form mud or pools of water. Over-saturated subgrade areas that are creating excessive wheel tracking by concrete hauling equipment, as determined by the Public Works Director/City Engineer, shall be removed and replaced with appropriate select material prior to placement of the concrete pavement.

6.48.05 Placing Concrete

(A) Concrete which has developed initial set or does not have workable consistency shall not be used.

(B) The contractor shall take necessary precaution to prevent segregation of concrete when discharged. Conveying equipment shall be washed and kept clean at all times.

(C) The concrete shall be deposited to such depth that, when consolidated and finished, the slab will not be below grade at any point. The concrete shall be deposited to require as little rehandling as possible. Necessary hand-spreading shall be done with shovels.

(D) The contractor shall be required to exercise such care in placing, vibrating, compacting, and finishing concrete at and about all transverse expansion joints and adjacent to side forms as to avoid damage to joint material and the forming of honeycomb and voids. Concrete shall not be dumped directly over or against a joint or in such a manner that the concrete will flow directly against the expansion joint. Concrete shall be shoveled against both sides of expansion joints simultaneously. The vibratory unit shall not be allowed to operate while the finishing machine or spreader is standing still, except at transverse joints where vertical joint material is used, where a short pause shall be made on both sides of the joint to consolidate the concrete.

(E) The consistency of concrete shall be kept uniform for each class of work and shall be checked by means of slump tests or Kelly ball tests. The workability of the concrete shall be varied as directed by the Public Works Director/City Engineer. At all times, concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels, and tie bars by the construction methods which are being used without excessive spading, segregation, or undue accumulation of water or laitance on the surface. If, through accident, intention, or error in mixing, any concrete fails to conform to the proportions of the approved mix design, such concrete shall not be incorporated in the work but shall be discarded off the project site as waste material at the contractor's expense. NO WATER SHALL BE ADDED AT THE JOB SITE WITHOUT PERMISSION OF AN APPROPRIATE CITY OFFICIAL. If approval is obtained and water is added at the job site, slump tests shall be run and test cylinders cast following the addition of water. Any expense incurred in excess of ordinary tests shall be borne by the contractor.

(F) Concrete shall not be placed when darkness will prevent good workmanship in placing and finishing operations. In good weather the header shall be placed at least forty-five (45) minutes before sunset. During cold weather more time shall be allowed for finishing and protection. All finishing and curing operations shall be performed prior to darkness.

(G) At the time of concrete placement the mix temperature shall be between fifty and ninety degrees Fahrenheit (50° F and 90° F).

(H) Concrete paving machines weighing more than five thousand (5,000) pounds shall not be utilized on freshly poured concrete slabs for adjacent and abutting pours until seventy-two (72) hours have elapsed. This time requirement shall be increased to

seven (7) days when the concrete paving machine weights more than thirty thousand (30,000) pounds.

6.48.06 Weather Restrictions

(A) **Hot Weather:**

Except by written authorization from the Public Works Director/City Engineer, concrete shall not be placed if the temperature of the plastic concrete cannot be maintained at ninety degrees Fahrenheit (90°F) or lower. The placement of concrete in hot weather shall comply with ACI 305.

(B) **Cold Weather:**

During extreme weather conditions, placing of concrete will be permitted only when the temperature of the concrete placed in the forms will not be less than fifty degrees Fahrenheit (50°F) nor more than ninety degrees Fahrenheit (90°F). To maintain this temperature range, the contractor shall provide acceptable heating apparatus for heating the aggregates and the water. Concrete slabs shall not be placed regardless of temperature conditions if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing will not be allowed. Concrete which has been frozen shall be completely removed and replaced as directed by, and to the satisfaction of, the Public Works Director/City Engineer.

Concrete may be placed when the air temperature in the shade is at least forty degrees Fahrenheit (40°F) and rising. No concrete shall be placed, regardless of the present temperature, when the weather forecast promises freezing weather before final set of the concrete unless special means of heating and protection are used. Protection against freezing is the contractor's responsibility regardless of the weather forecast or climatic conditions at the time of placing.

During cold weather conditions, concrete less than seventy-two (72) hours old shall be protected as follows:

TABLE 6.48.06
Forecasted Low Temperature

by National Weather Service	Protection
Between 40 and 32 Degrees	One layer of plastic or burlap.
Between 31 and 25 Degrees	One layer of plastic and one layer of burlap, or two layers of burlap.
Below 25 Degrees	Six inches (6") of hay or straw and two layers of plastic or burlap in addition to regular curing method, or equivalent commercial insulating material in addition to regular curing method. Those coverings shall remain in place until the concrete is at least five (5) days old. When straw is required on pavements, cured with only curing compound, the fresh concrete shall be covered with a layer of burlap or plastic before application of straw. Heated enclosures may be utilized in lieu of protection requirements cited above. If used, such enclosures shall be maintained for seven (7) days.

6.48.07 Mesh Reinforcement

(A) Mesh reinforcement, if required by the approved plan or other contract documents, shall be free from dirt, rust, scale, paint, grease, oil, or other foreign substances when placed in work.

(B) A screed or template shall be used to roughly strike off the first layer of concrete at one-half the specified thickness to permit placing the mesh reinforcement.

(C) Reinforcing mesh shall be placed at the midpoint of the concrete slab and be parallel to the finished surface. The mesh can be elevated using either bricks or chairs. Adjacent sheets shall lap at least the length of one spacing of the fabric in all directions. Reinforcing shall extend to within three inches (3") of the edge of the concrete but shall not cross expansion joints. The balance of the concrete shall then be placed, leveled, vibrated, and finished.

6.48.08 Joints

(A) **General:**

1. The contractor shall submit a construction joint pattern for approval. The pattern shall be based upon these STANDARDS AND SPECIFICATIONS.

2. Expansion and contraction joints shall be so constructed as to be continuous across all lanes, not staggered. The saw-cuts shall be one-fourth (1/4) of the thickness of the slab for the entire width of the concrete. The joints shall not be sawed until the concrete has hardened to the extent that tearing and raveling are precluded nor later than the day the protective coating, if any, is removed or that random cracking would be likely to occur if the joint were not sawed. Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of sawing the joints or the time interval involved between the placing or the concrete and the sawing of joints.

(B) **Transverse Contraction Joints:**

1. Sawed transverse contraction joints shall be spaced at fifteen-foot (15') centers when nominal slab thickness is less than eight inches (8"). They shall be at twenty-foot (20') centers when slab thickness is eight inches (8") or greater.

2. Formed contraction joints spaced at forty-five foot (45') to ninety-foot (90') centers shall be used when expected air temperatures during the first twenty-four (24) hours after the concrete is placed will be more than twenty degrees Fahrenheit (20°F) less than the temperature of the concrete at the time the concrete is placed. Sawed contraction joints shall be spaced evenly between formed contraction joints after the concrete has set sufficiently to allow sawing.

(C) **Transverse Expansion Joints:**

Normally, transverse expansion joints will be used at the beginning of radii at "T" intersections. Expansion joints shall consist of three-quarter-inch (3/4") smooth steel dowel bars, sixteen inches (16") long, spaced at twelve-inch (12") centers inserted through one-inch (1") non-extruding expansion material and supported by a performed dowel basket. Expansion material shall separate the two slabs with approximately one inch (1") of expansion material extending below the top of the subgrade. Dowel caps shall be placed over the greased ends of dowels that extend into the last slab poured at expansion joints. Reinforcing mesh shall terminate three inches (3") from the expansion joint and resume three inches (3") from the expansion material on the other side of the joint. Under no circumstances shall any concrete be left above the expansion material or across the joints at any point. All concrete spanning the ends of the joint next to the forms shall be carefully cut away after the forms are removed. Before the pavement is open to traffic, the groove above expansion joints shall be cleaned and sealed with joint-sealing material.

(D) **Longitudinal Contraction Joints:**

Longitudinal contraction joints will normally be constructed in the same manner as sawed transverse contraction joints. When located at the center of the pavement slab, one-half inch (1/2") deformed bars, thirty inches (30") long, shall be placed on thirty-inch (30") centers.

(E) **Transverse Construction Joints and Emergency Headers:**

Whenever the work of concreting stops for thirty (30) minutes or more, a header, the top of which is true to the shape and grade of the finished pavement, shall be set in a vertical position at right angles to the centerlines of the pavement. This header should line up with adjacent joints. The concrete shall be poured up to the header, spaded, vibrated, or tamped into place so as to leave no porous place in the concrete. Smooth steel dowel pins, three-quarter inches (3/4") in diameter, sixteen inches (16") long shall be placed at intervals of one foot (1') on the center height of the pavement for a distance of eight inches (8") into the concrete. When work is resumed, the header shall be removed without disturbing the concrete or rods. The fresh concrete shall be placed directly against the face of the previously poured concrete and well-spaced around the rods.

(F) **Permanent Headers:**

If a header is at the end of the project, the end of an intersection return, or if paving operations are to be suspended for thirty (30) days or more, the header board may be left in place and concrete placed over the dowel bars until such time as paving operations are resumed at the header.

(G) **Keyed Longitudinal Construction Joints:**

If the pavement width is placed in more than one pour then a longitudinal construction joint shall be constructed of one-half-inch (1/2") round, deformed bars two feet six inches (2'-6") long at two-foot six-inch (2'-6") centers; bent at ninety degrees (90^{o}) in the center; placed at the midpoint in the slab; one leg to extend at right angles to the centerline into the first pour; and parallel to the finished grade. The other leg shall be parallel to the edge and separated from the first pour by means of continuous fiber or metal key board. Prior to pouring the second half of the pavement, the bars shall be straightened. Care must be used in straightening the bars to not injure the concrete already in place. Bars shall not be straightened until the concrete has reached the age of twenty-four (24) hours when the air temperature is continuously higher than fifty degrees Fahrenheit ($50^{o}F$). If the air temperature is lower than fifty degrees Fahrenheit ($50^{o}F$) at any time during the first twenty-four (24) hours, then seventy-two (72) hours must elapse before the bars may be straightened.

(H) **Cleaning and Sealing Joints and Cracks:**

1. All joints to be sealed shall be sound, clean, dry, and frost free. Joints shall be thoroughly cleaned to remove any laitance or any foreign materials. Freshly sawed joints shall be washed with high-pressure water immediately after sawing to remove any loose material from the joint faces. Joint washing should be in one direction to prevent recontamination. Just before installing the backer rod, all joints shall be sandblasted and then blown out with compressed air at a pressure of at least ninety (90) psi. Air compressors used for this purpose shall be equipped with traps capable of removing moisture and oil from the air. Sealing shall be performed in accordance with the manufacturer's directions. The sealant manufacturer's representative shall be present at the start of work at the discretion of the Public Works Director/City Engineer.

2. Sealant shall be approved prior to application by the Public Works Director/City Engineer.

3. Hot-poured joint sealer material for concrete slab joints shall conform to the requirements of ASTM d 3405, latest edition, and to the following: "The shipping containers shall be marked by the manufacturer with the name of the material, the name and brand of the manufacturer, the weight, the batch number, and the safe heating temperature." The temperature at pour point shall be lower than the safe heating temperature by at least twenty degrees Fahrenheit (20ºF).

   The sealer material shall be melted in a heating kettle or tank constructed as a double boiler with a space between the inner and outer shells filled with oil, asphalt, or other material for heat transfer and for positive temperature control. The heating and melting unit shall be equipped so that the heat may be adjusted to provide control of the temperature of the heating medium used for melting the sealer material. The sealer material shall not be subjected to temperatures in excess of four-hundred-and-fifty degrees Fahrenheit (450ºF) at any stage or time during the melting operations.

6.48.09 <u>Final Strike-Off, Consolidation and Finishing</u>

(A) **Sequence:**

The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straight-edging, and final surface finish. Unless permitted by the Public Works Director/City Engineer, the addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted. If the application of water to the surface is directed by the Public Works Director/City Engineer, it shall be applied as a fog spray by means of accepted spray equipment.

(B) **Finishing at Joints:**

1. The concrete shall be placed under and around all applicable load transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated.

2. After the concrete has been placed and vibrated, the finishing machine shall be brought forward, operating in such manner to avoid damage to joints. If operation of the finishing machine appears to be causing damage to the joints, the machine shall be stopped when the front screed is approximately eight inches (8") from the joint. The front screed shall be lifted, set directly on top of the joint, and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Another pass with the finishing machine over the joint without lifting the screeds will be required.

(C) **Consolidation and Finishing:**

The concrete shall be sufficiently and uniformly vibrated so that the density of Class P concrete is not less than ninety-seven percent (97%) of maximum theoretical field density. The density of Class AX concrete shall not be less than ninety-four percent (94%) of maximum theoretical field density.

Unless otherwise specified, hand-finishing methods will not be permitted except under the following conditions:

1. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade when the breakdown occurs.

2. Narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical may be finished by hand methods.

Upon review by the City Engineer, the slump (consistency) may be increased up to one inch (1") above the maximum allowed in Table 6.77.04 for concrete in areas not accessible to mechanical finishing methods. Concrete shall be struck off and screed as soon as placed. Consolidation shall be attained by the use of a suitable vibrator or other acceptable equipment. In operation, the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion and manipulated so neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade, and cross-section end free from porous areas. The use of vibrating roller screed-type machines will be permitted for ramps and other areas not accessible to normal finishing methods.

(D) **Floating:**

After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated as described below. Aluminum floats will not be permitted. The contractor may use a machine composed of a cutting and smoothing float, or floats, suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on and constantly in contact with the side forms. If necessary, long-handled floats having blades not less than five feet (5') in length and four inches (4") in width may be used to smooth and fill in open-textured areas in the pavement. Such long-handled floats shall not be used to float the entire surface of the pavement. After floating, any excess water and laitance shall be removed from the surface of the pavement by a scraping straight edge ten feet (10") or more in length. Successive drags shall be lapped one-half the length of the blade.

(E) **Straight-Edge Testing and Surface Correction:**

After the floating has been completed and the excess water removed but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a ten-foot (10') straight edge. For this purpose, the contractor shall furnish and use an accepted accurate ten-foot (10') straight edge swung from handles three feet (3') longer than one-half the width of the slab. The straight edge shall be held in contact with the surface in successive positions parallel to the road centerline and the entire area gone over from one side of the slab to the other as necessary. If the entire slab cannot be reached from the side, a working bridge shall be provided to enable this testing to be accomplished the full width of the slab. Advance along the road shall be in successive stages of not more than one-half the length of the straight edge. Any depressions found shall be immediately filled with freshly-mixed concrete, struck off, consolidated, and refinished.

High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness and cross-slope. Straight-edge testing and corrections shall continue until the entire surface is found to be free from observable departures from the straight edge and the slab conforms to the required grade and cross-section. This straight-edge testing and correction operation shall be a separate operation from that described in the subsection on "Floating."

(F) **Final Finish:**

After the surface has been straight-edge tested and corrections made, a seamless strip of damp burlap or other accepted material shall be dragged longitudinally along the full width of pavement and curb to produce a uniform surface of gritty texture. For pavement sixteen feet (16') or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of material at least three feet (3') wide is in contact with the full width of the pavement surface while the drag is used. The drag shall consist of sufficient layers of material and maintained in such condition that the resultant surface finish is of uniform appearance and reasonably free from grooves over one-sixteenth inch (1/16") in depth. Where more than one layer of drag material is required, the bottom layer shall be approximately six inches (6") wider than the layer above. Drags shall be maintained

clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

(G) **Edging at Forms and Joints:**

After the final finish but before the concrete has taken its initial set, the edges of the pavement along each side of each slab and on each side of expansion joints shall be worked with an accepted tool. A well-defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use. At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

6.48.10 Surface Smoothness Test

The final riding surface shall meet the following tolerances:

Class I surfaces shall have a Section PI of no more than 14 inches/mile and a deviation of no more than 0.5 inches in 25 feet. Class II surfaces shall have a Section PI of no more than 18 inches/mile and a deviation of no more than 0.5 inches in 25 feet.

As soon as the concrete has sufficiently hardened, mainline pavement surfaces shall be tested to determine the Profile Index (PI) by using the profilograph method prescribed in Subsection 6.48.10(a). All other pavement surfaces are subject to testing using the 10-foot straight edge method prescribed in Subsection 6.48.10(b). Surfaces not meeting the requirements of Subsection (a) and (b) shall be corrected in accordance with Subsection 6.48.10(c).

Mainline pavement surfaces are defined as follows:

(1) Class I mainline surfaces consist of all through traffic and climbing lanes including bridges and bridge approach slabs with final riding surfaces of concrete. Excluded are the portions on horizontal curves having a centerline radius of curvature less than 1,000 feet and areas within the superelevation transition to such curves.

(2) Class II mainline surfaces consist of all acceleration and deceleration lanes, ramps, tapers, shoulders wider than six feet without rumble strips, and surfaces excluded from Class I due to horizontal curvature.

All other surfaces consist of shoulders that are six feet wide or less, shoulders with rumble strips, side street returns, or other small sections of pavement for which the use of a profilograph is not practical.

(A) Profilograph Method

The Contractor shall provide, operate and maintain on the project an approved multi-wheel profilograph that meets the requirements of Colorado Procedure 64. The profilograph shall be an approved computer equipped model.

The Contractor shall make arrangements, and payment if required, for the manufacturer of the profilograph that will be utilized on the project to conduct training for Contractor and City project personnel in the calibration, operation and maintenance of the profilograph. The training shall be conducted on the project at least three days before the start of any concrete pavement work. The representative of the profilograph manufacturer that conducts the training shall issue each individual attendee a letter stating that they have been trained in the calibration, operation and maintenance of the specific profilograph being used on the project.

The Contractor's operator shall have attended the aforementioned training and have a letter so stating. The Contractor's operator shall follow the manufacturer's instructions and shall measure and record profiles in accordance with Colorado Procedure 64 and this specification. The profilograph shall be operated at a speed of less than three miles.

The profilograph shall be calibrated after transportation and before each day's use in accordance with the manufacturer's instructions and Colorado Procedure 64.

During the initial paving operations, either when starting up or after a long shut down period, or when directed, the Contractor shall test the surface with the profilograph as soon as the concrete surface has sufficiently hardened to allow testing. This procedure shall continue until the Profile Index (PI) is equal to or less than the maximum pavement surface smoothness tolerance and the Public Works Director/Engineer has accepted the Contractor's paving methods and equipment.

During normal daily paving operations, the pavement surface shall be tested as soon as possible, preferably during the next working day following placement.

Additional profiles shall be taken to retest pavement surfaces that have received corrective work and when required to check previously submitted data or to identify the limits of irregularities. Additional profiles shall be taken as prescribed below or as directed.

Curing membrane damaged during the profilograph testing or the grinding or other corrective work shall be repaired immediately at the Contractor's expense.

1. Profile intex testing of daily paving shall be performed for:

   (1) Day's paving of 1,000 linear feet or more. When a day's paving is less than 1,000 linear feet, it shall be tested with the subsequent day's production.

   (2) Each block out, bridge, and bridge approach slab - when completed and joined to previously placed and profiled pavements.

   (3) Other areas as directed.

2. Profile Index Testing. The Contractor shall notify the Engineer prior to beginning each day's profilograph operation. Horizontal and vertical calibrations shall be made by the Contractor and witnessed by the City's inspector prior to performing daily profiles. The profile index testing locations are subject to the Public Works Director/City Engineer's approval, and testing will be witnessed by the inspector.

Profiles shall begin or end 25 linear feet from the end of pavement or from any joint between new pavement and existing pavement. Profiles shall overlap any previously profiled surfaces by at least 50 linear feet.

Profile traces shall be taken for each day's paving according to the following:

(1) For through traffic, climbing, acceleration, deceleration lanes, and ramps.

When constructed in one operation as multiple lanes with uniform lane width of 10 feet or wider: profiles shall be taken approximately three feet from and parallel to the outer edge of each exterior lane and approximately one foot right (when facing in the direction of traffic flow) of and parallel to each planned longitudinal joint or lane line.

(2) For each uniform width shoulder, lane taper or shoulder taper, a single profile shall be taken at the approximate midline.

Each profilograph shall include the following information:

(1) General Information:
Project Number
Project Location
Date
Lane Profiled
Operator's Signature
Inspector's Signature

(2) Each profile trace shall be marked to indicate the following:
Beginning and Ending Stations
Intermittent Reference Stations at Least Every 500 Feet
Horizontal Equations Stations
Construction Joints, Bridge Abutments
Location on the Pavement as Required by (3) Below
Plus Any Other Pertinent Information as Required by the Public Works Director/Engineer

(3) Multiple profiles of a day's paving shall:

Be on the Same Width of Paper
Be Parallel to Each Other
Having Stationing Running in the Same Direction

3. Upon completion of each profilogram, the profilogram shall be immediately submitted to the City inspector. The Public Works Director/City Engineer will review and evaluate the profilograms in accordance with Colorado Procedure 64 and report the evaluation results to the Contractor as they become available. The report will include the following for each pavement smoothness category for each class of a day's paving.

(1) Daily Average Profile Index. The daily average Profile Index is the weighted sum of all sections and partial section Profile Indexes of each category divided by the total number of 0.1 mile sections or remaining portion thereof of the daily production for that category.

(2) Section Profile Index. The section Profile Index is the average of the Profile Indexes for each 0.1 mile section or remaining portion thereof. If only one Profile Index is required, it will suffice.

(3) Irregular Areas. Irregular areas consist of those areas having high or low points in excess of that allowable in 25 feet, and areas needing reprofiling to identify the limits of irregularities.

(4) Areas and Sections Requiring Corrective Work. When the daily average Profile Index exceeds the maximum pavement surface smoothness tolerance by 20 percent, the Engineer will order paving operations suspended. Paving operations will not be allowed to resume until the Contractor has demonstrated that corrective action has been applied to the paving methods or equipment. Corrective work on pavement surfaces shall be performed in accordance with subsection 6.48.10(c).

(B) Ten-Foot Straightedge Method

The surface smoothness of pavements which are not required to be tested by the profilograph method are subject to testing by the 10-foot straightedge method.

The Contractor shall furnish an approved 10-foot straightedge and depth gauge and provide an operator to aid the Inspector in testing the finished pavement surface. Areas to be tested shall be as directed.

Areas showing high spots of more than 3/16 inch in 10 feet shall be marked and the Contractor shall perform corrective work in accordance with subsection 6.48.10(c).

(C) Corrective Work

The Contractor shall use an approved grinding device or a device consisting of multiple saws to bring the final surface within the specified pavement surface smoothness requirements. The Final surface of the concrete pavement shall provide an appearance and skid resistance comparable to adjacent sections that do not require corrective work. Additional profiles or testing may be required to define the limits of an out-of-tolerance surface variation.

Payment will not be made for any pavement that does not meet surface smoothness tolerances until corrective work has been completed and that pavement retested and found acceptable by the Public Works Director/Engineer.

Corrective work shall be completed and accepted prior to determining pavement thickness in accordance with subsection 6.48.21 or sealing the joints in accordance with subsection 6.48.08.

6.48.11 Curing

Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly-placed concrete shall be covered and cured in accordance with the following methods. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material or lack of water to adequately take care of both curing and other requirements shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than one-half (1/2) hour between stages of curing or during the curing period.

(A) **Impervious Membrane Method:**

The entire surface of the pavement shall be sprayed uniformly with an accepted white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. Curing compound shall be applied under pressure at the rate of one (1) gallon to not more than one hundred-and-fifty (150) square feet by mechanical sprayers. The spraying equipment shall be the fully-atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly-mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by effective mechanical means. Hand-spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compounds shall not be applied to the inside faces of joints yet to be sealed.

Membrane-curing compounds shall be wax base Protex DW3 or equal and meet the requirements of AASHTO M 148, Type 2, latest edition. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms, the side of the slabs exposed shall be protected immediately to provide a curing treatment equal to that provided for the surface.

(B) **Wet Burlap Curing:**

After completion of the finishing operations, the surface of the concrete shall be entirely covered with burlap mats. The mats used shall be in such length or width that as laid they will extend at least twice the thickness of the concrete beyond the edges of the slab or structure. They shall be placed so the entire structure and all edges of the concrete, when forms are removed, are completely covered. This covering shall be placed as soon as the concrete has set sufficiently to prevent marring of the surface. After being placed, the mats shall be thoroughly saturated with water by spraying with a mist spray. The burlap shall be placed and weighted down so it remains in contact with the surface covered, and covering shall be maintained fully wetted and in position for seven (7) days after the concrete has been placed. If it becomes necessary to remove the burlap for any reason, the concrete shall not be exposed for a period of more than one-half (1/2) hour. This method of curing shall not be used when the outside air temperature is below thirty-two degrees Fahrenheit (32°F) unless heated enclosures are provided.

(C) **Plastic Sheet Curing:**

As soon after the completion of the finishing operation as the concrete has set sufficiently to prevent marring of the surface, the top surface and sides shall be entirely covered with plastic sheet materials. The plastic sheet as prepared for use shall have dimensions such that each unit as laid will extend beyond the edges of the concrete at least twice the thickness of the concrete. The units as used shall be lapped at least twelve inches (12") and the laps of plastic sheet shall be secured in such a manner that they do not open or separate. The plastic shall be placed and weighted so it remains in contact with the surface covered during the entire curing period of seven (7) days.

(D) **Waterproof Paper Curing:**

The procedures used for plastic sheet curing shall be used when waterproof paper is used in curing concrete.

(E) **Insulation Pad:**

Insulation pads or other thermal devices may be used to protect concrete in cold weather.

(F) Other acceptable curing methods may be used upon review and acceptance by the City Engineer.

6.48.12 <u>Curing in Cold Weather</u>

When the air temperatures may be expected to fall below thirty-five degrees Fahrenheit (35°F), the contractor's written, detailed proposal for protecting the concrete must be accepted by the Public Works Director/City Engineer before commencement of the paving operation. A sufficient supply of straw, hay, grass, or other suitable material shall be provided along the work. The methods and materials used shall be such that a minimum temperature of forty degree Fahrenheit (40°F) will be maintained at the surface of pavement. Acceptance of the contractor's proposed method shall not relieve the contractor of the responsibility for the quality

and strength of the concrete placed during cold weather. Any concrete damaged by frost action shall be removed and replaced at the contractor's expense.

During paving operations, day or night, when the air temperature reaches thirty-five degrees Fahrenheit (35°F) and is falling, placement of concrete shall cease and the previously-approved protection method shall be initiated. All concrete placed within the previous seventy-two (72) hours shall be protected for a minimum of five (5) days after initial placement of the concrete.

Admixtures for curing or temperature control may be used only when permitted by the Public Works Director/City Engineer.

6.48.13 Removing Forms

Unless otherwise provided, forms shall not be removed from freshly placed concrete until it has set for at least twelve (12) hours, except auxiliary forms used temporarily in widened areas. Forms shall be removed carefully to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in these STANDARDS AND SPECIFICATIONS. Major honeycombed areas, as determined by the Public Works Director/City Engineer, will be considered as defective work and shall be removed and replaced. Any area or section removed shall not be less than ten feet (10') in length nor less than full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joint that is less than ten feet (10') in length, shall also be removed and replaced at the contractor's expanse.

6.48.14 Sealing Joints

All joints shall be sealed. They shall be filled with joint sealing material before the pavement is opened to traffic, and as soon after completion of the curing period as is feasible. The sealing material shall be applied to each joint opening to conform to the details shown on the plans or as directed by the Public Works Director/City Engineer. The pouring shall be done such that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. Poured joint-sealing material shall not be placed when the air temperature in the shade is less than forty degrees Fahrenheit (40°F) unless permitted by the Public Works Director/City Engineer.

6.48.15 Cleaning and Filling Joints

All concrete spanning expansion or dummy groove contraction joints shall be carefully cut away. At the end of the curing period, foreign material shall be removed from the joints by both mechanical means and the use of compressed air at ninety (90) psi pressure. All joints shall be filled flush with the specified joint filler. The joint filler shall not spill over the joint onto the adjacent surface.

6.48.16 Final Seal

Spray the entire concrete surface with boiled linseed oil cut back fifty percent (50%) with mineral spirits. (This is a protectionary measure against salt and abrasives during the first winter season of use.)

6.48.17 Clean-Up

When concrete operations have been completed, the contractor shall be responsible for the clean-up and removal of all leftover or waste materials resulting from any of his activities. All curbs shall be properly backfilled, and the adjacent ground left in an acceptably neat and presentable condition.

6.48.18 Concrete Pavement -- Slip-Form Method

When the pavement is to be constructed without the use of fixed forms, the following provisions shall apply:

(A) **Grade:**

After the grade has been placed and compacted to the required density designated within these specifications, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly-designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of a properly-designed machine. If the density of the grade is disturbed by the grading operations, it shall be corrected by additional compaction before concrete is placed. The grade should be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected to the satisfaction of the Public Works Director/City Engineer immediately ahead of the placing of the concrete. Any soft spots shall be dug out to stable material and recompacted or filled with sand.

For all slip-form paving and subgrade grading operations, the contractor shall provide two string lines, one on each side of the paver or trimmer to control finished vertical grades of pavement or subgrade. Tolerance of finished grades of pavement shall not exceed one-eighth inch (1/8") transverse along a ten-foot (10') straight edge nor shall it deviate in finished elevation by more than one-half inch (1/2") from the contract plans. The contractor shall remove and replace all pavement areas not conforming to these tolerances, unless otherwise permitted by the Public Works Director/City Engineer.

(B) **Placing and Consolidating Concrete:**

The concrete shall be placed with an approved slip-form paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine such that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with these STANDARDS AND SPECIFICATIONS.

Concrete shall be consolidated in accordance with Subsection 6.48.09. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The concrete shall be held at a uniform consistency in accordance with the Concrete Mix P. Any inconsistent mixes delivered to the site, whether meeting the requirements of Concrete Mix P or not, which produce an unacceptable finished quality of the concrete pavement, may be rejected by the Public Works Director/City Engineer.

The slip-form paver shall be operated with a continuous forward movement (as possible) and all operation of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

(C) **Finishing:**

The surface smoothness and texture shall meet the requirements of Subsection 6.48.09 and 6.48.10.

(D) **Curing:**

Curing shall be done in accordance with the method described in Subsection 6.48.11. The curing media shall be applied at the appropriate time and shall be applied uniformly and completely to all surfaces and edges of the pavement.

(E) **Joints:**

All joints shall be constructed in accordance with Subsection 6.48.08.

(F) **Protection Against Rain:**

In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the contractor shall be required to have materials available at all times for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of standard metal forms or wood plank having a nominal thickness of not less than two inches (2") and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges and covering material such as burlap or cotton mats, curing paper, or plastic sheeting material for the protection of the surface of the pavement. When rain appears imminent or when requested by the Public Works Director/City Engineer, all paving operations shall stop, forms shall be placed against the sides of pavement, and protective covering shall be placed over the surface of unhardened concrete.

6.48.19 <u>Opening to Traffic</u>

Opening to traffic, including the contractor's vehicles, shall not be permitted until the flexural strength of the concrete, as indicated by the modules of rupture of beams tested in conformity with the latest ASTM Standard Method of Test for "Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading." Designation C-78 is at least five hundred (500) pounds per square inch or the compressive strength of six-inch by 12-inch (6" x 12") cylinders, tested in conformity with the latest ASTM Standard Method of Test for "Compressive Strength of Molded Concrete Cylinders." Designation C-39 is at least three thousand (3000) pounds per square inch. These tests shall be performed when the concrete is seven (7) days old unless otherwise requested by the contractor. If permanent shoulders are not in place, a six-foot (6') wide temporary earth shoulder shall be placed against the outside pavement edges before traffic

is allowed on the pavement. Opening to traffic shall not constitute a final acceptance of the pavement.

6.48.20 Defects

Before final inspection and acceptance, tolerances and smoothness shall be tested by the City Engineer by means of surface-testing machine or a straightedge applied to each separate lane of pavement. All surface variations of one-eighth inch (1/8") or more in ten feet (10') shall be ground off. Brush-hammering shall not be permitted. Sections of pavement containing depressions with a depth in excess of one-eighth inch (1/8") in ten feet (10') shall be removed and replaced at the contractor's expense. Such removed sections shall not be less than full-lane width and full distance between joints in length. Slabs containing excessive cracking, fractures, spalling, or other defects shall be removed and replaced as above, when directed by the Public Works Director/City Engineer.

6.49.00 APPURTENANT CONCRETE STRUCTURES

6.49.01 Curb and Gutter Section

The section to be constructed shall be as identified on the approved plans or as shown on the detail drawings.

6.49.02 Sidewalks

Sidewalks shall be six inches (6") thick and detached or six inches (6") thick and attached and constructed to the dimensions shown on the approved construction plans. All areas of sidewalk that will be crossed by driveways will be constructed with six-inch (6") thick concrete in residential areas and eight-inch (8") thick concrete in commercial areas.

6.49.03 Crosspans and Curb Return Fillets

Crosspans and curb return fillets shall be constructed eight inches (8") thick with six by six/ten-ten (6x6/10-10) wire mesh. Typical crosspan sections are shown on the detail drawings. Where unusual conditions prevail, additional reinforcing steel and special joints may be required by the Public Works Director/City Engineer.

6.49.04 Curb Cuts and Driveways

Curb cuts shall be provided at all driveway locations and at additional locations, as shown on the approved plans. Construction of curb cuts shall be as shown on the detail drawings. Spacing will be as shown on the approved plans or as approved by the Public Works Director/City Traffic Engineer.

6.49.05 Curb Ramps

Curb ramps for the handicapped shall be installed at locations designated by the City Traffic Engineer and at all intersections unless approved otherwise by the Public Works Director/City Engineer. Curb ramps will be constructed as shown on the detail drawings.

6.49.06 Construction Stakes

The Contractor's surveyor shall provide all stakes required for curbs, gutters, walks, and structures and shall furnish all necessary information relating to lines and grades. The contractor shall be held responsible for the reasonable preservation of all such stakes. The contractor shall not remove stakes until three (3) working days after placement of concrete unless approved by the Public Works Director/City Engineer.

6.49.07 Backfilling

When side forms are removed, the space adjoining the concrete shall be backfilled in a timely manner with suitable material properly compacted and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill shall be level with the top of the concrete for at least two feet (2') and then sloped to the property line. Maximum slope shall be four to one (4:1). Where detached walks occur, the space between the curb and walk shall be backfilled on a straight line from the top of walk to the top of curb.

6.49.08 Connections with Existing Concrete Curb, Gutter, and Drives

Where new construction abuts existing, the work shall be accomplished so that no abrupt change in grade between the old and new work results.

6.50.00 BRIDGES AND MAJOR DRAINAGE STRUCTURES

6.50.01 General

(A) All culvert pipe, box culverts, and bridges which will ultimately be maintained by the City of Fort Lupton shall conform to the following:

1. AASHTO "Standard Specifications for Highway Bridges," latest edition, and applicable interims.

2. Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," latest edition.

3. Colorado Department of Transportation's "Bridge Manual," Volumes I and II.

(B) All structures shall be designed to an HS-20 loading.

(C) All box culverts and bridges shall have the year of construction permanently indentured on the downstream headwall face in legible numbers. The numbers shall be three inches (3") high by one-and-one-half inches (1-1/2") deep in the headwall face.

(D) All box culvert and bridge designs shall be certified by a Professional Engineer registered in the State of Colorado who is competent to perform such designs.

6.60.00 CONSTRUCTION TRAFFIC CONTROL

6.60.01 General

Traffic control devices shall be maintained in a safe operating condition at all times. The contractor shall provide for approval by the Traffic Engineer, a traffic control plan, and shall comply with Chapter 8 of these STANDARDS AND SPECIFICATIONS. If the Public Works Director/City Engineer finds the construction area to be inadequately barricaded, he has the authority to stop work and direct that corrective measures be taken prior to proceeding with work.

6.60.02 Pedestrian Traffic

Every precaution shall be taken to ensure that construction work does not interfere with the movement of pedestrian traffic, which shall be maintained on the sidewalk at all times. Flagmen shall be provided for guidance as necessary.

(A) Where an excavation interrupts the continuity of the sidewalk, the contractor shall provide suitable bridge or deck facilities to be supplemented by the use of such proper devices and measures as prescribed in the Manual on Uniform Traffic Control Devices, most recent edition, for the safe and uninterrupted movement of pedestrian traffic. The edges or ends of the pedestrian bridge or decking shall be beveled or chamfered to a thin edge to prevent tripping.

(B) Temporary diversion walkways shall be hard surfaced and electric lighting shall be provided and kept continuously burning during hours of darkness, when required by the Public Works Director/City Engineer.

(C) Unless otherwise authorized by the Public Works Director/City Engineer, pedestrians shall not be channeled to walk on the traveled portion of the roadway.

(D) Under certain conditions, it may be necessary to divert pedestrians to the sidewalk on the opposite side of the street. Such crossings shall only be made at intersections or marked pedestrian crossovers.

(E) Facilities satisfactory to the Public Works Director/City Engineer shall be provided for pedestrian crossing at corners, pedestrian crossovers, and public transportation stops.

6.60.03 Vehicular Traffic

(A) Construction work zone traffic shall be controlled by signs, barricades, detours, etc., which are designed and installed in accordance with the Manual on Uniform Traffic Control Devices, most recent edition, and applicable City of Fort Lupton traffic standards. Traffic control plan shall be submitted and approved by the City Engineer or his designee prior to start of any construction.

(B) During construction of new facilities, traffic control should strive to keep the motorist from entering the facility. The primary means to accomplish this is by use of temporary barricades, located in advance of the point where new construction joins existing, and by appropriate signing. New construction shall not be opened to traffic and, thus, the construction traffic control removed without the approval of the Public Works Director/Engineering Construction Inspector and the City Traffic Engineer.

(C) In general terms, a construction traffic control plan must be drawn on a map. For minor projects or local roadways, a neat sketch of the roadways and the proposed control devices will suffice. For major projects or major roadways, the traffic control plan should be superimposed on as-builts, construction plan drawings, or other detailed map.

(D) The Manual on Uniform Traffic Control Devices shall be the basis upon which the construction traffic control plan is designed in concern with proper, prudent, and safe engineering practice. All necessary signing, striping, coning, barricading, flagging, etc. shall be shown on the plan.

(E) Directional access on roadways may be restricted [minimum travel lane width in construction area is ten feet (10')], but proper controls including flagging must be indicated. Removal of on-street parking should be considered and noted where applicable.

6.70.00 MATERIAL SPECIFICATIONS

6.71.00 SUBBASE

Subbase material shall be composed of granular material consisting, essentially, of sand, gravel, rock, slag, disintegrated granite, or a combination of such materials. The coarse portions of the material shall be sound fragments of the crushed or uncrushed materials enumerated above. Supplied material shall be a well-graded mixture containing sufficient soil mortar, crushed dust, or other proper quality binding material which, when placed and compacted in the roadway structure, will result in a firm, stable foundation. Material composed of uniform size particles, or which contains pockets of excessively fine or excessively coarse material, will not be acceptable for use.

This material need not be crushed but shall be graded within the following limits:

TABLE 6.71.00

Standard-Size of Sieve	Percent by Weight Passing Sieve
2-1/2 Inch	100
2 Inch	95 - 100
No. 4	30 - 60
No. 200	5 - 15

Liquid Limit -- 35 Maximum
Plasticity Index -- 6 Maximum

6.72.00 BASE

Base shall consist of a foundation course composed of crushed gravel or crushed stone and filler constructed on the prepared subgrade or subbase course. Materials and construction shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 703. Gradation shall be Class 6 (3/4-inch maximum) in accordance with the following gradation:

TABLE 6.72.00
CLASSIFICATION TABLE FOR AGGREGATE BASE COURSE

Sieve Designation	Percent by Weight Passing Square Mesh Sieve Class 6
3/4 Inch	100
No. 4	30 - 65
No. 8	25 - 55
No. 200	3 - 12

Liquid Limit -- 30 Maximum
Plasticity Index -- 6 Maximum
R-Value Minimum -- 78

6.73.00 BITUMINOUS MATERIALS

6.73.01 Prime Coat

Materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702..

6.73.02 Hot Bituminous Pavement

All pavement shall be hot bituminous pavement of the plant mix type unless otherwise approved in writing by the City Engineer. Materials shall be in accordance with the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Sections 702 and 703, and the following exceptions and/or requirements:

(A) The asphalt cement shall be Superpave Performance Graded Binders and shall conform To the requirements listed in Table 702-~~2~~ 1 of the Colorado Department of Transportation's for Road and Bridge Construction" (Taken from AASHTO Provisional Standard MP1) and the following:

* On arterial streets the grade of asphalt cement for the top layer shall be PG 76-28 (Polymer Modified). The bottom layers may be PG 64-22.

* On all other street classifications, the grade of asphalt cement for the top layer shall be PG 64-28 (Polymer Modified). The bottom layers may be PG 64-22.

(B) The top layer of asphalt shall be stone matrix asphalt (SMA) or hot bituminous pavement (HBP) Grading SX. The lower layers may consist of HBP Grading SG or HBP Grading S. SMA mixes will only be required as determined by the Public Works Director/City Engineer. The minimum layer thickness shall be 2 inches and each layer should be a minimum of 2 times the aggregate size.

(C) **HBP pavements shall NOT contain any recycled or reclaimed asphalt pavements (RAP) in the mix.**

6.73.03 Tack Coat

When tack coat is specified on the approved plans or required by the City Engineer, all materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702. Bituminous material shall be SS-1h emulsion.

6.73.04 Seal Coat

When seal coat is required, all materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702. The type of bituminous material, cover aggregate, and rates of application will be as shown on the approved construction plans.

6.73.05 Rejuvenating Agent

When a rejuvenating agent is specified on the approved construction plans or required by the Public Works Director/City Engineer, all materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702. The rejuvenating agent shall be as shown on the approved construction plans or as specified by the Public Works Director/City Engineer.

6.73.06 Appurtenant Structures Concrete

Concrete used in the construction of curb, gutter, sidewalk, drive cuts, and other appurtenant roadway concrete structures shall be in accordance with Chapter 6 of these STANDARDS AND SPECIFICATIONS.

6.74.00 STRUCTURE BACKFILL MATERIAL

Structure backfill shall comply with Colorado Department of Transportation's specifications for Class I material and meet the following requirements from laboratory sieves:

TABLE 6.74.00

Sieve Designation	Percent by Weight Passing Lab Sieve
2 Inch	100
No. 4	30 - 100
No. 50	10 - 60
No. 200	5 - 20

Flowable Fly Ash or Flowfill may be required in lieu of Class ! backfill as determined by the City Engineer.

6.75.00 PORTLAND CEMENT CONCRETE PAVEMENT -- MATERIALS

6.75.01 Concrete and Concrete Admixtures

(A) **Fine Aggregate for Concrete:**

Fine aggregate for concrete shall conform to the requirements of AASHTO M 6, latest edition. The amount of deleterious substances removable by elutriation shall not exceed three percent (3%) by dry weight of fine aggregate when tested in accordance with AASHTO T 11 unless otherwise specified. The minimum sand equivalent, as tested in accordance with AASHTO T 176 shall be eighty (80) unless otherwise specified. The fineness modules shall not be less than 2.50 nor greater than 3.50 unless otherwise approved by the Public Works Director/City Engineer.

(B) **Coarse Aggregate for Concrete:**

Coarse aggregate for concrete shall conform to the requirement of AASHTO M 80, latest edition, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO T 96. Coarse aggregate shall conform to the grading in Table 6.75.01 for the grading specified in Table 6.77.04. Sizes 357 and 467 shall each be furnished in two separate sizes and combined in the plant in the proportions necessary to conform to the grading requirements. Size 357 is a combination of No. 3 and No. 57, and Size No. 467 is a combination of No. 4 and No. 67.

(C) **Portland Cement:**

Portland cement shall conform to the requirements of the following specifications for the type specified or permitted:

Type	Specifications
Portland Cement -- Types I, II, and III	ASTM C 150 AASHTO M 85
Air-Entraining Portland Cement	AASHTO M 134
Masonry Cement	AASHTO M 150

In general, Type II cement shall be used in concrete which will be in contact with the soil, unless otherwise allowed or directed by the Public Works Director/City Engineer. Unless otherwise permitted by the Public Works Director/City Engineer, the product of only one mill of any one brand and type of Portland cement shall be used on the project, except for reduction of any excessive air entrainment where air-entrainment cement is used. The contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which for any reason has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used.

TABLE 6.75.01
Concrete Aggregate Gradation Table
Percentages Passing Designated Sieves and Nominal Size Designation

	Coarse Aggregates (From AASHTO M 43)					Fine Aggregate				
	* No.3	* No.4	No.6	No.7	No.8	* No.57	* No.67	** No.357	** No.467	AASHTO M 6
Sieve Size	2" to1"	1-1/2" to3/4"	3/4" to3/8"	1/2" to#4	3/8" to#8	1" to#4	3/4" to#4	2" to#4	1-1/2" to#4	#4 to#100
2-1/2	100	.....	.....	.....	.....	.....	.....	.....	100	.....
2"	90-100	100	.....	.....	.....	.....	.....	.....	95-100	100
1-1/2"	35-70	90-100	.....	.....	.....	100	.....	.....	.....	95-100
1"	0-15	20-55	100	.....	.....	95-100	100	35-70	.....	.....
3/4"	.....	0-15	90-100	100	.....	.....	90-100	.....	35-70	.....
1/2"	0-5	.....	20-55	90-100	100	25-60	.....	10-30	.....	.....
3/8"	.....	0-5	0-15	40-70	85-100	.....	20-55	.....	10-30	100
#4	.....	.....	0-5	0-15	10-30	0-10	0-10	0-5	0-5	95-100
#8	.....	.....	.....	0-5	0-10	0-5	0-5	.....	.....	.....
#16	.....	.....	.....	.....	0-5	.....	.....	.....	.....	45-80
#50	.....	.....	.....	.....	.....	.....	.....	.....	.....	10-30
#100	.....	.....	.....	.....	.....	.....	.....	.....	.....	2-10

* Additional primary gradings may be permitted when produced on the project provided the theoretical combination meets the specifications for combined aggregate sizes. Size No. 357 is a combination of No. 3 and No. 57. Size No. 467 is a combination of No. 4 and No.67

6.75.02 Forms

Straight side forms shall be made of a metal having a thickness of not less than seven-thirty-seconds of an inch (7/32") and shall be furnished in sections not less than ten feet (10') in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete, without horizontal joint, and a base width equal to or greater than the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of one-hundred-foot (100') radius or less. Flexible or curved forms shall be of a design acceptable to the Public Works Director/City Engineer. Forms shall be provided with adequate devices for secure setting so when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less an two-thirds (2/3) the height of the form. Forms with battered top surfaces and bent, twisted, or broken forms shall be removed from the site. Repaired forms shall not be used until accepted by the Public Works Director/City Engineer. Built-up forms shall not be used except where the total area of pavement of any specified thickness on the project is less than two thousand (2000) square yards. The top face of the form shall not vary from a true plane more than one-eighth inch (1/8") in ten feet (10'), and the upstanding leg shall not vary more than one-quarter inch (1/4"). The forms shall contain provisions for locking the ends of abutting form sections together tightly and for secure setting.

Forms for bridge approach slabs or for pavement areas with irregular dimensions shall be made of metal or straight, sound timber. Forms shall be free from warp and of sufficient strength to resist springing out of shape. Forms shall be staked securely to line and grade to the satisfaction of the Public Works Director/City Engineer. All mortar and dirt shall be removed from the forms that have been previously used.

6.75.03 Reinforcing Steel

Reinforcing steel shall conform to the requirements of the following specifications:

(A) Deformed and plain billet -- steel bars for concrete reinforcement -- AASHTO M 31

(B) Axle-steel deformed and plain bars for concrete reinforcement -- AASHTO M 53

(C) Fabricated steel bar or rod mats for concrete reinforcement

(D) Welded steel wire fabric for concrete reinforcement -- AASHTO M 55

Bars conforming to AASHTO M 31 and M 53 shall be furnished in Grade 60 for No. 5 bars and larger and Grade 40 or Grade 60 for smaller than No. 5. Reinforcing mesh shall be 6 x 6 - W2.9 x W2.9 with a weight of at least forty-one (41) pounds per one hundred (100) square feet.

6.75.04 Water

Water used in mixing or curing shall be clean and free of oil, salt, acid alkali, sugar, vegetable, or other substance injurious to the finished product. Water will be tested in accordance with, and shall meet, the suggested requirements of AASHTO T 26, latest edition. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, or other foreign materials.

6.75.05 Joints

(A) **Joint Sealing Compound:**

Material for filling all types of pavement joints shall be a hot-poured elastomeric-type sealant specifically manufactured for sealing joints in concrete. The material shall not crack or break its bond when exposed to a temperature of zero degrees Fahrenheit (0°F). Joint sealing compounds shall meet the requirements of ASTM D 3406.

(B) **Expansion Joints:**

Expansion joint material shall be non-extruding and resilient bituminous types and shall conform to AASHTO M 213. The filler shall be furnished in a single piece for the depth and thickness required for the joint.

(C) **Cold Joint Sealer:**

Cold-applied joint sealer material for concrete slab joints shall conform to the requirements of ASTM D 1850, latest edition, "Concrete Joint Sealer, Cold Application Type." Cold-applied joint sealer shall be of such character that a homogenous mix can be obtained by combining the separate substances, either mechanically or manually, without having to heat the blended material above a temperature of one-hundred degrees Fahrenheit (100°F). The material shall pour or extrude readily at a temperature of seventy degrees Fahrenheit (70°F) immediately after preparation for use and shall remain in a condition suitable for application for at least one (1) hour.

6.75.06 Metal Supports

(A) **Steel Spaces:**

Metal chairs used to support longitudinal, tie, or reinforcing bar shall be channel shaped, pressed out of sheet steel of not less than twelve (12) gauge (U.S. Standard) metal.

(B) **Dowel Baskets:**

Pre-formed, continuous dowel expansion joint material supports shall be eighteen (18) gauge (U.S. Standard) metal or three- (3) gauge wire chairs with ten- (10) gauge tie wires or heavier spaced no further than eighteen inches (18") along the axis of the expansion joint.

6.75.07 Expansion Tubes

Metal dowel caps or tubes shall be manufactured from thirty-two- (32) gauge sheet metal or heavier, shall not be less than five inches (5") in length, shall be indented to provide a limiting stop for the dowel bars, and shall provide unobstructed expansion space of not less than one inch (1") to permit movement of the dowel bar. The inside diameter shall be one-sixteenth inch (1/16") larger than the diameter of the specified dowel bars and the closed end shall be watertight. Caps made from bituminous-treated paper or other similar material shall not be used.

6.75.08 Form Oil

Commercial quality, colorless mineral oil, free of kerosene and of a suitable viscosity, shall be used as form oil.

6.75.09 Air-Entraining Admixtures

Air-entraining admixtures shall conform to the requirements of AASHTO M 154, latest edition, and ASTM C 260, latest edition. Admixtures which have been frozen will be rejected.

6.75.10 Curing Materials

Curing materials shall conform to the following requirements:

Burlap cloth made from Jute or Keaff	AASHTO M 182
Sheet materials for curing concrete	AASHTO M 171
Liquid membrame-forming compounds for curing concrete (white pigmented) Type 2, latest edition	AASHTO M 148

Straw used for curing shall consist of threshed straw or oats, barley, wheat, or rye. Clean field or marsh hay may be substituted when approved by the Public Works Director/City Engineer. Old, dry straw or hay which breaks readily in the spreading process will not be permitted.

6.75.11 Chemical Admixtures

Chemical admixtures, if permitted by the City Engineer for concrete, shall conform to the requirements of AASHTO M 194, latest edition. Admixtures which have been frozen will be rejected.

6.75.12 Epoxy

Epoxy used for bonding new or wet concrete to old concrete shall be an acceptable product and shall be of the type specifically intended for bonding wet concrete to existing concrete and shall be submitted to the Public Works Director/City Engineer for review prior to use.

6.75.13 Fly Ash

Fly ash for concrete, when permitted by the Public Works Director/City Engineer, shall conform to the requirements of ASTM C 618, Table 1-A, latest edition, for Class C or Class F. (The pozzolanic activity index shall be 85 for Class C and Class F, Fly Ash.) Class C fly ash will not be permitted where sulfate-resistant cement is required.

The contractor shall notify the Public Works Director/City Engineer of the source of fly ash for review before using in the project. The fly ash shall be subject to sampling and testing by agents of the City. Test results that do not meet the physical and chemical requirements may result in the suspension of the use of fly ash until the necessary corrections have been taken to ensure that the material meets specifications. All costs associated with possible testing of fly ash by the City, which do not meet these specifications, shall be paid by the contractor. The fly ash for use on the project shall have been tested by the contractor for compliance with these specifications and submitted to the Public Works Director/City Engineer for review prior to its use in the project.

6.75.14 Test Specimens

The contractor shall furnish the concrete necessary for casting test cylinders. The number of cylinders and tests shall be as follows:

CONCRETE PAVEMENT

Type of Test	Frequency
Gradation (aggregate)	1 per 2500 sq. yard or fraction thereof for each size aggregate
Moisture Content, fine aggregate	1 per day or as often as needed for quality control
Moisture Content, coarse aggregate	1 per day minimum where moisture content is +0.5 percent from SSD condition
Slump	1 per set of cylinders and as often as needed for quality control
Air Content	1 per set of cylinders and as often as needed for quality control
Yield and Cement Factor	1 per set of cylinders and as often as needed for quality control
Compressive Strength	1 set of four (4) cylinders per 5000 sq. yards or major fraction thereof on each day pavement is placed, with two (2) cylinders to be field-cured. One additional set shall be made if the contractor intends to open early for traffic in accordance with Section 6.48.19
Thickness	1 per 1250 linear feet each traffic lane on freshly finished concrete and as often as needed for quality control

The degree and frequencies of all concrete testing beyond normal specified frequencies, if necessary to assure quality control, shall be determined by the Public Works Director/City Engineer at the time of concrete construction. All concrete testing necessary beyond normal specified frequencies to assure quality control shall be paid for by the contractor.

6.76.00 PORTLAND CEMENT CONCRETE PAVEMENT -- EQUIPMENT

6.76.01 General

All equipment necessary for the proper preparation of the subgrade, placing, finishing, and curing of the concrete pavement shall be on the project in good working condition and shall have been inspected by the Public Works Director/City Engineer before the contractor will be permitted to begin paving operations. Throughout construction, the contractor shall maintain sufficient, adequate equipment to assure the proper execution of the work.

6.76.02 Roller

Final subgrade compaction shall be by means of a self-propelled roller having a weight on the rear wheels of the roller of not less than two-hundred-and-fifty (250) pounds per inch of tread. Vibratory rollers may be used with the permission of the Public Works Director/City Engineer. The use of rubber-tired rollers is encouraged.

6.76.03 Subgrade Planer

The subgrade planer shall have an adjustable cutting edge which shall be set to leave the subgrade at the elevation necessary to produce pavement of the thickness shown on the plans. Each end of the planer shall be supported on the forms by means of two rollers with sufficient spacing to maintain stability. The planer shall be of sufficient weight to maintain contact with the forms during planing operations. Wheels or rollers on previously-placed concrete shall be rubber-faced and shall be adjusted so that bearing on concrete shall not be less than three inches (3") from the edge of a pavement.

6.76.04 Forms

(A) Side forms shall be made of metal except on curves of less than a one-hundred-foot (100') radius where wooden forms may be used. Forms shall have base width of not less than eight inches (8") for all forms more than eight inches (8") in height. All side forms less than eight inches (8") in height shall have a base width of not less than six inches (6"). The minimum length of each section of form used shall be ten feet (10'). Each section of form shall be straight and free from bends or warps.

(B) The maximum deviation of the top surface of any section shall not exceed one-eighth inch (1/8"). The inside face shall not deviate more than one-fourth inch (1/4") from a straight line. The method of connection between sections shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross-section and strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of any equipment which they support without springing or settlement.

(C) Each ten-foot (10') length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five feet (5'), having the end brace and socket not less than six inches (6") from the end of the form.

(D) Forms that are not required to support a mechanical finishing machine, subgrade planer, or other similar heavy equipment may, upon approval of the City Engineer, be made of wood. They shall have sufficient stiffness and be so staked to remain vertical and true to lines and grade during the placing and finishing of the concrete. Straight wood forms shall have a thickness of not less than one-and-one-half inches (1-1/2"). Wood forms used at intersection radius points may be one-fourth inch (1/4") thick. All wood forms shall be dressed on the side supporting the concrete and on their upper edge.

(E) Curb forms, if used, shall be made of steel, except where returns of small radius or other special sections make the use of steel forms impractical. Back forms for curbs shall be rigidly attached to the side forms for the pavement slab using all the fastening provided by the manufacturer of the forms. Slip forms or curb mules may be used.

6.76.05 Vibrators

Vibratory units shall be capable of frequencies of not less than ten thousand (10,000) vibrations per minute in air and shall produce vibration in vertical and horizontal planes and ensure a downward vibration of an intensity as great as in other directions to provide thorough vibration through the full depth of the concrete. The unit shall be adjustable to approximately the cross-section of the finished surface. Vibration shall not be used as a means to cause concrete to flow or run into position in lieu of placing and shall not be prolonged to the point where segregation occurs.

6.76.06 Finishing Equipment

(A) A screed or template shall be used to roughly strike off the first layer of concrete to permit placing of required reinforcement in the specified position.

(B) The contractor shall furnish an approved mechanical finishing machine of the screeding and troweling type. It shall be designed and operated both to strike off and to consolidate. The finishing machine shall be of adequate strength to withstand severe use and shall be fully and accurately adjustable to make the pavement conform to the required cross-section shown on the plans. If it is necessary to operate one or both sets of wheels on previously-placed concrete, they shall be rubber-faced and shall be adjusted so that bearing on concrete will not be less than three inches (3") from the edge of the pavement.

(C) Such additional hand equipment -- including but not limited to wooden floats, straightedges, bridges, edgers, etc. required for proper finishing -- shall be furnished by the contractor.

6.76.07 Concrete Saw

When sawing joints, the contractor shall provide sawing equipment adequate in number of units and power to complete the sawing with a water-cooled diamond-edge saw blade or an abrasive wheel to the required dimensions and at the required rate. The contractor shall provide at least one stand-by saw in good working order and meeting the same requirements as stated above. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. The contractor shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and continuously during concrete placement.

6.77.00 PORTLAND CEMENT CONCRETE PAVING -- MIXING

6.77.01 General Mixing

Concrete may be mixed in a central mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are placed in the drum.

The time elapsing from the time water is added to the mix (or cement comes in contact with aggregate) until the concrete is deposited in place at the site of the work shall not exceed forty-five (45) minutes when the concrete is hauled in non-agitating trucks nor ninety (90) minutes when hauled in truck mixers or agitating trucks. The contractor may use approved mixes utilizing admixtures which conform to AASHTO M 194, latest edition, Types A, B, and D. The use of AASHTO M 194 admixtures Types C and E may be used only when specifically provided for in the contract or upon written permission from the City Engineer.

6.77.02 Stationary Mixing

When mixing or in a central mixing plant, the mixing time shall not be less than fifty (50) seconds nor more than ninety (90) seconds. Four (4) seconds shall be added to the specified mixing time if timing starts the instant the skip reaches its maximum raised position. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The volume of concrete mixed per batch may exceed the mixer's nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer, up to ten percent (10%) provided concrete test data for strength, segregation, and uniform consistency are satisfactory and provided spillage of concrete does not occur.

The batch shall be charged into the drum such that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of accumulations that may restrict the free flow of materials into the drum.

The timing device on stationary mixers shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure

of the timing device, the contractor will be permitted to operate while it is being repaired, provided he furnishes an approved timepiece equipped with minute and second hands. If the timing device is not placed in good working order within twenty-four (24) hours, further use of the mixer will be prohibited until repairs are made.

6.77.03 Ready-Mixed Concrete

The use of ready-mixed concrete in no way relieves the contractor or developer of the responsibility for proportion, mix, delivery, or placement of concrete. All concrete must conform to all requirements of these STANDARDS AND SPECIFICATIONS and ASTM C-94 and AASHTO M 157.

The City shall have free access to the mixing plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate. (The contractor will collect delivery, or batch, tickets from the driver for all concrete used on the project and deliver them to the Public Works Director/City Engineer.) Batch tickets shall provide the following information:

(A) Weight and type of cement

(B) Weights of fine and coarse aggregates

(C) Volume (in gallons) of water, including surface water on aggregates

(D) Quantity (cubic yards) per batch

(E) Times of batching and discharging of concrete

(F) Name of batch plant

(G) Name of contractor

(H) Type of mixture (mix designations code)

(I) Name and amount of admixture

(J) Date and truck number

6.77.04 Mixing Proportions of Concrete Materials

Proportioning shall conform to the requirements for Class P concrete as described in Table 6.77.04. When small quantities of pavement are involved (1000 square feet or less), Class A, AX, or B may be used in lieu of Class P upon approval of the Public Works Director/City Engineer. The design mixes are described in Table 6.77.04.

Upon review by the Public Works Director/City Engineer, the contractor shall have the option of substituting approved fly ash for Portland cement in any class concrete mentioned above up to a maximum of twenty percent (20%) by weight. The total weight of cement plus fly ash shall not be less than the minimum weight for cement content as shown in Table 6.77.04. Where the voluntary use of fly ash by the contractor results in delays, necessary changes in admixture quantities or admixture source, or unsatisfactory work, the costs of such delays, changes, or corrective actions shall be borne by the contractor. In the event the finished concrete is unsuitable for its intended purpose, the use of fly ash shall be discontinued.

TABLE 6.77.04
Concrete Table

	Concrete Class	A	AX	B	(k)P
LABORATORY	DESIGN MINIMUM [a] COMPRESSIVE STRENGTH 28 days (45 days for Type V cement) Pounds Per Square Inch	3750	3750	3750	3750
	CEMENT CONTENT (Cement Factor) Range (Pounds Per Cubic Yard):				
	Minimum --	550	600	550	550
	Maximum --	600	700	600	600
	WATER CEMENT RATIO (Pounds of Water Per Pounds of Cement):	0.500	0.500	0.530	0.480
	PERCENT ENTRAINED & ENTRAPPED AIR (Total Range):	4-7	5-8	5-8	4-7
COARSE	CONSISTENCY AASHTO DESIGNATION T-119 [b] -- Range in Inches:	2-4	1-3	1-4	1-3
	AGGREGATE AASHTO DESIGNATION M-43 -- Size Number:	467	(f)	67	467 357
FINE	AGGREGATE AASHTO DESIGNATION M-6 -- Percent Total Aggregate Range:	34-39	(f)	37-44	34-38 33-38

[a] Not a field specification requirement. The desired minimum field strength is 80 percent of the specified laboratory strength.

[b] The point of acceptance for consistency requirements will be at the mixer discharge for transit-mixed concrete.

6.77.05 Limitations of Mixing

Concrete shall be mixed, placed, and finished only when the natural light is sufficient unless an adequate and approved artificial lighting system is provided. Unless authorized in writing by the Public Works Director/City Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches forty degrees Fahrenheit (40°F) and not resumed until an ascending air temperature in the shade and away from artificial heat reaches thirty-five degrees Fahrenheit (35°F).

When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might injure the materials. Unless otherwise authorized by the Public Works Director/City Engineer, the temperature of the mixed concrete shall not be less than fifty degrees Fahrenheit (50°F) and not more than eighty degrees Fahrenheit (80°F) at the time of placing it in the forms.

If the air temperature is thirty-five degrees Fahrenheit (35°F) or less at the time of placing concrete, it will be required that the water and/or the aggregate be heated to not less than seventy degree Fahrenheit (70°F) nor more than one-hundred-fifty degrees Fahrenheit (150°F). Concrete shall not be placed on frozen subgrade nor shall frozen aggregates be used in the concrete. In concreting operations during the summer months, maximum temperature of the mixed concrete shall not exceed ninety degrees Fahrenheit (90°F).

In cold weather, aggregates and water may be heated as part of the batching operation but they shall not be heated beyond a temperature of one-hundred-fifty degrees Fahrenheit (150°F). Aggregates shall not be heated directly by gas or oil flame or on sheet metal over direct flame. Materials containing frost or lumps of frozen material shall not be used in the mix, and their presence in the concrete shall be cause for rejection of that batch.

6.78.00 PCCP MUDJACKING

6.78.01 Description

Raise and support the existing portland cement concrete pavement (PCCP) by drilling injection holes and pumping a grout or polyurethane material under the pavement slab as shown in the Contract Documents.

BID ITEMS	UNITS
Cement (Mudjacking)	Square Foot (SF)
Area of complete stone to be leveled	

6.78.02 Materials

a. Grout. Provide materials that comply with the applicable requirements.

Portland Cement (Type I or II) **Section 6.75.01(C)**

Non-Expansive Cementitious Grout

a. Provide material that complies with ASTM C 1107 or Corps of Engineers CRD-C 621.

b. For self-contained grouts, provide material complying with:

Property	Test Method	Requirement
Soaking Time		1 to 3 min.
Initial Set Time, min.	ASTM C 1102	20 min.
Compressive Strength. 28-day min	ASTM C 39	4,000 psi
Shrinkage	ASTM C 1090	0.00%
Expansion	ASTM C 1090	1.5%
Pull Out Strength	ASTM E 488	9,000 lbf
Freeze-Thaw, min.	ASTM C 666, 300 cycles	95%

6.78.03 Submittals

a. Contractor must submit the following to Engineer for material approval

(1) A complete description, literature, and set of instructions and recommendations,
(2) A copy of test results performed in accordance with ASTM C 1107 or CRD-C 621,
(3) Certificate stating results comply with ASTM C 1107 or CRD-C 621, and
(4) Material Safety Data Sheets (MSDS).

Mix the water, portland cement (not less than 25% by volume of solids) and fly ash (75% by volume of solids) into a cement/fly ash grout complying with **TABLE 1**:

TABLE 1: GROUT FOR MUDJACKING		
Property	**Test Method**	**Value**
Fluidity (efflux time)	ASTM C939	16 to 36 seconds
7-Day Compressive Strength	ASTM C942	600 psi minimum

Submit to the Engineer the results of tests conducted on the design mix by a certified testing laboratory. Provide test results for 1, 3, and 7 day strengths, fluidity, time of initial set (ASTM C 266), and shrinkage and expansion observed (ASTM C 940).

Use admixtures only with written approval from the Engineer.

The Engineer will accept the fly ash grout on the results of the compressive strength and visual inspection of the mixture placed on the project.

6.78.04 Construction Requirements

a. Specialty Contractor Prequalification. The Specialty Contractor must be regularly engaged in work similar to this project in difficulty and/or scope, and document that the company has performed a minimum of the following work in the United States:

- Provided all supervision, labor, material, and equipment necessary to successfully complete 10 separate projects.

- Provide reference contact names and their telephone numbers as part of this submittal.

Submit the specialty contractor's qualifications to the City Engineer for approval. The Engineer will approve or deny the specialty contractor's qualifications.

b. Weather and Seasonal Limitations. Do not mudjack the PCCP if the pavement surface temperatures are below 35°F, if the subgrade or base course is frozen, or if the subgrade is saturated from recent rainfall, as evidenced by standing water on the pavement or in the joints or cracks.

Mudjacking operations may start when the pavement surface temperature is above 35ºF, the ambient air temperature is 35ºF and rising and is expected to exceed 40ºF. Discontinue paving when the ambient air temperature falls below 40ºF. Do not place when it is raining or snowing.

c. Drilling Holes. Submit a hole pattern and pumping sequence to the Engineer. Do not damage the existing reinforcing steel in the pavement. Before drilling the holes, determine the location of reinforcing steel.

Drill holes vertically and round to the maximum diameter 1 to 1½ inch**.** Drill to a depth sufficient to penetrate the base and into the subgrade material. Holes may be washed to create a small cavity, allowing initial spread of material. Drill the holes in a manner preventing breakout at the bottom of the pavement. Do not put downward force on the drill that exceeds 200 lbf.

d. Pavement Mudjacking.

(1) General. Use a string line or monitoring equipment to create a smooth profile. Raise PCCP by injecting grout or polyurethane material within ± ¼ inch of adjacent unjacked PCCP as shown in the Contract Documents. Replace all slabs raised more than ½ inch greater than adjacent PCCP. Grind all slabs raised more than ¼ inch and less than ½ inch. Grade tolerances are applicable to both transverse and longitudinal grades.

Begin the injection as soon as practicable after mixing the material. Do not use material held in the mixer or injection sump pump for more than 1 hour after mixing. Do not add water to the material after the initial mixing.
Inject the mudjacking material in the submitted pattern sequence, and in the quantity required to fill voids under the PCCP.

Cease injection when material appears at any joint, crack or adjacent hole, or when monitoring devices indicate slab movement.

Prevent grout material from being injected into any drainage facility or other open structure.
Prevent excessive loss of material through cracks, joints, other drilled holes or back pressure.

Replace slabs in which cracks emanate radially from the injection holes and in slabs where cracks develop between adjacent injection holes.

(2) Grout. Connect an expanding rubber packer, or other approved device, to the end of the grout plant discharge hose. Place the expanding rubber packer in the injection hole, being careful not to extend the discharge end of the rubber packer below the lower surface of the PCCP.

Produce grout slurry to a 12 second flow cone time. Pump the grout into the holes using an injection pump with a pressure capability of 250 to 300 psi when pumping grout slurry mixed to a 12 second flow cone time.
Cease injection at a hole when grout flow does not occur after 7 seconds of sustained 150 psi gauge pressure, and there is no indication of slab movement.

Prior to grout drying on the drilled holes, fill the holes with a fast setting sand/cement mixture or other patching material approved by the Engineer.

6.78.05 Measurement and Payment

The Engineer will measure mudjacking by the square foot.
Monitoring for pavement lift and injection holes are subsidiary to the bid items mudjacking.

Payment for "Mudjacking", at the contract unit prices is full compensation for the specified work. No adjustment in contract unit prices will be made regardless of the amount of underruns or overruns.

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CHAPTER 6
ROADWAY

6.00.00 GENERAL PROVISIONS

6.01.00 APPLICABILITY

This chapter contains minimum criteria to be met on all streets and parking lots designed and constructed in the City, both by private land developers and by the City.

6.02.00 VARIANCES

Where any particular minimum requirements contained in this chapter can be shown to be inappropriate when applied to an "out-of-the-ordinary" situation, variances to said minimum requirements will be considered and may be authorized by the Public Works Director/City Engineer where the proposed variance in minimum requirements will result in a level of safety, service, and quality equal to or greater than that intended by the application of the minimum requirements.

6.40.00 STREET CONSTRUCTION STANDARDS

6.41.00 GENERAL

The purpose of this section is to set forth the criteria to be used in the construction of all streets and appurtenances within the City of Fort Lupton.

6.42.00 COMPACTION IN UTILITY TRENCHES

Before street construction will be permitted, the top four feet (4') of all utility trenches within the street right-of-way (including service lines) shall be compacted to ninety-five percent (95%) of maximum standard density and the balance of the trench compacted to ninety percent (90%) of maximum density, as determined by ASTM D 698-78 or as specified in the approved soils report. This compaction shall extend to the street right-of-way lines as a minimum. Water settlement of trenches shall not be permitted. All water and sewer services, including water and sewer main stub-outs, shall be installed prior to street construction except that curb and gutter and sidewalk shall be installed prior to water service line installation.

6.43.00 EXCAVATION AND EMBANKMENT

6.43.01 General

The intent of this section is to specify methods and standards to be used in the construction of embankments or excavations for City streets or for other purposes, as indicated on the approved drawings or contract documents. The work will include excavation, embankment, grading; compacting; clearing and grubbing; removal of topsoil, trees, stumps, or other vegetation; removal and/or resetting of minor obstructions; subgrade preparations; and any other work incidental for the construction of excavations and embankments. All workmanship and materials shall be in accordance with the requirements of these STANDARDS AND

SPECIFICATIONS and in conformity with the lines, grades, quantities, and the typical cross-section shown on the plans or as directed by the Public Works Director/City Engineer.

6.43.02 Clearing and Grubbing

Work shall consist of clearing, grubbing, removing and disposing of all vegetation and debris within the limits of the project, and such other areas as may be indicated on the approved plans or required by the work except such objects as are designated to remain or are to be removed in accordance with other sections of these STANDARDS AND SPECIFICATIONS. All surface objects and trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and/or grubbed as required except non-perishable solid objects which shall be a minimum of two feet (2') below subgrade.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted in accordance with these STANDARDS AND SPECIFICATIONS. Materials and debris shall be disposed of in a manner acceptable to the Public Works Director/City Engineer. Burning shall not be permitted without prior written approval of the Public Works Director/City Engineer, Fire Marshal and the county health department.

The contractor shall make all necessary arrangements for obtaining suitable disposal locations. If disposal will be at other than established dump sites, the Public Works Director/City Engineer may require the contractor to furnish written permission from the property owner on whose property the materials and debris will be placed. Branches on trees or shrubs shall be removed as directed. Branches of trees extending over the road bed shall be trimmed to give a clear height of twenty feet (20') above the road bed surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

The contractor shall scalp areas where excavation or embankment is to be made, except that mowed sod need not be removed where the embankment to be constructed is four feet (4') or more in height below subgrade elevation. Scalping shall include the removal of material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and other vegetable matter from the surface of the ground. Hedges shall be pulled or grubbed in such a manner as to assure complete and permanent removal. Sod not required to be removed will be thoroughly disked before construction of embankment.

6.43.03 Removal of Existing Structures

(A) The contractor shall raze, remove, and dispose of all foundations, signs, structures, fences, old pavements, abandoned pipe lines, traffic signal materials, and other obstructions which are within the project limits except for utilities and for those items which other provisions have been made for removal. Traffic signals and related materials will include all attachment hardware and other incidental materials such as, but not limited to, mast arms and span wire. Concrete adhering to sign posts shall be removed, and pedestals and bases shall be removed to one foot (1') below the surrounding ground or subgrade.

Where portions of structures are to be removed, the remaining portions shall be prepared to fit new construction. The work shall be done in accordance with plan details and in such a manner that materials to be left in place will be protected from damage. All damage to portions of structures which are to remain in place shall be repaired by the contractor at his expense. Reinforcing steel, projecting from the remaining structure, shall be cleaned and aligned to provide bond with new extension. Dowels shall be securely grouted with approved grout.

Removal of sign panel shall include all work necessary to remove the panel and its attachment hardware from the existing installation. Where culverts or sewers are to be left in place and plugged, the ends shall be filled with concrete. In addition, the entire length of pipe to be left in place shall be blown full of sand. Materials used in detour structures and supplied by the contractor shall be the property of the contractor. After the detour is abandoned, the contractor shall completely remove the detour structures and shall dispose of materials according to these STANDARDS AND SPECIFICATIONS.

(B) Bridges, culverts, and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic. Unless otherwise directed, the substructures of existing structures shall be removed to one foot (1') below natural stream bottom or ground surface. Where such portions of existing structures lie wholly or in part within the limits of a new structure, it shall be removed as necessary to accommodate the construction of the proposed structure. Steel, precast concrete, and wood bridges shall be carefully dismantled without unnecessary damage. Steel members to be salvaged shall be match-marked with waterproof paint.

(C) Unless otherwise provided, all pipe shall be carefully removed and cleaned. Every precaution shall be taken to avoid breaking or damaging the pipe. Pipes to be relaid shall be removed and stored, when necessary, so that there will be no loss or damage before relaying. When removing manholes, catch basins, and inlets, any live sewer connected to these items shall be properly reconnected and satisfactory bypass service shall be maintained during such operation.

(D) Concrete or asphalt concrete that is to remain shall be cut in a straight, true line with a vertical face. The contractor shall be responsible for the cost of removal and replacement of all overbreak. Sawing shall be done carefully, and all damages to concrete or asphalt to remain in place, which are caused by the contractor's operations, shall be repaired by the contractor at his expense. The minimum depth of saw cuts in

concrete shall be two inches (2"). If the removed portion falls within five feet (5') of an existing joint or edge, the concrete shall be removed to that joint or edge.

6.43.04 Salvage

All salvageable material shown on the plans shall be removed without unnecessary damage in sections or pieces which may be readily transported and shall be stored by the contractor in locations approved by the Public Works Director/City Engineer. The contractor shall be required to replace any materials lost from improper storage methods or damaged by negligence.

6.43.05 Disposal

The contractor shall make all necessary arrangements for obtaining suitable disposal locations, and the cost involved shall be included in the work. If disposal will be at other than established dump sites, the Public Works Director/City Engineer may require the contractor to furnish written permission from the property owner on whose property the materials will be placed.

6.43.06 Excavation and Embankment

Excavation of whatever substances that are encountered within the limits of the project shall be performed to the lines and grades indicated on approved plans. All excavated areas shall be graded in a manner that will permit adequate drainage. Whenever practicable, all suitable material removed from the excavations shall be used in the formation of embankments, for backfilling, and for other approved purposes. Where material encountered within the limits of the work is considered unsuitable, such material shall be excavated below the grade shown on the approved drawings or as directed by the City Engineer and replaced with suitable material. All unsuitable excavated materials and any surplus or excavated material which is not required for embankments shall be disposed of by the contractor.

Before any embankment is placed, clearing, tree removal, sod and topsoil removal over the entire area shall be performed in accordance with these STANDARDS AND SPECIFICATIONS. The base of fill areas shall be scarified to a depth of not less than six inches (6") prior to placement of embankment material. Each layer shall be wetted or aerated, if necessary. No embankment material shall be placed upon organic, spongy, or frozen material or other material unsuitable for the placement thereof in the opinion of the Public Works Director/City Engineer. When an embankment is to be placed on slopes, it shall be continuously benched in horizontal layers to key to the existing slopes.

The construction of embankments by deposition, placing, and compacting materials of acceptable quality above the natural ground or other surface shall be in accordance with the lines, grades, and cross-sections shown on the approved plans and/or as required by the City Engineer. Each lift of the embankment material shall not exceed eight inches (8") in loose depth. The contractor shall thoroughly mix the different materials to secure a uniform moisture content and to insure uniform density and proper compaction. Each layer shall be thoroughly compacted by roller or vibratory equipment which is suitable for the type of embankment material to the densities specified below:

TABLE 6.43.06 *

AASHTO M145 Soil Classification	AASHTO T99 Minimum Relative Compaction (Percent)	AASHTO T180 Minimum Relative Compaction (Percent)
A-1	100	95
A-3	100	95
A-2-4	100	95
A-2-5	100	95
All Others	95	90

* Table 6.43.06 taken from Colorado Department of Transportation Specifications Section 203.07

Class I structural backfill shall be used on all bridges, box culverts, or where otherwise specified. All other backfill shall be developed on site.

6.43.07 Select Borrow Material

In the event the material found on site is unsatisfactory for constructing subgrade, embankments, or filling excavations, the contractor shall provide material from off-site. The selected borrow material shall be a well-graded mixture of sound mineral aggregate particles containing sufficient quality bonding material to secure a firm stable foundation when placed and compacted on the roadway. The R-value of the borrow shall be equal to or greater than the design R-value required for the street. The R-value of the borrow shall be provided to the Public Works Director/City Engineer prior to placing borrow. If tests reveal that material being placed is not of suitable quality and structural value, the contractor shall provide other material as approved by the Public Works Director/City Engineer.

6.44.00 SUBGRADE PREPARATION AND GRADING

6.44.01 General

The work covered by this section concerns the furnishing of all labor, equipment, supplies, and materials needed to perform preparation of subgrade within the public right-of-way. The bottom of the excavation for the pavement, or top of the fill, will be known as the pavement subgrade and shall conform to the lines, grades, and cross-sections shown on the approved plans. Prior to the street being excavated, all service cuts shall be checked to see if the backfill meets density requirements. If deficient, they shall be recompacted and brought up to the density as specified in Chapter 9, Trenching, Backfilling and Compaction.

6.44.02 Subgrade Stabilization

Embankment and subgrade soils shall be compacted to ninety-five percent (95%) of maximum standard density at plus or minus two percent (±2%) optimum moisture or as recommended in the approved soils report. Maximum density shall be determined by ASTM D 698-78. Soft and yielding material and other portions of the subgrade which will not compact when rolled or tamped shall be removed as directed by the Public Works Director/City Engineer and replaced with suitable material.

Subgrade surfaces below excavated areas such as cut areas and undisturbed areas shall require additional preparation. Said subgrade shall be scarified to a minimum depth of twelve inches (12"), wetted or aerated as needed, and compacted until the required density is obtained, unless otherwise approved by the Public Works Director/City Engineer. No paving, subbase, or base shall be placed on soft, spongy, or frozen unstable subgrade which is considered unsuitable by the Public Works Director/City Engineer.

The contractor shall, when requested by the Public Works Director/City Engineer, furnish the necessary equipment to proof roll, even though density tests may indicate compliance. Heavy construction equipment or loaded trucks acceptable to the City shall be driven over the finished subgrade and deflections noted. Soft and yielding material and portions of the subgrade which show deflection shall be scarified and re-rolled or shall be removed and replaced with subgrade course material and then placed and compacted as specified herein. Subgrade shall not be approved for base course construction or paving until it is uniformly stable and unyielding.

6.44.03 Lime and Cement Treated Subgrade

When recommended by the approved soils report and/or pavement design, the surface of the road bed shall be bladed to the established lines, grades, and cross-sections as shown on the approved plans. The prepared road bed shall be scarified to the depth and width required for the subgrade stabilization. The material thus obtained shall be pulverized. Application, mixing, and finishing shall be in accordance with Colorado Department of Transportation Specifications, 1991 Edition, Section 307.04 through 307.07. Hydrated lime shall conform to the requirements of ASTM C 107-79, Type N.

6.44.04 Subgrade Surface Tolerance

The excavation and embankments for the street, intersections, and driveways shall be finished to a reasonably smooth and uniform surface. Variations from the subgrade shall not be more than one-half inch (1/2") in solid nor more than one inch (1") above or six inches (6") below in rock.

6.45.00 SUBBASE CONSTRUCTION

6.45.01 General

The subbase shall consist of a foundation course composed of granular material constructed on the prepared subgrade in accordance with these STANDARDS AND SPECIFICATIONS and in reasonable conformity to the lines and grades and typical cross-sections as shown on the approved plans.

6.45.02 Placement and Compaction

Each layer of subbase material shall be placed in layers not to exceed six inches (6") in compacted depth. Each layer shall be wetted or aerated, if necessary, and compacted to ninety-five percent (95%) maximum density at plus or minus two percent ($\pm$2%) of optimum moisture as determined by ASTM D 698-78. No subbase material shall be placed upon a soft, spongy, or frozen subgrade or other subgrade, the stability of which is unsuitable for the placement thereof.

6.45.03 Subbase Surface Tolerance

The prepared surface of the subbase shall not vary from the approved grade by more than a half inch (1/2").

6.46.00 BASE CONSTRUCTION

6.46.01 General

The intent of this section is to specify methods to be used for the construction, overlaying, sealcoating, and pavement rejuvenating of streets, parking lots, walks, drainageways, and other miscellaneous work requiring the use of aggregates. The work covered shall include general requirements that are applicable to aggregate base course, bituminous base, and pavements of the plant-mix type, bituminous prime coat, bituminous tack coat, rejuvenating applications, and asphalt concrete overly. All workmanship and material shall be in accordance with requirements of these STANDARDS AND SPECIFICATIONS and in conformity with the lines, grades, depths, quantity requirements, and the typical cross-section shown on the approved plans or as directed by the Public Works Director/City Engineer.

6.46.02 Base Course

This item shall consist of a foundation course composed of crushed gravel or crushed stone and filler, constructed on the prepared subgrade or subbase course. Construction shall be in accordance with the requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 304 and the approved pavement design. The composite base course material shall be free from vegetation and lumps or balls of clay.

6.46.03 Placement and Compaction

The base course material shall be deposited and spread in a uniform layer without segregation of size to a compacted depth not to exceed six inches (6"). The material shall be compacted to a minimum ninety-five percent (95%) density as determined by ASTM D 698-78. No base course material shall be placed upon a soft, spongy, or frozen subgrade or subbase with an unsuitable stability. Base material shall not be placed on a dry or dusty foundation where the existing condition would cause rapid dissipation of moisture from the base material and hinder or preclude its proper compaction. Such dry foundations shall have water applied and shall be reworked and recompacted.

Rolling shall be continuous until the base material has been compacted thoroughly in accordance with these STANDARDS AND SPECIFICATIONS. Water shall be uniformly applied as needed during compaction to obtain optimum moisture content and to aid in consolidation. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates are firmly placed.

6.46.04 Base Surface Tolerance

The prepared surface of the base shall not vary from the approved grade by more than one-half inch (1/2").

6.47.00 BITUMINOUS CONSTRUCTION

6.47.01 Hot Bituminous Pavement

All pavement shall be hot bituminous pavement of the plant mix type unless otherwise approved in writing by the Public Works Director/City Engineer. Construction shall be in accordance with the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 403, and the following requirements:

(A) The asphalt cement shall be in accordance with Section 6.73.02 (A) of these STANDARDS AND SPECIFICATIONS.

(B) The gradation of the mineral aggregate shall be in accordance with Section 6.73.02 (B) of these STANDARDS AND SPECIFICATIONS.

6.47.02 Tack Coat

When tack coat is specified on the approved plans or required by the Public Works Director/City Engineer, all construction shall be in accordance with the requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 407. Bituminous material shall be applied at the rate of five one-hundredths (0.05) to fifteen one-hundredths (0.15) gallons per square yard.

6.47.03 Seal Coat

When seal coat is required, all construction shall be in accordance with the requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 409. The type of bituminous material, cover aggregate, and rate of application shall be as shown on the approved construction plans.

6.47.04 Rejuvenating Agent

When a rejuvenating agent is specified on the approved construction plans or required by the Public Works Director/City Engineer, all materials and construction shall be in accordance with the requirements of the Colorado Department of Highways' Standard Specifications for Road and Bridge Construction, Section 407. The rejuvenating agent shall be as shown on the approved construction plans or as specified by the Public Works Director/City Engineer.

6.47.05 Heating and Scarifying

When heating and scarifying treatment is specified on the approved construction plans or required by the Public Works Director/City Engineer, all materials and construction shall be in accordance with requirements of the Colorado Department of Transportation's Standard Specifications for Road and Bridge Construction, Section 405.

6.47.06 Grinding

Grinding shall consist of milling, grinding, or cold planing the existing pavement surface to establish a new surface profile and cross-section in preparation for a bituminous overlay. After grinding, the surface shall have a grooved or ridged finish, uniform, and resistant to raveling or traffic displacement. This textured surface shall have grooves of one-quarter inch (1/4") plus or minus one-eighth inch ($\pm$1/8).

Wedge cut grinding shall consist of grinding the existing pavement surface a minimum of four feet (4') wide at the existing concrete gutter. The edge of the gutter end of the finished wedge cut shall be one-and-one-half inches (1-1/2") below the edge of the existing concrete gutter. The centerline of the street edge of the wedge cut will be cut one-eighth inch (1/8"). The depth of cut shall be determined by measuring to the top of the ridges by placing a five-foot (5') straight edge perpendicular to the grooving pattern. Full-width grinding shall consist of grinding the existing pavement surface from edge of gutter to edge of gutter to a minimum depth of two inches (2") unless otherwise directed by the Public Works Director/City Engineer.

In grinding around utility castings, the contractor may choose to remove the entire existing bituminous pavement around the castings where grinding is not completed and replace it with bituminous surface course placed and compacted in three-inch (3") lifts. The contractor shall vertically cut the limits of the area to be patched, mechanically compact the existing base course, and prime the bottom and vertical edges before backfilling. The contractor shall remove the cuttings immediately behind the grind machine by belt loader, end loader, power sweeper, and/or by hand. The removed material shall be disposed of as approved by the Public Works Director/City Engineer.

The grinding machine shall be a power-operated, self-propelled machine having a cutting drum with lacing patterns that will attain a grooved surface and produce grinding chips of less than one inch (1") in size. The grinding machine shall be equipped with a pressurized watering system for dust control. The equipment shall be a type that has successfully performed similar work.

The cleaning equipment shall be a type which will efficiently remove all loosened material and load into trucks for hauling and spreading. Because of the nature of the streets to be ground and the traffic restrictions, a belt loader followed by a power sweeper and manual sweeper is the most desirable method. Flushing into the City's storm sewer system as a means of clean-up will not be allowed.

6.48.00 PORTLAND CEMENT CONCRETE PAVEMENT

6.48.01 General

Work covered by this section consists of furnishing all tools, transportation, labor, equipment, accessories, services and material, and in performing all operations in constructing a single course of air-entrained Portland cement concrete pavement constructed on a prepared subgrade in accordance with these STANDARDS AND SPECIFICATIONS and in conformity with the lines, grades, thickness, and typical cross-sections as shown on the contract documents. **Portland Cement Concrete Pavements will only be allowed if approved in writing by the Public Works Director/City Engineer.**

6.48.02 Method

Construction may be of either of the following methods:

(A) **Standard Concrete Pavement:**

Standard concrete pavement shall consist of concrete of the type and thickness in the other contract documents, placed within fixed forms, and consolidated and finished by equipment operating on forms. This method is only to be used with written permission of the Public Works Director/City Engineer.

(B) **Slip-Form Pavement:**

Slip-form pavement shall consist of concrete of the type and thickness specified in the other contract documents placed, consolidated, and finished without the use of fixed forms. Unless specifically permitted in the contract documents, the use of slip-form type paving equipment shall be by permission of the Public Works Director/City Engineer only.

6.48.03 Setting Forms

(A) **Base Support:**

The foundation under the forms shall be hard and true to grade so that the form, when set, will be firmly in contact for its whole length and at the specified grade. Any grade which at the form line is found below established grade shall be filled to grade with granular material in lifts of one-half inch (1/2") or less for a distance of eighteen inches (18") on each side of the base of the form and thoroughly compacted. The granular material shall meet the ASTM D 4253 specification (<10 percent passing the No. 200 sieve). Imperfections or variations above grade shall be corrected by tamping or by cutting as necessary.

(B) **Form Setting:**

Forms shall be set sufficiently in advance of the point where concrete is being placed. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than three pins for each ten-foot (10') section. A pin shall be placed at each side of every joint. Form sections shall be tightly locked, free from play or movements in any direction. The forms shall not deviate from true line by more than one-quarter inch (1/4") at any point. Curb forms shall remain in place at least six hours after curb is placed. The curb form shall extend the vertical plane one-eighth inch (1/8"). No excessive settlement or springing of forms under the finishing machine will be tolerated. Forms shall be cleaned and oiled prior to the placing of concrete.

(C) **Grade and Alignment:**

The alignment and grade elevations of the forms shall be checked and corrections made by the contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked by the contractor.

6.48.04 <u>Subgrade Planing</u>

(A) After the setting of forms has been approved, the subgrade shall be fine graded with a subgrade planer or electronically controlled trimmer to correct the crown and elevation. Any excess material, as indicated by this template, shall be removed. To bring low areas up to the correct elevation, approved material shall be furnished. The existing subgrade in low areas shall be tamped or rolled in place until thoroughly compacted. Use of a rubber-tired roller is encouraged. Any ruts and depressions which develop shall be filled and consolidated.

(B) Equipment of such weight or used in such a way as to cause ruts in the finished subgrade two inches (2") or more in depth shall be removed from the work or the rutting otherwise prevented.

(C) Unless waterproof subgrade or base course cover material is specified, the subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the subgrade or base course shall be sprinkled but the method of sprinkling shall not be such as to form mud or pools of water. Over-saturated subgrade areas that are creating excessive wheel tracking by concrete hauling equipment, as determined by the Public Works Director/City Engineer, shall be removed and replaced with appropriate select material prior to placement of the concrete pavement.

6.48.05 Placing Concrete

(A) Concrete which has developed initial set or does not have workable consistency shall not be used.

(B) The contractor shall take necessary precaution to prevent segregation of concrete when discharged. Conveying equipment shall be washed and kept clean at all times.

(C) The concrete shall be deposited to such depth that, when consolidated and finished, the slab will not be below grade at any point. The concrete shall be deposited to require as little rehandling as possible. Necessary hand-spreading shall be done with shovels.

(D) The contractor shall be required to exercise such care in placing, vibrating, compacting, and finishing concrete at and about all transverse expansion joints and adjacent to side forms as to avoid damage to joint material and the forming of honeycomb and voids. Concrete shall not be dumped directly over or against a joint or in such a manner that the concrete will flow directly against the expansion joint. Concrete shall be shoveled against both sides of expansion joints simultaneously. The vibratory unit shall not be allowed to operate while the finishing machine or spreader is standing still, except at transverse joints where vertical joint material is used, where a short pause shall be made on both sides of the joint to consolidate the concrete.

(E) The consistency of concrete shall be kept uniform for each class of work and shall be checked by means of slump tests or Kelly ball tests. The workability of the concrete shall be varied as directed by the Public Works Director/City Engineer. At all times, concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels, and tie bars by the construction methods which are being used without excessive spading, segregation, or undue accumulation of water or laitance on the surface. If, through accident, intention, or error in mixing, any concrete fails to conform to the proportions of the approved mix design, such concrete shall not be incorporated in the work but shall be discarded off the project site as waste material at the contractor's expense. NO WATER SHALL BE ADDED AT THE JOB SITE WITHOUT PERMISSION OF AN APPROPRIATE CITY OFFICIAL. If approval is obtained and water is added at the job site, slump tests shall be run and test cylinders cast following the addition of water. Any expense incurred in excess of ordinary tests shall be borne by the contractor.

(F) Concrete shall not be placed when darkness will prevent good workmanship in placing and finishing operations. In good weather the header shall be placed at least forty-five (45) minutes before sunset. During cold weather more time shall be allowed for finishing and protection. All finishing and curing operations shall be performed prior to darkness.

(G) At the time of concrete placement the mix temperature shall be between fifty and ninety degrees Fahrenheit (50^{o} F and 90^{o} F).

(H) Concrete paving machines weighing more than five thousand (5,000) pounds shall not be utilized on freshly poured concrete slabs for adjacent and abutting pours until seventy-two (72) hours have elapsed. This time requirement shall be increased to

seven (7) days when the concrete paving machine weights more than thirty thousand (30,000) pounds.

6.48.06 Weather Restrictions

(A) **Hot Weather:**

Except by written authorization from the Public Works Director/City Engineer, concrete shall not be placed if the temperature of the plastic concrete cannot be maintained at ninety degrees Fahrenheit (90°F) or lower. The placement of concrete in hot weather shall comply with ACI 305.

(B) **Cold Weather:**

During extreme weather conditions, placing of concrete will be permitted only when the temperature of the concrete placed in the forms will not be less than fifty degrees Fahrenheit (50°F) nor more than ninety degrees Fahrenheit (90°F). To maintain this temperature range, the contractor shall provide acceptable heating apparatus for heating the aggregates and the water. Concrete slabs shall not be placed regardless of temperature conditions if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing will not be allowed. Concrete which has been frozen shall be completely removed and replaced as directed by, and to the satisfaction of, the Public Works Director/City Engineer.

Concrete may be placed when the air temperature in the shade is at least forty degrees Fahrenheit (40°F) and rising. No concrete shall be placed, regardless of the present temperature, when the weather forecast promises freezing weather before final set of the concrete unless special means of heating and protection are used. Protection against freezing is the contractor's responsibility regardless of the weather forecast or climatic conditions at the time of placing.

During cold weather conditions, concrete less than seventy-two (72) hours old shall be protected as follows:

TABLE 6.48.06
Forecasted Low Temperature

by National Weather Service	Protection
Between 40 and 32 Degrees	One layer of plastic or burlap.
Between 31 and 25 Degrees	One layer of plastic and one layer of burlap, or two layers of burlap.
Below 25 Degrees	Six inches (6") of hay or straw and two layers of plastic or burlap in addition to regular curing method, or equivalent commercial insulating material in addition to regular curing method. Those coverings shall remain in place until the concrete is at least five (5) days old. When straw is required on pavements, cured with only curing compound, the fresh concrete shall be covered with a layer of burlap or plastic before application of straw. Heated enclosures may be utilized in lieu of protection requirements cited above. If used, such enclosures shall be maintained for seven (7) days.

6.48.07 Mesh Reinforcement

(A) Mesh reinforcement, if required by the approved plan or other contract documents, shall be free from dirt, rust, scale, paint, grease, oil, or other foreign substances when placed in work.

(B) A screed or template shall be used to roughly strike off the first layer of concrete at one-half the specified thickness to permit placing the mesh reinforcement.

(C) Reinforcing mesh shall be placed at the midpoint of the concrete slab and be parallel to the finished surface. The mesh can be elevated using either bricks or chairs. Adjacent sheets shall lap at least the length of one spacing of the fabric in all directions. Reinforcing shall extend to within three inches (3") of the edge of the concrete but shall not cross expansion joints. The balance of the concrete shall then be placed, leveled, vibrated, and finished.

6.48.08 Joints

(A) **General:**

1. The contractor shall submit a construction joint pattern for approval. The pattern shall be based upon these STANDARDS AND SPECIFICATIONS.

2. Expansion and contraction joints shall be so constructed as to be continuous across all lanes, not staggered. The saw-cuts shall be one-fourth (1/4) of the thickness of the slab for the entire width of the concrete. The joints shall not be sawed until the concrete has hardened to the extent that tearing and raveling are precluded nor later than the day the protective coating, if any, is removed or that random cracking would be likely to occur if the joint were not sawed. Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of sawing the joints or the time interval involved between the placing or the concrete and the sawing of joints.

(B) **Transverse Contraction Joints:**

1. Sawed transverse contraction joints shall be spaced at fifteen-foot (15') centers when nominal slab thickness is less than eight inches (8"). They shall be at twenty-foot (20') centers when slab thickness is eight inches (8") or greater.

2. Formed contraction joints spaced at forty-five foot (45') to ninety-foot (90') centers shall be used when expected air temperatures during the first twenty-four (24) hours after the concrete is placed will be more than twenty degrees Fahrenheit ($20^{o}F$) less than the temperature of the concrete at the time the concrete is placed. Sawed contraction joints shall be spaced evenly between formed contraction joints after the concrete has set sufficiently to allow sawing.

(C) **Transverse Expansion Joints:**

Normally, transverse expansion joints will be used at the beginning of radii at "T" intersections. Expansion joints shall consist of three-quarter-inch (3/4") smooth steel dowel bars, sixteen inches (16") long, spaced at twelve-inch (12") centers inserted through one-inch (1") non-extruding expansion material and supported by a performed dowel basket. Expansion material shall separate the two slabs with approximately one inch (1") of expansion material extending below the top of the subgrade. Dowel caps shall be placed over the greased ends of dowels that extend into the last slab poured at expansion joints. Reinforcing mesh shall terminate three inches (3") from the expansion joint and resume three inches (3") from the expansion material on the other side of the joint. Under no circumstances shall any concrete be left above the expansion material or across the joints at any point. All concrete spanning the ends of the joint next to the forms shall be carefully cut away after the forms are removed. Before the pavement is open to traffic, the groove above expansion joints shall be cleaned and sealed with joint-sealing material.

(D) **Longitudinal Contraction Joints:**

Longitudinal contraction joints will normally be constructed in the same manner as sawed transverse contraction joints. When located at the center of the pavement slab, one-half inch (1/2") deformed bars, thirty inches (30") long, shall be placed on thirty-inch (30") centers.

(E) **Transverse Construction Joints and Emergency Headers:**

Whenever the work of concreting stops for thirty (30) minutes or more, a header, the top of which is true to the shape and grade of the finished pavement, shall be set in a vertical position at right angles to the centerlines of the pavement. This header should line up with adjacent joints. The concrete shall be poured up to the header, spaded, vibrated, or tamped into place so as to leave no porous place in the concrete. Smooth steel dowel pins, three-quarter inches (3/4") in diameter, sixteen inches (16") long shall be placed at intervals of one foot (1') on the center height of the pavement for a distance of eight inches (8") into the concrete. When work is resumed, the header shall be removed without disturbing the concrete or rods. The fresh concrete shall be placed directly against the face of the previously poured concrete and well-spaced around the rods.

(F) **Permanent Headers:**

If a header is at the end of the project, the end of an intersection return, or if paving operations are to be suspended for thirty (30) days or more, the header board may be left in place and concrete placed over the dowel bars until such time as paving operations are resumed at the header.

(G) **Keyed Longitudinal Construction Joints:**

If the pavement width is placed in more than one pour then a longitudinal construction joint shall be constructed of one-half-inch (1/2") round, deformed bars two feet six inches (2'-6") long at two-foot six-inch (2'-6") centers; bent at ninety degrees (90^{o}) in the center; placed at the midpoint in the slab; one leg to extend at right angles to the centerline into the first pour; and parallel to the finished grade. The other leg shall be parallel to the edge and separated from the first pour by means of continuous fiber or metal key board. Prior to pouring the second half of the pavement, the bars shall be straightened. Care must be used in straightening the bars to not injure the concrete already in place. Bars shall not be straightened until the concrete has reached the age of twenty-four (24) hours when the air temperature is continuously higher than fifty degrees Fahrenheit (50^{o}F). If the air temperature is lower than fifty degrees Fahrenheit (50^{o}F) at any time during the first twenty-four (24) hours, then seventy-two (72) hours must elapse before the bars may be straightened.

(H) **Cleaning and Sealing Joints and Cracks:**

1. All joints to be sealed shall be sound, clean, dry, and frost free. Joints shall be thoroughly cleaned to remove any laitance or any foreign materials. Freshly sawed joints shall be washed with high-pressure water immediately after sawing to remove any loose material from the joint faces. Joint washing should be in one direction to prevent recontamination. Just before installing the backer rod, all joints shall be sandblasted and then blown out with compressed air at a pressure of at least ninety (90) psi. Air compressors used for this purpose shall be equipped with traps capable of removing moisture and oil from the air. Sealing shall be performed in accordance with the manufacturer's directions. The sealant manufacturer's representative shall be present at the start of work at the discretion of the Public Works Director/City Engineer.

2. Sealant shall be approved prior to application by the Public Works Director/City Engineer.

3. Hot-poured joint sealer material for concrete slab joints shall conform to the requirements of ASTM d 3405, latest edition, and to the following: "The shipping containers shall be marked by the manufacturer with the name of the material, the name and brand of the manufacturer, the weight, the batch number, and the safe heating temperature." The temperature at pour point shall be lower than the safe heating temperature by at least twenty degrees Fahrenheit (20^{o}F).

   The sealer material shall be melted in a heating kettle or tank constructed as a double boiler with a space between the inner and outer shells filled with oil, asphalt, or other material for heat transfer and for positive temperature control. The heating and melting unit shall be equipped so that the heat may be adjusted to provide control of the temperature of the heating medium used for melting the sealer material. The sealer material shall not be subjected to temperatures in excess of four-hundred-and-fifty degrees Fahrenheit (450^{o}F) at any stage or time during the melting operations.

6.48.09 <u>Final Strike-Off, Consolidation and Finishing</u>

(A) **Sequence:**

The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straight-edging, and final surface finish. Unless permitted by the Public Works Director/City Engineer, the addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted. If the application of water to the surface is directed by the Public Works Director/City Engineer, it shall be applied as a fog spray by means of accepted spray equipment.

(B) **Finishing at Joints:**

1. The concrete shall be placed under and around all applicable load transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated.

2. After the concrete has been placed and vibrated, the finishing machine shall be brought forward, operating in such manner to avoid damage to joints. If operation of the finishing machine appears to be causing damage to the joints, the machine shall be stopped when the front screed is approximately eight inches (8") from the joint. The front screed shall be lifted, set directly on top of the joint, and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Another pass with the finishing machine over the joint without lifting the screeds will be required.

(C) **Consolidation and Finishing:**

The concrete shall be sufficiently and uniformly vibrated so that the density of Class P concrete is not less than ninety-seven percent (97%) of maximum theoretical field density. The density of Class AX concrete shall not be less than ninety-four percent (94%) of maximum theoretical field density.

Unless otherwise specified, hand-finishing methods will not be permitted except under the following conditions:

1. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade when the breakdown occurs.

2. Narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical may be finished by hand methods.

Upon review by the City Engineer, the slump (consistency) may be increased up to one inch (1") above the maximum allowed in Table 6.77.04 for concrete in areas not accessible to mechanical finishing methods. Concrete shall be struck off and screed as soon as placed. Consolidation shall be attained by the use of a suitable vibrator or other acceptable equipment. In operation, the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion and manipulated so neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade, and cross-section end free from porous areas. The use of vibrating roller screed-type machines will be permitted for ramps and other areas not accessible to normal finishing methods.

(D) **Floating:**

After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated as described below. Aluminum floats will not be permitted. The contractor may use a machine composed of a cutting and smoothing float, or floats, suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on and constantly in contact with the side forms. If necessary, long-handled floats having blades not less than five feet (5') in length and four inches (4") in width may be used to smooth and fill in open-textured areas in the pavement. Such long-handled floats shall not be used to float the entire surface of the pavement. After floating, any excess water and laitance shall be removed from the surface of the pavement by a scraping straight edge ten feet (10") or more in length. Successive drags shall be lapped one-half the length of the blade.

(E) **Straight-Edge Testing and Surface Correction:**

After the floating has been completed and the excess water removed but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a ten-foot (10') straight edge. For this purpose, the contractor shall furnish and use an accepted accurate ten-foot (10') straight edge swung from handles three feet (3') longer than one-half the width of the slab. The straight edge shall be held in contact with the surface in successive positions parallel to the road centerline and the entire area gone over from one side of the slab to the other as necessary. If the entire slab cannot be reached from the side, a working bridge shall be provided to enable this testing to be accomplished the full width of the slab. Advance along the road shall be in successive stages of not more than one-half the length of the straight edge. Any depressions found shall be immediately filled with freshly-mixed concrete, struck off, consolidated, and refinished.

High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness and cross-slope. Straight-edge testing and corrections shall continue until the entire surface is found to be free from observable departures from the straight edge and the slab conforms to the required grade and cross-section. This straight-edge testing and correction operation shall be a separate operation from that described in the subsection on "Floating."

(F) **Final Finish:**

After the surface has been straight-edge tested and corrections made, a seamless strip of damp burlap or other accepted material shall be dragged longitudinally along the full width of pavement and curb to produce a uniform surface of gritty texture. For pavement sixteen feet (16') or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of material at least three feet (3') wide is in contact with the full width of the pavement surface while the drag is used. The drag shall consist of sufficient layers of material and maintained in such condition that the resultant surface finish is of uniform appearance and reasonably free from grooves over one-sixteenth inch (1/16") in depth. Where more than one layer of drag material is required, the bottom layer shall be approximately six inches (6") wider than the layer above. Drags shall be maintained

clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

(G) **Edging at Forms and Joints:**

After the final finish but before the concrete has taken its initial set, the edges of the pavement along each side of each slab and on each side of expansion joints shall be worked with an accepted tool. A well-defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use. At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

6.48.10 Surface Smoothness Test

The final riding surface shall meet the following tolerances:

Class I surfaces shall have a Section PI of no more than 14 inches/mile and a deviation of no more than 0.5 inches in 25 feet. Class II surfaces shall have a Section PI of no more than 18 inches/mile and a deviation of no more than 0.5 inches in 25 feet.

As soon as the concrete has sufficiently hardened, mainline pavement surfaces shall be tested to determine the Profile Index (PI) by using the profilograph method prescribed in Subsection 6.48.10(a). All other pavement surfaces are subject to testing using the 10-foot straight edge method prescribed in Subsection 6.48.10(b). Surfaces not meeting the requirements of Subsection (a) and (b) shall be corrected in accordance with Subsection 6.48.10(c).

Mainline pavement surfaces are defined as follows:

(1) Class I mainline surfaces consist of all through traffic and climbing lanes including bridges and bridge approach slabs with final riding surfaces of concrete. Excluded are the portions on horizontal curves having a centerline radius of curvature less than 1,000 feet and areas within the superelevation transition to such curves.

(2) Class II mainline surfaces consist of all acceleration and deceleration lanes, ramps, tapers, shoulders wider than six feet without rumble strips, and surfaces excluded from Class I due to horizontal curvature.

All other surfaces consist of shoulders that are six feet wide or less, shoulders with rumble strips, side street returns, or other small sections of pavement for which the use of a profilograph is not practical.

(A) Profilograph Method

The Contractor shall provide, operate and maintain on the project an approved multi-wheel profilograph that meets the requirements of Colorado Procedure 64. The profilograph shall be an approved computer equipped model.

The Contractor shall make arrangements, and payment if required, for the manufacturer of the profilograph that will be utilized on the project to conduct training for Contractor and City project personnel in the calibration, operation and maintenance of the profilograph. The training shall be conducted on the project at least three days before the start of any concrete pavement work. The representative of the profilograph manufacturer that conducts the training shall issue each individual attendee a letter stating that they have been trained in the calibration, operation and maintenance of the specific profilograph being used on the project.

The Contractor's operator shall have attended the aforementioned training and have a letter so stating. The Contractor's operator shall follow the manufacturer's instructions and shall measure and record profiles in accordance with Colorado Procedure 64 and this specification. The profilograph shall be operated at a speed of less than three miles.

The profilograph shall be calibrated after transportation and before each day's use in accordance with the manufacturer's instructions and Colorado Procedure 64.

During the initial paving operations, either when starting up or after a long shut down period, or when directed, the Contractor shall test the surface with the profilograph as soon as the concrete surface has sufficiently hardened to allow testing. This procedure shall continue until the Profile Index (PI) is equal to or less than the maximum pavement surface smoothness tolerance and the Public Works Director/Engineer has accepted the Contractor's paving methods and equipment.

During normal daily paving operations, the pavement surface shall be tested as soon as possible, preferably during the next working day following placement.

Additional profiles shall be taken to retest pavement surfaces that have received corrective work and when required to check previously submitted data or to identify the limits of irregularities. Additional profiles shall be taken as prescribed below or as directed.

Curing membrane damaged during the profilograph testing or the grinding or other corrective work shall be repaired immediately at the Contractor's expense.

1. Profile intex testing of daily paving shall be performed for:

   (1) Day's paving of 1,000 linear feet or more. When a day's paving is less than 1,000 linear feet, it shall be tested with the subsequent day's production.

   (2) Each block out, bridge, and bridge approach slab - when completed and joined to previously placed and profiled pavements.

   (3) Other areas as directed.

2. Profile Index Testing. The Contractor shall notify the Engineer prior to beginning each day's profilograph operation. Horizontal and vertical calibrations shall be made by the Contractor and witnessed by the City's inspector prior to performing daily profiles. The profile index testing locations are subject to the Public Works Director/City Engineer's approval, and testing will be witnessed by the inspector.

Profiles shall begin or end 25 linear feet from the end of pavement or from any joint between new pavement and existing pavement. Profiles shall overlap any previously profiled surfaces by at least 50 linear feet.

Profile traces shall be taken for each day's paving according to the following:

(1) For through traffic, climbing, acceleration, deceleration lanes, and ramps.

When constructed in one operation as multiple lanes with uniform lane width of 10 feet or wider: profiles shall be taken approximately three feet from and parallel to the outer edge of each exterior lane and approximately one foot right (when facing in the direction of traffic flow) of and parallel to each planned longitudinal joint or lane line.

(2) For each uniform width shoulder, lane taper or shoulder taper, a single profile shall be taken at the approximate midline.

Each profilograph shall include the following information:

(1) General Information:
Project Number
Project Location
Date
Lane Profiled
Operator's Signature
Inspector's Signature

(2) Each profile trace shall be marked to indicate the following:
Beginning and Ending Stations
Intermittent Reference Stations at Least Every 500 Feet
Horizontal Equations Stations
Construction Joints, Bridge Abutments
Location on the Pavement as Required by (3) Below
Plus Any Other Pertinent Information as Required
by the Public Works Director/Engineer

(3) Multiple profiles of a day's paving shall:

Be on the Same Width of Paper
Be Parallel to Each Other
Having Stationing Running in the Same Direction

3. Upon completion of each profilogram, the profilogram shall be immediately submitted to the City inspector. The Public Works Director/City Engineer will review and evaluate the profilograms in accordance with Colorado Procedure 64 and report the evaluation results to the Contractor as they become available. The report will include the following for each pavement smoothness category for each class of a day's paving.

(1) Daily Average Profile Index. The daily average Profile Index is the weighted sum of all sections and partial section Profile Indexes of each category divided by the total number of 0.1 mile sections or remaining portion thereof of the daily production for that category.

(2) Section Profile Index. The section Profile Index is the average of the Profile Indexes for each 0.1 mile section or remaining portion thereof. If only one Profile Index is required, it will suffice.

(3) Irregular Areas. Irregular areas consist of those areas having high or low points in excess of that allowable in 25 feet, and areas needing reprofiling to identify the limits of irregularities.

(4) Areas and Sections Requiring Corrective Work. When the daily average Profile Index exceeds the maximum pavement surface smoothness tolerance by 20 percent, the Engineer will order paving operations suspended. Paving operations will not be allowed to resume until the Contractor has demonstrated that corrective action has been applied to the paving methods or equipment. Corrective work on pavement surfaces shall be performed in accordance with subsection 6.48.10(c).

(B) Ten-Foot Straightedge Method

The surface smoothness of pavements which are not required to be tested by the profilograph method are subject to testing by the 10-foot straightedge method.

The Contractor shall furnish an approved 10-foot straightedge and depth gauge and provide an operator to aid the Inspector in testing the finished pavement surface. Areas to be tested shall be as directed.

Areas showing high spots of more than 3/16 inch in 10 feet shall be marked and the Contractor shall perform corrective work in accordance with subsection 6.48.10(c).

(C) Corrective Work

The Contractor shall use an approved grinding device or a device consisting of multiple saws to bring the final surface within the specified pavement surface smoothness requirements. The Final surface of the concrete pavement shall provide an appearance and skid resistance comparable to adjacent sections that do not require corrective work. Additional profiles or testing may be required to define the limits of an out-of-tolerance surface variation.

Payment will not be made for any pavement that does not meet surface smoothness tolerances until corrective work has been completed and that pavement retested and found acceptable by the Public Works Director/Engineer.

Corrective work shall be completed and accepted prior to determining pavement thickness in accordance with subsection 6.48.21 or sealing the joints in accordance with subsection 6.48.08.

6.48.11 Curing

Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly-placed concrete shall be covered and cured in accordance with the following methods. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material or lack of water to adequately take care of both curing and other requirements shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than one-half (1/2) hour between stages of curing or during the curing period.

(A) **Impervious Membrane Method:**

The entire surface of the pavement shall be sprayed uniformly with an accepted white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. Curing compound shall be applied under pressure at the rate of one (1) gallon to not more than one hundred-and-fifty (150) square feet by mechanical sprayers. The spraying equipment shall be the fully-atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly-mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by effective mechanical means. Hand-spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compounds shall not be applied to the inside faces of joints yet to be sealed.

Membrane-curing compounds shall be wax base Protex DW3 or equal and meet the requirements of AASHTO M 148, Type 2, latest edition. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms, the side of the slabs exposed shall be protected immediately to provide a curing treatment equal to that provided for the surface.

(B) **Wet Burlap Curing:**

After completion of the finishing operations, the surface of the concrete shall be entirely covered with burlap mats. The mats used shall be in such length or width that as laid they will extend at least twice the thickness of the concrete beyond the edges of the slab or structure. They shall be placed so the entire structure and all edges of the concrete, when forms are removed, are completely covered. This covering shall be placed as soon as the concrete has set sufficiently to prevent marring of the surface. After being placed, the mats shall be thoroughly saturated with water by spraying with a mist spray. The burlap shall be placed and weighted down so it remains in contact with the surface covered, and covering shall be maintained fully wetted and in position for seven (7) days after the concrete has been placed. If it becomes necessary to remove the burlap for any reason, the concrete shall not be exposed for a period of more than one-half (1/2) hour. This method of curing shall not be used when the outside air temperature is below thirty-two degrees Fahrenheit (32°F) unless heated enclosures are provided.

(C) **Plastic Sheet Curing:**

As soon after the completion of the finishing operation as the concrete has set sufficiently to prevent marring of the surface, the top surface and sides shall be entirely covered with plastic sheet materials. The plastic sheet as prepared for use shall have dimensions such that each unit as laid will extend beyond the edges of the concrete at least twice the thickness of the concrete. The units as used shall be lapped at least twelve inches (12") and the laps of plastic sheet shall be secured in such a manner that they do not open or separate. The plastic shall be placed and weighted so it remains in contact with the surface covered during the entire curing period of seven (7) days.

(D) **Waterproof Paper Curing:**

The procedures used for plastic sheet curing shall be used when waterproof paper is used in curing concrete.

(E) **Insulation Pad:**

Insulation pads or other thermal devices may be used to protect concrete in cold weather.

(F) Other acceptable curing methods may be used upon review and acceptance by the City Engineer.

6.48.12 Curing in Cold Weather

When the air temperatures may be expected to fall below thirty-five degrees Fahrenheit (35°F), the contractor's written, detailed proposal for protecting the concrete must be accepted by the Public Works Director/City Engineer before commencement of the paving operation. A sufficient supply of straw, hay, grass, or other suitable material shall be provided along the work. The methods and materials used shall be such that a minimum temperature of forty degree Fahrenheit (40°F) will be maintained at the surface of pavement. Acceptance of the contractor's proposed method shall not relieve the contractor of the responsibility for the quality

and strength of the concrete placed during cold weather. Any concrete damaged by frost action shall be removed and replaced at the contractor's expense.

During paving operations, day or night, when the air temperature reaches thirty-five degrees Fahrenheit (35°F) and is falling, placement of concrete shall cease and the previously-approved protection method shall be initiated. All concrete placed within the previous seventy-two (72) hours shall be protected for a minimum of five (5) days after initial placement of the concrete.

Admixtures for curing or temperature control may be used only when permitted by the Public Works Director/City Engineer.

6.48.13 Removing Forms

Unless otherwise provided, forms shall not be removed from freshly placed concrete until it has set for at least twelve (12) hours, except auxiliary forms used temporarily in widened areas. Forms shall be removed carefully to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in these STANDARDS AND SPECIFICATIONS. Major honeycombed areas, as determined by the Public Works Director/City Engineer, will be considered as defective work and shall be removed and replaced. Any area or section removed shall not be less than ten feet (10') in length nor less than full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joint that is less than ten feet (10') in length, shall also be removed and replaced at the contractor's expanse.

6.48.14 Sealing Joints

All joints shall be sealed. They shall be filled with joint sealing material before the pavement is opened to traffic, and as soon after completion of the curing period as is feasible. The sealing material shall be applied to each joint opening to conform to the details shown on the plans or as directed by the Public Works Director/City Engineer. The pouring shall be done such that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. Poured joint-sealing material shall not be placed when the air temperature in the shade is less than forty degrees Fahrenheit (40°F) unless permitted by the Public Works Director/City Engineer.

6.48.15 Cleaning and Filling Joints

All concrete spanning expansion or dummy groove contraction joints shall be carefully cut away. At the end of the curing period, foreign material shall be removed from the joints by both mechanical means and the use of compressed air at ninety (90) psi pressure. All joints shall be filled flush with the specified joint filler. The joint filler shall not spill over the joint onto the adjacent surface.

6.48.16 Final Seal

Spray the entire concrete surface with boiled linseed oil cut back fifty percent (50%) with mineral spirits. (This is a protectionary measure against salt and abrasives during the first winter season of use.)

6.48.17 Clean-Up

When concrete operations have been completed, the contractor shall be responsible for the clean-up and removal of all leftover or waste materials resulting from any of his activities. All curbs shall be properly backfilled, and the adjacent ground left in an acceptably neat and presentable condition.

6.48.18 Concrete Pavement -- Slip-Form Method

When the pavement is to be constructed without the use of fixed forms, the following provisions shall apply:

(A) **Grade:**

After the grade has been placed and compacted to the required density designated within these specifications, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly-designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of a properly-designed machine. If the density of the grade is disturbed by the grading operations, it shall be corrected by additional compaction before concrete is placed. The grade should be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected to the satisfaction of the Public Works Director/City Engineer immediately ahead of the placing of the concrete. Any soft spots shall be dug out to stable material and recompacted or filled with sand.

For all slip-form paving and subgrade grading operations, the contractor shall provide two string lines, one on each side of the paver or trimmer to control finished vertical grades of pavement or subgrade. Tolerance of finished grades of pavement shall not exceed one-eighth inch (1/8") transverse along a ten-foot (10') straight edge nor shall it deviate in finished elevation by more than one-half inch (1/2") from the contract plans. The contractor shall remove and replace all pavement areas not conforming to these tolerances, unless otherwise permitted by the Public Works Director/City Engineer.

(B) **Placing and Consolidating Concrete:**

The concrete shall be placed with an approved slip-form paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine such that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with these STANDARDS AND SPECIFICATIONS.

Concrete shall be consolidated in accordance with Subsection 6.48.09. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The concrete shall be held at a uniform consistency in accordance with the Concrete Mix P. Any inconsistent mixes delivered to the site, whether meeting the requirements of Concrete Mix P or not, which produce an unacceptable finished quality of the concrete pavement, may be rejected by the Public Works Director/City Engineer.

The slip-form paver shall be operated with a continuous forward movement (as possible) and all operation of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

(C) **Finishing:**

The surface smoothness and texture shall meet the requirements of Subsection 6.48.09 and 6.48.10.

(D) **Curing:**

Curing shall be done in accordance with the method described in Subsection 6.48.11. The curing media shall be applied at the appropriate time and shall be applied uniformly and completely to all surfaces and edges of the pavement.

(E) **Joints:**

All joints shall be constructed in accordance with Subsection 6.48.08.

(F) **Protection Against Rain:**

In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the contractor shall be required to have materials available at all times for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of standard metal forms or wood plank having a nominal thickness of not less than two inches (2") and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges and covering material such as burlap or cotton mats, curing paper, or plastic sheeting material for the protection of the surface of the pavement. When rain appears imminent or when requested by the Public Works Director/City Engineer, all paving operations shall stop, forms shall be placed against the sides of pavement, and protective covering shall be placed over the surface of unhardened concrete.

6.48.19 Opening to Traffic

Opening to traffic, including the contractor's vehicles, shall not be permitted until the flexural strength of the concrete, as indicated by the modules of rupture of beams tested in conformity with the latest ASTM Standard Method of Test for "Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading." Designation C-78 is at least five hundred (500) pounds per square inch or the compressive strength of six-inch by 12-inch (6" x 12") cylinders, tested in conformity with the latest ASTM Standard Method of Test for "Compressive Strength of Molded Concrete Cylinders." Designation C-39 is at least three thousand (3000) pounds per square inch. These tests shall be performed when the concrete is seven (7) days old unless otherwise requested by the contractor. If permanent shoulders are not in place, a six-foot (6') wide temporary earth shoulder shall be placed against the outside pavement edges before traffic

is allowed on the pavement. Opening to traffic shall not constitute a final acceptance of the pavement.

6.48.20 Defects

Before final inspection and acceptance, tolerances and smoothness shall be tested by the City Engineer by means of surface-testing machine or a straightedge applied to each separate lane of pavement. All surface variations of one-eighth inch (1/8") or more in ten feet (10') shall be ground off. Brush-hammering shall not be permitted. Sections of pavement containing depressions with a depth in excess of one-eighth inch (1/8") in ten feet (10') shall be removed and replaced at the contractor's expense. Such removed sections shall not be less than full-lane width and full distance between joints in length. Slabs containing excessive cracking, fractures, spalling, or other defects shall be removed and replaced as above, when directed by the Public Works Director/City Engineer.

6.49.00 APPURTENANT CONCRETE STRUCTURES

6.49.01 Curb and Gutter Section

The section to be constructed shall be as identified on the approved plans or as shown on the detail drawings.

6.49.02 Sidewalks

Sidewalks shall be six inches (6") thick and detached or six inches (6") thick and attached and constructed to the dimensions shown on the approved construction plans. All areas of sidewalk that will be crossed by driveways will be constructed with six-inch (6") thick concrete in residential areas and eight-inch (8") thick concrete in commercial areas.

6.49.03 Crosspans and Curb Return Fillets

Crosspans and curb return fillets shall be constructed eight inches (8") thick with six by six/ten-ten (6x6/10-10) wire mesh. Typical crosspan sections are shown on the detail drawings. Where unusual conditions prevail, additional reinforcing steel and special joints may be required by the Public Works Director/City Engineer.

6.49.04 Curb Cuts and Driveways

Curb cuts shall be provided at all driveway locations and at additional locations, as shown on the approved plans. Construction of curb cuts shall be as shown on the detail drawings. Spacing will be as shown on the approved plans or as approved by the Public Works Director/City Traffic Engineer.

6.49.05 Curb Ramps

Curb ramps for the handicapped shall be installed at locations designated by the City Traffic Engineer and at all intersections unless approved otherwise by the Public Works Director/City Engineer. Curb ramps will be constructed as shown on the detail drawings.

6.49.06 Construction Stakes

The Contractor's surveyor shall provide all stakes required for curbs, gutters, walks, and structures and shall furnish all necessary information relating to lines and grades. The contractor shall be held responsible for the reasonable preservation of all such stakes. The contractor shall not remove stakes until three (3) working days after placement of concrete unless approved by the Public Works Director/City Engineer.

6.49.07 Backfilling

When side forms are removed, the space adjoining the concrete shall be backfilled in a timely manner with suitable material properly compacted and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill shall be level with the top of the concrete for at least two feet (2') and then sloped to the property line. Maximum slope shall be four to one (4:1). Where detached walks occur, the space between the curb and walk shall be backfilled on a straight line from the top of walk to the top of curb.

6.49.08 Connections with Existing Concrete Curb, Gutter, and Drives

Where new construction abuts existing, the work shall be accomplished so that no abrupt change in grade between the old and new work results.

6.50.00 BRIDGES AND MAJOR DRAINAGE STRUCTURES

6.50.01 General

(A) All culvert pipe, box culverts, and bridges which will ultimately be maintained by the City of Fort Lupton shall conform to the following:

1. AASHTO "Standard Specifications for Highway Bridges," latest edition, and applicable interims.

2. Colorado Department of Transportation’s "Standard Specifications for Road and Bridge Construction," latest edition.

3. Colorado Department of Transportation’s "Bridge Manual," Volumes I and II.

(B) All structures shall be designed to an HS-20 loading.

(C) All box culverts and bridges shall have the year of construction permanently indentured on the downstream headwall face in legible numbers. The numbers shall be three inches (3") high by one-and-one-half inches (1-1/2") deep in the headwall face.

(D) All box culvert and bridge designs shall be certified by a Professional Engineer registered in the State of Colorado who is competent to perform such designs.

6.60.00 CONSTRUCTION TRAFFIC CONTROL

6.60.01 General

Traffic control devices shall be maintained in a safe operating condition at all times. The contractor shall provide for approval by the Traffic Engineer, a traffic control plan, and shall comply with Chapter 8 of these STANDARDS AND SPECIFICATIONS. If the Public Works Director/City Engineer finds the construction area to be inadequately barricaded, he has the authority to stop work and direct that corrective measures be taken prior to proceeding with work.

6.60.02 Pedestrian Traffic

Every precaution shall be taken to ensure that construction work does not interfere with the movement of pedestrian traffic, which shall be maintained on the sidewalk at all times. Flagmen shall be provided for guidance as necessary.

(A) Where an excavation interrupts the continuity of the sidewalk, the contractor shall provide suitable bridge or deck facilities to be supplemented by the use of such proper devices and measures as prescribed in the Manual on Uniform Traffic Control Devices, most recent edition, for the safe and uninterrupted movement of pedestrian traffic. The edges or ends of the pedestrian bridge or decking shall be beveled or chamfered to a thin edge to prevent tripping.

(B) Temporary diversion walkways shall be hard surfaced and electric lighting shall be provided and kept continuously burning during hours of darkness, when required by the Public Works Director/City Engineer.

(C) Unless otherwise authorized by the Public Works Director/City Engineer, pedestrians shall not be channeled to walk on the traveled portion of the roadway.

(D) Under certain conditions, it may be necessary to divert pedestrians to the sidewalk on the opposite side of the street. Such crossings shall only be made at intersections or marked pedestrian crossovers.

(E) Facilities satisfactory to the Public Works Director/City Engineer shall be provided for pedestrian crossing at corners, pedestrian crossovers, and public transportation stops.

6.60.03 Vehicular Traffic

(A) Construction work zone traffic shall be controlled by signs, barricades, detours, etc., which are designed and installed in accordance with the Manual on Uniform Traffic Control Devices, most recent edition, and applicable City of Fort Lupton traffic standards. Traffic control plan shall be submitted and approved by the City Engineer or his designee prior to start of any construction.

(B) During construction of new facilities, traffic control should strive to keep the motorist from entering the facility. The primary means to accomplish this is by use of temporary barricades, located in advance of the point where new construction joins existing, and by appropriate signing. New construction shall not be opened to traffic and, thus, the construction traffic control removed without the approval of the Public Works Director/Engineering Construction Inspector and the City Traffic Engineer.

(C) In general terms, a construction traffic control plan must be drawn on a map. For minor projects or local roadways, a neat sketch of the roadways and the proposed control devices will suffice. For major projects or major roadways, the traffic control plan should be superimposed on as-builts, construction plan drawings, or other detailed map.

(D) The Manual on Uniform Traffic Control Devices shall be the basis upon which the construction traffic control plan is designed in concern with proper, prudent, and safe engineering practice. All necessary signing, striping, coning, barricading, flagging, etc. shall be shown on the plan.

(E) Directional access on roadways may be restricted [minimum travel lane width in construction area is ten feet (10')], but proper controls including flagging must be indicated. Removal of on-street parking should be considered and noted where applicable.

6.70.00 MATERIAL SPECIFICATIONS

6.71.00 SUBBASE

Subbase material shall be composed of granular material consisting, essentially, of sand, gravel, rock, slag, disintegrated granite, or a combination of such materials. The coarse portions of the material shall be sound fragments of the crushed or uncrushed materials enumerated above. Supplied material shall be a well-graded mixture containing sufficient soil mortar, crushed dust, or other proper quality binding material which, when placed and compacted in the roadway structure, will result in a firm, stable foundation. Material composed of uniform size particles, or which contains pockets of excessively fine or excessively coarse material, will not be acceptable for use.

This material need not be crushed but shall be graded within the following limits:

TABLE 6.71.00

Standard-Size of Sieve	Percent by Weight Passing Sieve
2-1/2 Inch	100
2 Inch	95 - 100
No. 4	30 - 60
No. 200	5 - 15

Liquid Limit -- 35 Maximum
Plasticity Index -- 6 Maximum

6.72.00 BASE

Base shall consist of a foundation course composed of crushed gravel or crushed stone and filler constructed on the prepared subgrade or subbase course. Materials and construction shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 703. Gradation shall be Class 6 (3/4-inch maximum) in accordance with the following gradation:

TABLE 6.72.00
CLASSIFICATION TABLE FOR AGGREGATE BASE COURSE

Sieve Designation	Percent by Weight Passing Square Mesh Sieve Class 6
3/4 Inch	100
No. 4	30 - 65
No. 8	25 - 55
No. 200	3 - 12

Liquid Limit -- 30 Maximum
Plasticity Index -- 6 Maximum
R-Value Minimum -- 78

6.73.00 BITUMINOUS MATERIALS

6.73.01 Prime Coat

Materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702..

6.73.02 Hot Bituminous Pavement

All pavement shall be hot bituminous pavement of the plant mix type unless otherwise approved in writing by the City Engineer. Materials shall be in accordance with the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Sections 702 and 703, and the following exceptions and/or requirements:

(A) The asphalt cement shall be Superpave Performance Graded Binders and shall conform To the requirements listed in Table 702-2 of the Colorado Department of Transportation's for Road and Bridge Construction" (Taken from AASHTO Provisional Standard MP1) and the following:

* On arterial streets the grade of asphalt cement for the top layer shall be PG 76-28 (Polymer Modified). The bottom layers may be PG 64-22.

* On all other street classifications, the grade of asphalt cement for the top layer shall be PG 64-28 (Polymer Modified). The bottom layers may be PG 64-22.

(B) The top layer of asphalt shall be stone matrix asphalt (SMA) or hot bituminous pavement (HBP) Grading SX. The lower layers may consist of HBP Grading SG or

HBP Grading S. SMA mixes will only be required as determined by the Public Works Director/City Engineer. The minimum layer thickness shall be 2 inches and each layer should be a minimum of 2 times the aggregate size.

(C) **HBP pavements shall NOT contain any recycled or reclaimed asphalt pavements (RAP) in the mix for top surface layer.**

6.73.03 Tack Coat

When tack coat is specified on the approved plans or required by the City Engineer, all materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702. Bituminous material shall be SS-1h emulsion.

6.73.04 Seal Coat

When seal coat is required, all materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702. The type of bituminous material, cover aggregate, and rates of application will be as shown on the approved construction plans.

6.73.05 Rejuvenating Agent

When a rejuvenating agent is specified on the approved construction plans or required by the Public Works Director/City Engineer, all materials shall be in accordance with the requirements of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction," Section 702. The rejuvenating agent shall be as shown on the approved construction plans or as specified by the Public Works Director/City Engineer.

6.73.06 Appurtenant Structures Concrete

Concrete used in the construction of curb, gutter, sidewalk, drive cuts, and other appurtenant roadway concrete structures shall be in accordance with Chapter 6 of these STANDARDS AND SPECIFICATIONS.

6.74.00 STRUCTURE BACKFILL MATERIAL

Structure backfill shall comply with Colorado Department of Transportation's specifications for Class I material and meet the following requirements from laboratory sieves:

TABLE 6.74.00

Sieve Designation	Percent by Weight Passing Lab Sieve
2 Inch	100
No. 4	30 - 100
No. 50	10 - 60
No. 200	5 - 20

Flowable Fly Ash or Flowfill may be required in lieu of Class ~~I~~ 6 backfill as determined by the City Engineer.

6.75.00 PORTLAND CEMENT CONCRETE PAVEMENT -- MATERIALS

6.75.01 Concrete and Concrete Admixtures

(A) **Fine Aggregate for Concrete:**

Fine aggregate for concrete shall conform to the requirements of AASHTO M 6, latest edition. The amount of deleterious substances removable by elutriation shall not exceed three percent (3%) by dry weight of fine aggregate when tested in accordance with AASHTO T 11 unless otherwise specified. The minimum sand equivalent, as tested in accordance with AASHTO T 176 shall be eighty (80) unless otherwise specified. The fineness modules shall not be less than 2.50 nor greater than 3.50 unless otherwise approved by the Public Works Director/City Engineer.

(B) **Coarse Aggregate for Concrete:**

Coarse aggregate for concrete shall conform to the requirement of AASHTO M 80, latest edition, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO T 96. Coarse aggregate shall conform to the grading in Table 6.75.01 for the grading specified in Table 6.77.04. Sizes 357 and 467 shall each be furnished in two separate sizes and combined in the plant in the proportions necessary to conform to the grading requirements. Size 357 is a combination of No. 3 and No. 57, and Size No. 467 is a combination of No. 4 and No. 67.

(C) **Portland Cement:**

Portland cement shall conform to the requirements of the following specifications for the type specified or permitted:

Type	Specifications
Portland Cement -- Types I, II, and III	ASTM C 150 AASHTO M 85
Air-Entraining Portland Cement	AASHTO M 134
Masonry Cement	AASHTO M 150

In general, Type II cement shall be used in concrete which will be in contact with the soil, unless otherwise allowed or directed by the Public Works Director/City Engineer. Unless otherwise permitted by the Public Works Director/City Engineer, the product of only one mill of any one brand and type of Portland cement shall be used on the project, except for reduction of any excessive air entrainment where air-entrainment cement is used. The contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which for any reason has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used.

TABLE 6.75.01
Concrete Aggregate Gradation Table
Percentages Passing Designated Sieves and Nominal Size Designation

	Coarse Aggregates (From AASHTO M 43)					Fine Aggregate				
	* No.3	* No.4	No.6	No.7	No.8	* No.57	* No.67	** No.357	** No.467	AASHTO M 6
Sieve Size	2" to1"	1-1/2" to3/4"	3/4" to3/8"	1/2" to#4	3/8" to#8	1" to#4	3/4" to#4	2" to#4	1-1/2" to#4	#4 to#100
2-1/2	100	.....	.....	.....	.....	.....	.....	.....	100	.....
2"	90-100	100	.....	.....	.....	.....	.....	.....	95-100	100
1-1/2"	35-70	90-100	.....	.....	.....	100	.....	.....	.....	95-100
1"	0-15	20-55	100	.....	.....	95-100	100	35-70	.....	.....
3/4"	.....	0-15	90-100	100	.....	.....	90-100	.....	35-70	.....
1/2"	0-5	.....	20-55	90-100	100	25-60	.....	10-30	.....	.....
3/8"	.....	0-5	0-15	40-70	85-100	.....	20-55	.....	10-30	100
#4	.....	.....	0-5	0-15	10-30	0-10	0-10	0-5	0-5	95-100
#8	.....	.....	.....	0-5	0-10	0-5	0-5	.....	.....	.....
#16	.....	.....	.....	.....	0-5	.....	.....	.....	.....	45-80
#50	.....	.....	.....	.....	.....	.....	.....	.....	.....	10-30
#100	.....	.....	.....	.....	.....	.....	.....	.....	.....	2-10

* Additional primary gradings may be permitted when produced on the project provided the theoretical combination meets the specifications for combined aggregate sizes. Size No. 357 is a combination of No. 3 and No. 57. Size No. 467 is a combination of No. 4 and No.67

6.75.02 Forms

Straight side forms shall be made of a metal having a thickness of not less than seven-thirty-seconds of an inch (7/32") and shall be furnished in sections not less than ten feet (10') in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete, without horizontal joint, and a base width equal to or greater than the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of one-hundred-foot (100') radius or less. Flexible or curved forms shall be of a design acceptable to the Public Works Director/City Engineer. Forms shall be provided with adequate devices for secure setting so when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less an two-thirds (2/3) the height of the form. Forms with battered top surfaces and bent, twisted, or broken forms shall be removed from the site. Repaired forms shall not be used until accepted by the Public Works Director/City Engineer. Built-up forms shall not be used except where the total area of pavement of any specified thickness on the project is less than two thousand (2000) square yards. The top face of the form shall not vary from a true plane more than one-eighth inch (1/8") in ten feet (10'), and the upstanding leg shall not vary more than one-quarter inch (1/4"). The forms shall contain provisions for locking the ends of abutting form sections together tightly and for secure setting.

Forms for bridge approach slabs or for pavement areas with irregular dimensions shall be made of metal or straight, sound timber. Forms shall be free from warp and of sufficient strength to resist springing out of shape. Forms shall be staked securely to line and grade to the satisfaction of the Public Works Director/City Engineer. All mortar and dirt shall be removed from the forms that have been previously used.

6.75.03 Reinforcing Steel

Reinforcing steel shall conform to the requirements of the following specifications:

(A) Deformed and plain billet -- steel bars for concrete reinforcement -- AASHTO M 31

(B) Axle-steel deformed and plain bars for concrete reinforcement -- AASHTO M 53

(C) Fabricated steel bar or rod mats for concrete reinforcement

(D) Welded steel wire fabric for concrete reinforcement -- AASHTO M 55

Bars conforming to AASHTO M 31 and M 53 shall be furnished in Grade 60 for No. 5 bars and larger and Grade 40 or Grade 60 for smaller than No. 5. Reinforcing mesh shall be 6 x 6 - W2.9 x W2.9 with a weight of at least forty-one (41) pounds per one hundred (100) square feet.

6.75.04 Water

Water used in mixing or curing shall be clean and free of oil, salt, acid alkali, sugar, vegetable, or other substance injurious to the finished product. Water will be tested in accordance with, and shall meet, the suggested requirements of AASHTO T 26, latest edition. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, or other foreign materials.

6.75.05 Joints

(A) **Joint Sealing Compound:**

Material for filling all types of pavement joints shall be a hot-poured elastomeric-type sealant specifically manufactured for sealing joints in concrete. The material shall not crack or break its bond when exposed to a temperature of zero degrees Fahrenheit (0^{o}F). Joint sealing compounds shall meet the requirements of ASTM D 3406.

(B) **Expansion Joints:**

Expansion joint material shall be non-extruding and resilient bituminous types and shall conform to AASHTO M 213. The filler shall be furnished in a single piece for the depth and thickness required for the joint.

(C) **Cold Joint Sealer:**

Cold-applied joint sealer material for concrete slab joints shall conform to the requirements of ASTM D 1850, latest edition, "Concrete Joint Sealer, Cold Application Type." Cold-applied joint sealer shall be of such character that a homogenous mix can be obtained by combining the separate substances, either mechanically or manually, without having to heat the blended material above a temperature of one-hundred degrees Fahrenheit (100^{o}F). The material shall pour or extrude readily at a temperature of seventy degrees Fahrenheit (70^{o}F) immediately after preparation for use and shall remain in a condition suitable for application for at least one (1) hour.

6.75.06 Metal Supports

(A) **Steel Spaces:**

Metal chairs used to support longitudinal, tie, or reinforcing bar shall be channel shaped, pressed out of sheet steel of not less than twelve (12) gauge (U.S. Standard) metal.

(B) **Dowel Baskets:**

Pre-formed, continuous dowel expansion joint material supports shall be eighteen (18) gauge (U.S. Standard) metal or three- (3) gauge wire chairs with ten- (10) gauge tie wires or heavier spaced no further than eighteen inches (18") along the axis of the expansion joint.

6.75.07 Expansion Tubes

Metal dowel caps or tubes shall be manufactured from thirty-two- (32) gauge sheet metal or heavier, shall not be less than five inches (5") in length, shall be indented to provide a limiting stop for the dowel bars, and shall provide unobstructed expansion space of not less than one inch (1") to permit movement of the dowel bar. The inside diameter shall be one-sixteenth inch (1/16") larger than the diameter of the specified dowel bars and the closed end shall be watertight. Caps made from bituminous-treated paper or other similar material shall not be used.

6.75.08 Form Oil

Commercial quality, colorless mineral oil, free of kerosene and of a suitable viscosity, shall be used as form oil.

6.75.09 Air-Entraining Admixtures

Air-entraining admixtures shall conform to the requirements of AASHTO M 154, latest edition, and ASTM C 260, latest edition. Admixtures which have been frozen will be rejected.

6.75.10 Curing Materials

Curing materials shall conform to the following requirements:

Burlap cloth made from Jute or Keaff	AASHTO M 182
Sheet materials for curing concrete	AASHTO M 171
Liquid ~~membrane~~membrane-forming compounds for curing concrete (white pigmented) Type 2, latest edition	AASHTO M 148

Straw used for curing shall consist of threshed straw or oats, barley, wheat, or rye. Clean field or marsh hay may be substituted when approved by the Public Works Director/City Engineer. Old, dry straw or hay which breaks readily in the spreading process will not be permitted.

6.75.11 Chemical Admixtures

Chemical admixtures, if permitted by the City Engineer for concrete, shall conform to the requirements of AASHTO M 194, latest edition. Admixtures which have been frozen will be rejected.

6.75.12 Epoxy

Epoxy used for bonding new or wet concrete to old concrete shall be an acceptable product and shall be of the type specifically intended for bonding wet concrete to existing concrete and shall be submitted to the Public Works Director/City Engineer for review prior to use.

6.75.13 Fly Ash

Fly ash for concrete, when permitted by the Public Works Director/City Engineer, shall conform to the requirements of ASTM C 618, Table 1-A, latest edition, for Class C or Class F. (The pozzolanic activity index shall be 85 for Class C and Class F, Fly Ash.) Class C fly ash will not be permitted where sulfate-resistant cement is required.

The contractor shall notify the Public Works Director/City Engineer of the source of fly ash for review before using in the project. The fly ash shall be subject to sampling and testing by agents of the City. Test results that do not meet the physical and chemical requirements may result in the suspension of the use of fly ash until the necessary corrections have been taken to ensure that the material meets specifications. All costs associated with possible testing of fly ash by the City, which do not meet these specifications, shall be paid by the contractor. The fly ash for use on the project shall have been tested by the contractor for compliance with these specifications and submitted to the Public Works Director/City Engineer for review prior to its use in the project.

6.75.14 Test Specimens

The contractor shall furnish the concrete necessary for casting test cylinders. The number of cylinders and tests shall be as follows:

CONCRETE PAVEMENT

Type of Test	Frequency
Gradation (aggregate)	1 per 2500 sq. yard or fraction thereof for each size aggregate
Moisture Content, fine aggregate	1 per day or as often as needed for quality control
Moisture Content, coarse aggregate	1 per day minimum where moisture content is +0.5 percent from SSD condition
Slump	1 per set of cylinders and as often as needed for quality control
Air Content	1 per set of cylinders and as often as needed for quality control
Yield and Cement Factor	1 per set of cylinders and as often as needed for quality control
Compressive Strength	1 set of four (4) cylinders per 5000 sq. yards or major fraction thereof on each day pavement is placed, with two (2) cylinders to be field-cured. One additional set shall be made if the contractor intends to open early for traffic in accordance with Section 6.48.19
Thickness	1 per 1250 linear feet each traffic lane on freshly finished concrete and as often as needed for quality control

The degree and frequencies of all concrete testing beyond normal specified frequencies, if necessary to assure quality control, shall be determined by the Public Works Director/City Engineer at the time of concrete construction. All concrete testing necessary beyond normal specified frequencies to assure quality control shall be paid for by the contractor.

6.76.00 PORTLAND CEMENT CONCRETE PAVEMENT -- EQUIPMENT

6.76.01 General

All equipment necessary for the proper preparation of the subgrade, placing, finishing, and curing of the concrete pavement shall be on the project in good working condition and shall have been inspected by the Public Works Director/City Engineer before the contractor will be permitted to begin paving operations. Throughout construction, the contractor shall maintain sufficient, adequate equipment to assure the proper execution of the work.

6.76.02 Roller

Final subgrade compaction shall be by means of a self-propelled roller having a weight on the rear wheels of the roller of not less than two-hundred-and-fifty (250) pounds per inch of tread. Vibratory rollers may be used with the permission of the Public Works Director/City Engineer. The use of rubber-tired rollers is encouraged.

6.76.03 Subgrade Planer

The subgrade planer shall have an adjustable cutting edge which shall be set to leave the subgrade at the elevation necessary to produce pavement of the thickness shown on the plans. Each end of the planer shall be supported on the forms by means of two rollers with sufficient spacing to maintain stability. The planer shall be of sufficient weight to maintain contact with the forms during planing operations. Wheels or rollers on previously-placed concrete shall be rubber-faced and shall be adjusted so that bearing on concrete shall not be less than three inches (3") from the edge of a pavement.

6.76.04 Forms

(A) Side forms shall be made of metal except on curves of less than a one-hundred-foot (100') radius where wooden forms may be used. Forms shall have base width of not less than eight inches (8") for all forms more than eight inches (8") in height. All side forms less than eight inches (8") in height shall have a base width of not less than six inches (6"). The minimum length of each section of form used shall be ten feet (10'). Each section of form shall be straight and free from bends or warps.

(B) The maximum deviation of the top surface of any section shall not exceed one-eighth inch (1/8"). The inside face shall not deviate more than one-fourth inch (1/4") from a straight line. The method of connection between sections shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross-section and strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of any equipment which they support without springing or settlement.

(C) Each ten-foot (10') length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five feet (5'), having the end brace and socket not less than six inches (6") from the end of the form.

(D) Forms that are not required to support a mechanical finishing machine, subgrade planer, or other similar heavy equipment may, upon approval of the City Engineer, be made of wood. They shall have sufficient stiffness and be so staked to remain vertical and true to lines and grade during the placing and finishing of the concrete. Straight wood forms shall have a thickness of not less than one-and-one-half inches (1-1/2"). Wood forms used at intersection radius points may be one-fourth inch (1/4") thick. All wood forms shall be dressed on the side supporting the concrete and on their upper edge.

(E) Curb forms, if used, shall be made of steel, except where returns of small radius or other special sections make the use of steel forms impractical. Back forms for curbs shall be rigidly attached to the side forms for the pavement slab using all the fastening provided by the manufacturer of the forms. Slip forms or curb mules may be used.

6.76.05 Vibrators

Vibratory units shall be capable of frequencies of not less than ten thousand (10,000) vibrations per minute in air and shall produce vibration in vertical and horizontal planes and ensure a downward vibration of an intensity as great as in other directions to provide thorough vibration through the full depth of the concrete. The unit shall be adjustable to approximately the cross-section of the finished surface. Vibration shall not be used as a means to cause concrete to flow or run into position in lieu of placing and shall not be prolonged to the point where segregation occurs.

6.76.06 Finishing Equipment

(A) A screed or template shall be used to roughly strike off the first layer of concrete to permit placing of required reinforcement in the specified position.

(B) The contractor shall furnish an approved mechanical finishing machine of the screeding and troweling type. It shall be designed and operated both to strike off and to consolidate. The finishing machine shall be of adequate strength to withstand severe use and shall be fully and accurately adjustable to make the pavement conform to the required cross-section shown on the plans. If it is necessary to operate one or both sets of wheels on previously-placed concrete, they shall be rubber-faced and shall be adjusted so that bearing on concrete will not be less than three inches (3") from the edge of the pavement.

(C) Such additional hand equipment -- including but not limited to wooden floats, straightedges, bridges, edgers, etc. required for proper finishing -- shall be furnished by the contractor.

6.76.07 Concrete Saw

When sawing joints, the contractor shall provide sawing equipment adequate in number of units and power to complete the sawing with a water-cooled diamond-edge saw blade or an abrasive wheel to the required dimensions and at the required rate. The contractor shall provide at least one stand-by saw in good working order and meeting the same requirements as stated above. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. The contractor shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and continuously during concrete placement.

6.77.00 PORTLAND CEMENT CONCRETE PAVING -- MIXING

6.77.01 General Mixing

Concrete may be mixed in a central mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are placed in the drum.

The time elapsing from the time water is added to the mix (or cement comes in contact with aggregate) until the concrete is deposited in place at the site of the work shall not exceed forty-five (45) minutes when the concrete is hauled in non-agitating trucks nor ninety (90) minutes when hauled in truck mixers or agitating trucks. The contractor may use approved mixes utilizing admixtures which conform to AASHTO M 194, latest edition, Types A, B, and D. The use of AASHTO M 194 admixtures Types C and E may be used only when specifically provided for in the contract or upon written permission from the City Engineer.

6.77.02 Stationary Mixing

When mixing or in a central mixing plant, the mixing time shall not be less than fifty (50) seconds nor more than ninety (90) seconds. Four (4) seconds shall be added to the specified mixing time if timing starts the instant the skip reaches its maximum raised position. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The volume of concrete mixed per batch may exceed the mixer's nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer, up to ten percent (10%) provided concrete test data for strength, segregation, and uniform consistency are satisfactory and provided spillage of concrete does not occur.

The batch shall be charged into the drum such that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of accumulations that may restrict the free flow of materials into the drum.

The timing device on stationary mixers shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure

of the timing device, the contractor will be permitted to operate while it is being repaired, provided he furnishes an approved timepiece equipped with minute and second hands. If the timing device is not placed in good working order within twenty-four (24) hours, further use of the mixer will be prohibited until repairs are made.

6.77.03 Ready-Mixed Concrete

The use of ready-mixed concrete in no way relieves the contractor or developer of the responsibility for proportion, mix, delivery, or placement of concrete. All concrete must conform to all requirements of these STANDARDS AND SPECIFICATIONS and ASTM C-94 and AASHTO M 157.

The City shall have free access to the mixing plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate. (The contractor will collect delivery, or batch, tickets from the driver for all concrete used on the project and deliver them to the Public Works Director/City Engineer.) Batch tickets shall provide the following information:

(A) Weight and type of cement

(B) Weights of fine and coarse aggregates

(C) Volume (in gallons) of water, including surface water on aggregates

(D) Quantity (cubic yards) per batch

(E) Times of batching and discharging of concrete

(F) Name of batch plant

(G) Name of contractor

(H) Type of mixture (mix designations code)

(I) Name and amount of admixture

(J) Date and truck number

6.77.04 Mixing Proportions of Concrete Materials

Proportioning shall conform to the requirements for Class P concrete as described in Table 6.77.04. When small quantities of pavement are involved (1000 square feet or less), Class A, AX, or B may be used in lieu of Class P upon approval of the Public Works Director/City Engineer. The design mixes are described in Table 6.77.04.

Upon review by the Public Works Director/City Engineer, the contractor shall have the option of substituting approved fly ash for Portland cement in any class concrete mentioned above up to a maximum of twenty percent (20%) by weight. The total weight of cement plus fly ash shall not be less than the minimum weight for cement content as shown in Table 6.77.04. Where the voluntary use of fly ash by the contractor results in delays, necessary changes in admixture quantities or admixture source, or unsatisfactory work, the costs of such delays, changes, or corrective actions shall be borne by the contractor. In the event the finished concrete is unsuitable for its intended purpose, the use of fly ash shall be discontinued.

TABLE 6.77.04
Concrete Table

	Concrete Class	A	AX	B	(k)P
LABORATORY	DESIGN MINIMUM [a] COMPRESSIVE STRENGTH 28 days (45 days for Type V cement) Pounds Per Square Inch	3750	3750	3750	3750
	CEMENT CONTENT (Cement Factor) Range (Pounds Per Cubic Yard):				
	Minimum --	550	600	550	550
	Maximum --	600	700	600	600
	WATER CEMENT RATIO (Pounds of Water Per Pounds of Cement):	0.500	0.500	0.530	0.480
	PERCENT ENTRAINED & ENTRAPPED AIR (Total Range):	4-7	5-8	5-8	4-7
COARSE	CONSISTENCY AASHTO DESIGNATION T-119 [b] -- Range in Inches:	2-4	1-3	1-4	1-3
	AGGREGATE AASHTO DESIGNATION M-43 -- Size Number:	467	(f)	67	467 357
FINE	AGGREGATE AASHTO DESIGNATION M-6 -- Percent Total Aggregate Range:	34-39	(f)	37-44	34-38 33-38

[a] Not a field specification requirement. The desired minimum field strength is 80 percent of the specified laboratory strength.

[b] The point of acceptance for consistency requirements will be at the mixer discharge for transit-mixed concrete.

6.77.05 Limitations of Mixing

Concrete shall be mixed, placed, and finished only when the natural light is sufficient unless an adequate and approved artificial lighting system is provided. Unless authorized in writing by the Public Works Director/City Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches forty degrees Fahrenheit (40°F) and not resumed until an ascending air temperature in the shade and away from artificial heat reaches thirty-five degrees Fahrenheit (35°F).

When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might injure the materials. Unless otherwise authorized by the Public Works Director/City Engineer, the temperature of the mixed concrete shall not be less than fifty degrees Fahrenheit (50°F) and not more than eighty degrees Fahrenheit (80°F) at the time of placing it in the forms.

If the air temperature is thirty-five degrees Fahrenheit (35°F) or less at the time of placing concrete, it will be required that the water and/or the aggregate be heated to not less than seventy degree Fahrenheit (70°F) nor more than one-hundred-fifty degrees Fahrenheit (150°F). Concrete shall not be placed on frozen subgrade nor shall frozen aggregates be used in the concrete. In concreting operations during the summer months, maximum temperature of the mixed concrete shall not exceed ninety degrees Fahrenheit (90°F).

In cold weather, aggregates and water may be heated as part of the batching operation but they shall not be heated beyond a temperature of one-hundred-fifty degrees Fahrenheit (150°F). Aggregates shall not be heated directly by gas or oil flame or on sheet metal over direct flame. Materials containing frost or lumps of frozen material shall not be used in the mix, and their presence in the concrete shall be cause for rejection of that batch.

6.78.00 PCCP MUDJACKING

6.78.01 Description

Raise and support the existing portland cement concrete pavement (PCCP) by drilling injection holes and pumping a grout or polyurethane material under the pavement slab as shown in the Contract Documents.

BID ITEMS	UNITS
Cement (Mudjacking)	Square Foot (SF)
Area of complete stone to be leveled	

6.78.02 Materials

a. Grout. Provide materials that comply with the applicable requirements.

Portland Cement (Type I or II) **Section 6.75.01(C)**

Non-Expansive Cementitious Grout

a. Provide material that complies with ASTM C 1107 or Corps of Engineers CRD-C 621.

b. For self-contained grouts, provide material complying with:

Property	Test Method	Requirement
Soaking Time		1 to 3 min.
Initial Set Time, min.	ASTM C 1102	20 min.
Compressive Strength. 28-day min	ASTM C 39	4,000 psi
Shrinkage	ASTM C 1090	0.00%
Expansion	ASTM C 1090	1.5%
Pull Out Strength	ASTM E 488	9,000 lbf
Freeze-Thaw, min.	ASTM C 666, 300 cycles	95%

6.78.03 Submittals

a. Contractor must submit the following to Engineer for material approval

(1) A complete description, literature, and set of instructions and recommendations,
(2) A copy of test results performed in accordance with ASTM C 1107 or CRD-C 621,
(3) Certificate stating results comply with ASTM C 1107 or CRD-C 621, and
(4) Material Safety Data Sheets (MSDS).

Mix the water, portland cement (not less than 25% by volume of solids) and fly ash (75% by volume of solids) into a cement/fly ash grout complying with **TABLE 1**:

TABLE 1: GROUT FOR MUDJACKING		
Property	**Test Method**	**Value**
Fluidity (efflux time)	ASTM C939	16 to 36 seconds
7-Day Compressive Strength	ASTM C942	600 psi minimum

Submit to the Engineer the results of tests conducted on the design mix by a certified testing laboratory. Provide test results for 1, 3, and 7 day strengths, fluidity, time of initial set (ASTM C 266), and shrinkage and expansion observed (ASTM C 940).

Use admixtures only with written approval from the Engineer.

The Engineer will accept the fly ash grout on the results of the compressive strength and visual inspection of the mixture placed on the project.

6.78.04 Construction Requirements

a. Specialty Contractor Prequalification. The Specialty Contractor must be regularly engaged in work similar to this project in difficulty and/or scope, and document that the company has performed a minimum of the following work in the United States:

- Provided all supervision, labor, material, and equipment necessary to successfully complete 10 separate projects.

- Provide reference contact names and their telephone numbers as part of this submittal.

Submit the specialty contractor's qualifications to the City Engineer for approval. The Engineer will approve or deny the specialty contractor's qualifications.

b. Weather and Seasonal Limitations. Do not mudjack the PCCP if the pavement surface temperatures are below 35°F, if the subgrade or base course is frozen, or if the subgrade is saturated from recent rainfall, as evidenced by standing water on the pavement or in the joints or cracks.

Mudjacking operations may start when the pavement surface temperature is above 35ºF, the ambient air temperature is 35ºF and rising and is expected to exceed 40ºF. Discontinue paving when the ambient air temperature falls below 40ºF. Do not place when it is raining or snowing.

c. Drilling Holes. Submit a hole pattern and pumping sequence to the Engineer. Do not damage the existing reinforcing steel in the pavement. Before drilling the holes, determine the location of reinforcing steel.

Drill holes vertically and round to the maximum diameter 1 to 1½ inch**.** Drill to a depth sufficient to penetrate the base and into the subgrade material. Holes may be washed to create a small cavity, allowing initial spread of material. Drill the holes in a manner preventing breakout at the bottom of the pavement. Do not put downward force on the drill that exceeds 200 lbf.

d. Pavement Mudjacking.

(1) General. Use a string line or monitoring equipment to create a smooth profile. Raise PCCP by injecting grout or polyurethane material within ± ¼ inch of adjacent unjacked PCCP as shown in the Contract Documents. Replace all slabs raised more than ½ inch greater than adjacent PCCP. Grind all slabs raised more than ¼ inch and less than ½ inch. Grade tolerances are applicable to both transverse and longitudinal grades.

Begin the injection as soon as practicable after mixing the material. Do not use material held in the mixer or injection sump pump for more than 1 hour after mixing. Do not add water to the material after the initial mixing.
Inject the mudjacking material in the submitted pattern sequence, and in the quantity required to fill voids under the PCCP.

Cease injection when material appears at any joint, crack or adjacent hole, or when monitoring devices indicate slab movement.

Prevent grout material from being injected into any drainage facility or other open structure.
Prevent excessive loss of material through cracks, joints, other drilled holes or back pressure.

Replace slabs in which cracks emanate radially from the injection holes and in slabs where cracks develop between adjacent injection holes.

(2) Grout. Connect an expanding rubber packer, or other approved device, to the end of the grout plant discharge hose. Place the expanding rubber packer in the injection hole, being careful not to extend the discharge end of the rubber packer below the lower surface of the PCCP.

Produce grout slurry to a 12 second flow cone time. Pump the grout into the holes using an injection pump with a pressure capability of 250 to 300 psi when pumping grout slurry mixed to a 12 second flow cone time.
Cease injection at a hole when grout flow does not occur after 7 seconds of sustained 150 psi gauge pressure, and there is no indication of slab movement.

Prior to grout drying on the drilled holes, fill the holes with a fast setting sand/cement mixture or other patching material approved by the Engineer.

6.78.05 Measurement and Payment

The Engineer will measure mudjacking by the square foot.
Monitoring for pavement lift and injection holes are subsidiary to the bid items mudjacking.

Payment for "Mudjacking", at the contract unit prices is full compensation for the specified work. No adjustment in contract unit prices will be made regardless of the amount of underruns or overruns.

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CHAPTER 7
CONCRETE

7.00.00 INTRODUCTION

7.01.00 GENERAL

This specification enumerates the requirements for the materials, storage, transportation, measuring, mixing, placing, and curing of Portland cement concrete. This specification applies to all Portland cement concrete used in sidewalks, driveways, approaches, patches, manholes, inlets, and other structures constructed in the City of Fort Lupton. Specifications for Portland cement concrete pavement are in Chapter 6 of these STANDARDS AND SPECIFICATIONS. Engineering plans, licenses, permits, inspection, warranty, and acceptance shall be as detailed in these STANDARDS AND SPECIFICATIONS for the applicable type of construction involved. Permits shall be obtained before work begins. The contractor shall contact the Engineering Division twenty-four (24) hours in advance of concrete placement when the form work is ready to receive the concrete. Where required, compaction test results shall verify the adequacy of all ground upon which concrete is to be placed.

7.20.00 PLACING CONCRETE

7.20.01 Preparation

Before depositing concrete, debris shall be removed from the space to be occupied by the concrete and the forms. Concrete shall not be placed until all forms and reinforcing steel have been inspected and approved by the Public Works Director/City Engineer. The soil receiving the concrete shall be moist, but not wet, and shall not contain frost or frozen material.

7.20.02 Timing

Concrete which has developed initial set or does not have workable consistency shall not be used. Concrete shall be continuously mixed or agitated from the time the water is added until the time of use, and shall be completely discharged from the truck mixer or truck agitator within one-and-one-half (1-1/2) hours after it comes in contact with the mixing water or with the aggregates. Retempered concrete will not be allowed.

7.20.03 Concrete Temperature

At the time of concrete placement, the mix temperature shall be between fifty degrees Fahrenheit (50°F) and ninety degrees Fahrenheit (90°F). In cold weather (see Section 7.11.06), aggregates and water may be heated as part of the batching operation but they shall not be heated beyond a temperature of one-hundred-and-fifty degrees Fahrenheit (150°F). Aggregates shall not be heated directly by gas or oil flame or on sheet metal over direct flame. Materials containing frost or lumps of frozen material shall not be used in the mix, and their presence in the concrete shall be cause for rejection of that batch.

7.20.04 Handling

(A) Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods which prevent separation or loss of ingredient. The concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling.

Concrete shall be deposited in continuous layers, the thickness of which generally shall not exceed twelve inches (12"). Concrete shall be placed in one continuous operation, except where keyed construction joints are shown on the plans or as approved by the Public Works Director/City Engineer. Delays in excess of thirty (30) minutes may require removal and replacement of that pour, as determined by the City Engineer.

(B) Concrete shall be placed in a manner that will avoid segregation and shall not be dropped freely more than five feet (5'). If segregation occurs, the Public Works Director/City Engineer may require the concrete to be removed and replaced at the contractor's expense. Necessary hand spreading shall be done with shovels and not with rakes.

(C) Concrete shall be thoroughly compacted or vibrated. All concrete shall be compacted by internal vibration using mechanical vibrating equipment, except that concrete in floor slabs, sidewalks, or curb and gutter, not poured against form linings, shall be either tamped or vibrated. Care shall be taken in vibrating the concrete to vibrate only long enough to bring a continuous film of mortar to the surface. Vibration shall stop before any segregation of the concrete occurs. Mechanical vibrators shall be an approved type as specified in ACI Publication 309, Chapter 5. Vibrators shall not be used to move or spread the concrete. Any evidence of lack of consolidation or over consolidation will be regarded as sufficient reason to require the removal of the section involved and its replacement with new concrete at the contractor's expense. The contractor shall be responsible for any defects in the quality and appearance of the completed work.

7.20.05 Workability

The consistency of concrete shall be kept uniform for each class of work and shall be checked by means of a slump tests or Kelly ball tests. The workability of the concrete will be varied as directed by the City Engineer. At all times, concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels, and tie bars by the construction methods which are being used without excessive spading, segregation, or undue accumulation of water or laitance on the surface. If, through accident, intention, or error in mixing, any concrete that fails to conform to the proportions of the approved mix design, such concrete shall not be incorporated in the work but shall be discarded off the project site as waste material at the contractor's expense. NO WATER MAY BE ADDED AT THE JOB SITE WITHOUT PERMISSION OF THE CITY ENGINEER or his representative. If approval is obtained and water is added at the job site, slump tests shall be run and test cylinders cast following the addition of the water. Any expense incurred in excess of ordinary tests will be borne by the contractor.

7.20.06 Weather Restrictions

(A) Hot Weather:

Except by written authorization, concrete will not be placed if the temperature of the plastic concrete cannot be maintained at ninety degrees Fahrenheit (90^{o}F) or lower. The placement of concrete in hot weather shall comply with ACI 305. Refer also to Section **7**.11.03 of these STANDARDS AND SPECIFICATIONS.

(B) Cold Weather:

During extreme weather conditions, placing of concrete will be permitted only when the temperature of the concrete placed in the forms will not be less than sixty degrees Fahrenheit (60°F), nor more than ninety degrees Fahrenheit (90°F). To maintain this temperature range, the contractor shall provide acceptable heating apparatus for heating the aggregates and the water. Concrete slabs shall not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing will not be allowed. Concrete which has been frozen shall be completely removed and replaced as directed by and to the satisfaction of the Public Works Director/City Engineer.

Concrete may be placed when the air temperature in the shade is at least forty degrees Fahrenheit (40°F) and rising. No concrete shall be placed, regardless of the present temperature, when the weather forecast promises freezing weather before final set of the concrete unless special means of heating and protection are used. Protection against freezing is the contractor's responsibility regardless of the weather forecast or climatic conditions at the time of placing. During cold weather conditions, concrete less than seventy-two (72) hours old shall be protected as follows:

TABLE 7.20.06

Forecast Low Temperature (by the National Weather Service)	Protection
Between 40 and 32 Degrees	One layer of plastic or burlap
Between 31 and 25 Degrees	One layer of plastic and one layer of burlap, or two layers of burlap
Below 25 Degrees	Six inches (6") of hay or straw and two layers of plastic or burlap in addition to regular curing method, or equivalent commercial insulating material in addition to regular curing method

These coverings must remain in place until the concrete is at least five (5) days old. When straw is required on concrete, and the concrete is cured with only curing compound, the fresh concrete shall be covered with a layer of burlap or plastic before application of straw. Heated enclosures may be utilized in lieu of protection requirements cited above. If used, such enclosures shall be maintained for seven (7) days.

7.20.07 Jointing

(A) Expansion Joints:

Expansion joint material shall be provided at the following locations and shall be in place prior to the placing of concrete:

1. Between new concrete and existing masonry buildings

2. As shown on the drawings

3. As directed by the City Engineer

(B) Contraction Joints:

Transverse joints shall be placed at maximum intervals of ten feet (10') to control random cracking. Joints shall be formed, sawed, or tooled to a minimum depth of one-third (1/3) of the total thickness, but no less than 1.5 inches. Contraction joints shall be placed as follows:

1. Not more than ten feet (10') nor less than six feet (6') apart in curb and gutter and combination curb-walk.

2. Not more than the walk width in non-monolithic concrete sidewalk.

3. At least two joints equally spaced at not greater than ten-foot (10') intervals as applicable in driveways.

4. As approved and shown on the plans for special concrete structures.

7.20.08 Finishing and Curing

In addition to the curing techniques unique to hot and cold weather placement, adequate attention shall be given to finishing and curing the fresh concrete. Exposed faces of curbs and sidewalks shall be finished to true line and grade, as shown on the plans. The surface shall be floated to a smooth, but not slippery, finish. The addition of surface water to assist in the finishing process is prohibited. Sidewalk and curb shall be broomed or combed and edged, unless otherwise indicated by the Public Works Director/City Engineer. After completion of brooming and before concrete has taken its initial set, all edges in contact with the forms shall be tooled with an edger having a three-eighths-inch (3/8") radius. No dusting or topping of the surface or sprinkling with water to facilitate finishing will be permitted.

Immediately following the removal of the forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed or are not to be waterproofed. On all surfaces cavities produced by form ties, honeycomb spots, broken corners or edges, and other defects shall either be thoroughly cleaned, moistened with water, and carefully pointed and trued with a mortar consisting of cement and fine aggregate or removed and replaced at the direction of the Public Works Director/City Engineer. The surface shall be left sound, smooth, even, and uniform in color. Mortar used in pointing shall not be more than thirty (30) minutes old. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

Fresh concrete shall be adequately protected from weather damage and mechanical injury during the curing periods. The selected curing process shall be started as soon as it can be done without injury to the concrete surface. The use of a membrane-curing compound is recommended. The following curing procedures may be used subject to the approval of the Public Works Director/City Engineer.

(A) Wet Burlap Curing:

After completion of the finishing operations, the surface of the concrete shall be entirely covered with burlap mats. The mats used shall be in such length or width that as laid they will extend at least twice the thickness of the concrete beyond the edges of the slab or

structure. They shall be placed so that the entire structure and all edges of the concrete, when forms are removed, are completely covered. This covering shall be placed as soon as the concrete has set sufficiently to prevent marring of the surface. After being placed, the mats shall be thoroughly saturated with water by spraying with a mist spray. The burlap shall be so placed and weighted down so it remains in contact with the surface covered, and the covering shall be maintained fully wetted and in position for seven (7) days after the concrete has been placed. If it becomes necessary to remove the burlap for any reason, the concrete shall not be exposed for a period of more than one-half (1/2) hour. This method of curing shall not be used when the outside air temperature is below thirty-two degrees Fahrenheit (32^{o}F) unless heated enclosures are provided.

(B) Plastic Sheet Curing:

As soon after the completion of the finishing operation as the concrete has set sufficiently to prevent marring of the surface, the top surface and sides shall be entirely covered with plastic sheet materials. The plastic sheet as prepared for use shall have such dimensions that each unit as laid will extend beyond the edges of the concrete at least twice the thickness of the concrete. The units as used shall be lapped at least twelve inches (12"), and the laps of plastic sheet shall be secure such that they do not open up or separate. The plastic shall be placed and weighted so it remains in contact with the surface covered, curing the entire curing period of seven (7) days.

(C) Waterproof Paper Curing:

The procedures used for plastic sheet curing shall be used when waterproof paper is used in curing concrete.

(D) Liquid Curing Membrane:

Immediately after the surface water has disappeared from the concrete surface, the liquid membrane curing compound (white pigmented) shall be sprayed under pressure to the concrete surface at a rate not less than one (1) gallon per one-hundred-fifty (150) square feet with a spray nozzle, or nozzles, so it covers the entire pavement with a uniform water-impermeable film. If the forms are removed within seven (7) days, the exposed sides and edges shall be sprayed in the above-described manner or the backfill completed immediately.

(E) Insulation Pad:

Insulation pads or other thermal devices may be used to protect concrete in cold weather.

(F) Wax base and resin base solutions shall not be used if linseed oil protection is to be applied to the concrete surface. If linseed oil protection is to be utilized, the method of curing shall be either linseed oil base curing compound, wet burlap, plastic sheet, or waterproof paper curing.

7.20.09 Testing of Concrete

The requirements of this section shall apply to testing services for all concrete curb and gutter, sidewalk, slope paving, retaining walls, structures, and for all miscellaneous concrete testing. Testing for concrete pavement shall be in accordance with Chapter 5 of these STANDARDS AND SPECIFICATIONS.

The contractor shall furnish the concrete necessary for casting test cylinders. The number of cylinders and tests shall be as follows:

Type of Test	Frequency
Gradation (aggregate)	1 per 2500 square yards, or fraction thereof, for each size aggregate
Moisture Content (fine aggregate)	1 per day or as often as needed for quality control
Moisture Content (course aggregate)	1 per day minimum where the moisture content is plus 0.5 percent from SSD condition
Slump	1 per set of cylinders and as often as needed for quality control
Air Content	1 per set of cylinders and as often as needed for quality control
Yield and Cement Factor	1 per set of cylinders and as often as needed for quality control
Compressive Strength	1 set of four (4) cylinders per 100 cubic yards or major fraction thereof on each day concrete is placed; 2 cylinders to be field cured
Thickness	1 per 1250 linear feet each traffic lane on freshly finished concrete and as often as needed for quality control

The degree and frequencies of all concrete testing beyond normal specified frequencies, if necessary to assure quality control, shall be determined by the Public Works Director/City Engineer at the time of concrete construction. All concrete testing necessary shall be paid for by the Contractor/ Developer.

7.20.10 Repairs

After stripping of the forms, if any concrete is found to be not formed as shown on the drawings or is out of alignment or level or shows a defective surface, it shall be considered as not conforming with the intent of these STANDARDS AND SPECIFICATIONS and shall be removed and replaced by the contractor at his expense unless the Public Works Director/City Engineer gives written permission to patch the defective area. In this case, patching shall be done as described in the following paragraphs. Defects that require replacement or repair are those that contain honeycomb, damage due to stripping of forms, loose pieces of concrete, bolt holes, tie-rod holes, uneven or excessive ridges at form joints, and bulges due to movement of the forms and other deficiencies noted in Section 10.40.06. Ridges and bulges shall be removed by grinding. Honeycombed and other defective concrete that does not affect the integrity of the structure shall be chipped out and the vacated areas shall be filled in a manner acceptable to the Public Works Director/City Engineer. The repaired area shall be patched with a non-shrink, non-metallic grout with a minimum compressive strength of five thousand (5000) psi in twenty-eight (28) days. All repair areas treated with an epoxy bonding agent shall have the approval of the Public Works Director/City Engineer before the repair filling is placed.

Bolt holes, tie-rod holes, and minor imperfections as approved by the City Engineer shall be filled with dry-patching mortar composed of one (1) part Portland cement to two (2) parts of regular concrete sand (volume measurement) and only enough water so that after the ingredients are mixed thoroughly the mortar will stick together on being molded. Mortar repairs shall be placed in layers and thoroughly compacted by suitable tools. Care shall be taken in filling rod and bolt holes so that the entire depth of the hole is completely filled with compacted mortar. The mortar mix proportions described above are approximate.

An approved mix shall be prepared by a commercial testing laboratory to insure that grout has a twenty-eight (28) day compressive strength equal to that of the area on which it is placed. All costs for mix design and testing shall be paid by the contractor. Those areas with excessive deficiencies as determined by the Public Works Director/City Engineer shall be removed and replaced at the contractor's expense. Where repairs are made in existing sidewalks, all edges of the old sidewalk allowed to remain shall be saw-cut to a minimum depth of two inches (2"). No rough edges will be permitted where new construction joins the old section. Unless directed by the Public Works Director/City Engineer, no section less than five feet (5') in length shall be placed or left in place. Where new sidewalk construction abuts existing sidewalks, the work shall be accomplished so that there is no abrupt change in grade between the old section and the new work.

7.30.00 MATERIAL SPECIFICATIONS

7.31.00 CONCRETE MIX DESIGN

Concrete shall be classed according to Table 6.77.04 in Chapter 6 of these STANDARDS AND SPECIFICATIONS. Project application of the different concrete classes shall be as follows:

Concrete Pavement	--	See Chapter 6 of these STANDARDS AND SPECIFICATIONS
Concrete Sidewalk	--	Class B
Concrete Curb and Gutter	--	Class B
Concrete Structures	--	Class A, B, or D as designed
Precast Products	--	Refer to Materials Section of appropriate chapter

7.32.00 CONCRETE MATERIALS

Concrete shall be composed of Portland cement and aggregate and water and shall be reinforced with steel bars, steel strands, or steel-wire fabric where required. No admixture other than air-entraining agents shall be used without written permission of the Public Works Director/City Engineer.

7.32.01 Cement

Portland Cement shall conform to the requirements of the following specifications for the type specified or permitted:

Type	Specification
Portland Cement, Type I, II, III	ASTM C 150, AASHTO M 85
Air-Entraining Portland Cement	AASHTO M 134
Masonry Cement	AASHTO M 150

In general, Type II cement shall be used in concrete which will be in contact with the soil unless otherwise allowed or directed by the Public Works Director/City Engineer. Unless otherwise permitted by the Public Works Director/City Engineer, the product of only one (1) mill of any one brand and type of Portland cement shall be used on the project, except for reduction of any excessive air entrainment, where air-entrainment cement is used. The contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which for any reason has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used.

7.32.02 Aggregate

Aggregate for concrete shall be proportioned in conformance with Table 6.75.01 in Chapter 6 of these STANDARDS AND SPECIFICATIONS.

(A) Coarse Aggregate:

The coarse aggregate shall consist of broken stone or gravel composed of clean, hard, tough, and durable stone and shall be free from soft, thin, elongated, or laminated pieces, disintegrated stone, clay, loam, vegetable, or other deleterious matter. Coarse aggregate for concrete shall conform to the requirements of AASHTO M 80, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO T 96.

(B) Fine Aggregate:

Fine aggregate shall be composed of clean, hard, durable, uncoated particles of sand, free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall be well-graded from course to fine and, when tested by means of laboratory sieves, shall meet the grading requirements of Table 6.75.01 in Chapter 6 of these STANDARDS AND SPECIFICATIONS.

7.32.03 Water

Water used in mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substance injurious to the finished product. Water shall be tested in accordance with and shall meet the suggested requirements of AASHTO T 26. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be so enclosed to exclude silt, mud, grass, or other foreign materials.

7.32.04 Admixtures

The contractor shall use air-entraining admixtures for all concrete that will have exposed surfaces. The contractor may elect to use another admixture provided the admixture is specifically approved by the Public Works Director/City Engineer. Documentary evidence of acceptability will be required when new or unknown admixtures are proposed for use. Air-entraining admixtures shall conform to the requirements of ASTM C 260.

7.33.00 REINFORCING STEEL

Reinforcing steel shall conform to the requirements of the following specifications:

(A)	Deformed and plain billet-steel bars for concrete reinforcement	AASHTO M 31
(B)	Axle-steel deformed and plain bars for concrete reinforcement	AASHTO M 53
(C)	Fabricated steel bar or rod mats for concrete reinforcement	AASHTO M 54

D)	Welded steel-wire fabric for concrete reinforcement	AASHTO M 55
E)	Welded deformed steel wire fabric	AASHTO M 221
F)	Epoxy coated rebar	AASHTO M 284

Unless otherwise designated, bars conforming to AASHTO M 31 and M 53 shall be furnished in Grade 60 for No. 5 bars and larger and Grade 40 or 60 for bars smaller than No. 5. In AASHTO M 54, bar material conforming to AASHTO M 42 will not be permitted.

7.34.00 CURING MATERIALS

Curing materials shall conform to the following requirements:

A)	Burlap cloth made from Jute or Kenaff	AASHTO M 182
B)	Sheet materials for curing concrete	AASHTO M 171
C)	Liquid membrane-forming compounds for curing concrete (white pigmented)	AASHTO M 148

Straw used for curing shall consist of threshed straw of oats, barley, wheat, or rye. Clean field or marsh hay may be substituted when approved by the Public Works Director/City Engineer. Old dry straw or hay which breaks readily in the spreading process will not be permitted.

7.35.00 FORM WORK

Whenever necessary, forms shall be used to confine the concrete and shape it to the required lines. Forms shall have sufficient strength to withstand, without deformation, the pressure resulting from placement and vibration of the concrete. Forms shall be constructed so that the finished concrete will conform to the shapes, lines, grades, and dimensions indicated on the approved plans. Any form which is not clean and has not had the surface prepared with a commercial form oil that will effectively prevent bonding and that will stain or soften concrete surfaces shall not be used. Plywood forms, plastic coated plywood forms, or steel forms shall be used for all surfaces requiring forming which are exposed to view, whether inside or outside any structure. Surfaces against backfilled earth, interior surfaces, of covered channels, or other places permanently obscured from view may be formed with forms having substandard surfaces.

Forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal without damaging the concrete or until the forms are not required to protect the concrete from mechanical damage. Minimum time before removal of forms after placing concrete shall be one (1) day for footings and two (2) days for all other concrete except curbs, gutters, and sidewalks.

7.36.00 JOINTING MATERIAL

Joint materials will conform to AASHTO specifications according to type as follows:

(A)	Concrete joint sealer, hot-poured elastic	M 173
(B)	Performed expansion joint filler (bituminous type)	M 33

(C)	Performed sponge rubber and cork expansion joint fillers	M 153
(D)	Performed expansion joint fillers (non-extruding and resilient bit)	M 213

7.37.00 BATCHING AND MIXING

7.37.01 General

All concrete shall be thoroughly mixed in a batch mixer of an approved type and capacity for a period of not less than two (2) minutes after all the materials, including the water, have been placed in the drum. During the period of mixing, the drum shall be operated at the speed specified by the manufacturer of the equipment. The entire contents of the mixer shall be discharged before recharge, and the mixer shall be cleaned frequently. The concrete shall be mixed only in such quantities that are required for immediate use. No retempering of concrete will be permitted. Hand-mixed concrete will not be permitted except by written approval of the Public Works Director/City Engineer and then in only very small quantities or in case of an emergency.

7.37.02 Proportioning the Mix

Proportioning the dry constituents of all concrete mixtures shall be accomplished by weighing. The supplier shall provide adequate and accurate scales for this work. There shall be no variance permitted in the minimum cement factor (sacks per cubic yard) as specified for the classes of concrete. The total quantity of mixing water per sack of cement, including free water in the aggregate, shall not exceed the minimum specified herein. The supplier shall be responsible for developing the proper proportions of aggregates, cement, and water that will conform to the various requirements of these STANDARDS AND SPECIFICATIONS.

7.37.03 Ready-Mixed Concrete

The use of ready-mixed concrete in no way relieves the contractor or developer of the responsibility for proportion, mix, delivery, or placement of concrete. All concrete shall conform to all requirements of these STANDARDS AND SPECIFICATIONS and ASTM C 94 and AASHTO M 157.

The City shall have free access to the mixing plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate. The contractor shall collect delivery or batch tickets from the driver for all concrete used on the project and deliver them to the Public Works Director/City Engineer. Batch tickets shall provide the following information:

(A) Supplier's name and date
(B) Truck number
(C) Project number and location
(D) Concrete class designation
(E) Cubic yards batched
(F) Time batched
(G) DOH mix design number
(H) Type, brand, and amount of cement and fly ash
(I) Brand and amount of any admixture
(J) Weights of fine and coarse aggregates
(K) Moisture content of fine and coarse aggregates
(L) Gallons of batch water (including ice)
(M) Gallons of water added by truck operator.

Provide the following titles with blank space to record information:

(N) Discharge time
(O) Water-cement ratio
(P) Air content
(Q) Slump
(R) Revolutions

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CHAPTER 8
TRAFFIC CONTROL

8.00.00 INTRODUCTION

8.01.00 GENERAL

The standards contained in this chapter regulate all improvements and private work to be dedicated to the public and accepted by the City and all work within the public right-of-way. They are intended to provide for adequate, coordinated, modern development with required facilities to serve and protect the potential users of the various areas of the community.

The standards in this chapter apply to new developments which are not constrained by already existing improvements. This chapter is not to be applied without qualification to in-fill development. In-fill development in an urban area is often constrained by existing improvements. To the extent deemed possible by the City, in-fill developments shall be required to conform to these STANDARDS AND SPECIFICATIONS. The City may allow modification of these STANDARDS AND SPECIFICATIONS when necessary to allow private and public construction which is compatible with surrounding in-place improvements.

8.20.00 CONSTRUCTION STANDARDS

8.21.00 TRAFFIC SIGNALS

8.21.01 General Requirements

The work specified in this section describes the installation of necessary material and equipment to complete traffic signals and/or other electrical systems as specified on the drawings, in the special contract provisions, or herein.

8.21.02 Traffic Control and Street Closure

The contractor will be required to maintain access to all private drives throughout the period of construction for this project. The contractor shall be required to erect and maintain all barricades, traffic control signs, cones, and other traffic control items necessary to provide proper traffic control during construction. The contractor shall submit three (3) copies of the traffic control plan to the Public Works Director/City Transportation Engineer for approval 72 hours prior to beginning construction. At the completion of the project the contractor shall remove all barricades, traffic control signs, cones and other necessary construction traffic control items and return all areas or permanent traffic control devices damaged during construction to their original condition at no cost to the City. Traffic control signs and devices shall be in accordance with Part VI of the "Manual on Uniform Traffic Control Devices for Streets and Highways", 1988 Edition, Revision 3 dated September 3, 1993, published by the Federal Highway Administration, and as directed by the Engineer.

8.21.03 Testing

The City may at its option and cost retain the services of an independent testing lab to perform all testing consultation and to assist in the review of the work and equipment.

8.21.04 Intersection Power

The contractor shall notify the Public Works Director/engineer two (2) weeks prior to the signal turn-on so that orders may be issued for power connection to the intersection on the specified turn-on date.

8.21.05 Equipment Salvage

All traffic signal equipment which is removed shall remain the property of the City. Such property is to be removed from the work site and returned by the contractor to the City of Fort Lupton Municipal Service Center located at 800 12th St/.

8.21.06 Existing Traffic Signals

When existing traffic signal installations are modified or completely rebuilt, the contractor shall avoid disturbing existing traffic signal equipment until the new or modified traffic signal system has been installed and put into operation. If the existing traffic signal equipment must be removed to accommodate the new construction, the contractor shall, with the engineer's approval and at the contractor's sole expense, install temporary overhead traffic signal equipment. The contractor shall at all times maintain a minimum of two (2) three-section (red, yellow, and green) traffic signal heads for each roadway approach.

8.21.07 Signal Heads

Signal heads installed on standards or poles at new signal locations which are not ready for actual electrical operation shall be bagged.

8.21.08 Field Location

All loops, poles, control cabinets, pull box locations, and pole foundations shall be field located by the engineer. Traffic signal poles and mast arms shall not be ordered until field verification of pole foundations is complete.

8.21.09 Utilities

All utilities shall be shown on the maps to the extent that they can, based upon utility records, surface field indications and proposed installations. During the progress of the work, all utility locations and elevations will necessarily require field verification in cooperation with the affected companies and public agencies. The contractor shall be responsible for locating all valve boxes, manholes, etc., and insuring that they are properly protected and/or adjusted.

8.21.10 Notification of Work

The contractor shall work only on weekdays between the hours of 8:30 a.m. and 4:00 p.m. The contractor must receive written approval from the engineer to work at any other time.

8.22.00 REGULATIONS AND CODE

All electrical equipment and material shall conform to the standards of the National Electrical Manufacturers Association (NEMA), U.S. West Communications Company or the Colorado State Highway Department, whichever is applicable. In addition to requirements of these specifications, the plans, the special contract provisions, all material, and work shall conform to the requirements of the National Electrical Code (hereinafter referred to as the "Code"), the Rules for Overhead Electrical Line Construction of the Public Utilities Commission, the Standards of the American Society for Testing Materials (ASTM), the American Standards Association (ASA), and any local ordinance which may apply. Wherever reference is made in these specifications or in the special contract provisions to the code, rules, or the standards mentioned above, the reference shall be construed to mean the code, rule, or standard that is in effect at the date of bidding.

8.23.00 EQUIPMENT LIST AND DRAWINGS

The contractor shall submit a list of equipment and material which he proposes to furnish within five days of the execution of the owner-contractor agreement. The submittal shall including all equipment and material as identified on the plans or in the specifications by the manufacturer's name which is necessary or customary in the trade to identify such equipment and material. The list shall be complete as to name of manufacturer, unit size, material composition and shall be supplemented by such other data as may be required by the Public Works Director/City Transportation Engineer.

Inspection or sampling of any materials, other than those already approved, according to the material specifications must be made by the engineer or his designee prior to installation. If the contractor proposes a substitution of equipment called for in the plans or specifications, he shall provide additional information to prove the substitution item is of equal or superior quality. Any material and/or equipment installed by the contractor that is not in conformance with the City of Fort Lupton specifications will be removed or changed at the contractor's expense. Upon completion of the work, the contractor shall submit an "as-built" or corrected plan showing, in detail, all construction changes including, but not limited to, wiring, cable, and location and depth of conduit.

8.24.00 EXCAVATING AND BACKFILLING

Excavations for the installation of conduit, foundations, and other traffic signal items shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks, and other improvements. The trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. Excavating shall not be performed until immediately before installation of conduit and other appliances. The material from the excavation shall be removed as the trenching progresses.

Trenches in existing or proposed roadways shall be backfilled with concrete or approved flow-fill material. After backfilling all trenches shall be kept well filled and maintained in a smooth and well-drained condition until permanent repairs are made.

Excavations in streets or highways shall be performed in such a manner that one (1) lane of traffic in each direction shall be open to public traffic. All lane closures shall be approved by engineer prior to closure. At the end of each day's work and any other time construction operations are suspended, all construction equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic. When excavations must remain open overnight, they shall be properly marked to warn motorists and/or pedestrians according to guidelines established in the "Manual on Uniform Traffic Control Devices for Streets and Highways" latest edition.

8.25.00 REMOVING AND REPLACING IMPROVEMENTS

The contractor shall at his sole expense, replace or reconstruct sidewalks, curbs, gutters, rigid or flexible pavement, and any other City or privately owned property which is removed, broken, or damaged by him with material which conforms to current City STANDARDS AND SPECIFICATIONS. Whenever a part of a square or slab or existing concrete, sidewalk, or driveway is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed as above specified.

The outline of all areas to be removed in Portland cement concrete sidewalks and in pavements shall be cut to a minimum depth of one-and-one-half inches (1-1/2") with an abrasive type saw prior to removing the sidewalk and pavement material. Cut for remainder of the required depth may be made by a method satisfactory to the engineer. Cuts shall be neat and true with no shatter outside the removal area.

8.26.00 UNDERGROUND FACILITIES

8.26.01 Foundations

(A) All foundations shall be Portland cement concrete conforming to the applicable requirements of construction specifications of the City of Fort Lupton, except as herein provided.

(B) The bottom of concrete foundations shall rest on firm ground. Cast-in-place foundations shall be poured monolithically where practicable. The exposed portions shall be formed to present a neat appearance.

(C) Forms shall be true to line and grade. Tops of foundations, except as noted on plans, shall be finished to curb or sidewalk grade or as ordered by the engineer. Forms shall be rigid and securely braced in place and inspected prior to the pouring of concrete. Conduit ends and anchor bolts shall be placed in proper position and in a template until the concrete sets.

(D) Anchor bolts shall conform to the specifications and each individual bolt shall have two (2) flat washers, one (1) lock washer, and two (2) nuts. Shims or other similar devices for plumbing or raking will not be permitted.

(E) Both forms and ground which will be in contact with the concrete shall be moistened before placing concrete. Forms shall not be removed until the concrete has thoroughly set.

(F) All abandoned foundations shall be removed and disposed of by the contractor. All conduit runs associated with an abandoned foundation shall be extended or abandoned as

called for on the plans. When a foundation is removed, the hole shall be backfilled in accordance with State of Colorado and City of Fort Lupton standard practices.

8.26.02 Conduit

(A) All cables and conductors not shown on the plans as aerial cable shall be installed in conduit unless installed in poles, pedestals, or mast arms. All metal conduit referred to in the specifications and shown on the plans shall be rigid and adequately galvanized. All PVC conduit will be of Schedule 80 or greater.

(B) All trenches excavated in roadways, including new construction areas, shall be backfilled with concrete or State of Colorado approved flow fill, and capped with six inches (6") of Grade E Asphaltic Pavement.

(C) Following conduit schedule is in effect unless otherwise specified in the plans:

Run Type	Quan.	Size	Use
Street Crossings	1	3"	120 voltage
Street Crossings	1	2"	Low voltage
Street Crossings	1	2"	Xcel use
Signal Pole	1	3"	Signal cables
Signal Pole	1	2"	Xcel use
Controller Cabinet	2	3"	120 voltage
Controller Cabinet	2	2"	Low voltage
Interconnect	1	2"	Interconnect
Service Point	1	2"	Xcel use

(D) The contractor, at his sole expense, may use larger conduit if desired. Where larger conduit is used, it shall be for the entire length of the run from outlet. No reducing couplings will be permitted underground.

(E) The end of all metal conduit, existing or new, shall be well reamed to remove burrs and rough edges. Field cuts of existing or new conduit shall be made square and true, and the ends shall butt together for the full circumference thereof. Slip joints of running thread will not be permitted for coupling metal conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. All couplings shall be screwed up until the ends of the metal conduits are brought together.

(F) Where a "stub out" is called for on the plans, a sweeping ell shall be installed in the direction indicated and properly capped. The locations of ends of all conduits in structures or terminating at curbs shall be marked by a "Y" at least three inches (3") high cut into the face of the curb, gutter, or wall directly above the conduit.

(G) Conduit bends, except factory bends, shall have a radius of not less than six (6) times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable.

(H) Conduit shall be laid at a depth of not less than twenty-four inches (24") below the top of curb grade in sidewalk or grass areas and to a depth of not less than thirty inches (30") below the finished grade in all other areas. Conduit under railroad tracks shall be not less than forty-eight inches (48') below the bottom of the tie.

(I) Trench excavations for conduit shall be two inches (2") wider than the outside diameter of the conduit. Backfilling of conduit trenches shall be accomplished by placing concrete or approved flow-fill up to the bottom surface of the existing or new roadway surface material. The remaining portion of the excavation shall be backfilled with the same type of material used to construct the existing roadway surface.

(J) Conduit shall always enter a foundation, pull box, or any other type structure from the direction of the run only.

(K) Conduits terminating in a pole shall extend approximately two inches (2") vertically above the foundation.

(L) All conduit runs that exceed ten feet (10') in length shall have a continuous nylon line pulled into the conduit along with the specified electrical cables. The line shall be firmly secured at each end of the conduit run with a minimum slack of three feet (3'). The purpose of this line is to be able to pull future electrical cable through the existing conduit runs.

(M) Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or blown out with compressed air.

(N) New conduit runs shown on the plans are for bidding purposes only and may be changed with approval of the engineer.

8.26.03 <u>Pull Boxes</u>

(A) A pull box shall always be installed in combination with a steel strain pole and at all other locations shown on the plans and at such additional points as ordered by the engineer. The contractor may install, at his own expense, any additional pull box that he may desire to facilitate the work.

(B) Special pull boxes which are required shall be fabricated and installed in general conformance with the size and details shown on standard drawings.

(C) Pull boxes installed in concrete or similar finished areas shall be designed for such installations and shall be stackable and manufactured of a pre-cast polymer concrete material such as Quazite or an approved equal. Unless otherwise noted, pull box lids shall have the word “Traffic” cast into them. Pull boxes shall be installed so that the covers are level with curb or sidewalk grade or level with the surrounding ground when no grade is established. The bottoms of all pull boxes shall be bedded in crushed rock.

(D) When a new conduit run enters an existing pull box, the contractor shall remove the pull box or tunnel under the side at no less than eighteen inches (18") and enter from the direction of the run. No new conduit will be allowed to enter a new or existing pull box in any other manner than that shown on standard drawings.

(E) Loop detector pull boxes installed in the street shall be placed according to the plans or as directed by the Public Works Director/engineer. The lids shall have the word "Traffic" cast into them.

8.26.04 Detector Loop Wire Installation

(A) Each individual detector loop is to be terminated within a water valve housing as specified on the construction drawing, and each loop shall consist of one continuous wire, without splicing, to this termination point. Any required series or parallel connections are to be at the termination point.

(B) All loops shall have a tag attached to the leading clockwise lead of the loop. This tag shall be marked to indicate the relative location of the loop. This marking shall correspond directly to the loop designations on the intersection drawing provided in the contract.

(C) Detector loop roadway slots shall be cut in asphalt that has a 6 inch minimum depth and sealed one-fourth inch (1/4") below the surface level of the roadway with 3M or approved equal. This sealer is to be used whether or not the roadway is to be overlaid.

(D) The contractor shall include cost for loop wire, saw cutting, sealant, splice and test for a complete installation of the loop to the termination point for the pay item price.

8.26.05 Conductor and Cable

(A) Wiring shall conform to appropriate articles of the National Electric Code. Wiring within cabinets, junction boxes, etc., shall be neatly arranged.

(B) Powdered soap stone, talc, or other approved lubricant shall be used in placing conductors in conduit.

(C) A common neutral conductor, separate from the signal light circuit neutral, shall be used for all low-voltage circuits, including the detectors and pedestrian push-button circuits.

(D) Splicing of cable will not be permitted in conduit or pull boxes or outside of signal heads, standards or foundations.

(E) In no case shall any shellac compounds be used. Wire nut type connectors shall be used on all splices made above ground level. Detector loop lead-in splices in underground systems shall be waterproofed with 3M splice kits or City approved equivalent. A minimum of twelve inches (12") of slack shall be left at each splice except within hand-holes where twenty-four inches (24") shall be left.

(F) When conductors and cables are pulled into the conduit, all ends of conductors and cables shall be taped to exclude moisture and shall be so kept until the splices are made or terminal appliances attached. Ends of spare conductors shall be taped and marked.

(G) Cable shall be stranded. For span wire type installations, cable shall be installed where specified on the plans and secured to messenger cable with cable rings in accordance with standard practices. Aerial cable shall be supported by strand vices of proper size and strength as well as insulators used where necessary.

(H) A small permanent tag on which the direction and phase is printed, in the order named, using the codes given in "**Cable Schedule**," shall be securely attached near the end of each conductor at each controller, standard, or pull box where conductors are separated.

Where direction and phase are not clearly indicated by conductor insulation, additional tags shall be used.

TABLE 8-26-05
Cable Schedule

Phase/Tag		Tape Color
1.	NBLT	Red/White
2.	NB	Red
3.	SBLT	Green/White
4.	SB	Green
5.	EBLT	Orange/White
6.	EB	Orange
7.	WBLT	Blue/White
8.	WB	Blue
9.	Pedestrian	Yellow

NOTE: This is a typical cable schedule and shall be used for the wiring of all signal installations. A new cable schedule will be noted on the plans at each intersection where different phasing and/or special equipment is required. It should be noted that a band of white is used to indicate a left turn and yellow for a pedestrian movement. This is in addition to directional tape for the phase. For cable size and number of conductors see traffic signal material specifications and/or standard drawings.

(I) Inboard and outboard heads, mounted on mast arms, are to be wired separately from head to base of pole.

8.26.06 Bonding and Grounding

(A) Metallic cable sheaths, conduit, metal poles, and foundations shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded. Bonding and grounding jumpers shall be copper wire, No. 8 AWG, for all systems. Beldon cable sheath for loop detectors to be grounded in control cabinet only. The other end of the sheath to be left ungrounded.

(B) Bonding of standards shall be by means of a bonding wire attached to a bolt or a three-sixteenths inch (3/16") or larger bolt installed in the lower portion of the shaft.

(C) At each pull box the ground electrode shall be a one-piece copper ground rod of five-eighths inch (5/8") diameter and eight feet (8') in length, driven into the ground so that the top is two inches (2") above the bottom of the pull box. The ground rod connector will be placed so that the bare copper wire, No. 8, can be pulled into a pole, foundation, or attached to the control cabinet ground buss.

8.26.07 Maintenance

The contractor shall have full maintenance responsibility of the traffic signal from the date of the written notification by the Public Works Director/City Transportation Engineer to the final inspection and date of written approval of the work performed. Continuous maintenance and emergency service shall be provided by the Contractor 24 hours each day during the time frame outlined above. The Contractor shall provide and maintain a 24-hour a day continuous one number telephone answering service. All malfunctions of a controller and its accessory equipment shall be considered an emergency unless otherwise identified by the City. Equipment malfunctions and/or damage, which in the opinion of Fort Lupton's Transportation Engineer or other authorized person, constitutes a serious hazard or inconvenience to the public shall be considered an emergency. Such malfunctions or damage may include, but not necessarily be limited to, situations where:

(A) all indications are out including bulbs and lenses, for any one traffic movement;

(B) signal heads give conflicting indications to any intersection approach;

(C) a signal has been knocked down;

(D) an overhead red indication is out

Contractor shall undertake each such emergency repair no later than one hour after Fort Lupton notifies Contractor of the emergency.

In instances of repairs that are not of an emergency nature, such repairs shall be undertaken at the site within one working day after Fort Lupton notifies Contractor of the needed repair. Fort Lupton shall pay the Contractor for the materials, parts and/or supplies actually used by the Contractor in making any such repair in the amount of the Contractor's cost plus five percent (5%). Labor and equipment rates associated with work performed due to vandalism or vehicle accident damage will be reimbursed at the rate set forth in the City's Traffic Signal Maintenance Contract.

Should the Contractor fail to perform any maintenance responsibilities within the prescribed time periods, the Public Works Director/City Transportation Engineer or other authorized person shall employ the services of the City's designated Traffic Signal Maintenance Contractor to perform said maintenance work. The Contractor shall reimburse the City for labor and equipment charges associated with the utilization of the City's designated Traffic Signal Maintenance Contractor plus a fifteen percent (15%) administration fee.

8.26.08 Field Testing

Prior to completion of the work, the contractor shall cause the following tests to be made on all traffic signals in the presence of the engineer or his designee.

(A) Each circuit shall be tested for continuity.

(B) Each circuit shall be tested for grounds.

(C) A functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test for each traffic signal system shall consist of not less than fourteen (14) days of continuous, satisfactory operation commencing with full operation of all electrical facilities. During the fourteen-day period, the contractor will maintain the system or systems. The cost of any maintenance necessary, except electrical energy and maintenance due to damage by public traffic, shall be borne by the contractor and will be considered as included in the price paid for the contract item involved, and no additional compensation will be allowed.

8.27.00 TRAFFIC CONTROL IN CONSTRUCTION AREAS

8.27.01 General

For any construction done on, in or to an existing City roadway and/or right-of-way or for the construction of a new City roadway, appropriate traffic control during construction shall be provided. For any such construction, a construction traffic control plan shall be prepared by the contractor and/or project engineer and shall be approved by the Public Works Director/City Transportation Engineer prior to issuance of a street cut permit or public improvement construction permit.

Where a roadway does not currently exist, it is presumed that there is no motorist expectation of a travel route. Therefore, a construction traffic control plan for construction of a new roadway should strive to do two things: alert the motorist that this is a construction area, and alert the motorist that the road is not open to traffic. Construction traffic control plans shall also be prepared for construction occurring on existing City roadways where the motorist has an expectation of accessibility and shall be warned, advised, guided or regulated through any construction activity.

8.27.02 Time of Submittal

A construction traffic control plan shall be submitted to the Public Works Director/City Transportation Engineer at the earliest with the submittal of final construction plans and at the latest with the application for a right-of-way or public improvement construction permit(s). All final construction plans submitted to the City of Fort Lupton that entail constriction on an existing City roadway or construction of a new City roadway must either:

(A) Be accompanied by a construction traffic control plan.

(B) Include a note stating a construction traffic control plan shall be submitted to the City of Fort Lupton for approval before any permit for construction is issued. No right-of-way or public improvement construction permit shall be issued without the approved construction traffic control plan.

8.27.03 Scope of Construction Traffic Control Plan

For construction of new roadways, traffic control during construction should strive to keep the motorist from entering the facility. The primary means to accomplish this are by use of temporary barricades located in advance of the point where new construction joins old and appropriate signing. New roadways shall not be opened to general traffic, nor the construction traffic controls remove, without the approval of the Public Works Director/Engineering Construction Inspector and the Public Works Director/City Transportation Engineer. One precondition of such an opening is that permanent signage and striping be in place.

8.27.04 Elements of Construction Traffic Control Plan

(A) All construction traffic control plans shall contain the following information:

1. Name of contracting firm and, if different, the name of the firm responsible for traffic control devices.

2. Name and phone number(s) of 24-hour contact person responsible for traffic control devices.

3. Description of location of activity (roadway names, north arrow, etc.

(B) Projects identified as minor construction traffic control plans as determined by the Public Works Director/City Transportation Engineer shall include, in addition to items listed in (A) above, either one of the following:

1. A neat sketch of the roadways and the proposed traffic control devices; or

2. A copy of a typical drawing of traffic device layout from an accepted source approved by the Public Works Director/City's Transportation Engineer.

(C) Projects identified as major construction traffic control plans as determined by the Public Works Director/City Transportation Engineer shall include, in addition to items in (A) above, the following: The proposed traffic control devices specifically identified as to type and explicitly noted and dimensioned on as-builts, construction plan drawings or other detailed drawings.

8.27.05 Basis for Construction Traffic Control Plan

The Manual on Uniform Traffic Control Devices shall be the basis upon which the traffic control plan is designed in concert with proper, prudent and safe engineering practice. All necessary signing, striping, coning, barricading, flagging, etc. shall be shown on the plan. Other acceptable documents may be consulted or referenced, such as Traffic Control in Construction and Maintenance Work Zone (FHWA), Flagging and Traffic Control Supervisor's Training Manual (CDOT) and Work Area Traffic Control Handbook (City of Fort Lupton, Public Works/Engineering Division).

8.27.06 Restriction, Regulations and Opportunities

In concept, City streets shall not be closed overnight and work shall not force road or lane closures before 8:30 a.m. or after 3:30 p.m. If exceptions to this are required, this shall be noted on the construction traffic control plan and shall be approved by the Public Works Director/City Transportation Engineer. Travelway width may be restricted. Minimum travel lane width in construction areas shall be ten feet (10'), but proper controls, including flagging, shall be indicated. Prohibition of on-street parking should be considered and noted where applicable.

All traffic control devices necessary to provide for public safety at the work site shall be furnished and maintained by the contractor at his own expense. If the contractor does not provide the approved traffic control devices. The Public Works Director/City Transportation Engineer may install such devices, and the entire costs of such devices shall be borne by contractor. If the City is required to install the required traffic control devices due to negligence by the contractor, a minimum administrative charge of three hundred dollars ($300) will be assessed to the contractor.

8.27.07 Approval

Staff of the Public Works and City's Transportation Engineering Section must approve (sign and date) all construction traffic control plans. In general, this responsibility rests with the Engineering Division Inspection Section. However, it is likely that most major plans will be referred to the Traffic Section for consideration. All complete road closures and all partial road closures (removing one or more travel lanes) that are proposed for overnight shall be approved by the Public Works Director/City Transportation Engineer. One (1) copy of the approved plan shall remain with the Inspection Section for their verification that the traffic control plan has been adhered to in the field. One (1) copy shall be placed in the engineering project file. The contractor shall have one (1) approved copy of the traffic control plan on site at all times.

8.27.08 Modifications

Actual conditions in the field may necessitate modifications to the construction traffic control plan. Provided that the general intent of the original plan is satisfied, these modifications may occur without revision to the plan. The Public Works Director/Engineering Construction Inspector shall be notified of any substantial changes and may refer these to the Traffic Section as needed for construction.

8.27.09 Applicability

The requirements of this chapter shall apply to any person, corporation, municipality, quasi-municipality agencies, mutual companies, electric, gas or communication utility (including cable TV) who for any reason cuts, disturbs or otherwise defaces any City road for the purposes of installing or repairing or for any reason pertaining to the presence of an underground utility or structure.

8.28.00 TRAFFIC SIGNING AND PAVEMENT MARKINGS

8.28.01 General

The installation of all traffic control devices shall conform to the Manual on Uniform Traffic Control Devices and the Colorado Standard Specifications for Road and Bridge Construction, latest edition.

8.28.02 Traffic Control Devices on Public Property

All permanently fixed traffic signals will generally be installed by the City at the developer's expense. However, if the developer submits a signage plan which is subsequently approved by the Public Works Director/City Transportation Engineer, the developer may install these traffic signs. Traffic signs shall be placed to conform to the drawing details.

8.28.03 Traffic Control Devices on Private Property

(A) Responsibility: All traffic control devices on private property; i.e., pavement markings, regulatory signs, fire lane signs, and handicapped parking signs shall be installed and maintained by the property owner.

(B) Placement: A signage and striping plan specifying the various types and combinations of traffic control devices shall be submitted to the Public Works Director/City Transportation Engineer for approval.

8.28.04 Pavement Markings

All Pavement Markings required to be installed as a result of new construction or development shall be THERMOPLASTIC as per CDOT specification 627. Temporary pavement markings necessary to facilitate construction (i.e. detours) may be installed using paint.

The contractor shall submit a plan for all pavement markings to the Public Works Director/City Transportation Engineer for approval prior to the beginning of the work. The pavement marking plan shall meet the requirements for such work as outlined in the Manual on Uniform Traffic Control Devices. All pavement marking materials must be approved by the City ~~Transportation~~ Engineer.

8.30.00 MATERIAL SPECIFICATIONS

8.31.00 SIGNAL HEADS

8.31.01 Traffic Signal Unit Specifications

(A) All signal units shall be of the individual section, adjustable type, black polycarbonate or approved equivalent. Unless otherwise noted on the plans, all signal and pedestrian displays shall be ITE approved Light Emitting Diodes (LED) and conform to the appropriate sections below. All southbound overhead red and southbound overhead red-arrows shall be incandescent type and conform to sections B through F below.

(B) Visors shall be detachable, of the eight-inch (8") or twelve-inch (12") tunnel type, open at the bottom; be black in color on the outside and flat black on the inside.

(C) Reflectors shall be silvered glass or Alzak type units.

(D) Lenses shall be in accordance with Institute of Traffic Engineers Specifications.

(E) Sockets shall be fixed focus.

(F) Doors on the signal heads for the installation of lamps and lens replacement or other maintenance shall not require use of any tool whatsoever to be opened. Doors and lenses shall be equipped with neoprene weatherproof gaskets to insure against infiltration of moisture, road film, and dust. Each three-color signal unit shall have the socket leads from all signal sections connected to a terminal board stamped with identifiable terminals. There shall be a terminal for color indication plus a common terminal where one lead from each socket shall terminate. The terminal board shall be mounted in the middle section and be properly insulated. All openings, top and bottom, shall be for one-half-inch (1/2") pipe or pipe mounting brackets. Gaskets shall be supplied for top and bottom openings.

8.31.02 <u>Pedestrian Signal Units</u>

Sixteen-inch (16"), one-way, ICC or equal pedestrian signal head as specified on the plans. "Walk/Don't Walk" indications shall be symbolized and side by side. Visors shall be egg crate type and heads shall be black.

8.31.03 <u>Backplates</u>

(A) Where shown on the plans, black back plates shall be furnished and installed on signal faces. No background light shall show between the back plates and the signal face or between sections. All back plates are to be of aluminum or plastic construction and shall be the louvered type. Back plates shall provide a five-inch (5") border for all twelve-inch (12") signal heads.

(B) Traffic signal heads requiring backboards shall be drilled for three-sixteenths-inch diameter by one-half-inch (3/16" x 1/2") pan head bolt with nut and lock washer. If the manufacturer fails to supply as described, it will then be the contractor's responsibility to do so. When installing backboards on the traffic signal head, the contractor will furnish three-sixteenths-inch (3/16") fender washers between bolt head and backboard

(C) The manufacturer will fabricate all backboards with a three-sixteenths-inch (3/16") washer on both sides of each rivet which is used to hold each section of backboard together.

8.31.04 <u>Traffic Signal Lamps</u>

(A) Traffic signal lamps shall meet the requirements of the latest version of the ITE Standard "Traffic Signal Lamps." All lamps shall have 8,000-hour minimum rating. Lamp manufacturers shall be limited to General Electric, Sylvania, Phillips. Size of lamps to be used in traffic signal units shall be as follows:

(B) 69 watt, 125 volt, lamps for all eight-inch (8") traffic signals and peds.

(C) 150 watt or 1950 lumens minimum, 125 volt, lamps for all twelve-inch (12") traffic signals.

(D) If the manufacturer recommends a lower rating, the City of Fort Lupton will be advised of this recommendation and will have the option to decide which rating will be used.

8.32.00 ELECTRICAL CABLE

8.32.01 Signal Cable

14 AWG multi-conductor, stranded, copper wire manufactured to meet IMSA 19-1 specifications or approved equivalent. Each conductor in the cable will be individually insulated and rated at 600 volts. There shall be a minimum of four (4) and a maximum of nine (9) strands per conductor. There shall be a separate 19-conductor cable installed from the controller cabinet to the bottom handhold of each signal pole. From that point, a separate 5 or 7-conductor cable for each overhead signal shall be spliced to the 19-conductor cable.

8.32.02 Interconnect Cable

(A) Unless otherwise noted, all traffic signal interconnect communications shall be accomplished through a fiber optic cable system. Provisions for the fiber optic system shall be annotated on the plans or described by supplemental specifications. The remaining portions of this section reference hardwire systems and are applicable when specified. The telephone hardwire interconnect wire shall be #19 AWG, 6 twisted pairs, shielded cable, with petrolatum-polyethylene gel filling compound. The cable shall meet R. E. A. Specification PE-39 (Clifford of Vermont Catalog #6P19-B1-BJFC or approved equal).

(B) No splicing of the interconnect cable will be allowed. The cable shall be installed between two adjacent controller cabinets in continuous runs.

(C) All telephone interconnect cable pairs will be connected to either active or spare terminal points provided in the controller cabinet. The Contractor shall identify and label all terminal points.

(D) All interconnect wires shall be checked after installation to determine their resistance and resistance to ground. Each pair shall be shorted together at one end and a resistance check will be made at the other end or wherever a splice exists. Resistance will be checked between each conductor and ground. All resistance readings shall be recorded showing value, color and location or wire. Data is to be supplied to the Public Works Director/City's Traffic Department within 30 days of completion of the project.

(E) At the terminal points the jackets shall be stripped and the ends taped. Gel filling compound shall be removed using filled cable cleaner.

8.32.03 Service Cable

Two (2) No. TRW-8, seven (7) strands, tinned, soft-drawn copper wire, one-sixteenth-inch (1/16") neoprene insulation, black and white in color.

8.32.04 Loop Wire

Detect-A-Duct Cable consisting of single conductor No. 14, stranded THHN with an outer protective sleeve.

8.32.05 Pedestrian Push-Button Cable

Two (2) conductor No. 14, seven (7) strands, tinned, soft-drawn copper wire, one-sixteenth-inch (1/16") neoprene insulation. Conductors to be twisted. Color coded one (1) white and one (1) black.

8.32.06 Loop Lead-In Cable

Detector loop lead-in cable shall be a four conductor .25 inch diameter, shielded and jacketed cable suitable for installation in a pavement sawslot, conduit or direct burial. Conductors shall be AWG No. 18 stranded copper with polypropylene insulation. The conductors shall be twisted at least six turns per foot. Color rotation shall be black, red, white, green. The interior of the cable shall be filled with an amorphous material which prevents water penetration. Aluminized polyester shielding shall be applied around the conductors to prevent electromagnetic interference. The Cable jacket shall consist of black high density polyethylene. The jacket shall not be degraded by prolonged exposure to typical pavement runoff components. The cable shall be suitable for operation at temperatures of -60^{o}C to +80^{o}C. (Canoga 30003 43#18 AWG shielded loop detector lead-in cable or approved equal.)

8.32.07 Ground

Single conductor, AWG No. 8, soft-drawn bare copper wire.

8.32.08 Optical Detector Lead-In Cable

The lead-in cable for the Emergency Vehicle Optical Detectors shall be 3M Type 138 or approved equal.

8.33.00 VEHICLE DETECTORS

8.33.01 General

(A) Unless otherwise noted, all traffic signal vehicle detection systems shall be accomplished through a video camera system. All camera systems shall be 100 percent compatible and identical in both operations and programming with the City's existing Autoscope and Solo Pro equipment. The remaining portions of this section reference roadway imbedded inductive loop systems and are applicable when specified. This specification defines the minimum design operational and performance requirements for

multiple channel, digital self-tuning inductive loop detectors, detector units shall be card rack mounted plug-in type and operate from an external 24 VDC power supply. Detector units shall be in full compliance with the environmental and size requirements of NEMA standard TS1-Section 15 and meet the design, operation, electrical and functional performance requirements of both TS1 and TS2 specifications.

(B) The front panel shall include an erasable, write-on channel identification area and clearly indicated switch operating position. I.D. area one centimeter square per channel minimum.

(C) All component part and test points shall be clearly identified by permanent marking of circuit referenced on the P. C. Board. Integrated circuit devices having 16 or more leads shall be socket-mounted to facilitate repair and maintenance of units. Detectors supplied to this specification shall be warranted by the supplier to be free of defects in materials and workmanship for a period of five years from date of shipment from manufacturer.

(D) Each detector unit shall include two or four complete detector channels. Each channel shall sequentially energize its loop inputs to eliminate crosstalk (mutual coupling) between large, very closely spaced adjacent loops connected to the same unit. The sequential time sharing and digital processing of loop inductance data shall be accomplished on a single LSI microcircuit per unit for maximum reliability. The method of measuring shall be crystal reference digital period counting, multi-channel scanning. Only one channel input per unit shall be active at any point in time.

1. Sequential scanning shall fully prevent crosstalk between channels of a detector connected to closely spaced or overlapped loops for directional detection.

2. Sequential scanning shall allow two detection channels to operate with full performance using a common home-run cable.

3. Sequential scanning shall allow two or more detection channels to be connected to a single detection amplifier with full operating performance, including separate mode and sensitivity selection capability on each channel.

(E) Each channel of the sensor unit shall automatically self tune to any loop and lead-in inductance from 20 to 2500 microhenries within 2 seconds with full sensitivity after application or interruption of supply voltage. Units shall also track changes in loop/lead-in electrical characteristics, as might reasonably be expected to occur in undamaged loops, properly installed in sound pavements, without producing false indications or changes in sensitivity.

(F) Each detector unit shall be provided with a loop test switch position to verify loop system integrity and reduce maintenance costs. The "open loop test" position shall indicate a previous fault via the front panel indicator. The memory shall remain intact and can be queried repeatedly. Existing detections shall not be reset and the memory shall only be reset by power interruption as by removing and re-inserting the plug-in detector units.

(G) Each channel shall include a 16-position Push type wheel switch to allow selection of 8 pulse sensitivities, 7 presence levels and a "Reset" and an "Off" position. Each detector

unit shall include 8 sensitivity selections in 2:1 steps that can be correlated to the relationship of the number of turns of wire in a loop versus the sensitivity required to detect a specified vehicle. The selections shall be designed to allow detection of licensable vehicles in loops of two or more turns electrically in series, parallel or series/parallel configuration in non-reinforced or reinforced pavements with lead-in/homerun combinations from 50-feet to 1000-feet. The number of turns in a loop, electrical configuration of multiple loops and pavement type will dictate the sensitivity required for proper, predictable detection.

(H) If specified, channel presence time shall be modified if delay or extension time is selected. The timing switch shall select delay or extension or "Off", if no timing is desired. Internal DIP switches shall provide for selection of "Delay" time of 0 to 31 seconds in 1.0 second increments and "Extension" time of 0 to 7-3/4 seconds in .25 second increments.

(I) Presence indicators shall be wide angle, high brightness type Led's suitable for sunlight visibility. When timing is selected and a channel is active that channel's indicator shall flash at 4 Hz during Delay and at 16 Hz during Extension to indicate timing is in progress. Further, the timing shall be aborted when the vehicle is no longer present and/or the channel control input shall become inactive. The Delay timer shall be reset when a vehicle leaves the loop prior to time out and shall abort when the control input becomes inactive. The Extension timer shall operate and reset when a vehicle leaves the loop and be aborted when the control input becomes inactive. Each timer (Delay and Extension) shall be provided with buffer circuitry to enable or disable the timer based on an external input (green gate) signal. Circuit shall be designed for AC or DC input control on AC powered units and for DC control on DC powered units.

(J) Each detector unit shall utilize a $\underline{\triangle}L$ = (Delta-L) thresholding technique to provide a more constant, predictable vehicle detection sensitivity with series added inductance, i.e., many loops connected in series and/or long lead-in/homeruns will generally require the same sensitivity setting as would be required for a single loop with short lead-in, to simplify setup.

(K) Each channel shall automatically recover from intermittent opens or multiple shorts to ground. Each channel shall tolerate and continue to operate with no change with a single point short to ground on the loop or lead-in system. Each channel shall provide a continuous, non-resettable (fail-safe) output and indication in response to an open loop/open lead-in system. The open loop indication and output shall not be resettable as long as the open exists, except that they shall be defeated when the channel "Off" position is selected.

(L) Extended features shall include: Two serial ports (front panel RS232 and Edge connector Xmit/Recve), TS1 and TS2 compatible from manual or software switch, microloop occupancy detection, Traffic counting capable to include long-loop presence count from 15 minute to infinite intervals all accessible from either serial interface, Dual Detect and Fault LED indicators per channel, External inputs to control Timing functions and enable Remote Reset, Extended diagnostics, programming and Live status available via serial interface utilizing windows compatible software.

8.34.00 EMERGENCY VEHICLE DETECTORS

OPTIcal COMmunication Detectors for emergency vehicle pre-emption shall be the 3M Model 711, 712 or 722 Optical Detector or approved equal as specified in the construction plan notes. Placement of the Detectors shall be determined by the Engineer. Optical phase selector modules for emergency vehicle pre-emption shall be 3M Model M752 or approved equal.

8.35.00 DETECTORS (PEDESTRIAN PUSH-BUTTON)

8.35.01 General

(A) Pedestrian push-buttons shall be of the direct push-button contact type. They shall operate on a voltage not to exceed 18 volts AC. They shall be of tamper-proof design and equipped with a push-button instruction sign as shown in the Standard Details.

(B) The assembly shall be weatherproof.

(C) The housing shall be shaped to fit the curvature of the pole to which it is attached to provide a rigid installation. Saddles shall be provided to make a neat fit when required. Pedestrian signs shall be installed as shown on the Standard Details.

8.36.00 TRAFFIC SIGNAL POLES, PEDESTALS AND MAST ARMS

Traffic signal poles, pedestals, and mast arms shall be of the general configuration shown on standard drawings. All traffic signal poles and mast arms shall be designed to meet the requirements outlined in the 1994 edition of "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals," published by AASHTO, for a wind velocity of 90 mph.

8.37.00 CONTROLLER CABINET

8.37.01 General

(A) All controllers and auxiliary equipment shall be housed in a factory wired, weatherproof, metal cabinet following **NEMA** specification **TS2 type 1**. The cabinet shall have minimum interior dimensions, exclusive of stiffeners, shelf brackets, etc., of height - 46 inches, width - 29 inches, and depth - 15 inches.

(B) The cabinet shall be constructed of 0.125 minimum thickness bare aluminum. Cabinets shall be braced internally or by folded seams in order to provide sufficient rigidity to withstand normal handling and transport to the field location without deforming.

(C) The main door shall have a self locking, keyed, tumbler lock with two keys. Hinges shall be mounted on the cabinet in such a way that interchange-ability of doors is possible between cabinets of like size and manufacturer. Hinge pins shall be stainless steel. Doors shall have neoprene gaskets of sufficient thickness to provide a rain tight and dust tight seal.

(D) The engineer will provide, during the construction period, an additional external lock for the controller cabinet to maintain security of the controller cabinet.

(E) A police or auxiliary door shall be provided. It shall be constructed so that no sharp edges protrude from the main door and shall provide access to a panel with labeled switches for automatic to flashing operation and signal power on/off.

(F) The cabinet shall be equipped with a thermostatically controlled, ball bearing fan with a capability of at least 100 cubic feet per minute. The fan shall be mounted in a weatherproof housing attached to the top of the cabinet. The thermostat shall be adjustable to turn on between 90° F and 150° F and be so mounted as to be easily accessible for adjustment from the front of the cabinet. An internally mounted incandescent lamp socket shall be provided with 150 watt capability and switched "on" only when the main door is open.

(G) The cabinet shall have two shelves each capable of supporting 75 pounds. Shelves shall be supported on brackets which provide for height adjustments. Each cabinet shall contain a 10 mil thick plastic envelope with side opening. It shall be a minimum size of 10" x 12" and be attached to the door by screws.

(H) Assembly wiring - All cabinet wiring shall be neatly arranged and laced or enclosed in plastic tubing. No harness or wire shall be attached to any shelf rack or other point where it may be damaged by movement of shelves or doors.

(I) Terminal Facilities - Terminal facilities (load bays) shall be firmly attached in a position not less than 6 inches from the bottom of the cabinet so as to provide easy access and maximum convenience to the user.

(J) Side mounted auxiliary panels should be firmly installed with the forward edge not more than 4 inches from the door sill and not less than 6 inches from the bottom of the cabinet in all cabinets.

(K) The load bay and it's associated equipment, harness, switches, etc., shall be grouped on removable panels. Each panel or group of receptacles and connecting cables shall be arranged to permit so that work can be performed on panel backs or cables.

(L) A load switch bay and flash transfer capability is required for each phase. Load switches shall be provided for only the phases shown on the plans.

(M) The load bay shall be protected by a main circuit breaker. A gas tube surge arrester with MOV and a suitable radio interference filter shall be supplied. The arrester shall be a three electrode type with the following ratings:

1. Impulse Breakdown - less than 1,000 volts in less than .1 microseconds at 10 KV per micro-second.

2. Standby Current - less than 1 milliampere

3. Striking Voltage - greater than 212 VDC

4. Energy Capability - capable of withstanding pulses of peak current each of which will rise in 8 microseconds and fall in 20 micro-seconds to one-half the peak voltage at 3 minute intervals.

5. Peak Current Ratings shall be 20,000 amps. The MOV shall have ratings equal to or better than a General Electric type VI50LA20A. The RFI filter shall have a current rating equal to or greater than the main circuit breaker capacity.

(N) Field terminals shall be screw type, capable of accommodating at least three number 12AWG wires. All terminals in the load bay shall be permanently identified by engraving, silk screening or contrasting plastic labels. Terminal blocks shall be the barrier type and no live parts shall extend above the barrier.

(O) A convenience outlet with a ground fault interrupter fused at 15 amps shall be provided. It should be located in a position which is convenient and safe for service personnel.

(P) All AC power busses, switch or relay lugs and/or similar activity connection points which extend more than 1-1/2 inches from the panel are to be protected by insulation for safety. The locations of these items shall provide reasonable protection for service personnel.

(Q) Signal power relays shall be mercury wetted, equal to or greater than circuit breaker capacity. Flash transfer relays shall be as manufactured by Midtex Model 136-62 T 3A1, 120 VAC, DPDT, 30 amp with Jones Plug base and dust cover or approved equal.

(R) Flasher. The cabinet shall be equipped for flashing operation of signal lights with a 2 circuit solid state flasher in accordance with the latest NEMA specifications (15 amps per circuit). Flashing operation shall be set for flashing yellow on all main street approaches and red on all other approaches. Pedestrian and turn signals shall be extinguished during flashing operation. The flashing mechanism shall remain in operation during shutdown or removal of controller.

(S) Load Switches. The cabinet shall be equipped with solid state load switching assemblies in accordance with the latest NEMA specification. Each load switch to be equipped with a 3 input LED indicator. Load switches shall contain 3 separate cube type solid state relays, which use a solid state switch which is capable of operations at 240 VAC and 25 amps when properly heat sinked but derated to 10 amps when used in load pack assembly.

(T) Conflict Monitor. The cabinet shall have provision for conflict prevention in accordance with the latest NEMA TS2 specification. Conflict prevention shall be provided by a conflicting display monitor unit that monitors all green, yellow and walk displays and detects absence of reds to cause flashing operation and stop timing if conflicting indications are detected. Removal of the monitor from the cabinet shall cause flashing operation. Conflict monitors shall be as manufactured by Eberly Designs, 12 LEP or approved equal.

(U) Emergency Vehicle Preemption. The cabinet shall be equipped and wired with an Opticom Card rack mount for 3M Model 562 or approved equal. All equipment shall be capable of accommodating a minimum of two modules with capability of four-channel operation.

8.38.00 ACTUATED CONTROLLERS

8.38.01 General

(A) **Compatibility - THE LOCAL CONTROLLER AND CABINET SHALL BE 100% COMPATIBLE WITH THE CITY OF FORT LUPTON'S EXISTING COMPUTERIZED SIGNAL SYSTEM WHICH UTILIZES ECONOLITE EQUIPMENT OR NECESSARY MODIFICATIONS OF THE SOFTWARE AND HARDWARE SHALL BE INCLUDED TO MAKE BOTH SYSTEMS FULLY COMPATIBLE.**

(B) An actuated controller shall be completely solid state, electronic device capable of selecting and timing traffic movements. It shall provide timing and load switch control of each major vehicular phase, including concurrent associated pedestrian movements. The controller shall conform to the latest NEMA specifications and shall provide for complete and full operation of eight phases from within either a TS1 or TS2 type 1 cabinet.

(C) The controller shall have all electronic components easily accessible and arranged in functional groupings on the printed circuit boards. Printed circuit boards shall be designed to facilitate identification of components for maintenance purposes. Printed circuit design shall be of NEMA specification quality and designed so that components may be removed and replaced without permanent damage to the board or track.

(D) Timing shall be adjustable on the controller face by keyboard programming. A security code or other means shall be provided to prevent unauthorized or accidental entry.

(E) Timing shall be readable from a display which is sufficient to make certain that all register positions can be easily and definitely recalled. Every keyboard controller shall have an easily followed legend silk screened on the face of the controller or on a metal or plastic card or placard which is securely attached by screws or rivets.

(F) All circuitry components shall be available on the open market and the original manufacturer's part number shall be shown on the part's list.

(G) Overlap programming shall be provided by NEMA standard overlap board and/or keyboard.

(H) An entry mode to any single phase parameter of a keyboard controller shall not affect any other parameter or the same parameter on another phase, unless programmed by specific keyboard instructions, such as, "copy" sequences or other prescribed methods of rapid program entry.

(I) Every controller supplied shall be the manufacturer's latest, first line production model tested and delivered by a domestic manufacturer who is regularly engaged in the construction of such equipment.

(J) Each controller shall be supplied with a complete set of operational and service manuals, wiring schematics and part's layout up to a maximum of ten sets per order. Any controller for which these documents are not available is not a production model within the meaning of these specifications.

(K) Each controller shall have a removable data module.

(L) Pre-emption. All actuated controllers shall be equipped to accommodate four E.V.P. inputs and one railroad preemption input.

8.38.02 Coordination Unit

(A) The coordination unit shall be an internal function within each local controller and shall meet, as a minimum, the following functional requirements.

(B) The coordinator shall provide for at least four cycle lengths adjustable from 30 to 255 seconds, three offsets adjustable from 0 to 99 percent with offset correction by dwelling in coordinated phase or smooth transition, and four splits per cycle.

(C) Standard NEMA functions shall be used to control the intersection timing.

(D) The coordinator shall be capable of changing the controller's phase sequence upon command and telemetry failure.

(E) The coordinator shall be capable of setting the intersection free by loss of system sync, cycle/offset false commands, free command and telemetry failure.

(F) The coordinator shall be capable of setting the intersection into a flashing operation in accordance with the Manual on Uniform Traffic Control Devices, latest edition.

(G) The coordinator shall be capable to operate with telemetry module without additional hardware or software.

(H) Time-base coordination mode shall be provided as a backup with all standard coordination features available. At least two 7-day programs shall be available with 50 additional holiday programs in the event of a master controller or communications failure. Time-base standby mode shall be programmable for an entire year with automatic daylight savings and leap-year changes.

8.38.03 System Telemetry

(A) Telemetry equipment shall be an internal plug-in module to a local controller with easy access for removal. Master controller or stand-alone chassis may contain standard plug-in module. Each telemetry unit shall be capable of transmitting data to and from local controller, local detectors and system detectors (8 per intersection). A provision shall be made to reject invalid messages. The system command shall be transferred each second to maintain time sync.

(B) The telemetry equipment shall be designed so that all communications among intersections in one system can be accomplished over no more than two pairs of hard wire interconnect or leased phone lines. Dedicated pairs from the master to each local intersection are not permitted.

8.39.00 ON-STREET MASTER

8.39.01 General

(A) Cabinet Assembly - The master controller shall be wired into a cabinet assembly which also includes a local intersection equipment configuration. The cabinet shall be wired complete with master connecting cables in accordance with applicable portions of the local controller cabinet specifications. The incoming power service and interconnect terminals shall be adequately equipped with surge arrestors to protect against high energy transients.

(B) Incoming Sensor Data - The master shall have the ability to receive output data from at least eight sensors from each local intersection. It shall be possible to assign at least 32 of the incoming sensors to internal computational channels for pattern selection analysis.

(C) Traffic Pattern Selection. The program-in-effect shall be selected on a priority basis with the following priority arrangements:

1. Manual entry from keyboard
2. External command from a master
3. Time-of-day/day-of-week schedule
4. Traffic responsive -based on sampling sensor analysis

(D) The master shall select one of six different cycle lengths or "free" operation based on inbound or outbound volume levels. It shall be possible to program segments in the volume range levels to change to the next higher or lower cycle lengths.

(E) The master shall be able to select any of five different offset plans per cycle. Offset plans shall be chosen based on the differential between inbound and outbound volume levels. The five offset plans shall be designated as follows:

1. Heavy inbound
2. Inbound
3. Average
4. Outbound
5. Heavy outbound

(F) When balanced flow occurs, the master shall select the Average Offset plan. When the volume in one direction exceeds the volume in the other direction by the programmed amount, a standard preferential offset shall be implemented. If the volume differential exceeds a second (higher) programmed amount, a heavy preferential offset must be implemented. It shall also be possible to reserve the heavy preferential offset plans for special pattern implementation only. Programmable settings must be provided for both entering and leaving each offset.

(G) Split plan selection shall be identical to offset plan selection except that arterial traffic volume levels must be compared to side street volume levels. Three different split plans shall be provided:

1. Heavy arterial
2. Average
3. Heavy side street

(H) The master shall call for the average split plan during normal conditions. If the arterial volume exceeds the side street volume by the programmed amount, the heavy arterial split shall be selected. In the same manner, if side street volume exceeds arterial volume by a programmed amount, the heavy side street split shall be called.

(I) Crossing Artery Synchronization - The master controller shall have capability to coordinate with a separate master controller of the crossing artery through the common intersection for both systems.

(J) System Diagnostics - Diagnostic tests shall be performed on system detectors, telemetry communications and intersection operation.

(K) Sampling sensors shall be monitored for absence of calls or constant calls. If a sensor fails, it shall be automatically disconnected from the calculations for traffic responsive plan selection. If normal sensor operation resumes, the sensor shall be automatically reinstated.

(L) Telemetry communications diagnostics shall monitor readbacks for no response condition including local telemetry and telemetry channels.

(M) Intersection diagnostics shall be available to display intersection status condition. All fault conditions shall be reported and logged.

(N) Count storage - The master shall have the ability to tabulate and store 15 minute count data from up to 32 different sensors. The data shall be available for automatic transfer to the central office facility upon request.

(O) The selection of the sensors to be counted in any 24 hour period shall be completely programmable from the central office computer.

(P) Miscellaneous Data Storage. The master shall store all of the following data:

1. The time of day and location of all sampling sensor failures. If normal operation resumes, this time shall also be recorded.

2. The time of day, location and mode of all local intersection failures. The time that normal operation resumes must also be recorded.

3. The time and mode of all pattern changes. Changes due to external override must be distinguished from normal pattern changes.

4. The average volume or occupancy level for each 15 minute period for all computational channels.

(Q) It shall be possible to transmit any of the data listed above to the central office computer automatically or upon demand.

(R) Downloading Local Coordination Settings. It shall be possible to download any local intersection coordination setting (offset, force off or permissive period) from the master via the unit's keyboard.

(S) Display. During normal operation, the timing patter in effect shall be displayed on the front panel, including the cycle, offset plan and split plans selected. Also, the unit shall indicate how the timing plan was selected - through normal volume calculations, by an occupancy channel or by manual or central computer override. The master shall also indicate when the time of day mode is in effect and show whether this mode was selected manually or because of sensor failures.

(T) External Override. The master controller shall have appropriate inputs to externally select any timing pattern and override the pattern selected through traffic analysis.

(U) Telemetry. The master shall include a telemetry module for two way communications between the master and local controllers. The equipment shall be compatible with the telemetry equipment specified for the local controllers

8.40.00 MISCELLANEOUS HARDWARE

8.40.01 General

(A) Aluminum pedestal mounts (Type III) shall be either of two (2) types, as called for in the plans and specifications. Center mount with two (2) side ports, plain or offset mount serrated with one (1) side port.

(B) Covers for water valve pull boxes shall have the word "Traffic" cast into them to avoid confusion with a water department pull box.

(C) Mast arm brackets shall be Astro brackets or City approved equivalent and shall be installed 90 degrees to the roadway.

8.41.00 PAINT - SIGNAL POLES

8.41.01 New Structures

(A) All new signal poles and mastarms shall be factory painted with an epoxy primer and Polyurethane top coat liquid coating. Surface preparation shall be blast cleaned to Steel Structure Painting Council Surface Preparation Specification No. 6 (SSPC-SP6) requirement utilizing cast steel abrasives conforming to the Society of Automotive Engineers (SAE) Recommended Practice J827.

(B) All accessible interior surfaces shall be coated with a lead and chromate free red oxide rust inhibitive alkyd primer to a minimum dry film thickness of 1.0 mils.

(C) All exterior surfaces shall be coated with a rust-inhibitive Epoxy-Polyamide Primer to a minimum dry film thickness of 2.0 mils. The top coat shall consist of one coat of Semi-Gloss High-Build Acrylic Polyurethane Enamel, Tnemec Endura Shield or

approved equal, to a minimum dry film thickness of 2.0 mils. The top coat color shall be Federal Green No. 14056.

(D) Any surface areas damaged during handling or installation shall be repaired immediately with a spot coat of epoxy primer and a polyurethane finish as specified above. The paint manufacturer's application instructions shall be followed.

8.41.02 Existing Structures

(A) All designated previously installed signal poles and mast arms shall be field painted. All exterior surfaces shall be cleaned and examined for damaged paint, and any such damage shall be given a spot coat of primer and the entire exterior surface re-painted. Previously painted surfaces whether finish or prime coats, shall be scuff sanded to yield 500 PSI of adhesion with particular attention paid to the lower eight feet (8') of the pole. Inspection of the poles prior to application of the finish coat is required.

(B) A finish coat of Sherwin Williams DTM (Direct to Metal) Acrylic Gloss or approved equal shall be applied over the primer or previously painted surfaces. Two coatings shall be applied leaving approximately 6 mils of dry film. The color shall be a dark green formula (Federal Green No. 14056) which is available from the City Engineer.

(C) The painting shall be done in a neat and workmanlike manner and may be applied either by hand brushing or spraying. The engineer reserves the right to require the use of brushes for the application of paint should the work done by the paint spraying machine prove unsatisfactory or objectionable.

(D) All designated traffic and pedestrian signal heads shall be painted flat black unless otherwise specified. Previously painted controller cabinets shall be painted white.

8.42.00 INSTRUCTIONS AND WIRING DIAGRAMS

All equipment shall be provided with three sets of complete installation instructions, including a complete chart of field connections as well as a manual for the controller, containing service instructions, wiring diagrams, trouble-shooting procedures, etc. Each and every component used shall be clearly referenced in the service manual and its value, ratings and manufacturer part number shall be given.

8.43.00 GUARANTEE

The contractor shall include in his proposal all warrants and/or guarantees with respect to materials, parts, workmanship and performance of the product to be supplied. The minimum guarantee period for the product shall be one (1) year from the date of final acceptance of the contract. The contractor shall attach to the bid a statement that all material to be supplied is either in exact accordance with the specifications or shall list in detail any and all deviations therefrom. The supplying of equipment that is not in accord with the specification and on which the contractor has indicated no exception shall be cause for rejection of the equipment and correction of the non-specification items entirely at the contractor's expense.

8.44.00 SIGN SPECIFICATIONS

8.44.01 Sign Face Materials

All stop signs, yield signs, and "Do Not Enter" sign faces shall be fabricated from Scotchlite reflective sheeting, high-intensity grade or approved equal. All other sign faces shall be fabricated from Scotchlite reflective sheeting, engineer grade or approved equal.

8.44.02 Sign Post Materials

All sign posts shall be fabricated from 12-gauge galvanized, perforated Telespar tubing or approved equal. The sign post assembly shall consist of a VLOC steel 2 foot anchor sleeve and a two inch by two inch by ten-foot (2" x 2" x 10') post. See detailed drawing in Appendix.

8.44.03 Fire Lane Sign Specifications

Size:	12 Inches by 18 Inches
Materials:	Engineer Grade Reflective Sheeting
Colors:	Sign Letters on White Background. The letter on the symbol sign shall be black.
Wording:	"No Parking" (or) "Fire Lane" (with appropriate arrow)
General:	Letter size, border, hole locations, and corner radii shall be per the Manual on Uniform Traffic Control Devices specifications.

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CHAPTER 9
TRENCHING, BACKFILLING AND COMPACTING

9.00.00 GENERAL

9.01.00 DESCRIPTION

(A) This section covers excavation and trenching including drainage, dewatering, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipe lines, service lines, and appurtenances.

(B) Reference detail drawing in the appropriate chapter of these STANDARDS AND SPECIFICATIONS.

9.02.00 QUALITY ASSURANCE

9.02.01 Compaction

Soil compaction tests shall be performed in accordance with:

(A) ASTM D 698, Standard Method of Test for Moisture Density Relations of Soils

(B) ASTM D 2049, Standard Method of Test for Relative Density of Cohesionless Soils

9.02.02 Construction Staking

(A) Construction staking shall be performed with qualified, competent personnel under the direction of a professional land surveyor registered in the State of Colorado.

(B) All survey notes and construction staking notes shall be entered into bound, hard cover field books.

(C) Staking of the work shall be at fifty-foot (50') stations (maximum).

(D) Offsets shall be staked so that vertical and horizontal alignment may be checked.

(E) All survey data which is developed by the contractor or the developer's surveyor in performing surveys which are required by the work shall be available to the City for examination throughout the construction period.

9.03.00 JOB CONDITIONS

9.03.01 Drainage and Groundwater

(A) All excavations and trenches shall be kept free from excess groundwater during construction.

(B) Any water which is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade to permit joints to be made in the dry and to prevent the entrance of water into the pipeline.

(C) Surface run-off shall be diverted as necessary to keep excavations and trenches free from water during construction.

(D) The excavation or trench shall be kept free from water until the structure or pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

(E) Water shall be prevented from entering into previously constructed pipe.

(F) Except for storm drains, the pipe under construction shall not be used for dewatering.

9.03.02 Sequencing

(A) Pipeline installation shall be performed within two hundred (200) linear feet of trench excavation. If construction is occurring in an open field, this distance may be increased at the Public Works Director/City Engineer's discretion.

(B) Initial trench backfill shall be performed within fifty (50) linear feet of pipeline installation. If construction is occurring in an open field, this distance may be increased at the Public Works Director/City Engineer's discretion.

(C) Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the duration of that opening is to be minimized. The contractor shall coordinate the amount and duration of road closures with the City's Public Works and Traffic Department.

9.03.03 Underground Obstructions

(A) The contractor/developer shall field verify all drawings of record information obtained from the City or other affected utility company.

(B) The contractor/developer shall notify each utility owner and request utilities to be field located by surface reference at least forty-eight (48) hours prior to trenching or excavation.

(C) In situations where conflicts may exist, the contractor shall expose and verify the size, location, and elevation of underground utilities and other obstructions sufficiently in advance of construction to permit changes to be made to the construction drawings.

(D) In the case of a conflict, the contractor shall notify the City and the affected utility company, the proposed work may then be modified by the Design Engineer and after the Public Works Director/City Engineer's approval.

(E) Existing improvements, adjacent property, utilities, trees, and plants that are not to be removed shall be protected from injury or damage resulting from the contractor's operations. If damage should occur, the contractor shall make repair such that damaged materials are restored in original or better condition, as directed by the Public Works Director/City Engineer, utility or property owner in question.

(F) If the contractor removes any underground obstructions, the following shall apply:

1. Drainage culverts may be salvaged, stored, and reused in the original location if approval is obtained from the City Engineer. All other underground obstructions shall be replaced with new materials.

2. The area in which the underground obstruction was located shall be restored to original or better condition.

9.04.00 MAINTENANCE AND CORRECTION

9.04.01 Trench Settlement

The contractor/developer shall maintain and repair all trench settlement and make necessary repairs to pavement, sidewalks, or other structures which may be damaged as a result of backfill settlement. Contractor shall warrant work for a period of one (1) year after final completion and acceptance of the work.

9.04.02 Subcontractors

The contractor/developer may perform such maintenance and repairs by subcontract. If the contractor chooses to subcontract the warranty work, he shall submit to the Public Works Director/City Engineer a copy of the subcontract or the work authorization as evidence of the contractor's faithful intention to perform any repairs which may become necessary during the one-(1) year warranty period.

9.10.00 CONSTRUCTION SPECIFICATIONS

9.11.00 PREPARATION

(A) Topsoil shall be stripped from areas which are to be disturbed by construction and stockpiled.

(B) Topsoil shall be segregated from non-organic trench excavation material and debris.

9.12.00 TRENCHING

(A) Trenches shall be excavated by open-cut methods, except where boring or tunneling is indicated, shown on drawings, or approved by the Public Works Director/City Engineer.

(B) Trench width shall be maintained to within three inches (3") of that specified on plans.

(C) Care shall be used when operating mechanical equipment in locations where it may cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground.

(D) Mechanical equipment shall be designed and operated in such a manner that the bottom elevation of the trench can be controlled with uniform trench widths and vertical sidewalls which extend from the bottom of the trench to an elevation one foot (1') above the top of the installed pipe.

(E) Trench alignment shall be sufficiently accurate to permit pipe to be aligned properly with an eight-inch (8") minimum clearance between the pipe and the sidewalls of the trench. The trench sidewall shall not be undercut in order to obtain clearance.

(F) Contractor shall over-excavate a minimum of six inches (6") below the bottom of the pipe wherever the trench bottom is rock, shale, or other unsuitable material. Over-excavation shall be backfilled and compacted with acceptable granular material. Granular material shall conform to Section 9.22.00 of these STANDARDS AND SPECIFICATIONS.

(G) Preparation of Trench Bottom:

1. Trench bottoms shall be graded uniformly to provide clearance for each section of pipe.

2. Loose material, water, and foreign objects shall be removed from the trench.

3. The contractor shall provide a firm subgrade which is suitable for application of bedding material.

4. Wherever unstable material is encountered in the bottom of the trench, said material shall be over-excavated to a depth suitable for construction of a stable subgrade. The depth suitable for construction of a stable subgrade shall be determined by the Public Works Director/City Engineer. The over-excavation shall be backfilled with stabilization material and compacted as required by the Public Works Director/City Engineer. Stabilization material shall conform to Section 9.21.00 of these STANDARDS AND SPECIFICATIONS.

(H) Stockpiling Excavated Materials:

1. Suitable material for backfilling shall be stockpiled in an orderly manner at a minimum of four feet (4') from the edge of the trench.

2. Excess excavated materials not suitable or not required for backfilling shall be removed from the site and disposed.

3. Excavated material shall not be stockpiled against existing structures or appurtenances.

4. Excavated materials containing <u>any</u> hazardous materials shall be disposed of at an approved site in accordance with an abatement plan to be prepared by the developer/engineer or other qualified professional in accordance with all federal, state, and local ordinances.

(I) Limiting Trench Widths:

1. Trenches shall be excavated to a width necessary to provide an eight-inch (8") minimum working space between the pipe and the trench walls for proper pipe installation, joining, and bedding.

2. The maximum trench width at an elevation twelve inches (12") above the top of the installed pipe shall be the pipe diameters of the pipe plus 24 inches, or thirty inches (30") whichever is greater. If the width of the trench, twelve inches (12") above the top of the pipe, exceeds the maximum allowable trench width, a higher strength pipe or special pipe

bedding shall be provided as required by soil-loading conditions and as approved by the Public Works Director/City Engineer.

9.13.00 PIPE BEDDING

(A) Placement and Compaction:

1. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. Pipe shall not be supported by the bells.

2. To prevent lateral displacement, granular bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.

3. Granular bedding material shall be compacted in accordance with these STANDARDS AND SPECIFICATIONS.

(B) Ground water barriers shall be constructed in such a manner to prevent passage of water through bedding material for the full depth of the granular bedding material and the full width of the trench.

1. Ground water barriers, if shown on the approved construction plans, shall be approximately four feet (4') long and spaced not more than four hundred feet (400') apart.

2. Material for ground water barriers shall be as specified by the ditch company which controls the irrigation ditch to be crossed. If there is no ditch company, the Public Works Director/City Engineer shall determine the material to be used.

9.14.00 BACKFILLING AND COMPACTION

(A) Trenches shall be backfilled promptly after the pipe has been installed and inspected. Backfill around manholes and valve boxes shall be compacted with hand-operated equipment.

(B) Backfill material shall be deposited in uniform horizontal layers which may not exceed six inches (6") (compacted depth) in all areas. Other thickness may be used with the prior written approval of the Public Works Director/City Engineer.

(C) Methods and equipment which are appropriate for the backfill of material shall be employed. Backfill equipment or backfilling methods which transmit damaging shocks to the pipe shall not be used.

(D) Compaction shall not be performed by jetting or water settling.

(E) If compaction cannot be obtained with job excavated material, trench backfill material shall be imported.

(F) Topsoil shall be replaced to the depth of stripping over all areas which are to receive vegetation.

(G) Excess excavated materials and materials not suitable for backfill shall be removed from the site.

9.15.00 FIELD QUALITY CONTROL

(A) Field Compaction Control:

1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with ASTM D 2922 (Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods).

2. Compaction tests shall be performed at a depth of one-and-one-half feet (1-1/2') above the top of the pipe and in one-foot (1') vertical increments up to the finish grade.

3. Compaction tests shall be performed at least once every one hundred (100) linear feet as measured along the length of the pipe.

4. If the Public Works Director/City Engineer determines that reliable and uniform results are produced by the contractor's construction techniques, the frequency of testing may be changed to one every three hundred feet (200').

(B) Compaction shall be to the following minimum densities (reference ASTM D 698 or AASHTO T 99 unless otherwise indicated):

1. Barrier Material - 95 Percent of Maximum Standard Density.

2. Pipe Bedding:

   a. Compacted Granular Material -
   80 Percent of Maximum Relative Density (ASTM D 2049).

   b. Carefully Compacted Select Soil -
   95 Percent of Maximum Standard Density

   c. Barrier Material - 95 Percent of Maximum Standard Density

3. Trench Backfill:

   a. Paved roadways, sidewalks, and other areas - 95 Percent of Maximum Standard Density

   b. Gravel Roadways - 95 Percent of Maximum Standard Density

   c. Fields and All Other Areas - 90 Percent of Maximum Standard Density

   d. Under Footings, Foundations, Structures, 100 Percent of Maximum Standard Density or in Conformance with the Approved Soils Report and Recommendations

(C) Moisture Content:

1. All compacted backfill shall be within two percent (2%) (plus or minus) of the optimum moisture content of the soil as determined by ASTM D 698.

2. Water shall be added to the material or the material shall be harrowed, disced, bladed, or otherwise worked to insure a uniform moisture content, as specified.

9.16.0 EXCAVATIONS AND REMOVAL WITHIN EXISTING PAVED SURFACES

(A) Sawcutting of the existing pavement is required prior to final patching.

(B) Minimum patching depths are as follows;

ARTERIAL STREETS – 9" FULL DEPTH
COLLECTOR STREETS - 7" FULL DEPTH
LOCAL STREETS - 5" FULL DEPTH

In the event existing asphalt thickness exceeds these minimums, the patch depth shall match existing.

(C) ALL TRENCH BACKFILLING SHALL BE ACCOMPLISHED BY USING FLOW-FILL/FLOWABLE FLYASH MATERIAL CONFORMING TO SECTION 9.24.00 OF THESE SPECIFICATIONS.

(D) No dimension of existing pavement less than 3 feet shall be left between the new patch and existing lip of gutter (5 feet for concrete). On Arterial or Collector streets, no side of a patch shall fall within 2 feet of the existing wheel path. Patches within 2 feet shall require the removal of additional pavement to meet this requirement.

(E) All patches will be 4 sided.

(F) ALL PATCHES WILL REQUIRE THE REMOVAL AND REPLACEMENT OF AN ADDITIONAL 2 FEET OF ASPHALT ON EACH SIDE OF THE TRENCH TO COMPENSATE FOR THE VERTICAL SHEAR OF THE TRENCH WALLS. (See detail TCB1 of 1)

(G) Patches shall not be less than 4 feet in any direction unless previously approved.

(H) Patches in concrete pavement shall be from construction joint to construction joint.

(I) All existing traffic control devices, including traffic marking paint, thermoplastic markings, and traffic signal loop detectors shall be replaced prior to acceptance of the patching.

(J) Excavations that result in a patch that exceeds 8 feet in each direction shall require the use of a spreader box. Patches exceeding 12 feet in width and 200 feet in length shall require the use of a self- propelled paver.

(K) Patches in existing paved areas shall be warranted for a period of 1 year from the date of acceptance.

(L) Final surface tolerances shall not exceed ½ inch as measured with a 10-foot straight edge.

9.20.00 MATERIAL SPECIFICATIONS

9.21.00 STABILIZATION MATERIAL

(A) If the existing soil in the trench bottom is judged to be unsuitable by the City Engineer, the top six inches (6") of the pipe subgrade shall be removed and replaced with a stabilization material.

Stabilization material shall conform to ASTM D 448 or CDOT No. 4, according to Table 9.21.00:

TABLE 9.21.00
Stabilization Material

Size	Percent Passing
2 Inch	100
1-1/2 Inch	90-100
1 Inch	20-55
3/4 Inch	0-15
3/8 Inch	0-5

(B) Geotextiles used for erosion control, drainage and silt fence shall conform to CDOT requirements of 712.08 in the Standard Specifications for Road and Bridge Construction.

9.22.00 BEDDING MATERIALS

(A) Granular Material. Uniformly-graded material conforming to AASHTO M6, according to Table 9.22.00:

TABLE 9.22.00
Bedding Material

Size	Percent Passing
3/8 Inch	100
No. 4	95-100
No. 16	45-80
No. 50	10-30
No. 100	2-10

(B) Select Soil. Excavated material which is free from rocks, clods, and stones greater than one-and-one-half inches (1-1/2") in any dimension and which meets other requirements of trench backfill material.

(C) Barrier Material -- Soil Classification:

1. GC -- Clayey gravel, gravel-sand-clay mixtures.

2. SC -- Clayey sands, sand-clay mixtures.

3. CL -- Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, clean clays.

4. Material may be finely divided, suitable, job-excavated material free from stones, organic matter, and debris.

9.23.00 TRENCH BACKFILL MATERIAL

(A) Trench backfill material shall be placed from a point twelve inches (12") above the pipe to twelve inches (12") below the ground surface or to the bottom of the pavement subgrade, whichever is greater.

(B) Trench backfill material shall be either soil excavated from the trench or imported soil.

1. Any soil used for trench backfill shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, hazardous material, debris, and any rocks or stones which are larger than six inches (6") in any dimension. Rocks or stones which are larger than three inches (3") in any dimension shall not be placed within one foot (1') of pavement subgrade or within one foot (1') of the finished surface of unpaved areas or within one foot of the pipe.

2. If imported soil is used for trench backfill it shall meet CDOT specifications for Class 2 structure backfill.

9.24.00 FLOW-FILL/FLOWABLE FLY ASH BACKFILL

9.24.01 General

When required or approved by the Public Works Director/City Engineer, and at the expense of the contract/developer, the following materials may be used in lieu of structure backfill (Class 1 and Class 2) or to backfill culvert pipes, storm sewer pipes, and utility cuts.

TABLE 9.24.00

FLOW-FILL

Ingredients	Pounds Per Cubic Yard
Cement	50
Coarse Aggregate (AASHTO No. 57 or 67)	1700
Fine Aggregate Water (AASHTO M6)	1845
Water (39 Gallons)	325(or as needed for proper consistency)

FLOWABLE FLY ASH BACKFILL

Ingredients	Pounds Per Cubic Yard
Class C Fly Ash	200-400
Class F Fly Ash	1,600-1,800
Water (96 Gallons)	800 (or as needed for proper consistency)

No flowable fly ash backfill will be used to backfill abutments.

9.24.02 Compaction

Compaction of flowable fly ash backfill will not be required if material meeting the above requirements is used.

The maximum layer thickness for flowable fly ash backfill shall be three feet. Additional layers shall not be placed until the flowable fly ash backfill has lost sufficient moisture to be walked on without indenting more than two inches. Damage resulting from placing flowable fly ash backfill in layers that are too thick or from not allowing sufficient time between placement of layers shall be removed and replaced.

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CHAPTER 10
ACCEPTANCE REQUIREMENTS

10.00.00 APPLICABILITY

Before the City will assume ownership and maintenance responsibility for public improvements, the public improvements shall be formally accepted by the Public Works Director/City Engineer. The developer is responsible for the proper installation of all improvements. Failure by the City's representatives to detect improper installations or defects during the construction of improvements or during subsequent inspections does not relieve the developer of the responsibility to correct such defects at a later date. There shall be no partial acceptances of public improvements within new developments.

10.01.00 ACCEPTANCE PROCEDURE

10.01.01 Written Request

At such time that the developer believes that the construction of all required public and private improvements have been completed, all improvements are accessible and visible for inspection and a written Release For Service (See Chapter 1) for water and sanitary sewer systems has been issued by the Public Works Director/City's Engineering Division, a written request for acceptance shall be submitted to the Public Works Director/City Engineer.

10.01.02 Record Drawings

A complete set of "blueline as-constructed" drawings of the public improvements shall accompany the request for acceptance. Upon approval by the City, the developer will be required to submit a certified set of 3 mil double matte mylar copies of the "as-constructed" drawings. These drawings shall be prepared on twenty-four-inch by thirty-six-inch (24" x 36") sheets, and lettering should be no smaller than one-eighth inch (1/8"). At a minimum, record drawings shall indicate the horizontal or vertical layout of all underground water, sanitary sewer, and storm sewer facilities (including distances between valves, fittings, manholes, etc.), profiles of streets, sanitary sewer mains and storm sewer mains, details of special or unusual installations, and detention pond volumes. If significant corrections to the improvements are noted during the acceptance inspection, the record drawings may be returned to the developer for revisions. The final submittal of record drawings shall include the mylar copy mentioned above along with a "blueline" copy with each sheet of the blueline signed and sealed by the Professional Engineer registered in the State of Colorado who is responsible for the preparation of the record drawings.

10.01.03 Certification of Storm Drainage Detention

A. Registered Land Surveyor: A land surveyor registered in the State of Colorado shall affirm the as-built detention pond volumes and surface areas at the design depths, outlet structure sizes and elevations, storm sewer sizes and invert elevations at inlets, manholes, and discharge location, and representative open channel cross-sections, and dimensions of all the drainage structures.

B. Registered Professional Engineer: The responsible design engineer shall state that "I have inspected the drainage facilities and to the best of my knowledge, belief, and opinion, the drainage facilities were constructed in accordance with the design intent of the approved drainage report and construction drawings."

10.01.04 Preparation of Corrections List

Upon receipt of the written request for acceptance, certification of storm drainage detention, and record drawings, the Public Works Director/City Engineer will instruct the appropriate Engineering Construction Inspector to schedule an inspection of the improvements. The developer or his representative will be invited to accompany the City's representative on all such inspections. The construction of public improvements will be inspected for conformance with the approved plans, the Official Development Plan, the Public Improvements Agreement, these STANDARDS AND SPECIFICATIONS, and City Code. If, due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the developer will be notified of the need to postpone these activities until the cause of the delay can be rectified. Deficiencies noted during the inspection will be compiled in a corrections list to be mailed to the developer.

10.01.05 Correction of Deficiencies

Correction list items shall be corrected within sixty (60) days of the date of the corrections list. If all of the noted deficiencies are not corrected within this time, the public improvements may be reinspected and any new defects may be added to the corrections list. Public improvements will not be accepted until all noted deficiencies are corrected within the proper time frame. The Public Works Director/Engineering Construction Inspector shall be notified before any corrective work commences and immediately upon the completion of the repairs.

10.01.06 Written Acceptance

Upon the completion of all items on the correction list and payment of all outstanding fees, reimbursements, and other items owed to the City, the Public Works Director/City Engineer will issue a written acceptance of the public improvements. The amount of the surety for the public improvements may then be reduced to fifteen percent (15%) of the original, estimated cost of the public improvements.

10.02.00 WARRANTY PERIOD

10.02.01 Duration

All public improvements shall be subject to a warranty period of at least two (2) years after the date of the letter of acceptance from the City Engineer.

10.02.02 Maintenance Responsibility

The developer shall be responsible for the maintenance of all public improvements during the warranty period. The Public Works Director/City Engineer will notify the developer of any maintenance that may be necessary during this time. Routine maintenance normally performed by the developer includes, but shall not be limited to, the cleaning of streets, patching of potholes, and removal of blockages from water, storm and sanitary sewer facilities. The cost of any routine maintenance not performed by the developer that must be performed by the City will be billed to the developer at cost plus fifteen percent (15%).

10.02.03 Emergency Repairs

In the event of a water main break, sanitary sewer main blockage, street or bridge failure, or other emergency that may occur during the warranty period, it may become necessary for the City to undertake immediate repairs to the facilities and/or make the area safe to residents, pedestrians, or motorists. The City will attempt to contact the developer in the event of such emergency. However, if the developer or his representative cannot be contacted quickly or if the developer is unable to take immediate action to relieve the urgent situation, the City may proceed with such action as deemed necessary by the Public Works Director/City Engineer, and the developer will be billed for all costs of these actions at cost plus fifteen percent (15%).

10.03.00 END OF WARRANTY PROCEDURE

10.03.01 Preparation of Corrections List

At approximately nine (9) months into the warranty period, the Engineering Construction Inspector will schedule and perform an inspection of the public improvements within the development. The developer or his representative will be invited to accompany the City's representative on all such inspections. The condition of the public improvements will be inspected for conformance with the approved plans, the Official Development Plan, the Public Improvements Agreement, these STANDARDS AND SPECIFICATIONS, and City Code. If due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the developer will be notified of the need to postpone these activities until the cause of the delay can be rectified. Deficiencies noted during the warranty inspection will be compiled in a corrections list to be mailed to the developer.

10.03.02 Correction of Deficiencies

Warranty correction list items should be corrected within 2 months of the date of the warranty correction list, and all corrections must be completed no later than ten (10) working days prior to the scheduled end of the warranty period. If all of the noted deficiencies are not corrected within this time, the public improvements may be reinspected, a revised correction list may be issued, and the end of the warranty period may be adjusted at the discretion of the Public Works Director/City Engineer to allow ample time for the completion of the corrections. The end of the warranty period will not be acknowledged until all noted deficiencies are corrected within the proper time frame. The appropriate Public Works Director/Engineering Construction Inspector shall be notified before any corrective work commences and immediately upon the completion of the repairs.

10.03.03 Written Acknowledgment of End of Warranty

Upon completion of the correction of all deficiencies noted in the warranty correction list, the city engineer will issue a written acknowledgment of the end of the warranty period for the public improvements. Surety for public improvements may be released in its entirety at this time.

10.04.00 ACCEPTANCE/WARRANTY INSPECTION CRITERIA

10.04.01 General

All public and private improvements shall be installed in conformance with the approved plans, the Official Development Plan, the Public Improvements Agreement, and these STANDARDS AND SPECIFICATIONS. The Public Works Director/City Engineer shall be the final authority in the determination of defects and required corrections to public and private improvements.

10.04.02 Grading and Seeding

Finished grades shall be in conformance with the approved plans and the Official Development Plan. Detention pond grading shall provide, at a minimum, the required volume as defined in the approved final drainage study. Unless otherwise approved, no slopes shall exceed a grade of four (horizontal) to one (vertical) (4:1). Seeding shall be performed and grass shall be established in conformance with Chapter 2 of these STANDARDS AND SPECIFICATIONS.

10.04.03 Water Systems

The required inspection and testing of water mains and appurtenances that shall be performed before systems can be released for service is outlined in Chapter 3 of these STANDARDS AND SPECIFICATIONS. At the time of acceptance and warranty inspections of all public and private improvements, additional aspects of water system construction that shall be inspected include, but shall not be limited to, the following:

(A) All valves, blow-off installations, and fire hydrants shall be operable.

(B) Valve box risers shall be vertical and shall be adjusted to within one-eighth inch (1/8") below grade in paved areas or one inch (1") above grade in landscaped areas.

(C) Valve operating nuts shall be accessible with a six-foot (6') valve key with between eighteen inches (18") and four feet (4') of clearance between the handle of the key and finished grade.

(D) Fire hydrants shall be vertical and shall be adjusted to a minimum of eighteen inches (18") from the center of the nozzle to finished grade.

(E) A minimum of five feet (5') of clearance for operation shall be provided around all fire hydrants and water valve risers.

(F) Manhole rims and covers for water valve vaults shall be adjusted to within one-eighth inch (1/4") below grade in paved areas or one inch (1") above grade in landscaped areas.

(G) The construction and operation of any required pumping systems shall be in conformance with the specifications issued and approved for that specific installation.

(H) All mains and manholes shall be free of construction debris, dirt, trash, and other foreign material.

(I) Manhole steps shall be properly spaced and aligned.

10.04.04 <u>Sanitary Sewer System</u>

The required inspection and testing of sanitary sewer mains and appurtenances that shall be performed before systems can be released is outlined in Chapter 4 of these STANDARDS AND SPECIFICATIONS. At the time of acceptance and warranty inspections of all public improvements, additional aspects of sanitary sewer system construction that shall be inspected include, but shall not be limited to, the following:

(A) All mains and manholes shall be free of construction debris, dirt, trash, and other foreign material.

(B) The City's TV inspection of all sanitary sewer mains shall be completed prior to the acceptance of public and private improvements.

(C) Manhole rims and covers shall be adjusted to within one-eighth inch (1/4") below grade in paved areas or one inch (1") above grade in landscaped areas.

(D) Manhole steps shall be properly spaced aligned.

(E) The construction and operation of any required sewage lift systems shall be in conformance with the specifications issued and approved for that specific installation.

10.04.05 Storm Sewer System

The required inspection and testing of storm sewer mains and appurtenances that shall be performed are outlined in Chapter 5 of these STANDARDS AND SPECIFICATIONS. At the times of acceptance and warranty inspections of all public improvements, additional aspects of storm sewer system construction that shall be inspected include, but shall not be limited to, the following;

(A) All pipes and manholes shall be free of construction debris, dirt, trash, and other foreign material.

(B) Manhole rims and covers shall be adjusted to within one-fourth inch (1/4") below grade in paved areas or one inch (1") above grade in landscaped areas.

(C) Manhole steps shall be properly spaced and aligned.

(D) Inlets shall be properly aligned to within one-eight inch (1/8") below grade next to sidewalk or curb and gutter.

10.04.06 Concrete

At the time of acceptance and warranty inspection of all public improvements the aspects of concrete construction that shall be inspected include, but shall not be limited to the following:

(A) Breakage or cracking greater than 1/32" at other than construction joints.

(B) Ponding of any size.

(C) Settlement affecting drainage, pedestrian or traffic safety.

(D) Surface spalling or deterioration.

(E) Longitudinal cracking.

10.04.07 Roadway

At the time of acceptance and warranty inspection of all public improvements, the aspects of roadway construction that shall be inspected include, but shall not be limited to, the following:

(A) Breakage or cracking greater than 1/8".

(B) Ponding of any size.

(C) Settlement affecting drainage, pedestrian or traffic safety.

(D) Surface segregation of fines or aggregate

(E) Hazardous conditions

(F) Alligatoring

(G) Improper grade or inverted crown.