

**City of Alamosa
Standard Construction Specifications
2012**

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1. INFORMATION FOR BIDDERS

Purpose and Mission Statement

It is the purpose and intent of these construction specifications to develop a set of City wide construction standards to assist contractors in producing high quality installation and repairs to new and existing streets, rights of way and utilities. It is intended assist contractors in providing their prospective clients with bids based on consistent parameters. These guidelines detail City of Alamosa requirements for producing long lasting, low maintenance, installation and repairs to City owned streets and utilities. These guidelines are not site specific but incorporate the best overall engineering and construction practices available. With these guidelines we hope to satisfy the general public that as stewards of City infrastructure, we (PWD) are protecting and maintaining their investments and not incurring future expenditures at their expense as a result of private utility improvements.

They are also intended to:

- instruct contractors on how to prepare and submit plans and other documentation for Right-of-Way Permits
- describe some of the processes and practices expected to result in quality repairs and installations
- define the policies, roles, requirements and responsibilities of all involved parties.

All contractors and public utility agencies must obtain a Right-of-Way Permit for any work performed within the public rights-of-way of the City of Alamosa (City). The storage of materials and equipment within the public rights-of-way also requires a Permit.

In an effort to preserve the original investment of the street and roadway systems within the City of Alamosa, minimize the disruption, maximize safety to the traveling public, and reduce future maintenance problems, IT IS THE POLICY OF THE CITY TO REQUIRE THE INSTALLATION OF NEW UTILITIES ACROSS EXISTING STREETS BE DONE BY TUNNELING OR BORING; OPEN CUTTING OF EXISTING STREETS FOR THE INSTALLATION OF NEW UTILITIES WILL BE PERMITTED ONLY WHEN IT CAN BE PROVEN IT IS NOT POSSIBLE TO USE BORING OR TUNNELING TECHNIQUES, OR WHEN WAIVED BY THE CITY.

Applicants for Right-of-Way Permits must plan for adequate review and approval time by the City. Generally, the greater the scope of work, the longer the permit review and approval process will take.

NOTE: THE CITY RESERVES THE RIGHT TO VARY FROM THESE STANDARDS BASED UPON CONDITIONS SPECIFIC TO THE LOCATION WHERE THE WORK WILL OCCUR. THE "SPECIAL CONDITIONS" SECTION OF THE PERMIT OR CONTRACT WILL OUTLINE ANY VARIATIONS FROM THE CITY-WIDE SPECIFICATIONS.

Entities Included Under These Guidelines

The following Local Entities are covered by these Guidelines:

- City of Alamosa

Definitions

Wherever the following words, phrases, or abbreviations appear in these standards, they shall have the following meanings:

AASHTO - American Association of State Highway and Transportation Officials

ANSI - American National Standard Institute

ASTM - American Society for Testing Materials

AWWA - American Water Works Association

As-Constructed Drawings – A set of construction drawings that has been red-penciled or otherwise marked to record all changes which have occurred during the construction

Base preparation - consists of the scarifying (if necessary), shaping, and compaction of the sub grade as necessary for pavement construction.

Bid Bond - is the cashier's check and/or bidder's bond accompanying the proposal submitted by the bidder, as a guaranty that the successful bidder will enter into a contract with the Owner for construction of the work

CDOT – Colorado Department of Transportation

Code - shall mean the latest official adopted ordinances, policies codes and/or regulations of the City of Alamosa

Contract - is the agreement covering the performance of the work described in the contract documents including all supplemental agreements therein and all general and special provisions pertaining to the work and materials thereof

Contract Documents - consist of the following:

- Bid
- Bid Bond
- Agreement
- City of Alamosa Standard Construction Specifications
- Plans and Drawings
- Special Provisions
- Notice to Proceed
- Performance and Payment Bonds
- Notice of Award
- Certificates of Insurance
- Any and all addendums
- Any Change Orders

Contractor - shall mean a person, partnership or corporation duly bonded, licensed and insured to perform work within public rights-of-way in the City of Alamosa, said contractor shall also be named in the Contract Documents

Days - intended as calendar days and not normal working days unless stipulated as working days

Drawing - are all general and detailed official drawing or reproductions of drawings pertaining to the work or to any structure connected therewith, including such working plans as may be furnished or approved by the Engineer from time to time as the work progresses

Driveway, Rural - that portion of gravel or hard surfaced roadway from the street, roadway or alley to the private property line to gain access to the private property

Driveway, Urban - that portion of portland cement concrete or asphalt extending from the street gutter lip to the property line for the full width of access from the public right-of-way to the private property

Embankment - consists of the placement of earth fill to levels near the final design grade

Engineer - shall mean the Public Works Director for the City of Alamosa or their authorized representative

Engineering Plans – Drawings, plans, profiles, cross sections and other required details for the construction of public or private improvements within the public rights-of-way or public easements, conforming with the City’s applicable improvement standards

Excavation - consists of the removal of earth to levels near the final design grade, and removal of unsuitable earth material from below planning fill sections.

Final design grade - is the bottom of the pavement structure as shown on the plans and as staked by the Engineer **or Contractor**

Functional Classification – the objective grouping of roads, streets and highways into integrated systems, each ranked by their relative importance to the general welfare, the motorists and land use

Standard Specifications for Road and Bridge Constructiton – Shall refer to the current edition of the “Standard Specifications for Road and Bridge Construction”, Colorado Department of Transportation

Standard Construction Specifications – A set of regulations established by the City of Alamosa setting forth the details, specifications, instructions, and procedures to be followed in the planning, design, installation and construction of public or private improvements within the public rights-of-way or public easements

Inspector - shall mean an authorized representative of the Engineer assigned to make inspections for contract performances, standards and contract compliance

City - shall mean the City of Alamosa, Colorado

May - a permissive condition. No requirement for design or application is intended

MUTCD- Current edition of the Manual on Uniform Traffic Control Devices (Federal Highway Administration).

OSHA - Occupational Safety and Health Administration

Owner - is the City of Alamosa, Colorado

Performance Bond - is the approved form of security furnished by the contractor and his surety as a guaranty of good faith on the part of the contractor to execute the work in accordance with the terms of the contract

Proposal - is the offer of a bidder to perform the work described in the contract documents when made out and submitted on the prescribed proposal form, properly signed and guaranteed

Right-of-Way (R.O.W.)- Any strip of area of land, including surface, overhead, or underground, granted by deed, easement, dedication, prescription or lease, for construction and maintenance according to designated use, such as for streets and highways, drainage ditches, irrigation canals, etc.

Right-of-Way Permit - An official document issued by of the City authorizing the performance of a specified activity or work within public rights-of-way and public easements by a person, contractor, company, firm, corporation, or public utility

SDR - Standard Dimension Ratio

Shall - a mandatory condition. Where certain requirements in the design or application are described with the shall stipulation, it is mandatory that these requirements be met

Should - an advisory condition. Where the word should is used, it is considered to be advisable usage, recommended but not mandatory. Deviations may be allowed when reasons are given which show intent of the standard is met

Specifications - shall mean the legal and procedural documents, general conditions of the contract, together with modifications thereof, and the detailed specification requirements, with all addenda thereto

Spot sub grade reinforcement - consists of the removal of unsuitable material in the sub grade and the placement of an equal quantity of suitable material to provide a sub grade as necessary for pavement.

Stakes - Any and all survey markings for the contractors, set by the Engineer or private land surveyor, i.e. wooden stakes, lathe, painted markings, etc.

Street - a general term denoting a public way for purposes of vehicular, pedestrian and bicycle travel ways, including the entire area within the right-of-way (includes alleyways). **Sub grade** - is the top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.

Traffic Control Supervisor (TCS) – A well trained and knowledgeable individual assigned the responsibility for traffic control devices at work sites. The TCS must be ATSSA (American Traffic Safety Services Association) or CCA (Colorado Contractor’s Association) certified

Traffic Engineer - shall mean the Traffic Engineer or person responsible for monitoring traffic in the City

UNCC – Utility Notification Center of Colorado (commonly referred to as “One Call”). Statewide clearinghouse for coordinating and scheduling utility locates. Most utilities, both public and private, utilize this service. Toll-free phone number for UNCC is 1-800-922-1987

Utility - Water, Sewer, Electric, Gas, Telephone, Cable TV, fiber optic or any other facility constructed within City owned Right of Ways or Easements

Written Notice - shall be considered as served when delivered in person or sent by certified mail to the contractor at the address shown on the contract

Printed Proposal Forms

The bidder will be furnished with the proposal form prepared by the engineer, which will state the location and description of the proposed work to be constructed and which will show the estimate of the various quantities of work to be performed and materials to be furnished, the time in which the work is to be completed, the amount of the bid bond (which must accompany the proposal) and the date and time of the opening of the proposals. It will also state any special provisions or requirements which vary from or are not contained in the standard specifications.

Variation in Estimated Quantities

The Contractor may reasonably expect a variation in the estimated quantities from the actual quantities and no claims will be allowed for anticipated profits, for loss of profits or for damage of any sort because of a difference between the estimate of any item and the amount of the item actually required. THE OWNER RESERVES THE RIGHT TO ELIMINATE ITEMS FROM THE PROPOSAL WHEN SUCH IS DEEMED IN THE OWNER'S BEST INTEREST.

Interpretation of Contract Documents

If any person contemplating submitting a bid for this contract is in doubt as to the true meaning of any of the contract documents, he may submit to the engineer a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt delivery. All official interpretations of the contract documents will be made only by addendum. The Owner will not be responsible for any other explanations or interpretations of the contract documents.

Bid Bond

- Bidder shall furnish a bid bond in the amount equal to 5% of the bid made payable to the City of Alamosa, Colorado. Bond shall be provided by a surety company authorized to do business in the State of Colorado, and supplied in a form satisfactory to the City. A cashier's check may be submitted in lieu of the bond.
- All such checks and bidder's bonds will be returned to the respective unsuccessful bidders within ten (10) days after the award is made.
- The check or bid bond for the successful bidder will be returned upon execution of the contract.

Signing of Proposals

If the proposal is made by an individual, his name and mailing address must be shown and the proposal must be signed. If made by a firm or partnership, the name and mailing address of each member of the firm or partnership must be shown and the proposal signed by an authorized member of the firm or partnership. If made by a corporation, the proposal must be signed by a corporation officer and must show the name and mailing address of the corporation.

Delivery of Proposals

All bids must be placed in a sealed envelope upon the outside of which there is disclosed the following information:

- The project name;
- The name of the person, firm or corporation submitting the bid; and
- The address of the person, firm or corporation submitting the bid.

Proposals shall be mailed to the Public Works Department at 300 Hunt, Room 107, Alamosa Colorado 81101 or submitted in person. No bids will be received after the time set for opening. A bidder may withdraw his proposal without prejudice to himself, any time before opening of the bids.

Opening of Proposals

Proposals will be opened publicly and read at the time, location and the date set in the "Advertisement for Bids". Bidders or their authorized agents are invited to be present and are permitted to examine any bid after opening.

Irregular Proposals

Proposals may be rejected if they show any omission, alteration of form, additions not called for, conditional alternate bids, or irregularities of any kind which may tend to make the proposal indefinite or ambiguous as to its meaning.

Disqualification of Bidders

Any or all proposals will be rejected if there is a reason for believing that collusion exists among the bidders. All participants in such collusion may not be considered in future proposals for the same work. Proposals in which the prices obviously are unbalanced as determined by the engineer will be rejected. No contract will be awarded except to responsible bidders capable of performing the class of work contemplated. The bidder shall furnish a complete statement of his experience and of the amount of capital and equipment available for the proposed work, if so requested by City Council or the engineer.

Award of Contracts

Contracts shall be awarded in accordance with Chapter Two, Article VI of the Alamosa City ordinances.

- The owner reserves the right to accept or reject any and all bids and to waive administrative irregularities.
- The award of the contract is contingent upon securing an acceptable bid which will fall within the amount of funds available for the project.
- The contract will be awarded to the lowest responsive and responsible bidder.

Lowest Responsible Bidder

In determining "Lowest Responsible Bidder," in addition to price, the following factors will be considered:

- The ability, capacity and skill of the bidder to perform the contract or provide the service required;
- Whether the bidder can perform the contract or provide the service promptly, or within the time specified, without delay or interference;
- The character, integrity, reputation, judgment, experience and efficiency of the bidder;
- The quality of performance of previous contracts or service;
- The previous and existing compliance by the Bidder with laws and ordinances relating to the contract or service;
- The sufficiency of the financial resources and ability of the Bidder to perform the contract or provide the service;
- The quality, availability and adaptability of the supplies, or contractual services to the particular use required;
- The ability of the Bidder to provide future maintenance and service for the use of the subject of the contract; and
- The number and scope of conditions attached to the bid.

Notice of Award

Within thirty (30) days, at a regularly scheduled council meeting after the opening of the proposals, the Owner will act upon them. The acceptance of the proposal will be a notice in writing signed (Notice of Award) by a duly authorized representative of the Owner, and no other act of the Owner shall be necessary to constitute acceptance of the proposal. The acceptance of a proposal shall bind the successful bidder to execute the required contract.

Time for Executing Contract and Damages for Failure to Execute

Any bidder whose proposal is accepted will be required to execute the contract and furnish performance bond required under "Performance Bond" hereof, within ten (10) days after notice that the contract has been awarded to him. Failure to do so shall constitute a breach of the agreement affected by the acceptance of the proposal.

The damages to the Owner of such breach will include loss from interference with his construction program and other items whose accurate amount will be difficult or impossible to compute. The amount of the bid bond accompanying the proposal for such bidder shall be retained by the Owner as liquidated damages for such breach.

The City Council shall be authorized, the same as if bond or bid contained in express stipulation to that effect, to cause such work to be done, or complete the work, or contract with some other contractor to do or complete the difference between actual cost to the City of such improvements and

the sum which it would cost if the defaulting bidder complied with his bid.

Engineer-Contractor Conference

If any plan holder wishes to meet with the engineer concerning the project to bid, he shall request a meeting and one will be set up for all plan holders not later than one (1) week prior to the bid opening.

GENERAL CONDITIONS

Notice to Proceed

Following the execution of the contract by the Owner, written notice to proceed with the work shall be given to the Contractor by the engineer. The Contractor shall commence with such force as to secure the completion of the work within the time stated in the proposal (unless otherwise directed in writing by the Owner).

Contractor's Understanding

It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during completion of the work, the general and local conditions, and all other matters, which can in any way affect the work under this contract. NO VERBAL AGREEMENT WITH ANY OFFICER, AGENT OR EMPLOYEES OF THE OWNER, EITHER BEFORE OR AFTER THE EXECUTION OF THE CONTRACT, SHALL AFFECT OR MODIFY ANY OF THE TERMS OR OBLIGATIONS HEREIN CONTAINED.

Intent of Drawings and Specifications

It is the intent of the drawings and specifications that the Contractor furnishes all labor and materials, equipment and transportation necessary for the proper execution of work unless specifically noted otherwise. The Contractor shall do all the work shown on the drawings and described in the specifications and all incidental work considered necessary to complete the project in the substantial and acceptable manner, and to fully complete the work, ready for use, by the Owner.

Drawings and Specifications

- Copies of drawings and specifications furnished: The engineer shall furnish to the Contractor, free of charge, up to four (4) copies of drawings and specifications reasonably necessary for execution of the work. All additional copies shall be furnished at reproduction cost.
- Discrepancies in drawings: Any discrepancies found between the drawings and specifications and site conditions or any errors or omissions in the drawings and specifications shall be immediately reported to the engineer who shall promptly correct such error or omission in writing. Any work done by the Contractor after his discovery of such discrepancies, errors or omissions, but before the engineer's correction, shall be done at the Contractor's risk.
- Dimensions: Figured dimensions shall govern over scaled dimensions.
- Drawings and Specifications at job site: One complete set of all drawings and specifications shall be maintained at the job site and shall be available to the engineer or his representative at all times.
- Changes to drawings: The Contractor shall be furnished with four (4) copies of any changes made to the drawings free of charge. All additional copies shall be furnished at reproduction cost.

Shop Drawings

- The Contractor shall provide shop drawings, settings, schedules and such other drawings that may be necessary for the completion of the work in the shop and in the field as required by the drawings, specifications or engineer's instructions.
- The Contractor shall submit for approval four (4) copies of all shop drawings and descriptive data as applicable showing all features not fully detailed on the contract plans but essential for a complete co-ordinate installation.
- The approval of shop drawings indicates only that the type and kind of equipment, general method of construction and/or detailing is satisfactory but shall not be construed as a complete check. The responsibility rests on the Contractor for the proper dimensioning, detailing of connections and incorporating into the work satisfactory material and equipment meeting the requirements of the contract plans and specifications.

Surveys

The Contractor shall develop and make all detail surveys necessary for construction and shall assume full responsibility for construction in accordance with established lines and grades.

The Contractor shall protect carefully from disturbance or damage all monuments and property markers until the engineer has witnessed or otherwise referenced their location and shall not remove them until directed.

Performance Bond

On all contracts with a value in excess of \$100,000, the Contractor shall furnish a performance bond in an amount at least equal to the contract price as security for the faithful performance and payment of all Contractors' obligations under the contract documents.

This bond shall remain in effect at least until one year after the date when final payment becomes due, except as otherwise provided by law or regulation or by the contract documents. Contractor shall also furnish such other bonds as are required by the special provisions. All bonds shall be in the forms prescribed by law or regulation or by the contract documents and be executed by such sureties authorized to do business in the State of Colorado. All bonds signed by an agent must be accompanied by a certified copy of the authority to act.

If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated or it ceases to meet the above stated requirements, Contractor shall within five days thereafter substitute another bond and surety, both of which must be acceptable to the Owner. In addition, no further progress payments shall be made by the Owner until the Contractor complies with these provisions.

Contractor's Terms of Insurance

Insurance required shall be with companies qualified to do business in the State of Colorado with a general policy holder's financial rating of not less than "A" as set forth in the most current edition of "Best's Insurance Reports" and may provide for deductible amounts as the Contractor may deem to be reasonable for the project, but in no event greater than \$1,000. No such policies shall be cancelable or subject to reduction in coverage limits or other modification except after thirty (30) days prior written notice to the City. However, where cancellation of coverage is due to nonpayment of premium a ten (10) day written notice to the City is required. The Contractor shall not do nor permit to be done anything, which shall invalidate the insurance policies referred to in this section. Policies described in Sections 1 and 2 above shall be for the mutual and joint benefit and protection of the Contractor and the City. Such policies shall contain a provision that the City, although named as an additional insured, shall nevertheless be entitled to recovery under said policies for any loss occasioned to it, its servants, agents, citizens, and employees by reason of negligence of the Contractor. Such policies shall be written as primary policies not contributing to and not in excess of coverage which the City may carry.

Such policies shall be for the mutual and joint benefit and protection of the Contractor and the City. All policies shall contain a provision that the City, although named as an insured, shall nevertheless be entitled to recovery under said policies for any loss occasioned to it, its servants, agents, citizens, and employees by reason of negligence of the Contractor. All policies shall be written as primary policies not contributing with and not in excess of coverage which the City may carry. The type of coverage shall be "occurrence".

Indemnification

The Contractor agrees to indemnify and hold harmless the Owner, its officers, employees, insurers, and self-insurance pool, from and against all liability, claims and demands, on account of injury, loss, or damage, including without limitation, claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, or any other loss of any kind whatsoever, which arise out of or are in any manner connected with the Contract. If such injury, loss, or damage is caused in whole or in part by the act, omission, error, professional error, mistake, negligence, or other fault of the Contractor, or any officer, employee, representative, or agent of the contractor or of any subcontractor of the Contractor, or which arise out of any women's compensation claim of any employee of the Contractor or any employee of any subcontractor of the Contractor. The Contractor agrees to investigate, handle, respond to, and to provide defense for and defend against, any such liability, claims or demands at the sole expense of the Contractor. The Contractor also agrees to bear all other costs and expenses related thereto, including court costs, expert fees and attorney fees, whether or not any such liability, claims, or demands alleged are groundless, false or fraudulent.

Contractor shall furnish certificates evidencing required insurance coverage to the City. Such certificates shall be in a form acceptable to the City.

Contractor shall not commence work under the contract until he has obtained all insurance required under this article to provide protection from claims which may arise out of or result from the Contractor's performance of the work and the Contractor's other obligations under the contract documents whether such performance is by the Contractor, by any Sub-Contractor, by anyone directly or indirectly employed by them or by anyone for whose acts any of them may be liable.

The Contractor shall secure and maintain, throughout the duration of the contract, insurance of such types and in such amounts as may be necessary to protect himself and SHALL ADD THE OWNER AS AN ADDITIONAL INSURED. As a minimum, the Contractor shall secure and maintain the types of insurance as hereinafter specified, and shall submit evidence to the Owner on an annual basis that the insurance coverages are in force. The form and limits of such insurance, together with the underwriter thereof in each case, shall be acceptable to the Owner, but regardless of such acceptance it shall be the responsibility of the Contractor to maintain adequate insurance coverage until final payment and at all times thereafter when the Contractor may be correcting, removing or replacing defective work. Failure of the Contractor to maintain adequate coverage shall not relieve him of any contractual responsibility or obligation.

The contractor shall provide certificates of insurance with the coverages and limits specified, prior to starting any construction work on the contract. Satisfactory insurance certificates filed with the Owner shall recite that 30 days prior written notice shall be given the Owner by certified mail before any policy is materially changed, canceled or not renewed.

Worker's Compensation and Employer's Liability:

This insurance shall protect the contractor against all claims under applicable state or federal Worker's Compensation Laws. The Contractor shall also be protected against claims for injury, disease or death of employees which for any reason may not fall within the provisions of a Worker's Compensation law. This policy shall include "broad form all states" endorsement coverage extended to cover all states except the monopolistic fund states, and shall include coverage for any liability that may be incurred under the U.S. Longshoremen's and Harbor Worker's Act, Admiralty (Jones) Act and Federal Employee Liability Act.

The liability limits shall not be less than:

- Worker's Compensation Statutory
- Employer's Liability \$250,000 per occurrence

Comprehensive Automobile Liability.

The Contractor shall procure and keep in force during the duration of all work covered under any Permit or Contract a policy of Automobile Liability insurance insuring the Contractor and naming the City as an additional insured against any liability for personal injury, bodily injury, or death arising from the use of motor vehicles and shall cover operations on or off the site of all motor vehicles controlled by the Contractor whether they are owned, non-owned, or hired with a combined single limit of at least \$1,000,000. The limits of said insurance shall not, however, limit the liability of the Contractor hereunder.

This insurance shall be written in comprehensive automobile liability form and shall protect the City and Contractor against all claims for injuries to persons and damage to property arising from the ownership, maintenance or use of any motor vehicles and shall cover operation on or off the site of all motor vehicles, whether they are owner, non-owner or hired.

The liability limits shall not be less than:

- Bodily Injury and Property Damage Combined \$1,000,000 per occurrence

Commercial General Liability:

The Contractor shall procure and keep in force during the duration of all work covered under any Permit or Contract a policy of Commercial General Liability insurance insuring the Contractor and naming the City as an additional insured against any liability arising out of the ownership, use, occupancy, or construction of the work and all areas appurtenant thereto with a combined single limit of at least \$1,000,000. The limits of said insurance shall not, however, be a limit to the liability of the Contractor hereunder.

This insurance shall be written in comprehensive general liability form and shall protect the Contractor and the City against all claims arising from injuries to persons or damage to property caused by any act or omission of the City or the Contractor or his agents, employees or subcontractors. The broad form general liability endorsement shall be included.

In addition, this policy shall contain a contractual liability endorsement covering any contractual liability assumed in this contract and all changes and modifications thereto, whether in writing or oral.

The scope of this coverage shall also include the personal injury hazards including "a", "b" and "c". "a" includes false arrest, malicious prosecution, and unwillfull detention or imprisonment. "b" includes libel, slander, and defamation of character. "c" includes wrongful eviction, invasion of privacy, and wrongful entry. Employee exclusion shall be removed.

The policy shall also include broad form property damage protection.

The Contractor shall include all the Contractor's employees as additional insured's under the policy.

Commercial General Liability coverage shall contain no exclusions for explosion, collapse or underground work (X, C, V).

The liability limits shall not be less than:

- Bodily Injury and Property Damage Combined \$ 500,000 per occurrence
\$1,000,000 aggregate
- Personal Injury Liability \$ 500,000 aggregate

Completed Operations and Products Liability:

This policy shall provide completed operations and products liability coverage for the life of the contract and the contractor shall maintain same coverage, for a period of time set forth, after final acceptance by the Owner. The Contractor shall provide evidence annually to the Owner that the type of coverage remains in force for the time period specified.

The liability limits shall be as required above for comprehensive general liability. The Contractor may furnish coverage for bodily injury and property damage for comprehensive motor vehicle liability and comprehensive general liability through the use of combined limits as indicated above or through separate single split limits acceptable to the Owner.

Aircraft Liability (Owner or Non-Owned) (including Helicopter):

The policy shall provide coverage for claims for bodily injury and/or property damage arising from the use of any aircraft including helicopter, if used in the course of the work.

If aircraft are to be used in the project, an appropriate certificate of insurance must first be submitted to and approved by the Owner prior to its use. If slung cargo is used in conjunction with aircraft, appropriate coverage is to be provided under the certificate of insurance must state that all policy exclusions relating to slung cargo have been deleted.

Watercraft Liability (Owned or Non-Owned)

The policy shall include coverage for claims for bodily injury and/or property damage arising from the use of any watercraft, if used, in the course of the work.

If watercraft are to be used in the project, appropriate coverage is to be provided under the comprehensive general liability Insurance and the certificate of insurance must state that all policy exclusions relating to watercraft have been deleted.

The Owner's Protective Liability (Independent Contractor's Insurance):

This coverage is designed to respond to claims for bodily injury and/or property damage arising from the operations of independent contractors. This policy or endorsement shall be primary and written in the name of the Owner and shall have the same liability limits as that of the comprehensive general liability policy. The policy or endorsement shall be maintained from the beginning of the work until its acceptance by the Owner.

Umbrella Excess Liability:

No special coverage is required subject to the following note:

Note: The liability limits may be provided through split limits, acceptable to the Owner, or through a combination of underlying and umbrella liability. The limits shall be provided under any policy or combination of policies.

Builder's Risk:

Builder's risk insurance shall insure against "all risk" of physical damage (flood and hydrostatic pressure not excluded), on a completed value basis. This insurance shall include the interests of the Owner, the Contractor and subcontractors in the work. This policy shall be written or endorsed to allow the Owner to occupy to use a portion or portions of the work prior to completion of all the work.

The insurance required as presented under the above paragraphs shall be written for not less than any limits of liability specified or required by law, whichever is greater.

The Owner and the Contractor waive all rights against each other and the subcontractors and their agents and employees, against the Engineer and separate contractors (if any) and their subcontractor's agents and employees, for damages caused by fire or other perils to the extent covered by insurance provided under item (9) or any other property insurance applicable to the work, except such rights as they may have to the proceeds of such insurance held by the Owner as trustee. The Owner shall require similar written waivers from each separate Contractor, and the Contractor shall require similar written waivers from each subcontractor each such waiver still be in

favor of all other parties enumerated in this paragraph.

Laws to be Observed

The Contractor shall give all notices and comply with all federal, state, and local laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he shall bear all costs arising therefrom.

Royalties and Patents

The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.

The Owner shall be responsible for all such loss when a particular process or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has information that the process or article specified is an infringement on a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

Indemnity

The Contractor shall indemnify and hold harmless the Owner from and against all losses and all claims, demands, payments, suits, actions, recoveries, and judgments of every nature and description brought or recovered against him by reason of any omission or act of the Contractor, his agents or employees, in the execution of the work or in the guarding of it.

Protection of Work

The Contractor shall, at his own expense, erect and maintain adequate signs, barricades, warning lights and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by signal lights which shall be kept burning from sunset to sunrise. The Contractor shall, at all times until its completion and final acceptance, protect his work, apparatus and material from accidental or other damage and shall make good any damages thus occurring, at his own expense. (See "Traffic Signing Requirement" for further information.) All barricades are to be securely anchored as weather conditions warrant.

Protection of Existing Utilities

It is the responsibility of the Contractor to provide for the location and protection of all structures and utilities.

The Contractor shall notify the "Utility Notification Center of Colorado" (1-800-922-1987) in a timely fashion as required by Section 9-1.5-101 *et seq.*, C.R.S.. Contractor shall request written record of any information from all owners or operators, including the City, of underground facilities (as defined in the above statute) regarding the location of the specific underground facilities. The Contractor shall comply with all requirements of the above as it pertains to the "excavator". The City shall not be responsible for the accuracy or completeness of any information provided by third-party owners or operators of underground facilities, including the marking thereof.

As stated in §9-1.5-101, once the underground facilities have been properly marked, it is the duty of the excavator to maintain adequate documentation, such as photographs, videos or sketches, so that the facilities can be accurately located and identified throughout the excavation period.

The approximate locations of underground facilities which are owned or operated by the City are shown on the Plans. The City shall, as required by the statute or local ordinance, mark the location of all such facilities. The City does not own or locate sewer and/or water service lines. UNLESS THE EXACT LOCATION OF CITY OWNED UNDERGROUND UTILITIES IS SHOWN ON THE PLANS, AS INDICATED BY REFERENCE TO HORIZONTAL AND VERTICAL DATUM, THEN THE CONTRACT PRICE SHALL INCLUDE, AND THE CONTRACTOR SHALL HAVE FULL RESPONSIBILITY FOR DETERMINING THE EXACT LOCATION AND DEPTH OF SUCH UNDERGROUND FACILITIES BY POTHOLING, HANDWORK OR SUCH OTHER MEANS AS MAY BE NECESSARY TO DETERMINE THE PRECISE LOCATION, WITHOUT DAMAGING SUCH UNDERGROUND FACILITIES, INCLUDING WATER AND SEWER SERVICE LINES. The Contractor shall incorporate the precise location of such underground facilities, including sewer and water service lines, into the as-built drawings.

The cost of all of the following shall be included in the work and the Contractor shall have full responsibility for:

- Reviewing and checking all information and data provided by all owners or operators of underground facilities
- Determining the horizontal and vertical location of all underground facilities shown or indicated in the Contract Documents;
- Coordination of the Work with the owners and operators of all underground facilities during construction; and
- The safety and protection of all such underground facilities and repairing any damage thereto resulting from the Work.

If any underground facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents or by reason of information supplied pursuant to Section 9-1.5101 *et seq.*, C.R.S., Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any work in conjunction therewith (except in emergency situations) identify the owner of such underground facility and give written notice to that owner, the "Utility Notification Center of Colorado", and the City. Contractor shall incorporate the location of all such underground facilities into the as-built drawings.

In the event of a break in an existing water main, gas main, sewer or underground cable, the Contractor shall immediately notify the responsible official of the organization operating the utility interrupted and shall lend all possible assistance in restoring services and making repairs.

The Contractor shall bear the entire expense of repairing or replacing any utilities or structures disturbed or damaged during construction, except those not properly located by the owner, pursuant to 9-1.5-101 *et seq.*, C.R.S.; except that the City may pay the Contractor to replace old and defective water and/or sewer service lines as the Project Engineer determines on a case-by-case basis.

Contractor must reconnect all active water and sewer service lines encountered during the Work, and shall install new taps and service lines to the property line of vacant property as shown on the drawings or as directed by the City. The Contractor shall determine which taps are active, in cooperation with the City and shall record the location of all new service lines, taps and other connections on the as-built drawings.

Unless otherwise specified in the Contract Documents, all utility relocations shall be the responsibility of the affected utility companies. The Contractor shall be responsible for coordinating his work and schedule with those of each utility company so that any utility relocation does not unnecessarily delay or interfere with other work on the Project.

Public Safety and Convenience

The Contractor shall, at all times, so conduct his work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property in a manner satisfactory to the Engineer. NO ROAD OR STREET SHALL BE CLOSED TO THE PUBLIC EXCEPT WITH THE PERMISSION OF THE ENGINEER. Prior to any street closure, the City of Alamosa Public Works Department and State Highway Patrol Dispatcher shall be notified. Fire hydrants on or adjacent to the work shall be kept accessible to the firefighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, and drainage ditches, which shall not be obstructed except as approved by the Engineer.

Accidents

The Contractor shall provide, at the site, such equipment and medical facilities as are necessary to supply first aid service to anyone who may be injured in connection with the work.

The Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the work, which caused death, personal injury, or property damages, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Engineer and the Owner.

Assignment of Contract

The Contractor shall not sublet, sell, transfer, assign or otherwise dispose of the contract or any portion thereof, or of his right, title, or interest therein, or his obligation there under, without written consent of the Owner.

Subcontracts

At the time specified by the Engineer, the contractor shall submit in writing to the Owner for approval of the Engineer, the name of any subcontractors proposed for the work. Subcontractors may not be changed except at the request or with the approval of the Engineer. The Contractor shall remain responsible to the Owner for the acts and omissions of his subcontractors. The contract documents shall not be construed as creating any contractual relationships between any subcontractors and the City.

Contractor's Responsibilities

The Contractor shall have charge of and be responsible for the entire work under contract until the completion, and any imperfect or unfaithful work which may be discovered any time before the final acceptance of the work covered by this contract shall be corrected immediately upon request of the Owner or Engineer.

Rights of Various Interests

Wherever work being done by the Owner's employees or by other contractors is contiguous to work covered by this contract, the respective rights of the various interests involved shall be established by the Engineer, to secure the completion of the various portions of the work in general harmony.

Engineer's Responsibility and Authority

The Engineer shall require, on the Owner's behalf, that the construction be performed by the Contractor in accordance with the plans and specifications. The Engineer shall also have authority on behalf of the Owner to require the proper completion of the work to the extent that the forces of labor may be increased or decreased by his order to insure the execution of the contract in the time and manner prescribed.

The Engineer shall, within a reasonable time after presentation, make decisions in writing on any claims between the Contractor and Owner, and such decisions shall be regarded as final.

Inspection of Work

Inspectors, as designated by the Engineer, may be stationed on the work site to report to the Engineer as to the progress of the work, the manner in which it is being performed, and also to report whenever it appears that materials furnished and work performed by the Contractor fail to fulfill the requirements of the specifications and contract. The inspector may direct the attention of the Contractor to such failure or infringement but such inspection shall not relieve the Contractor from any obligations to furnish acceptable materials or to provide completed construction that is satisfactory in every particular.

In case of any dispute arising between the Inspector and the Contractor as to material furnished or the manner of performing the work, the Inspector shall have the authority to reject materials, and/or suspend the work until the questions and issues can be referred to and decided upon by the Engineer. Inspectors are not authorized to revoke, alter, enlarge, relay, or release any requirements of these specifications, or to issue instructions contrary to the plans and specifications. Inspectors shall in no case act as management of the work by the Contractor.

Contractor's Employees

Contractor's superintendents - A qualified superintendent, who is acceptable to the Engineer, shall be maintained on the work site and give efficient supervision to the work until its completion. The superintendent shall have full authority to act on behalf of the Contractor, and all directions given to the superintendent shall be considered given to the Contractor. The Contractor shall remove from the project any superintendent unsatisfactory to the Engineer.

Character of workmen - Any foreman or workman employed by the Contractor, who, in the opinion of the Engineer, does not perform his work in a skillful manner, or appears to be incompetent or incorrigible shall be dismissed by the Contractor or his representatives when requested by the Engineer and such persons shall not again be permitted to return to the work without the written consent of the Engineer.

Materials, Services, and Facilities

It is understood that, except as otherwise specifically stated in the contract documents, the Contractor shall provide and pay for all materials, labor, mechanics for labor, tools, equipment,

equipment rental, water, light, power, transportation, superintendent, temporary construction of every nature whatsoever necessary to execute, complete and deliver the work within the specified time.

Workmanship and Materials

All work done and all materials and equipment furnished by the Contractor shall strictly conform to the plans and specifications. Competent labor, mechanics, and tradesmen shall be used on all work. The acceptance at any time of the materials by or on behalf of the Owner shall not be a bar to future rejection if they are subsequently found to be defective or inferior in quality or uniformity of the materials specified.

Whenever any material shall be condemned by the Engineer, such material shall be removed at once from the line of work at the Contractor's expense and shall not be brought back.

Inspection and Testing of Materials

- During the progress of the work, it shall be subject to the inspection of the Engineer, and the Contractor shall afford every reasonable facility and assistance to the Engineer to make such inspection thorough and intelligent.

The fact that the Engineer is on the grounds shall not be taken as an acceptance of the Contractor's work or any part of it. The Contractor shall be given final inspection and test by the Engineer and if all parts of the work are acceptable and comply with the intent of the plans and specifications, a recommendation of final acceptance shall be made by the Engineer to the Owner.

- Contractor shall submit to the Engineer from time to time, or when called upon to do so, and without charge, samples or specifications of materials he proposes to use.
- Contractor shall furnish tests and reports on tests of all materials called for in the specifications. The testing laboratory shall be selected by the Engineer. All tests shall be in accordance with the standards of ASTM, AASHTO, and other recognized standards. Initial testing shall be paid for by the Owner; however, any required testing due to failed tests shall be paid for by the Contractor.

Defective Work and Material

Any materials which do not conform to requirements of the contract documents, or are not equal to samples approved by the Engineer, or are in any way unsatisfactory or unsuited to the purpose for which they are intended, shall be rejected. Any defective work whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, shall be removed within ten (10) days after written notice is given by the Contractor. The fact that the Engineer may have previously overlooked such defective work shall not constitute an acceptance of any part of it.

Suspension of Work

The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods, as he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the effective completion of the work, or failure on the part of the Contractor to carry out the provisions of the contract or to supply materials meeting the requirements of the specifications. The Contractor shall not suspend operation without the Engineer's permission.

Owner's Right to Correct Deficiencies

If the Contractor shall neglect to prosecute the work properly or fail to perform any provisions of this contract, the Owner, after three (3) days written notice to the Contractor may, without prejudice to any other remedy he may have, correct such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

Owner's Right to Terminate Contract

The Owner shall have the right to terminate the employment of the Contractor after giving seven (7) days written notice of termination to the Contractor in the event of any default by the Contractor and upon receiving written notice from the Engineer certifying cause for such action. In the event of such termination, the Owner may take possession of the work and of all materials, tools, and equipment thereon and may finish the work by whatever method and means he may select. In such a case, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price shall exceed the expense of finishing the work, including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

It shall be considered a default by the Contractor whenever he shall:

- Undergo voluntary or involuntary bankruptcy, become insolvent, or assign his assets for the benefit of his creditor.
- Disregard or violation of important provisions of the contract documents or Engineer's instructions, or fail to finish the work according to the agreed schedule of completion, including extensions thereof.
- Fail to provide a qualified superintendent, competent workmen or subcontractor, or proper materials, or fail to make prompt payment therefore.

Removal of Equipment

At the termination of this contract, or in the case of annulment of the contract before completion, the Contractor, if notified to do so by the Owner, shall promptly remove all of his equipment and supplies from the property of the Owner. Should the Contractor fail to remove such equipment and supplies, the Owner shall have the right to remove them at the Contractor's expense.

Changes in the Work

The Owner may, as the need arises, order changes to the work through additions, deletions, or modifications without invalidating the contract. Compensation and time of completion affected by the change shall be adjusted at the time of ordering such change. The value of such change shall be determined by unit prices named in the contract, when the cost of said changes does not exceed 25% of the Bid. Special consideration may be given by the Engineer for any INCREASE or DECREASE in the purchase price of materials that may be required under this section. The Contractor shall provide the Engineer with the necessary supportive data to determine if any INCREASE or DECREASE in the purchase price of materials has occurred.

Extra Work

If any work should be required for which no unit price for the supplying of material or the performance of such work is provided in the proposal, it shall be classified as "extra work". No such extra work shall be done without written orders from the Engineer. In case such extra work becomes necessary, it shall be done by the Contractor, if so ordered, and shall be paid for by the City at a price which shall be agreed upon, in writing, between the Engineer and the Contractor, or on the basis of actual costs, plus fifteen percent (15%); but no extra work shall be paid for unless ordered by the Engineer at the time undertaken, and no office expense, overhead expense, carrying expense or charge for use of tools shall be included in such actual cost.

Operations and Storage Areas

All operations of the Contractor, including storage of materials, shall be confined to areas authorized by the Owner. Any additional land and access thereto not shown on the drawings that may be required for temporary construction facilities or for storage of material shall be provided by the Contractor with no liability to the Owner.

Schedule of Completion

The Contractor shall submit at such times as may reasonably be requested by the Engineer, schedules which shall show the order in which the Contractor proposes to carry on the work, with dates at which the Contractor plans to start the different phases of the project, and estimated dates of completion of each of the phases.

Order of Construction

The Engineer shall have control of the order in which the various parts of the construction work are to be performed. The order of the work as determined by the Contractor shall be followed except where the Engineer determines that such order would not be in the best interest of the Owner or the general public.

Extension of Contract Time

A delay beyond the Contractor's control, occasioned by an act of God, or act or omission on the part of the Owner or by strikes, lockouts, fire, etc., may entitle the Contractor to an extension of time in which to complete the work as determined by the Engineer; provided however, that the Contractor shall immediately give written notice to the Engineer of the cause of such delay. **Delay in material shipping shall not be sufficient reason for an extension unless so determined by the Engineer.**

Use of Completed Portions

The Owner shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding that the time for completing the entire work or such portions may not have expired. If such prior use increases the cost of or delays the completion of uncompleted work or causes refinishing of completed work, the Contractor shall be entitled to such extra compensation, or extension of time or both, as the Engineer may determine.

Protection of Property

The Contractor shall, at his own expense, protect by false work, braces, shoring or other effective means, all building, walls, fences, and other property along his line of work or affected directly by his

work, against all damage and shall repair or repay the injured owners for such damage.

Cleaning Up

The Contractor must keep all streets, alleys and sidewalks as free from material and debris as the character of the work shall permit, and upon completion of any part of the work, must within reasonable time, remove all surplus material and debris, and leave the right-of-way in a condition acceptable to the Engineer.

Failure to comply with this provision after due and proper notice has been given by the Owner shall be sufficient grounds for the Owner to proceed to clean up such material and debris and make such repairs, charging same to the Contractor, who hereby agrees to the provisions as herein set forth. Cost for said clean up and repair shall be billed on the basis of actual cost plus 30%.

Release of Liens

If required, the Contractor shall deliver to the Owner a complete release of all liens arising out of this contract before the retained percentage or before the final payment is paid. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner such amounts as the Owner may have been compelled to pay in discharging such liens including all costs and a reasonable attorney's fee.

Progress Payments

So long as the work herein contracted for is carried out in accordance with the provisions of the contract, the Contractor shall submit for payment an estimate to be paid for work performed prior to said date. At least ninety percent of the value of any work completed shall be paid until fifty percent of the work required by the contract has been performed. Thereafter, Owner shall pay all of the remaining billings without retaining additional funds, if in the opinion of the Owner, satisfactory progress is being made on the work. The withheld percentage of the contract price of any such work, improvement, or construction shall be retained until the contract is completed satisfactorily and finally accepted by the Owner.

Payment shall be made to the Contractor by check after submittal of the partial estimate by the Contractor and approval of same by the Engineer. In addition, the Engineer may require evidence of payment by the Contractor for materials and labor, at any time, and may withhold any payment until such evidence is provided. Payments by the Owner shall be made following the guidelines of the Owner's accounts payable schedule.

Measurement of Quantities

The quantities of work performed shall be computed by the Engineer on the basis of measurements taken by the Engineer, or his assistants, and these measurements shall be final and binding. All work computed under the contract shall be measured by the Engineer according to United States Measurements and Weights. Measurements for the various items shall be made as provided in Measurements and Payments Section of these specifications.

Final Payment

The Engineer shall, as soon as practical, after the completion and final acceptance of the work, make a final estimate of the amount of work done under the contract. This estimate shall be based on "as built" measurements made by the Engineer, and based on unit prices in the proposal plus all

approved additions less all approved deductions. **At the Engineer's discretion, final payment may be withheld until complete as-built drawings, in a format acceptable to the Engineer have been received.**

Warranty

The Contractor guarantees all work constructed under the contract for a period of one (1) year from the date of final acceptance, against defects in material or workmanship. He shall bear the entire cost and expense of all repairs which may, from any imperfection in work or material, become necessary within that time.

In the case the area fails where the work was done and the Contractor refuses to fix the problem, the contractors bonding and insurance companies will be contacted and all costs incurred by the City to correct the problem will be forwarded. In addition no further permits will be issued to the contractor and a lien may be placed on any available payment due the contractor from a current client.

If at any time within the period of guarantee, any of the work included in the guarantee shall, in the judgment of the Engineer, require any repair or reconstruction, he shall notify the Contractor to make the repairs required. Upon receipt of this notice, the Contractor shall proceed with such repairs and shall complete the same within a reasonable time. If the contractor shall neglect or fail to proceed with the repairs within twenty (20) days or if, in the opinion of the Engineer, the needed repairs do not permit the delay associated with issuance of said notice and to await the action of the Contractor, then the Owner shall have the right to cause such repairs to be made and the cost shall be paid by the Contractor. The liability of the bond given to secure the faithful performance of the contract shall continue during the full guarantee period.

At the expiration of the guarantee period, the Contractor and his surety shall be released from further obligation under this contract, providing the Engineer shall certify to the Owner that the work performed under this contract is in good and proper condition at the time.

Safety

The Contractor and sub-contractor(s) shall perform the work in compliance with Colorado State Compensation Insurance Authority and OSHA regulations.

Traffic Signing Requirements

The Contractor and or subcontractor shall sign the construction site in compliance with the most current edition of the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, US DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION.

The City of Alamosa Public Works Department may be available to the Contractor to determine signing requirements; however, any such assistance by this department shall in no way relieve the Contractor of his responsibility to sign according to the manual described above.

The Contractor shall be required to submit a traffic control plan prior to any construction activities. Upon approval of said plan by the Engineer, the Contractor shall be able to commence construction activities.

Traffic Control Plan

If work is to be performed in/on arterial or collector streets and a Traffic Control Plan (TCP) is not

provided in the plans, then the Contractor shall furnish one for approval by the Engineer. Any work in/on residential streets typically do not need a professional TCP, however, a simple sketch shall be submitted by the contractor and all signs, barricades and other necessary traffic control devices shall be placed in accordance with the MUTCD, Part VI. The TCP shall be prepared in accordance with the Manual on Uniform Traffic Control Devices, latest edition. The City of Alamosa Public Works Department may be available to the Contractor to determine signing requirements; however, any such assistance by this department shall in no way relieve the Contractor of his responsibility to sign according to the manual described above

The Contractor shall submit the TCP to the Engineer for review at least two (2) working days before the pre-construction meeting. The TCP shall consist of a drawing showing the following information:

- North arrow and project name; all streets and street names in the vicinity of the project and any proposed detour routes; location and dimension of traffic lanes, curbs, sidewalks and traffic control in the vicinity of the work.
- Layout of all proposed street and lane closures including detour routes. Show the number of days and hours per day the street and lane closures will be in effect.
- The type and location of all barricades, warning signs, detour signs, cones, delineators and other traffic control devices that will be used on the project.
- The location and schedules of all flag persons that will be needed
- The name(s) and phone number(s) of the Contractor's designated Traffic Control Supervisor (TCS) including persons who can be reached after working hours, and on holidays and weekends.
- Any special instructions and information on how the traffic control is to be setup, changed or removed

During the progress of the Work, if adjustments to the TCP are necessary, the Contractor shall submit a revised TCP to the Engineer for approval at least two (2) working days prior to implementation of the change(s).

No interference with traffic flow on arterial or collector streets shall be permitted during the hours of 7:30 a.m. to 8:30 a.m. or from 4:30 p.m. to 5:30 p.m. unless authorized in writing by the City Engineering Supervisor.

When work is stopped for the day, all lanes of an arterial or collector street shall be opened to traffic unless approved by the Engineer. A traffic lane shall be considered satisfactorily open only if it is paved with hot or cold mix asphalt paving, except when the Engineer allows an alternate temporary surface at his discretion. The contractor shall contact the Police Communications office with notification and schedule of any street closures.

It shall be the responsibility of the person performing the work authorized by the permit to notify the Engineer or his authorized representatives that such work is ready for inspection. The Engineer requires that every request for inspection be received at least twenty-four (24) hours before such inspection is desired. Such requests may be in writing, email, or by telephoning or faxing the Engineer.

Road closures will only be allowed with the approval of the Engineer. Upon approval the contractor

shall contact the Police Communications office (589-5807) the previous day and inform them of the construction and closure schedule.

At least twenty-four (24) hours prior to closing any street or roadway, the Contractor shall notify the Engineer, Police and Fire Departments, the City's solid waste supervisor, any applicable private trash haulers, the School District and the U.S. Postal Service. The Contractor shall make additional notifications prior to any significant change in the traffic control setup or detour routes. The Police and Fire Departments shall also be notified in advance of all traffic lane closures.

The Contractor shall furnish all traffic control devices and flag persons necessary to implement the approved TCP and any additional traffic control the Engineer determines necessary for the protection of the work and/or safety of the public.

The Contractor shall maintain access to all private driveways at all times unless otherwise approved by the Engineer. Residents and/or property owners shall be notified by the Contractor at least forty eight (48) hours prior to the temporary closure or relocation of street access. Access to properties in construction zones shall be maintained with a smooth gravel surface.

All traffic control devices shall be promptly removed from the roadway when they are no longer needed.

When Traffic Control is required and not provided by the City, the Contractor will provide for such and it shall be paid for at the lump sum pay item for Traffic Control.

When a Traffic Control Plan is required and is not included in the project plans, the Contractor shall provide for such and it shall be paid for at the lump sum pay item for Traffic Control Plan.

Discovery of Archaeological and Historical Items

In the event of an archaeological find during any phase of construction, the following procedure shall be adhered to:

- Construction shall be halted, with as little disruption to the archaeological site as possible.
- The Contractor shall notify the Engineer, who shall contact the State Historic Preservation Officer.
- The State Historic Preservation Officer may decide to have an archaeologist inspect the site and make recommendations about the steps needed to protect the site, before construction is resumed.
- Any claim made by the Contractor for down time or additional work required by the State Historic Preservation Officer shall be classified as "extra work".

(Or Equal) Provisions

The following procedure shall be followed to determine the equivalence of any material that is not directly referred to in these specifications:

- The Contractor shall submit a sample of the proposed product, including any and all available literature to the Engineer.

- The Engineer shall determine equivalency of the proposed product.
- The decision of the Engineer as to equivalency of the proposed product shall be final.

Any variation in the design concept of the proposed product, as compared to listed products, shall be grounds for rejection.

Availability of parts, cost of parts, and work involved in replacing said parts, can also be used by the Engineer in making his decision as to equivalency.

Notice

Any notice which is required or permitted to be given in the contract documents must be in writing and may be personally delivered or mailed by certified mail. Personal delivery may be by the Engineer or the City Clerk, on behalf of the Owner, to any on-site foreman, manager, or any officer, on behalf of the Contractor, and shall be deemed completed upon delivery. Notification by mail shall be addressed to the addresses specified in the contract documents for the respective parties and shall be deemed completed upon posting.

SPECIAL CONDITIONS

Liquidated Damages

Should the Contractor fail to complete the work at the time specified in the proposal, or within such extensions of time as may be allowed in writing by the Engineer, the Contractor shall pay to the City of Alamosa, as and for liquidated damages for such failure of completion, a sum of money based upon the value of such contract in accordance with the following schedule:

\$ 50 per day for contracts from	\$1.00	to	\$10,000.00
\$100 per day for contracts from	\$10,000.00	to	\$50,000.00
\$200 per day for contracts from	\$50,000.00	to	\$100,000.00
\$300 per day for contracts from	\$100,001.00	to	\$1,000,000.00
\$500 per day for contracts from	\$1,000,001.00		and above

The Contractor understands that the following clause is part of the construction contract whether it does or does not appear in said contract:

“The time limit for the completion of the work herein provided for is of the essence of this Contract, and in case the Contractor shall fail to complete the work hereunder, within the time aforesaid, or within such extensions of time as may be allowed by the Engineer, he agrees to pay the City of Alamosa \$_____ (this blank shall to be filled in with the appropriate daily figure from the above schedule) for each and every day the time consumed in said performance and completion exceeds the time hereinbefore allowed for that purpose, which said sum, in view of the difficulty in ascertaining the loss which the City shall suffer by reason of delay in the performance of the work hereunder is hereby agreed upon, fixed and determined by the parties hereto as liquidated damages that the City shall suffer by reason of said delay and default, and not as a penalty; and the City shall and may deduct and retain the amount of such liquidated damages out of the money which may be due or become due under this contract, or may require reimbursement by the Contractor if the Engineer deems money to become due to be insufficient.”

Use of Fire Hydrants

The Contractor is requested to make special note of the following paragraphs taken from the City Ordinances:

All fire hydrants shall be under the control and shall be kept in repair by the Superintendent of Water and shall be tested frequently to see if the same are in order. In case of fire, the members of the fire department and such other persons as the Superintendent of Water shall authorize, shall have free access to the hydrants. No other person shall open or operate any fire hydrant without permission of the Superintendent of Water, or draw water therefrom, or destroy the approach thereto.

Wrenches for fire hydrants shall be furnished by the superintendent to the fire department, whether the department be a voluntary or paid department, for the use of its members and to such other persons as the superintendent may deem proper, and no person to whom any wrench is so furnished shall permit the same to be taken from the place of deposit, or to be used by any other person for any other purpose than that authorized by the superintendent. (Code of Ordinances of Alamosa, Colorado, Section 20-18)

The Contractor is also requested to take special note of the following:

- The City of Alamosa may, upon written request, allow the contractor to take water from any

fire hydrant. .

- A water dispensing point, with the necessary safety features, is provided at the City of Alamosa Waterworks, for those individuals who must have water and are willing to purchase it from the City of Alamosa.

RIGHT OF WAY PERMIT APPLICATION PROCESS

Obtain Blank Permit Form

Blank permit forms can be obtained from the Public Works Department of the City of Alamosa or on the City web site, www.cityofalamosa.org Fill out the form completely and accurately. Be sure to sign and date the form. Turn in the completed form, together with all required submittals and copies to the Department of Public Works a minimum of two work days (not including Saturdays and Sundays) prior to the proposed start of work. **For emergency work only - a permit may be acquired after the start of excavation. A completed permit form shall be submitted the following work day to the Public Works office and marked "EMERGENCY".**

Submission of Plans

Drawings or plans that clearly depict the proposed work must be attached to the permit application. These drawings must show position and location of work, street/road names/numbers, widths of streets, property lines, topographic and man-made features, existing drainage patterns, etc. Plans shall show the relative position of proposed work to existing utilities and existing improvements and shall be drawn to a given scale of one (1) inch = fifty (50) feet or larger and shall include a north arrow.

Submission of Traffic Control Plans

Traffic Control Plans shall show in detail the proposed work area location and the traffic control devices being proposed. Such plan shall be on paper at least 8 1/2 inches by 11 inches and may be faxed, mailed or brought to the Public Works office a minimum of two work days prior to issuance the Permit. Traffic Control Plans may require more detail than normal at the discretion of the Engineering Supervisor due to unique or unusual conditions. Traffic control shall also include construction traffic routing requirements. The traffic control company hired by the contractor shall be identified on the application along with a contact person and phone number. Under all circumstances, any and all submittals shall be in accordance with the Traffic Control Plan portion of the General Conditions section of these specifications.

Payment of Fee

All fees must be submitted with the permit application.

Review of Submittals

The completed submittals will be reviewed by the Public Works Department. If additional information is needed, the Applicant will be contacted. The Public Works Department will check to make certain that the Applicant has provided the required bond, License, and insurance certificates.

Approval of Submittals

Once the permit form and all required submittals have been reviewed and found to be complete, the

permit may be approved by the City.

Issuance of Permit

Once the approved permit is issued to the applicant, any modifications to the permit, including any schedule or scope changes must be submitted in writing to the City for review and approval. As outlined in these specifications. The applicant is solely responsible for all work for a period of one (1) year following the project completion.

Required Inspections

Permittee shall call for inspection prior to backfilling any open trench and upon completion of backfill and before restoring pavement.

Permit Fees

A complete fee schedule for the City can be found in Appendix B. Governments are exempt from this fee.

Other Permits

Permit applicants are responsible for obtaining separate permits or permission as may be required. Examples may be when work is proposed within state highway, railroad or irrigation company right-of-ways, or private property.

When work is to be performed on City owned or managed easements the same application process shall be used. Approval may identify the inclusion of special provisions which are in addition to those in these specifications (such as planting, landscaping and fences).

Construction Details

General Conditions

The following general conditions apply to all work done within the public rights-of-way such as utility line installation or repairs performed by any contractor or utility department, public or private.

Protection of Existing Improvements

- The Contractor shall at all times take proper precautions and be responsible for the protection of existing street and alley surfaces, driveway culverts, street intersection culverts or aprons, irrigation systems, mail boxes, driveway approaches, curb, gutter and sidewalks and all other identifiable installations that may be encountered during construction.
- The Contractor shall at all times take proper precautions for the protection of existing utilities, the presence of which are known or can be determined by field locations of the utility companies. The Contractor shall contact the UNCC (One Call) at 1-800-922-1987 for utility locates a minimum of two (2) working days prior to his proposed start of work.
- Existing improvements to adjacent property such as landscaping, fencing, utility services, driveway surfaces, etc., which are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.
- The Contractor shall at all times take proper precautions for the protection of property pins/corners and survey control monuments encountered during construction. Any damaged or disturbed survey markers shall be replaced by a registered land surveyor at the Contractor's expense.
- The repair of any damaged improvements as described above shall be the responsibility of the permit holder.
- The Contractor shall make adequate provisions to assure that traffic and adjacent property owners experience a minimum of inconvenience
- Trees shall be protected from scarring. A sheet metal sheath is the minimum acceptable means of protection.

Temporary Surfaces Required

When the final surface is not immediately installed within two weeks of construction, it shall be necessary to place a temporary asphalt surface on any street cut opening. The temporary surface installation and its maintenance shall be the responsibility of the permittee until the permanent surface is completed and accepted. It shall be either a hot mix or cold mix paving material. Temporary surfaces shall be compacted, rolled smooth and sealed to prevent degradation of the repair and existing structures during the temporary period. Permanent patching shall occur within two (2) weeks except as outlined by the City in the Permit. During winter, the temporary surface (cold mix asphalt) shall be installed immediately. **Wheel rolling is not an acceptable means of final compaction.**

Pavement Patches

Paving shall be performed by an approved contractor. All material quality and installation shall meet the standards of the current edition of the CDOT Green Book as previously outlined. All permanent pavement patches and repairs shall be made with "in kind" materials. For example, concrete patches in concrete surfaces, full depth asphalt patches with full depth asphalt, concrete pavement with asphalt overlay patches will be expected in permanent overlaid concrete streets, etc. In no case is there to be an asphalt patch in concrete streets or concrete patch in asphalt streets. Any repair not meeting these requirements will be removed and replaced by the Contractor at his expense. Refer to Section 4 for details and quality control parameters.

STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION Work to be Done in Expedient Manner

All work shall be done in an expedient manner. Repairs shall be made as rapidly as is consistent with high quality workmanship and materials. Use of fast setting concrete and similar techniques are encouraged whenever possible without sacrificing the quality of repair. Completion of the work including replacement of pavement and cleanup shall normally be accomplished within two (2) weeks after the repair work or activity involving the cut is done. Extension of time for completion shall be with the written approval of the Engineer. If the repairs are not completed in the allotted time, the City has the right to repair the street at the Contractor's expense.

Removal and Replacement of Unsatisfactory Work

Removal and replacement of unsatisfactory work shall be completed within fifteen (15) days of written notification of the deficiency unless deemed an emergency requiring immediate action. In the event the replacement work has not been completed, the City will take action upon the Contractor's bond to cover all related costs.

Site Preparation

Scope

The work covered by this section shall consist of tree cutting, stump removal, concrete removal, asphaltic concrete removal, manhole casting or valve box adjustment and similar work as specified or necessarily incidental to the project involved.

Clearing and Grubbing

This work consists of clearing, grubbing, removing and disposing of vegetation and debris within the limit of the work area. Vegetation and objects designated to remain shall be preserved free from injury.

Clearing and grubbing shall extend to the top of fill or the top of cut shapes, unless otherwise designated.

All surface objects, trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and grubbed as required. Undisturbed stumps, roots, and imperishable solid objects located two feet or more below sub grade or embankment slope may remain in place.

Except in areas to be excavated, all holes resulting from the removal of obstructions shall be backfilled with suitable material and compacted to 90% of maximum density as determined by AASHTO T 99A.

No material or debris shall be disposed of within the project limits.

The Contractor shall scalp the areas within the excavation or embankment grading limits. Scalping shall include the removal from the ground surface of brush, roots, and other vegetable matter.

Removal of Concrete or Asphaltic Concrete

Where removal of existing concrete or asphalt is required, it shall be broken up and disposed of in a waste area selected by the Contractor and approved by the Engineer. Remaining exposed edges shall be straight and true. The Engineer shall determine whether sawing is necessary.

Removal of Asphalt Mat (Milling)

Removal of asphalt mat (milling) shall consist of removing portions of the existing pavement at locations shown on the plans, or as directed by the Engineer. Removal shall be done by the use of an approved milling machine or grinder capable of removing, in one pass, a layer of bituminous material two inches in depth.

All removed material shall be hauled and stockpiled by the Contractor at a location (or locations) as designated by the Engineer. Payment for hauling and stockpiling shall not be paid for separately but shall be included in the work.

All fines shall be broomed from the surface immediately after the milling operation by means of a pick-up type broom. Vertical cuts shall not be allowed to remain at the completion of the day's work if the area is to be opened to traffic. The traveled roadway shall be left in a safe, usable condition as approved by the Engineer. Payment for the removal of fines and making the vertical cuts safe and

usable shall not be paid for separately but shall be included in the work.

Adjust Curb Stop Box

Where encountered, existing curb stop boxes shall be adjusted to grade by the Contractor. Any extensions required shall be of the same material and quality as the original.

Adjust Gate Valve Box or Casting

Existing and new valve boxes and castings shall be adjusted to final grade prior to completion of the project by the Contractor. Extensions of valve boxes shall be of the same material and quality as the original; manholes and catch basins shall be adjusted by the use of concrete rings where practical. Base replacement around adjusted castings shall be equal to adjacent construction.

Replace Casting

Where ordered by the Engineer, old castings shall be replaced with new castings in compliance with the applicable sections of these specifications.

HORIZONTAL DIRECTIONAL DRILLING (HDD)

Scope of Work

Where indicated on the drawings and specified, the Contractor shall furnish and install piping systems for water distribution and fire protection, wastewater forcemains, or any other utilities as required. The work shall not include gravity sewer systems or road crossings for pipe-on-grade using the jack and bore method. The work shall be complete, tested, and ready for operation including connections, re-connections, stub-outs and appurtenances, temporary services, and all other provisions in regard to the existing operation and modification as is required to perform the new work. All references to Industry Standards (ASTM, ANSI, AWWA, etc.) shall be to the latest revisions unless otherwise stated. Only those materials included in the City's approved materials and equipment list shall be installed, unless otherwise specified or directed. All materials shall be new unless specifically called for otherwise.

It shall be the Contractors responsibility to perform the HDD operations, including any necessary street repairs in strict conformance with the requirements of the City as outlined herein performed.

Shop Drawing Submittals

Any specialty item not referenced herein will require a complete shop drawing submittal. The Project Engineer may require a complete detailed shop drawing submittal for any material which, in the Engineer's opinion, may not comply with these specifications.

Contractor Qualifications

All directional drilling operations shall be performed by a qualified directional drilling CONTRACTOR with at least (3) years' experience involving work of a similar nature to the work required of this project.

Equipment

The CONTRACTOR shall submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Equipment shall include but not be limited to: drilling rig, mud system, mud motors (if applicable), downhole tools, guidance system, and rig safety systems. Calibration records for guidance equipment **SHALL** be included. Specifications for any drilling fluid additives that CONTRACTOR intends to use, or might use, shall also be submitted.

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pull back, a drilling fluid mixing, delivery, and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused (if required), a magnetic guidance system or walk over system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good, safe condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

Drilling Rig: The directional drilling machine shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power

system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations.

There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.

Drill Head: The drill head shall be steerable by changing its rotation and shall provide necessary cutting surfaces and drilling fluid jets.

Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.

Drill Pipe: Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

Guidance System

An electronic walkover tracking system or a Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to fifty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to manufacturers specifications of the vertical depth of the borehole at sensing position at depths up to fifty feet and accurate to 2-feet horizontally on either side of the borehole.

The CONTRACTOR shall supply all components and materials to install, operate, and maintain the guidance system. The Guidance System shall be of a proven type, and shall be set up and operated by personnel trained and experienced with the system. The operator shall be aware of any geo-magnetic anomalies and shall consider such influences in the operation of the guidance system.

Drilling Fluid (Mud) System

Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives.

Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder and to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be minimum of 1,000 gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.

Drilling Fluids: Drilling fluid shall be composed of clean water and bentonite clay. Water shall be from an authorized source with a pH of 8.5 – 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. No additional material may be used in drilling fluid without prior approval from the ENGINEER. The bentonite mixture used shall have the minimum viscosities as measured by a March funnel:

Rocky Clay - 60 seconds
Hard Clay - 40 seconds
Soft Clay - 45 seconds
Sandy Clay - 90 seconds
Stable Sand - 80 seconds
Loose Sand -110 seconds
Wet Sand -110 seconds

These viscosities may be varied to best fit the soil conditions encountered, or as determined by the operator.

Delivery System: The mud pumping system shall have a minimum capacity of 35-500 GPM and the capability of delivering the drilling fluid at a constant minimum pressure of 1200 psi. The delivery system shall have filters in-line to prevent solids from being pumped into drill pipe. Used drilling fluid and drilling fluid spilled during operations shall be contained and conveyed to the drilling fluid recycling system or shall be removed by vacuum trucks or other methods acceptable to the ENGINEER. A berm, minimum of 12-inches high, shall be maintained around drill rigs drilling fluid mixing system, entry and exit pits, and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey drilling fluid containment areas to storage and recycling facilities for disposal.

Other Equipment

Pipe Rollers: Pipe rollers shall be used for pipe assembly during final product pull back.

Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the ENGINEER prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated without undo stoppage and maintain line and grade within the tolerances prescribed by the particular conditions of the project.

Personnel Requirements

All personnel shall be fully trained in their respective duties as part of the directional drilling crew, and in safety. Each person must have at least two years directional drilling experience. A competent and experienced supervisor representing the CONTRACTOR shall be present at all times during the actual drilling operations. A responsible representative who is thoroughly familiar with the equipment and type of work to be performed must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the job site during the actual Directional Bore operation. The CONTRACTOR shall have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner.

Personnel who are unqualified, incompetent or otherwise not suitable for the performance of this project shall be removed from the job site and replaced with a suitable person. A professional land surveyor registered in the State of Colorado may be required for Certified "as-builts" as per specifications.

Polyvinyl Chloride (PVC) Pipe, 4" thru 12"

The pipe material shall be of the restrained joint type in Class 150(DR18) or Class 200 (DR14), as shown in the proposal quantities, in sizes 4" thru 12" and tested to meet or exceed performance requirements of AWWA Standard C900. Pipe O.D.'s shall be equivalent to iron pipe O.D.'s. Pipe shall include couplings, gaskets, splines and lubricant as manufactured by the pipe supplier.

Pipe may be furnished in standard 20' lengths. Couplings shall be designed for use at the rated pressures of the pipe with which they are

used. All PVC pipe shall be color coded as follows:

Potable Water -Blue
 Forcemain -Green
 Re-Use -Purple

The pipe shall be joined using a separate PVC coupling with beveled edges, built in sealing gaskets, and restraining grooves. The restraining splines shall be square and made from Nylon 101.

Exposed splines shall be cut flush from the coupling wall to reduce soil drag.

Couplings shall be beveled on leading edges to minimize soil friction.

CONTRACTOR shall adhere to the pipe manufacturer's most current calculations regarding tensile load limitations for trenchless application. This calculation shall be part of the required shop drawing submittal. (See chart below)

Size (Inch)	SDR	Class (PSI)	Pipe O.D. (Inch)	Coupling O.D. (Inch)	Maximum Pull-In Force, Tightest Bending (lbs)	Maximum Pull-In Force, Straight Pull (lbs)
4	18	150	4.800	5.964	6,700	8,200
6	18	150	6.900	8.366	9,000	12,800
8	18	150	9.050	10.947	18,000	25,200
10	18	150	11.100	13.361	25,600	35,200
12	18	150	13.200	15.836	26,440	41,100
4	14	200	4.800	5.964	8,000	10,300
6	14	200	6.900	8.366	9,300	14,700
8	14	200	9.050	10.947	18,900	28,800
10	14	200	11.100	13.361	25,600	35,200
12	14	200	13.200	15.836	26,440	41,100

CONTRACTOR shall adhere to the pipe manufacturers most current calculations regarding radius of curvature for C900/RJ pipe used for trenchless application.

Pipe Diameter (Inch)	Min. Radius of Curvature (Feet)	Offset per 20' Length (Inch)	Deflection per 20' Length (Degree)
4	100	23	11.5
6	150	16	7.6
8	200	12	5.7
10	250	9	4.6
12	300	8	0.8

Polyvinyl Chloride (PVC) Pipe, 14"

PVC pipe of size 14" shall be at least 160psi pressure rated, DR 18, manufactured with IPS O.D.'s and conform to AWWA standard C900. All joints shall be restrained and couplings supplied by the pipe manufacture to withstand maximum safe tensile loads for HDD

applications. Safe tensile load calculations shall be part of the required shop drawing submittal. In addition, minimum radius of curvature per 20-ft. length of pipe and deflection per 20ft length of pipe shall be submitted as part of the required shop drawings. Pipe shall be color coded as follows:

Potable Water -Blue
Forcemain -Green
Re-Use -Purple

Polyvinyl Chloride (PVC) Pipe, 2" and 3"

PVC pipe of sizes 2" and 3" shall be 250psi pressure rated, SDR 17, manufactured with IPS O.D.'s, 20ft. lengths and meet or exceed ASTM Specifications D2241 and NSF 14 and 61. Couplings and fittings shall be thrust-restrained for use at the rated pressures of the pipe with which they are used. Maximum safe tensile loads allowable are 2,900 lbs. and 5,000 lbs. respectively for 2" and 3" PVC pipe. All couplings and fittings shall be manufactured for permanent use as for direct burial. Color-coding shall be as follows:

Potable Water -Blue
Forcemain -Green
Re-Use -Purple

Contractor shall adhere to the pipe manufactures most current limits regarding radius of curvature when the pipe is used for HDD.

High Density Polyethylene (HDPE) Pipe

The pipe material shall be high density (PE3408) pressure pipe intended for use as a potable water pipe, force main, or re-use main. Pipe and fittings shall meet or exceed AWWA C906, DR9 or DR 11, in sizes 4" thru 24" and AWWA C901, DR 7.3 or DR 9 in sizes 2" and 3". Pipe O.D.'s shall be equivalent to DIP pipe O.D.'s. All pipe shall be color coded by co-extruding longitudinal stripes into the pipe outside surface as follows:

Potable Water -Blue
Forcemain -Green
Re-Use Main - Purple

Polyethylene fittings shall be made from material meeting the same pressure requirements or greater as the pipe. Fittings shall be molded by the pipe manufacturer meeting AWWA 906 requirements.

HDPE Butt Fusion Process

For pipe sizes 4" and larger of IPS or DIPS, hydraulic fusion machines shall be used. For pipe sizes 4" IPS and smaller, manually operated equipment may be used. The butt fusion process shall be also used for fittings, the location of which is shown on the drawings. Hydraulic fusion machines shall be fully equipped with controls for setting pressures for facing, heating and fusing. If requested, the CONTRACTOR shall provide an experienced and fully qualified machine operator who shall demonstrate his qualifications to the PROJECT ENGINEER by conducting "dry-runs" of the fusion process using at least 2 different sizes of pipe and fittings.

Restrained Joint Ductile Iron Pipe

Ductile iron pipe wall thickness and pressure class shall conform to ANSI Specification ANSI A21.50

(AWWA C150) and ANSI A21.51 (AWWA C151) with working pressure class up to 350. Pipe shall also be certified by ISO 9002 by an accredited registrar. Each length shall be clearly marked with the name of the manufacturer, location of the foundry, pressure rating, thickness or pressure class, nominal pipe diameter, weight of pipe without lining and length. All pipe furnished by the manufacturer shall be cast and machined at one foundry location to assure quality control and provide satisfactory test data. All ductile iron pipe shall be externally coated and internally lined as specified in this section. All ductile iron pipe used for potable water shall be color coded blue by field painting a blue stripe, 3 inches wide, along the crown of the pipe barrel, use green for the forcemains and purple for the re-use mains. Furnish DIP as shown on the plans and proposal quantities.

Linings and Coatings

All ductile iron pipe used for potable water, forcemains, or re-use mains shall be coated on the outside with 1 mil thickness of asphaltic compound as specified in AWWA C151. Pipe used for potable water shall be furnished with cement lining as specified in AWWA C104. Pipe used for forcemains and re-use mains shall be lined with a minimum finished dry thickness of forty (40) mils of Polyethelene in accordance with the ANSI/ASTM D1248 standards.

Ductile Iron Fittings

Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53 for compact fittings and shall be furnished by the pipe manufacturer having equal or greater pressure ratings as the pipe furnished. All fittings shall have the same exterior and interior coatings and linings as the pipe furnished.

Joint Tensile Load Calculations

Wherever restrained joint ductile iron pipe is used for HDD purposes, each joint shall be restrained in conformance with the pipe manufacturers most current calculations regarding tensile load limitations for HDD applications. Such calculations shall be sufficient evidence as to maximum "pull-in" force for both the tightest bend and "straight pull" necessary to install the pipe without any separation of the joint. Calculations shall take into account pipe size, pressure rating, length of pull, joint restraint and other factors as certified by a registered professional engineer in the State of Colorado.

Horizontal Directional Drilling Operations

The CONTRACTOR shall provide all material, equipment and facilities for directional drilling. Proper alignment and elevation of the bore hole shall be consistently maintained throughout the directional drilling operation. The method used to complete the directional drill shall conform to the requirements of all applicable permits. Copies of all permits will be supplied to the ENGINEER by the CONTRACTOR.

Piping shall be placed with a minimum of 60" of cover from finish grade to top of pipe. Maximum depth of cover shall be 72" unless specifically authorized by the Project Engineer. Bore profiles demonstrating compliance with the depth of cover requirements must be submitted for piping work claimed on each request for payment. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If CONTRACTOR is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.

CONTACTOR shall place a silt fence between all drilling operations and any drainage, well-fields, wetland, waterway, storm water drainage system inlets or other area designated for such protection

necessary by documents, state, federal or local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. The pilot hole shall be drilled on the bore path with no deviations greater than 2% of depth over a length of 100-feet.

In the event that pilot does deviate from the bore path more than 2-feet of depth in 100-feet, CONTRACTOR will notify ENGINEER and ENGINEER may require CONTRACTOR to pull-back and re-drill from the location along bore path before the deviation. In the event that a drilling fluid fracture, inadvertently returns or a returns loss occurs during pilot hole drilling operations, CONTRACTOR shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a Marsh funnel and wait another 30 minutes. If mud fracture or returns loss continues, CONTRACTOR will discuss additional options with the ENGINEER and work will then proceed accordingly.

Upon completion of the pilot hole phase of the operation, a complete set of "asbuilt" records shall be submitted in duplicate to the ENGINEER. These records shall include copies of the plan and profile drawing, as well as directional survey reports as recorded during the drilling operation.

Upon completion and approval of the pilot hole location the hole enlarging phase shall begin. The final hole enlargement shall not exceed by 1.5 times the O.D. of the pipe joint.

The open bore hole may be stabilized by means of bentonite drilling slurry pumped through the inside diameter of the drill rod and through openings in the reamer. The drilling slurry must be in a homogenous / flowable state serving as an agent to carry the loose cuttings to the surface through the annulus of the borehole. The bentonite slurry is to be contained at the exit or entry side of the directional bore in pits or holding tanks. The slurry may be recycled at this time for re use in the hole opening operation, or shall be hauled by the CONTRACTOR to an approved dumpsite for authorized disposal. Following completion of the bore hole the product pipe shall be pulled through the hole by means of a pulling eye attached to the lead joint of pipe. Attach a 10 gauge stranded insulated locate wire to the pulling eye and the crown of the pipe (PVC or HDPE) at each joint and at 10 ft. intervals along the pipe with plastic zip ties.

Testing Pipe

Cleaning and flushing are to be done by the CONTRACTOR in accordance with the requirements of the contract and these specifications.

Directional drilled pipe shall be tested by the CONTRACTOR after pullback. The average pressure shall be maintained at 150 psi for two hours with no leakage as may be indicated by a drop in pressure, or as may be allowed by the ENGINEER.

The test pump and water supply shall be arranged to allow accurate measurements of the water required to maintain the test pressure. Any material showing seepage or the slightest leakage shall be replaced as directed by the ENGINEER at no additional expense to the OWNER.

The manufacturer's recommendations on pipe stretch allowances, bend radius and tensile strength, allowable make-up water, and duration of test pressure shall be observed but may not be approved by the ENGINEER.

Installed pipelines shall be tested end to end. All service lines on the new main shall also be tested along with the newly installed mains.

Site Restoration

Following HDD operations, CONTRACTOR will de-mobilize equipment and restore the work site to the original condition or better. All excavations will be backfilled and compacted according to these specifications or as directed by the ENGINEER.

Surface restoration shall be completed in accordance with the requirements of the contract, to a condition as good or better than existed prior to construction using like materials as the original.

Record Keeping and As-Builts

CONTRACTOR shall maintain a daily project log of drilling operations and a guidance system log with a copy given to the ENGINEER at completion of the project.

The CONTRACTOR shall furnish "as-built" plan and profile drawings based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation. "As-Built" plans shall be submitted for piping work claimed on each pay request. "As-built" drawings shall be completed and certified by a Colorado registered professional surveyor and mapped at CONTRACTOR'S expense in a form as required by ENGINEER. A final, complete, signed and sealed set of As-Builts shall be submitted with the final request for payment.

Subsurface Investigation

The CONTRACTOR shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the nature and location of the work, the ground conformation, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions and all other matters which can, in any way affect the work under this Contract. The prices established for the work to be done will reflect all costs pertaining to the work described in these specifications. For purposes of this specification the definition of "substrata" shall mean "a layer of earth beneath the surface soil".

Measurement and Payments (Pipe Items)

Except as otherwise provided, the length of potable water pipe, forcemain or reuse main of the type and size shown in the contract proposal quantities shall be measured along the centerline of the pipe including fittings, and to a minimum depth to provide 60" of cover and a maximum depth of 72" or as approved. PVC fittings only will be included as pipe. Payment will be made on a per linear foot basis for all directional drilled pipe and shall include all other related incidental work and materials including excavation, remove and replace unsuitable backfill, layout and reference points, fence and shrub restoration, leakage and bacteriological testing, pressure testing, thrust restraint, silt barriers where required, locate wiring and testing, interior lining and exterior coating, restrained joints, retainers, glands and couplings, system connections, drainage maintenance, and traffic maintenance.

Measurement and Payment (Other Items)

Items, other than pipe quantities, as shown in the contract proposal shall be furnished and installed in accordance with the specifications or as described in the proposal quantities. Payment will be made based on final quantities installed and accepted.

UTILITY EXCAVATION AND BACKFILL

Scope

The work covered by this section shall consist of all necessary excavation and backfill for all utilities.

Excavation

Excavation shall consist of removal of all material necessary for the construction of the roadway section to the subgrade elevation, line, and grade shown on the plans or as specified in the contract documents. Unacceptable material defined as any earthen material containing vegetable or organic silt, topsoil, frozen material, trees, stumps, certain man-made deposits, or industrial waste, sludge or landfill, or other undesirable materials will be categorized as unclassified excavation and removed from the site and disposed of in accordance with applicable City, State and Federal requirements. All tree stumps and roots shall be removed to a minimum of two (2) feet below subgrade. Unclassified excavation includes any and all earthen materials encountered, including rocks and boulders measuring less than one-half cubic yard in volume, during construction.

Any work in the R.O.W. on trees, including roots, must be reviewed by the City Parks Department. Maintenance of the trees health shall be the responsibility of the contractor. Final protection and work around the tree shall be approved by the City.

Excavation shall be performed in a careful and orderly manner with due consideration given to protection of adjoining property, the public and workmen. Any damage to streets, parking lots, utilities, irrigation systems, plants, trees, building or structures or private property, or the bench marks and construction staking due to the negligence of the Contractor, shall be repaired and restored to its original conditions by the Contractor at his expense. Those areas that are to be saved will be clearly fenced off by the Contractor per the owner's instructions and it will be the Contractor's responsibility to ensure that these areas are not damaged during the construction process. Following completion of construction, should any of these trees, shrubs or irrigation facilities, etc. require replacement, it shall be done at the Contractor's expense.

All materials determined acceptable by the Engineer acquired from roadway excavations may be used for embankment fill and backfill as needed. The entire area in the vicinity of the construction where excavation and filling has been performed shall be raked clean of all trash, wood forms, and debris, after completion of the work with no additional cost to the Owner. Material removed in excavation and not acceptable or not required for embankment fill or backfill shall be disposed of by the Contractor. It shall not be wasted on private property without written permission of the property owner. Waste banks shall be left with reasonable smooth and regular surfaces.

The construction of any repair activity within the street or alley rights-of-way shall be accomplished by open cut, jacking, boring, tunneling or a combination of these methods as approved by the permit. **The Engineer shall approve any change from the approved permit.**

Trenches shall be excavated along the lines and grades established and in no case shall be more than **four hundred (400) feet in length**, or be trenched or backfilled in non-continuous sections unless approved by the Engineer. Failure by the Contractor to comply with these requirements may result in an order to stop the excavation in progress until compliance has been achieved.

All excavated material shall be **stockpiled** in a manner that does not endanger the work or workers and that does not obstruct sidewalks, streets and driveways. **No stockpiled materials shall be allowed on the asphalt surface or adjacent walkways unless approved by the Engineer.** The work shall be done in a manner that will minimize interference with traffic and/or drainage of the street. The Contractor at the end of each day shall barricade all excavations and ditch lines, remove excess material from travel

ways, and thoroughly clean all street, alleys and sidewalks affected by the excavation. If it becomes necessary to accomplish this, all streets, alleys (if asphalt or concrete) and sidewalks shall be swept or washed as required by the Engineer.

Materials encountered during excavation such as rubbish, organic, or frozen material, and any other **material that is not satisfactory for use as backfill** in the opinion of the Engineer, shall be removed from the site and disposed of daily by the Contractor at his expense. Stones, concrete or asphalt chunks larger than six (6) inches or frozen material shall be considered unsatisfactory backfill and removed by the Contractor.

All excavation, shoring and trenching, and the like shall comply with **OSHA's "Construction Industry Standards"** as well as all applicable Federal and State regulations.

No tracked vehicles shall be allowed on asphalt or concrete unless approved by the Engineer.

Crossings under sidewalks or curbs may be made by tunneling only when approved by the Engineer. If the Contractor elects to remove a portion of the sidewalk or curb, the applicable City standards shall be followed and material matched upon replacement. Mark appropriate box on the permit form.

Grading shall be done as necessary to prevent surface water from entering the excavation; any other water accumulation therein shall be promptly removed. Surface drainage, driveways, fire hydrants, manholes, water valves, etc. of adjoining areas shall be unobstructed. Water pumped from the excavation may require special handling prior to reentry into the river.

When soft or unstable material or rock is encountered in the trench subgrade that will not uniformly support the pipe, such material may be excavated to additional depths directed by the Engineer and backfilled with Type B material, as described in Subsection G, Part 2. An acceptable alternative for bedding is pea gravel or washed rock up to 1½". This material shall not exceed 12" above the installation, or half the trench depth without the City's approval. Vibration, water and compaction may be required for sand backfill if directed by the City.

Where ground water is encountered in the excavation, it shall be removed to avoid interfering with the work. It is the Contractor's responsibility to comply with all Federal, State and local permitting requirements prior to beginning any dewatering operations. The contractor may be required to secure approval from the U.S. Corps of Engineers prior to dewatering into a local river. Following pumping, washed rock may be used to a level 6" above the water table when approved by the City.

For openings less than or equal to 6" in diameter, bore holes shall be filled with patching material (**cold mix is not acceptable**) to prevent entry of moisture. Patching material used shall be in all cases compatible with the existing surface. Subgrade shall be replaced with flowable fill to provide necessary support to the surface. The sealing of bore holes is the responsibility of the Contractor or persons making the bore.

For openings greater than 6" in diameter, the limits of repair shall be identified in the permit.

The completed job shall be flush with the surrounding pavement and have no indentations, pockets, or recesses that may trap and hold water.

The use of trench digging equipment will be permitted in places where its operation will not cause damage to existing structures or features, in which case hand methods shall be employed.

No tracked vehicles shall be permitted on streets unless approved by the City. When tracked vehicles are allowed, existing facilities will be restored to original condition at the Contractor's expense. The City may require the track scarred area to be Slurry Sealed at the contractors expense.

Construction equipment and material delivery routing will be made a condition of the Permit.

The Contractor shall perform all excavation of every description and all materials to the depth required. Excavation shall be by open cut unless otherwise specified or specially authorized by the Engineer. Excess excavated material shall be disposed of in a waste area selected by the Contractor and approved by the Engineer. Trench width up to one foot above the pipe top shall be from 12 to 18 inches wider than the outside size of the pipe.

For sewer pipe, the trench shall be excavated to a depth of at least 3 inches below the outside diameter of the bell and backfilled with a sufficient amount of clean sand to provide support for the full length of the pipe. Excavation below grade limits as outlined above, whether caused by error or to replace unstable soil as ordered by the Engineer, shall be filled with sand, gravel or other material approved by the Engineer and compacted to an extent consistent with surrounding material.

For water main, the trench shall be excavated to a depth at least 3 inches below the invert grade and backfilled with a sufficient amount of clean sand to provide support for the full length of the pipe. After the pipe is installed, additional backfill in the form of clean sand shall be placed to a level of 6 inches above the main. Excavation below grade limits, as outlined above, whether caused by error or to replace unstable soil, as ordered by the Engineer, shall be filled with sand, gravel, or other material approved by the Engineer and compacted to an extent consistent with surrounding material.

All grading in the vicinity of trench excavations shall be controlled to prevent surface runoff from flowing into trenches. Any water accumulated in the trenches shall be removed by the Contractor by pumping or by other approved methods. During excavation, material suitable for backfilling shall be piled or windrowed in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and to prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted as directed.

Trenches for utility installation under asphaltic paving must have a wheel or saw cut straight edge; other method approved by the Engineer. Trenches for utility installation under concrete or asphalt paving must have a straight edge saw cut or other method approved by the Engineer.

Backfill

FLOWABLE-FILL WILL BE REQUIRED AS UTILITY TRENCH BACKFILL FOR ALL TRENCHES UNLESS OTHERWISE APPROVED BY THE TOWN. This requirement applies to all pavement and gravel locations. Flowable-fill vibration may be required. Flowable-fill shall be used in **all utility service connect** trenches. **It shall be used in any utility main repair or replacement when the work is less than one hundred feet (100') in length and when the work is less than six (6') deep.**

The recommended mix for flowable-fill is shown below. **Concrete backfill will not be allowed** within the public right-of-way. Flash-fill may be used if approved by the Engineer. Refer to CDOT specification 206.02.

INGREDIENTS	POUNDS/CUBIC YARD
Cement	42 (0.47 sack)
Water	235 (39 gallons or as needed)

Coarse Aggregate (Size No. 57)	1700
Sand (ASTM C-33)	1845

The maximum desired 28-day strength is 60 psi. The above combination of material, or an equivalent, may be used to obtain the desired flowable-fill

Flowable-fill or flash-fill shall be prohibited as a temporary or permanent street surface.

Trenches shall initially be backfilled to the level of the original surface. After the flowable-fill has cured, the top surface of the flowable-fill shall be removed and the temporary or permanent surface shall be placed.

Bridging and cutback requirements as described in these standards may still be required if the street failures indicate a clear need.

Repair of failed trenches will be the responsibility of the party requiring the trench.

Another acceptable use of flowable-fill backfill (with proper vibrating) is in situations where there is over break on concrete streets.

Conventional Backfill (Other Than Flowable Fill)

When "non flowable-fill" backfill material has been pre-approved by the Engineer, backfill in existing or proposed streets, curbs, gutters, sidewalks and alleys is divided into three (3) categories: initial, intermediate and final lifts as defined below:

INITIAL LIFT, designated as Class B and generally comprised of a washed, clean gravel material or sand, consists of the section from the bottom of the excavation to a point six to twelve (6 - 12) inches above the top of the installation. Placement and compaction of the initial layer shall be as specified by the utility to protect their installation.

INTERMEDIATE LIFT, generally comprised of native material, consists of the section above the initial layer to a point within six (6) inches of the ground level or the bottom of the pavement section whichever is greater. Excavated material may be used in the intermediate layer provided that it is deemed suitable by the Engineer.

FINAL LIFT includes both **road base and asphalt** surfacing. Road base material shall be CDOT Class 5 or 6 aggregate base course or as specified by the Engineer and placed at a depth of not less than 2". Asphalt shall be grading 'CX' and 4" minimum thickness or match existing.

Maximum dry density of all soil types used will be determined in accordance with AASHTO T 99 or AASHTO T 180. These densities will be determined prior to placement of backfill.

When a hydro-hammer or drop hammer compaction machine is used for compaction of fill in trenches, the maximum layer shall be 30 inches.

Compaction Testing Requirements

See Section 5, page 21.

Embankment and Slopes

The Town shall approve all slope angles, fill compaction and fill material.

All cut slopes shall conform to OSHA standards. Testing of native and imported material may be required, at the contractor's expense, prior to approval. Unless otherwise specified or approved by the Engineer, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown in the Standard Details. All backfill material shall be adjusted to within two percent (2%) of the optimum moisture content prior to its placement in the trench. Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when:

- soil sample tests show that the backfill and excavated trench materials consist of gravel or other granular material having less than 15 percent by weight passing a No. 200 sieve;
- the Engineer has given written approval prior to water soaking.

A minimum of 24 inches of compacted backfill shall be placed over the top of all polyvinyl chloride (PVC) and polyethylene (PE) pipe before vehicles or heavy equipment are allowed to pass over the pipe. Less cover may be allowed only where *flow-fill* or other approved material is used for the initial backfill above the pipe spring line.

During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe haunch backfill material shall be placed and compacted in even lifts on both sides of the conduit to six (6) inches above the top of the pipe. Above the bedding and haunch material, earth backfill material shall be placed full width in uniform layers not more than eight (8) inches thick.

Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment. Hydro-hammers or other heavy compaction equipment shall not be used unless approved by the City Utility Engineer. No hydro-hammer shall be used for compaction with less than 48 inches of cover over the pipe.

Surface water from any source shall be prevented from entering the excavation. No additional payment or extension of contract time will be made to the contractor due to saturated or unstable conditions caused by surface water entering the excavation.

All backfill shall be frequently tested to insure that the required density is being attained. For every 400 lineal feet of trench and each branch or section of trench less than 400 feet in length, at least one compaction test shall be performed for each two-foot vertical of depth of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement sub grade or 6 inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the failing area shall be defined by additional tests, if necessary, and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

If full-time inspection is provided during the backfilling operation by a WAQTC or NICET Level 2 certified technician, and sufficient initial testing has been performed to demonstrate that the methodology being used achieves the required results, then the frequency of compaction testing may be reduced as shown in the table at the end of these specifications. The methodology shall be verified for each soil type or trench condition encountered.

It shall be the Contractor's responsibility to make necessary excavations and to provide safe access into the excavations in accordance with OSHA Standards in order to accommodate compaction tests at all locations designated by the Inspector or authorized Technician.

Failed compaction tests shall be immediately reported to the Inspector and the Contractor. A summary report of all compaction test results, including retests of failed tests and a test location map or other approved location format shall be submitted to the Project Engineer and to the Contractor. Compaction test results are required as a basis of acceptance of facilities by the City in accordance with Section 107.1.

Manholes, storm inlet boxes and other concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of 2000 psi and can sufficiently support the loads imposed by the backfill. Backfill shall consist of approved materials uniformly distributed in layers brought up equally on all sides of the structure.

Each layer of backfill shall not exceed 8 inches before compacting to the required density and before successive layers are placed. Each layer shall be compacted to not less than ninety-five percent (95%) of the maximum density determined in accordance with AASHTO T-99 or 90% of the maximum density in determined accordance with AASHTO T-180 as determined by the Engineer. All backfill placed within two (2) feet measured horizontally from any structure shall be compacted with hand operated mechanical equipment.

Backfill **shall not** be started without approval of the Engineer, but such approval shall not constitute acceptance of the utility.

Any trench settlement in excess of ½" within the agreed to 12 month warrantee period, shall be repaired by the Contractor.

For sewers, backfill to one foot over the pipe shall consist of fine excavated materials compacted in a 4 inch layer. For water mains, backfill to 6 inches over pipe shall consist of clean sand.

In the event that insufficient material suitable for backfill remains from the excavation, the shortage shall be made up of Class 5 or 6 road base aggregate or other approved material.

PAVEMENT GRADE PREPARATION

Scope

This work shall consist of all necessary excavation, embankment, base preparation, back sloping, and spot sub grade reinforcement for proper pavement grade preparation.

Excavation

Excavation shall be finished to within ½ inch of the final design grade. Excavated materials shall be re-used on the project when that re-use is depicted on the project plans and/or approved by the Engineer. Unsuitable and excess material not needed shall be disposed of by the Contractor.

Embankment

Embankment shall be constructed of suitable materials placed in successive level layers not more than 12 inches in thickness, loose measure, for the full width of the embankment and shall be constructed in lengths of not less than 300 feet, or for the full length of the embankment and compacted to an average density of 95% of the maximum density value as determined by AASHTO T-180 (Modified).

Embankments constructed for the purpose of retaining water (retention ponds, dams, etc.) shall be constructed to the plan specifications. The soils testing laboratory shall certify to the City that the embankment is constructed of an impervious material and that a stability analysis was conducted and said analysis reflects a minimum safety factor of two when the water elevation is a design high water.

Sub Grade

The subgrade for the pavement structure shall be graded to conform to the cross sections and profile required by the construction plans. Prior to the placement of aggregate base course or sub-course, the subgrade should be properly prepared. The subgrade should be scarified to a minimum depth of six (6) inches, moisture adjusted as necessary, and recompact to not less than the following:

- For cohesive soils, 95% maximum Modified Proctor dry density at 2% of optimum moisture content, or **95% maximum Standard Proctor** dry density at 2% of optimum moisture content.
- For non-cohesive soils, 92% maximum Modified Proctor dry density at 2% of optimum moisture content, or 97% maximum Standard Proctor dry density at 2% of optimum moisture content.

Prior to approval to place the base or sub-base course, all utility main and service trenches shall be compacted to not less than the above referenced densities required for the given soil classification. **This density requirement also applies to all utility trenches within the public rights-of-way from a point four (4) feet beyond the edge of asphalt and descending at 1:1 outward.**

Sub grade shall be defined as that portion of the roadbed immediately below the base course or pavement, including curb and gutter, the limits of which will ordinarily include those portions of the project shown in the plans to be constructed to a design bearing value or to be otherwise specially treated. The limits of the sub grade shall be considered to extend to a depth of twelve inches below the bottom and twelve inches beyond the horizontal extents of said base course. On roadways where curbs are utilized, the sub grade shall extend twenty four inches beyond back of curb.

Any and all soft and yielding material within the sub grade which will not compact readily shall be

removed and replaced with suitable material and the whole sub grade brought to line and grade allowing for subsequent compaction. The sub grade shall be compacted to the requirements as shown on the plans. If the natural in place soils do not meet the required stability, sufficient borrow material for stabilization shall be uniformly mixed with the in place soils to meet the bearing and compaction requirements.

The stabilized sub grade in both cuts and fills shall be compacted to a density of 95% of the maximum density as determined by AASHTO T-180. The sub grade shall be shaped before conducting any density tests. The required density shall be maintained until the aggregate materials for the base or pavement course have been spread in place. After the sub grade has been prepared as specified above, the contractor shall maintain it free from ruts and depressions and all damage resulting from the hauling or handling of any materials, equipment, tools, etc.. Ditches and drains, if called for in the project plans, shall be constructed and maintained along the completed sub grade section.

After the sub grade has been prepared, and immediately before any base course is laid, it shall be inspected by the engineer for substantial compliance, as determined by the engineer, as to crown and elevation. If deficiencies are noted, material shall be added or removed to achieve substantial compliance, and again stabilized and compacted to bring all portions of the sub grade to the specified elevation, stability and density.

The sub grade shall be finished to within .1 feet of the design grade of the bottom of base course.

Base Course

Unless otherwise specified herein or on the project plans, the materials, placing, mixing and compaction of base course shall comply with Section 304 of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, 2005 edition.

Base course shall be defined as the layer or layers of specified or selected material placed on a sub grade to support a surface course. The limits of the base course shall be considered to extend to the depth depicted and defined on the project plans and twelve inches beyond the horizontal extents of the surface course. On roadways where curbs are utilized, the base course shall extend twelve inches beyond back of curb.

The base course shall be constructed in accordance with these specifications and in conformity with the project plans.

The base course shall be transported over previously placed base course and dumped on the end of the previous spread, in no case shall rock be dumped directly on the sub grade.

During final compacting operations, if blading of any areas is necessary to obtain true grade and cross section, the density of those areas will be tested before the placement of a surface course.

If a prime coat is to be applied, the surface of the base shall be "hard-planed" with a motor grader to remove surface glazing to allow the free penetration of the prime material, any materials removed during this process shall be removed from the base area.

If, at any time, the sub grade material should become mixed with the base course material, the contractor shall excavate and remove the mixture, reshape and compact the sub grade, and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.

The finished surface of the base course shall be checked with a template cut to the required cross

section and with a 15 foot straight edge or string line laid parallel to the centerline of the road or other approved testing devices. All irregularities greater than ¼ inch shall be corrected by scarifying and removing or adding base course, after which the entire area shall be recompact and tested as specified herein.

The engineer or construction inspector may require proof rolling of the compacted base course or sub grade stabilization material with a heavy pneumatic tired vehicle, with a minimum axle load of 18 kips / axle, to test for deflection. Pavement design procedures assume a stable sub grade. If while proof rolling, any visible deflection, rutting or pumping is observed, additional compaction, reblending or replacement of the aggregate base course at the contractors expense may be required, regardless of compaction test results.

After the base course is completed, test holes shall be dug or cores taken at intervals of not more than 300 feet, or at closer intervals if necessary. Where the base course is more than ½ inch deficient in thickness, the

surface will be scarified to a depth of not less than three inches; base course will be added to achieve compliance with the plans subsequent to final compaction and testing.

When trenches are excavated in streets or alleys which have only a gravel surface, the contractor shall replace such surfacing on a satisfactory compacted backfill with gravel conforming to CDOT Class 5 or Class 6 aggregate base course. Gravel replacement shall be one (1) inch greater in depth to that which originally existed, but not less than four (4) inches. The surface shall conform to the original street grade. Where the completed surface settles, additional gravel base shall be placed and compacted by the Contractor immediately after being notified by the City, to restore the roadbed surface to finished grade.

Some streets may have been treated with a special surface treatment to control dust and/or bind the aggregates together. In these cases the Contractor is responsible for installing the gravel surface in the same manner as what was existing. Such surface treatments shall be of the same chemical composition as what existed prior to the excavation work. The Engineer shall note on the permit the surface treatment that will be required.

Back Sloping

The Contractor shall provide a 2 foot wide, level earth berm, if applicable, behind the curb, pavement, and on each side of the sidewalk. The Contractor shall further back slope in a cut section on a 1:1 slope to the existing ground line, and in a fill section on a 3:1 slope down to existing ground line. Compaction in fill sections shall be 90% of maximum density as determined by AASHTO T99A.

Spot Sub grade Reinforcement

The finished grade for this item shall be the final design grade. The top 6 inches of the sub grade shall be compacted to 95% of maximum density and sub grade below the top 6 inches shall be compacted to 90% of maximum density as determined by AASHTO T99A. The nature and/or the composition of suitable materials for this item shall be as directed by the Engineer.

Prime and Tack Coats for base Courses

Unless otherwise specified herein, or on the project plans, the materials, surface preparation and application prime and tack coats shall comply with Section 407 of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, 2005 edition.

The material will be applied with either a truck or trailer mounted standard hot asphalt distributor

capable of spreading the prime or tack coat at specified quantities uniformly over the base area.

Surface area to be primed and tack coated shall be swept and cleaned of any foreign material. For proper penetration, optimum moisture and surface characteristics must be attained. Any scabbing or other imperfections noted in the base course will require remedial action prior to the application of bituminous material. If the base course is adjacent to any concrete it shall be protected and kept free of bituminous material.

No bituminous material shall be applied when the air temperature is less than 40°F in the shade, or when the weather conditions or the condition of the existing surface is unsuitable.

The temperature of the prime material shall be between 100°F and 150°F, optimum distribution characteristics shall determine the exact temperature.

The prime coat material shall be applied at a rate of approximately 0.10 to 0.25 gallons per square yard, dependant upon the type of base material. The rate of application shall be sufficient so as to coat the surface thoroughly and uniformly without pooling.

A light, uniform application of clean sand shall be applied and rolled prior to the opening of the primed base to traffic.

In general, a tack coat will not be required on a primed base, however, in areas that have become excessively dirty and cannot be cleaned, or in areas where the prime coat has cured and lost bonding effect a tack coat will be required. In all cases, an applied tack coat will be kept free from traffic until the surface course is laid.

STORM SEWERS

Scope

The work covered by this section shall consist of all necessary construction of storm sewers, manholes, catch basins and other appurtenances.

Materials

Pipe shall be of the types listed unless otherwise specified or approved by the Engineer. All pipe shall have a minimum design life of fifty (50) years. The wall thickness and/or class of pipe shall be determined by the Engineer based on the dead and live loads applied over the design life including maximum design loads that will be applied to the pipe during construction. Pipe installed under roadways, driveways and parking areas shall be designed for H-20 minimum live load.

Reinforced Concrete Pipe

Reinforced Concrete Pipe (RCP) shall be manufactured in accordance with one of the following standards:

ASTM C 76 or ASTM C 655
ASTM C 507
ASTM C 506
ASTM C 361

RCP (designed for specific D-loads).
Reinforced Concrete Elliptical Pipe
Reinforced Concrete Arch Pipe
Low Head Concrete Pressure Pipe – All concrete pipe shall meet the requirements of this standard

Reinforced Concrete Pipe shall be made with Type V cement or other approved cement having less than 5% tricalcium aluminate. RCP shall not be used where the pH of the soil is less than 5.

RCP joints shall be manufactured with flexible water tight joints conforming to ASTM C 443 unless otherwise specified or approved by the Engineer. Non-water tight joints, when approved, shall conform to ASTM C 990.

PVC Sewer Pipe

PVC sewer pipe and fittings shall conform to ASTM D-3034 Type PSM for diameters 4" to 15" and ASTM F-679 Type I for diameters 18" to 27". The minimum wall thickness for PVC pipe shall conform to Standard Dimension Ratio (SDR) 35. Joints shall be bell-and-spigot type with flexible elastomeric seals conforming to ASTM D-3212 and shall not be longer than 14 feet in length. Gaskets shall be neoprene or other synthetic rubber material conforming to ASTM F-477. The bells shall be integrally formed with the pipe or fitting. Profile wall PVC pipe may be used for sizes 15" through 36" unless otherwise shown on the plans or specified. Profile wall pipe shall be seamless and meet the requirements of ASTM F949 or ASTM F794. The pipe stiffness shall be a minimum of 46 psi when tested at 5% deflection in accordance with ASTM D-2412.

Polyethylene Pipe - Corrugated or Profile Wall

Polyethylene pipe for storm drains shall be either corrugated pipe with a smooth inner liner conforming to AASHTO M252, Type S or AASHTO M294, Type S, or profile wall pipe conforming to ASTM F894. Polyethylene pipe for under-drains shall have a smooth interior conforming to AASHTO M252 or AASHTO M294, Type S or SP.

Corrugated polyethylene pipe used for storm drains shall have bell and spigot gasketed joints meeting AASHTO M294 or MP6-95. The joint shall be designed so that when assembled, the elastomeric gasket located on the spigot end is compressed radially on the pipe to form a water tight seal. The joint shall be designed to prevent displacement of the gasket from the joint during assembly and when in service. The pipe shall have a "home" mark on the spigot end to indicate proper penetration when the joint is made. The elastomeric gasket shall meet the provision of ASTM F477. Couplings for culverts and under drains may be bell and spigot, coupling bands or other type conforming to AASHTO M294. All culverts shall have gasketed joints for a water tight seal. Couplings for profile wall polyethylene pipe shall be bell and spigot gasketed type or thermal welded in accordance with the manufactures recommendations.

Fittings shall conform to AASHTO M294 or MP6-95. Fabricated fittings shall be welded on the interior and exterior at all junctions.

Manholes for Storm Drains

Manholes shall be constructed in accordance with City Standard Drawings.

Cement

All cement used in mortar, and concrete used in concrete bases, and precast manhole riser sections, cones and flat tops, for sanitary sewer manholes, shall be Type V or modified Type II Portland cement having less than five (5) percent tricalcium aluminate.

Precast Concrete Manhole Sections

Manhole risers, cones, flat tops and grade rings shall be precast reinforced concrete sections conforming to ASTM C-478 or AASHTO M-199. Flat top lid slabs will not be allowed for manholes located in an asphalt road section. Manhole risers, cones and flat tops shall be made with tongue and groove ends for continuous and uniform joints between sections. Joint configuration shall be consistent throughout each manhole, use of non compatible manhole joints on new systems or modification to existing systems shall not be allowed. The joint sealant shall be a flexible, preformed, bitumastic joint sealant.

When manhole waterproofing is required by the Project Specifications or on the Plans, the exterior surface of base, riser sections and cone shall be coated with a minimum of 10 mil. coal tar epoxy. Waterproofing may be field applied.

Manhole Steps

Steps are required in all manholes unless otherwise shown on the plans or specified in the Contract Documents. Manhole steps shall be a manufactured from copolymer polypropylene plastic with ½" diameter, Grade 60 steel core. The steps shall be set in the wall of the manhole riser at the time the riser is manufactured. For pre-cast manhole bases with integral riser sections, the steps and access hole shall be installed in alignment at a 45 degree angle from the inlet pipe (measured from the center of the manhole). The spacing between steps shall be such that when the manhole components are assembled the spacing is in conformance with OSHA Standards.

Pipe-to-Manhole Connector

Pipe-to-manhole connectors shall be manufactured with rubber conforming to ASTM C-923. All metal components shall be stainless steel.

Rings and Covers

Manhole rings and covers shall be grey iron conforming to AASHTO M 105, Class 30 and shall be designed to withstand HS 20 loading. The bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position and interchangeability. The cover shall have a beveled pick hole that has a width of ¾" at the top and 1" at the bottom. The length of the pick hole (along the circumference of the lid) shall be at least 1½". Frames shall be 4, 6 or 8 inches high, lids shall be 24 inches in diameter and 1 ¼ " thick. Inverted rings and covers are not allowed unless approved by the Engineer.

Catch basin frames and grates shall be gray iron castings conforming to the requirements of AASHTO M105, Class 30. All frames and grates shall be approved by the engineer prior to placement.

Construction

After the trench has been de-watered and the bedding prepared as outlined herein, the pipe shall be laid to the line and grade shown on the Construction Drawings. Variance from the designed location and elevation at the ends of every pipe section shall not be greater than three (3) inches horizontally and one (.50) inch vertically while still maintaining minimum positive slope of the pipe. Variance from the design slope shall be within ±0.04% of the design slope. At no point, however shall the slope be permitted to drop less than the allowed minimum positive slope of 0.40% or the design slope shown on the Construction Drawings, whichever is less. A deflection of up to 0.8 inches, creating a sag of not longer than 4 linear feet, will be allowed once in every 100 feet of pipe laid. The line will be televised, closed caption, to determine the severity of any deficiency.

The Contractor shall set the line and grade of each joint of pipe with a laser unless otherwise approved by the Engineer. Offset hubs shall be set by the Contractor's surveyor at intervals of 25', 50', 100' and 200' out of each manhole, inlet box, or starting point to verify vertical and horizontal line and grade of the gravity pipe being installed. Control stakes shall include station information for the horizontal control. Whenever the pipe is found to be outside the specified limits, the misaligned sections shall be removed and relayed to the correct line and grade at the Contractor's expense.

Pipe shall be laid upgrade from the point of connection to the existing sewer or from a designated starting point. Pipe with bell and spigot joints shall be laid with the bell end upgrade.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, soil, gravel, groundwater, and other foreign material. When pipe laying is not in progress, the upgrade end of the pipe shall be kept closed with a tightly fitting cap or plug.

All storm line stub outs longer than 10 feet shall terminate at a manhole, unless otherwise approved by the Engineer. The typical length of a stub out shall be 2 to 3 feet terminating with the bell end of a pipe. Each stub out shall be connected to the manhole with a Kor-n-seal gasket , or approved equal, and plugged with a PVC cap that can be removed for future extension, yet still prevent ground water infiltration. The manhole base shall be formed to provide positive flow through the manhole from the inverts of all connecting pipes, including stub outs.

Storm service pipe within the public way shall be laid at a minimum grade of one-fourth (1/4) inch per linear foot unless otherwise approved by the Engineer. Flatter slopes between one-eighth (1/8) and

one-fourth (1/4) inch per foot will be allowed only when there is not enough elevation difference to achieve one-fourth (1/4) inch per foot.

The maximum deflection permissible at any one fitting or any combination of adjacent fittings shall not exceed 90 degrees. 90 degree fittings shall be the long radius type.

On existing PVC storm mains the method of connection may be by the installation of a PVC tapping saddle with stainless steel straps. Where a tapping saddle is used, the hole in the main line shall be elliptical and slightly larger than that in the tapping saddle. The service line or wye shall not protrude beyond the inside wall into the main.

On existing non-PVC main lines such as concrete or clay, Inserta Tees shall be used in accordance with the manufacturer's recommendations. Verify that the supplied tee is intended for the diameter and type of the existing pipe. At no point shall the tee protrude more than 1/2 inch into the existing pipe.

The foundation for each manhole base shall be prepared by replacing unsuitable material with sub grade stabilization material as outlined herein and placing granular bedding material in accordance with the City Standard Details

The manhole base shall be precast or cast-in-place. The lines and grades of the pipe inverts shall be staked, as shown on the Construction Drawings. The inverts of sanitary sewer manholes shall be formed and smoothly finished to match the shape and elevation of all pipes connected to the manhole.

Where the storm line is designed with a continuous grade through the manhole, the pipe shall be laid through the manhole location, the top half of the pipe cut out and the manhole base formed around the bottom half of the pipe. A pre-cast base with a pre-cast invert may be used where there is at least 0.2 ft. of elevation difference across the manhole.

Water-stops shall be installed on all pipes going into or out of a cast-in-place base. Water stops shall be placed on both the uphill and downhill sides of the manhole on pipes laid continuously through a manhole. For precast bases the pipes shall be connected to the base with flexible rubber boots with stainless steel straps.

If cast-in-place bases are used, the first pre-cast manhole section shall be placed on the concrete base structure before the base has taken initial set, or the section shall be grouted into a suitable groove formed in the top of the manhole base. The first section shall be adjusted to the proper grade and alignment so that it is uniformly supported by the base concrete and not bearing on any of the pipes. The manhole barrel sections and cone shall be positioned so that the steps and access hole are in alignment and at a 45 degree angle from the inflow pipe (measured from the center of the manhole).

The pre-cast sections shall be placed and aligned to provide plumb vertical sides. The top of the cone section shall not be more than eighteen (18) inches below the finished grade elevation. A bitumastic or other approved sealer shall be placed between pre-cast sections so that the completed manhole is rigid and watertight. The sealer shall be placed both on the inside lip as well as the outside lip of each section.

The manhole ring and cover shall be set to match the adjacent ground or pavement surface. Concrete grade rings shall be dry stacked to within two (2) inches of the bottom of the cast iron ring elevation. The cast iron manhole ring shall be set to the final pitch and elevation with shims or other

approved devices. The space between the top grade ring and the cast iron manhole ring shall be filled with QUIKRETE® Rapid Road Repair (No. 1242) or an approved equal.

Cast iron grade adjustment (extension) rings are allowed to adjust the elevation of the manhole covers, only when a street is being overlaid. Inverted rings and covers will not be permitted without the approval of the Engineer.

Where the manhole is located in an unpaved street, alley or other area where grade has not been established, 6 to 12 inches of grade rings shall be placed between the top of cone and bottom of the CI ring (to allow future adjustment of the ring to grade).

Where the manhole is located in an unpaved area, a concrete collar with a #4 rebar hoop shall be cast around the ring and cover, and shall extend a minimum of 4" below the top of the concrete cone. The concrete collar shall be a continuous section with minimum dimensions of 12 inches wide and 12 inches thick.

Where a manhole is in a cultivated or landscaped area, a watertight manhole cover shall be used. In cultivated areas, the top of the casting shall be 18 to 24 inches below the existing ground surface.

In the event that any newly constructed manholes are not cleaned of any accumulation of silt, debris, or foreign matter of any kind at the time of final inspection, City crews will clean the manhole(s) and bill the Contractor. Cost for said clean up and repair shall be billed on the basis of actual cost plus 30%. All ram-neck shall be trimmed flush with manhole wall.

Excavation and backfill shall comply with section of "Utility Excavation and Backfill".

Storm pipe shall be checked for cracks and defects before installation, shall be laid true to the line and grade as depicted on the project plans, and shall be jointed by methods approved for the type of joint specified. PVC pipe shall be installed in accordance with ASTM Recommended Practice D2321.

Risers shall be installed where shown or ordered. These shall be laid on a slope not to exceed 1:1, cut back into the trench bank in such a manner that the service connection pipe shall have solid bearing on undisturbed earth.

Manholes shall be installed on top of a minimum thickness of 6" of Class 6 gravel backfill as directed by the Engineer.

All lift stations shall be approved by the Engineer prior to the completion of design plans.

SANITARY SEWERS AND SERVICES

Scope

The work covered by this section shall consist of all necessary construction of sanitary sewers, sewer services, manholes and other appurtenances.

PVC Gravity Sewer Pipe

PVC sewer pipe and fittings shall conform to ASTM D-3034 Type PSM for diameters 4" to 15" and ASTM F-679 Type I for diameters 18" to 27". The minimum wall thickness for PVC pipe shall conform to Standard Dimension Ratio (SDR) 35. Joints shall be bell-and-spigot type with flexible elastomeric seals conforming to ASTM D-3212 and shall not be longer than 143 feet in length. Gaskets shall be neoprene or other synthetic rubber material conforming to ASTM F-477. The bells shall be integrally formed with the pipe or fitting.

Profile wall PVC pipe may be used for sizes 15" through 36" unless otherwise shown on the plans or specified. Profile wall pipe shall be seamless and meet the requirements of ASTM F949 or ASTM F794. The pipe stiffness shall be a minimum of 46 psi when tested at 5% deflection in accordance with ASTM D-2412.

PVC Pressure Sewer Pipe

PVC pipe used for sanitary sewers under pressure shall meet the requirements of ASTM D-2241 (IPS) or AWWA C-900. Joints shall conform to ASTM D-3139 and have elastomeric seals conforming to ASTM F-477. The type and pressure class shall be as shown on the Construction Drawings or otherwise specified.

Small sewer force mains (1½" to 2") may be installed using pipe materials meeting HDPE 3408 – ASTM D2239 and ASTM D2737. The pipe must be produced from virgin material (Natural Virgin Core with Blue Virgin Exterior) or Utility Engineer approved equal.

Manholes for Sanitary Sewers

Manholes shall be constructed in accordance with City Standard Drawings.

Cement

All cement used in mortar, and concrete used in concrete bases, and precast manhole riser sections, cones and flat tops, for sanitary sewer manholes, shall be Type V or modified Type II Portland cement having less than five (5) percent tricalcium aluminate.

Precast Concrete Manhole Sections

Manhole risers, cones, flat tops and grade rings shall be precast reinforced concrete sections conforming to ASTM C-478 or AASHTO M-199. Flat top lid slabs will not be allowed for manholes located in an asphalt road section. Manhole risers, cones and flat tops shall be made with tongue and groove ends for continuous and uniform joints between sections. Joint configuration shall be consistent throughout each manhole, use of non compatible manhole joints on new systems or modification to existing systems shall not be allowed. The joint sealant shall be a flexible, preformed, bitumastic joint sealant.

When manhole waterproofing is required by the Project Specifications or on the Plans, the exterior surface of base, riser sections and cone shall be coated with minimum 10 mil. coal tar epoxy. Waterproofing may be field applied.

Manhole Steps

Steps are required in all manholes unless otherwise shown on the plans or specified in the Contract Documents. Manhole steps shall be a manufactured from copolymer polypropylene plastic with ½" diameter, Grade 60 steel core. The steps shall be set in the wall of the manhole riser at the time the riser is manufactured. For pre-cast manhole bases with integral riser sections, the steps and access hole shall be installed in alignment at a 45 degree angle from the inlet pipe (measured from the center of the manhole). The spacing between steps shall be such that when the manhole components are assembled the spacing is in conformance with OSHA Standards.

Pipe-to-Manhole Connector

Pipe-to-manhole connectors shall be manufactured with rubber conforming to ASTM C-923. All metal components shall be stainless steel.

Rings and Covers

Manhole rings and covers shall be grey iron conforming to AASHTO M 105, Class 30 and shall be designed to withstand HS 20 loading. The bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position and interchangeability. The cover shall have a beveled pick hole that has a width of ¾" at the top and 1" at the bottom. The length of the pick hole (along the circumference of the lid) shall be at least 1½". Frames shall be 6 inches high, lids shall be 24 inches in diameter and 1 ¼ " thick.

Inverted rings and covers are not allowed unless approved by the Engineer.

Manhole frames and lids shall be gray iron castings conforming to the requirements of AASHTO M105, Class 30. Frames shall be 6" high. Lids shall be 24" in diameter and 1 ¼" thick.

Construction

After the trench has been de-watered and the bedding prepared as outlined herein, the pipe shall be laid to the line and grade shown on the Construction Drawings. Variance from the designed location and elevation at the ends of every pipe section shall not be greater than three (3) inches horizontally and one (1) inch vertically while still maintaining minimum positive slope of the pipe. Variance from the design slope shall be within ±0.04% of the design slope. At no point, however shall the slope be permitted to drop less than the allowed minimum positive slope of 0.40% or the design slope shown on the Construction Drawings, whichever is less. A deflection of up to 0.8 inches, creating a sag of not longer than 4 linear feet, will be allowed once in every 100 feet of pipe laid. The line will be televised, closed caption, to determine the severity of any deficiency.

The Contractor shall set the line and grade of each joint of pipe with a laser unless otherwise approved by the Engineer. Offset hubs shall be set by the Contractor's surveyor at intervals of 25', 50', 100' and 200' out of each manhole, inlet box, or starting point to verify vertical and horizontal line and grade of the gravity pipe being installed. Control stakes shall include station information for the horizontal control. Whenever the pipe is found to be outside the specified limits, the misaligned sections shall be removed and relayed to the correct line and grade at the Contractor's expense.

Pipe shall be laid upgrade from the point of connection to the existing sewer or from a designated starting point. Pipe with bell and spigot joints shall be laid with the bell end upgrade.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, soil, gravel, groundwater, and other foreign material. When pipe laying is not in progress, the upgrade end of the pipe shall be kept closed with a tightly fitting cap or plug.

All sewer line stub outs longer than 10 feet shall terminate at a manhole, unless otherwise approved by the Engineer. The typical length of a stub out shall be 2 to 3 feet terminating with the bell end of a pipe. Each stub out shall be connected to the manhole with a Kor-n-seal gasket, or approved equal, and plugged with a PVC cap that can be removed for future extension, yet still prevent ground water infiltration. The manhole base shall be formed to provide positive flow through the manhole from the inverts of all connecting pipes, including stub outs.

Sewer service pipe within the public way shall be laid at a minimum grade of one-fourth (1/4) inch per linear foot unless otherwise approved by the Engineer. Flatter slopes between one-eighth (1/8) and one-fourth (1/4) inch per foot will be allowed only when there is not enough elevation difference to achieve one-fourth (1/4) inch per foot. Sewer service pipe and connections to the sewer main shall be inspected by a Department of Public Works, City Inspector prior to backfilling. The location and alignment of service lines shall be established by the Engineer. All sewer service lines shall have a clean-out installed per Standard Detail for Service "Y" Connection, page SS-06

The maximum deflection permissible at any one fitting or any combination of adjacent fittings shall not exceed 90 degrees. 90 degree fittings shall be the long radius type.

4" service lines shall be joined to the new sewer mains with a wye fitting connected above the spring line of the sewer pipe. On existing PVC sewer mains the method of connection may be by the installation of a PVC tapping saddle with stainless steel straps. Where a tapping saddle is used, the hole in the main line shall be elliptical and slightly larger than that in the tapping saddle. The service line or wye shall not protrude beyond the inside wall into the sewer main.

All 6" or larger service taps shall be accomplished using a manhole. On 8" or smaller main lines in which projected flows will be less than 1/3 full, the 6" service line shall enter the manhole approximately 0.2' higher than the invert of the existing pipe. On larger mains, the 6" line shall be placed vertically so that flow from the main line does not back into the service line.

On existing non-PVC main lines such as concrete or clay, Inserta Tees shall be used in accordance with the manufacturer's recommendations. Verify that the supplied tee is intended for the diameter and type of the existing pipe. At no point shall the tee protrude more than 1/2 inch into the existing pipe.

For the installation of sewer service lines to properties that will not be immediately connecting or reconnecting to the sewer system, the service lines shall be stubbed out to the house side of the multi-purpose easement, utility easement or right-of-way line where no easement exists. The end of the pipe shall be plugged and marked with either a 4" x 4" wood post or steel fence post buried vertically above the end of the pipe and extending 3 feet above the ground surface with the exposed portion painted green. The ends of the service lines shall be capped with watertight plugs braced to withstand test pressures. The horizontal location of each service tap shall be measured and shown on the As-Built drawings PRIOR to backfilling. The Contractor shall mark the end of the service with a post, as required above, with a reference mark and depth to the service pipe to be shot (for elevation) and documented at a later date. Tap locations shall be referenced using the stationing shown on the plans or referenced to property corners unless otherwise approved by the Engineer.

Where a PVC sewer service line is connected to an existing service line, the connection shall be made with a Calder® coupling, or approved equal, of the style or with the adapters to be compatible with the pipes being joined. The coupling shall be encased in concrete.

An alternative would be to use Mission type couplings with stainless steel bands. Mission type couplings need not be encased in concrete. All service lines over 100 feet in length have a clean-out installed in accordance with the Uniform Plumbing Code. When the clean-outs are located within the right-of-way, they shall be terminated in a cast iron ring and cover suitable for traffic loads as shown in the City Standard Details.

Sub-drains and/or French drains will not be permitted to be connected to sanitary sewers. Services for service stations, car washes and food-processing establishments shall have a grease and/or sand trap installed on their service lines.

The foundation for each manhole base shall be prepared by replacing unsuitable material with sub grade stabilization material as outlined herein and placing granular bedding material in accordance with the City Standard Details

The manhole base shall be precast or cast-in-place. The lines and grades of the pipe inverts shall be staked, as shown on the Construction Drawings. The inverts of sanitary sewer manholes shall be formed and smoothly finished to match the shape and elevation of all pipes connected to the manhole.

Where the sewer line is designed with a continuous grade through the manhole, the pipe shall be laid through the manhole location, the top half of the pipe cut out and the manhole base formed around the bottom half of the pipe. A pre-cast base with a pre-cast invert may be used where there is at least 0.2 ft. of elevation difference across the manhole.

Water-stops shall be installed on all pipes going into or out of a cast-in-place base. Water stops shall be placed on both the uphill and downhill sides of the manhole on pipes laid continuously through a manhole. For precast bases the pipes shall be connected to the base with flexible rubber boots with stainless steel straps.

If cast-in-place bases are used, the first pre-cast manhole section shall be placed on the concrete base structure before the base has taken initial set, or the section shall be grouted into a suitable groove formed in the top of the manhole base. The first section shall be adjusted to the proper grade and alignment so that it is uniformly supported by the base concrete and not bearing on any of the pipes. The manhole barrel sections and cone shall be positioned so that the steps and access hole are in alignment and at a 45 degree angle from the inflow pipe (measured from the center of the manhole).

The pre-cast sections shall be placed and aligned to provide plumb vertical sides. The top of the cone section shall not be more than eighteen (18) inches below the finished grade elevation. A bitumastic or other approved sealer shall be placed between pre-cast sections so that the completed manhole is rigid and watertight. The sealer shall be placed both on the inside lip as well as the outside lip of each section.

The manhole ring and cover shall be set to match the adjacent ground or pavement surface. Concrete grade rings shall be dry stacked to within two (2) inches of the bottom of the cast iron ring elevation. The cast iron manhole ring shall be set to the final pitch and elevation with shims or other approved devices. The space between the top grade ring and the cast iron manhole ring shall be

filled with QUIKRETE® Rapid Road Repair (No. 1242) or an approved equal.

Cast iron grade adjustment (extension) rings are allowed to adjust the elevation of the manhole covers, only when a street is being overlaid. Inverted rings and covers will not be permitted without the approval of the City Utility Engineer.

Where the manhole is located in an unpaved street, alley or other area where grade has not been established, 6 to 12 inches of grade rings shall be placed between the top of cone and bottom of the CI ring (to allow future adjustment of the ring to grade).

Where the manhole is located in an unpaved area, a concrete collar with a #4 rebar hoop shall be cast around the ring and cover, and shall extend a minimum of 4" below the top of the concrete cone. The concrete collar shall be a continuous section with minimum dimensions of 12 inches wide and 12 inches thick.

Where a manhole is in a cultivated or landscaped area, a watertight manhole cover shall be used. In cultivated areas, the top of the casting shall be 18 to 24 inches below the existing ground surface.

In the event that any newly constructed manholes are not cleaned of any accumulation of silt, debris, or foreign matter of any kind at the time of final inspection, City crews will clean the manhole(s) and bill the Contractor. Cost for said clean up and repair shall be billed on the basis of actual cost plus 30%. All ram-neck shall be trimmed flush with manhole wall.

Excavation and backfill shall comply with section of "Utility Excavation and Backfill".

Sewer and service pipe shall be checked for cracks and defects before installation, shall be laid true to the line and grade as depicted on the project plans, and shall be jointed by methods approved for the type of joint specified. PVC pipe shall be installed in accordance with ASTM Recommended Practice D2321.

Risers shall be installed where shown or ordered. These shall be laid on a slope not to exceed 1:1, cut back into the trench bank in such a manner that the service connection pipe shall have solid bearing on undisturbed earth.

Manholes shall be installed on top of a minimum thickness of 6" of Class 6 gravel backfill as directed by the Engineer.

All lift stations shall be approved by the Engineer prior to the completion of design plans.

WATER MAINS AND SERVICES

Scope

The work covered by this section shall consist of all necessary construction of water mains, water services, valves, hydrants and other appurtenances.

Materials

Pipe for all water mains shall be Polyvinyl Chloride (PVC) unless otherwise approved.

Ductile Iron Fittings

Unless otherwise specified in the Construction Drawings or Special Provisions, ductile iron pipe joints shall be mechanical or push-on joints conforming to AWWA C111. Gaskets shall be of neoprene or other synthetic rubber material.

Fittings for use with PVC pipe shall be ductile iron or cast iron conforming to AWWA C110 or C153. Fittings larger than 12-inch shall be cement-mortar lined per AWWA C104. Although minimal cracking in the cement lining is allowed, the absence of cement mortar lining in any part of the fitting shall be reason for rejection. All fittings, 12-inch and smaller, shall be coated inside and outside with fusion bonded epoxy coatings conforming to the requirements of ANSI/AWWA C116/A21.16.

Fittings shall be designed for use on ductile iron pipe conforming to ANSI/AWWA C151/A21.51 and PVC pipe conforming to AWWA C900. All fittings shall be provided with integral restrained joints and have seals conforming to ASTM F 477 and the physical testing requirement of AWWA C111. All fittings shall be coated with fusion bonded epoxy coatings conforming to the requirements of ANSI/AWWA C116/A21.16. Assembly of fitting joints shall not require beveling of the plain end of a cut pipe and shall not require the use of jacks or power equipment to force the pipe end past the gasket. Fittings shall be manufactured by One Bolt, Inc., or approved equal.

All bolts for mechanical joints shall be Cor-Blue® bolts or approved equal. All bolts for flange connections shall be stainless steel bolts with the threads coated with anti-seize.

Unless otherwise specified or approved by the City Utilities Engineer, all ductile iron fittings larger than 12" shall be wrapped with polyethylene encasement material conforming to AWWA C105, or shall be provided with fusion bonded epoxy coating conforming to the requirements of ANSI/AWWA C116/A21.16.

PVC Water Distribution Pipe

PVC pipe and fittings for the City's water distribution system shall conform to AWWA C900 for sizes 4" through 12" and to AWWA C905 for sizes 14" through 36". Unless otherwise specified, the minimum thickness class of C900 PVC pipe shall be a Dimension Ratio (DR) of 18. Minimum thickness class of C905 PVC is DR25.

Joints shall be bell and spigot type sealed with elastomeric gaskets conforming to ASTM D3139. Couplings shall be able to withstand the same internal pressure and external loading as the pipe.

PVC fittings will not be allowed. Ductile iron and cast iron fittings for use on PVC pipe shall conform to those requirements outlined above.

Water Service Pipe and Fittings

Copper tubing for water service lines 3/4" through 2" in diameter shall be Type K, soft temper copper tubing for underground service conforming to ASTM B-88 and ASTM B-251. The pipe shall be marked with the manufacturer's name or trademark and the type of pipe. The outside diameter of the pipe and minimum weight per foot shall not be less than that listed in ASTM B-251, Table II.

PVC pipe for water service lines will be allowed for pipe greater than or equal to 3" in diameter. Three inch diameter shall conform to ASTM D-2241 and unless otherwise specified, all pipe shall be CL 200 psi. All services 4" and larger shall conform to AWWA C 900.

HDPE pipe for water service lines will be allowed for pipe sizes 1½" and 2". This pipe material is suitable for water service line, or irrigation system infrastructure. Pipe materials must meet HDPE 3408 – ASTM D2239 and ASTM D2737 and be produced from virgin material (Natural Virgin Core with Blue virgin Exterior) or Engineer approved equal.

All fittings for copper water service lines shall be brass and have flared or Mueller 110 type compression copper connections. Curb stops shall be used for all water service line 2" in diameter or smaller. If copper service line is not utilized, 12" long brass nipples shall be installed on each side of the curb stop valve to mitigate potential twisting of the valve during operation. Valve shall have IP thread outlet, male to compression adapter to 2 inch Type K copper service.

Gate valves shall be iron body, resilient seated with non-rising stems. Valves shall have a two inch square operating nut, shall open counter clockwise, and shall have flanged or mechanical joint ends. Stem seal shall be O-ring. Valves shall conform to AWWA C509-87.

Valve boxes shall be manufactured of gray cast iron. The valve box shall be designed to eliminate the transmission of shock and stress to the valve. Valve boxes shall be three-piece slip or screw type and shall be of such length to reach proposed street grade at least six inches less than full extension. Box lids shall be marked with the word "water" and shall have a lip or flange that extends into the valve box shaft.

Fire hydrants shall conform to and be tested in accordance with AWWA C502. Approved fire hydrant manufacturers and models are Mueller A-423 and Waterous WB 67. Hydrants shall have two 2 ½" hose nozzles and one 4 ½" pumper nozzle with National Standard Threads. Standpipe above traffic flange shall be traffic yellow, bonnet and caps red. Hydrant shall be built with traffic flange and shall extend above the finished grade as indicated in the standard details. All hydrants are to be 5' bury length. Operating nut shall open counterclockwise.

River crossing pipe shall be AWWA C900, SDR 14, Class 200 PVC.

Water mains shall be installed to be in conformance with the project plans.

Curb stops shall be as follows:

Curb Stops		
Size	Mueller	Ford
¾"	H15200	B22-333
1"	H15200	B22-444
1 ½"	H15201	B22-666
2"	H15201	B22-777

Curb Boxes shall be Mueller H-10350

Corporation stops shall be as follows:

All corporation stops must have AWWA "CC Type" threads.

Saddles shall be as follows: (Saddles for mains larger than 12" shall not be allowed)

Main Size	Mueller	Ford
4"	H-16123	202B-540
6"	H-16126	202B-750
8"	H-16130	202B-962
10"	H-16134	202B-12.12
12"	H-16137	202B-14.38

All saddles must have AWWA "CC Type" threads.

All plugs required shall be considered as incidental items. Plugs shall be Tyler Plug -AC, AWWA C110, Fitting with Ears and Bolts, Solid 5-351.

Installation of Water Mains and Services

Water lines, force mains and other pipelines that will operate under pressure shall be laid on the alignment shown on the plans. Unless otherwise specified or approved, all pressure pipelines shall be laid to a depth to provide a minimum cover of 48 inches measured from the final ground surface to the top of the pipe. Pressure pipelines placed in service before final surface grading has been completed shall have a minimum cover of 36 inches during the winter season.

The inside of water pipe and jointing surfaces shall be kept clean and free from mud, dirt, gravel, ground water, and other foreign material. Whenever dirt or debris enters the pipe, the Contractor shall clean the pipe by swabbing or other approved method (see Section 4.3 of Appendix A). After cleaning, the City Inspector shall determine if the pipe is clean enough to be installed. When pipe laying is not in progress the open ends of the pipeline shall be kept closed with watertight plugs.

Long radius horizontal or vertical curves may be laid with standard pipe by deflections at the joints of rigid pipe or by deflecting the entire length of flexible pipe. Maximum deflections at pipe joints shall be per the Manufacturer's recommendations or applicable AWWA Standard.

All water mains and other pressure pipelines shall be buried with a continuous electrical tracing wire to enable future location of the pipe. Tracing wire shall be taped to the top of the pipe at 10-foot intervals to prevent dislocation of the wire during backfilling. The tracing wire shall be spliced and extended to the base of all fire hydrants as shown on the City Standard Details. On water transmission lines or mains not located in streets, the tracing wire shall be extended above grade near the top to the top of each gate valve box and the isolation valve box at each air release valve as shown in the City Standard drawings . Tracing wire shall be terminated at the ends of all pressure pipelines as detailed on the above referenced drawing. Tracing wire shall be spliced with a wire nut, wrapped with Aqua-Seal TBT-20 rubber tape to completely encase the connection, with an exterior wrap application of plastic electrical tape. It shall also be the Contractor's responsibility to demonstrate to the Engineer, at final inspection, that electrical continuity exists in all sections of tracer wire.

All ductile iron pipe with push on type joints shall be electrically connected with wedges or with cadweld connectors and No. 10 copper wire. The wire ends and cadwelds shall be sealed to prevent corrosion.

Prior to backfilling, all non-epoxy coated cast iron and ductile iron pipe, fittings, valves, appurtenances and all other metal pipes and fittings, except copper service lines, shall be wrapped with polyethylene encasement material. Polyethylene film shall have a minimum thickness of 0.008 inches (8mil). Installation of the polyethylene encasement shall be in accordance with one of the methods described in AWWA C-105. If a soil survey has been performed in accordance with Appendix A of AWWA C-105 and the soil is found to not be corrosive to ductile iron, then the Project Engineer or the Contractor or may submit a written request to the Engineer to install ductile iron pipe and fittings without a polyethylene encasement.

Ductile iron valves and fittings shall be fully encapsulated by the polyethylene encasement, except the valve operating nut. The ends of the polyethylene shall be taped around the full circumference of the pipe. If the polyethylene is cut or more than one piece is used to wrap the valve or fitting, the pieces shall overlap a minimum of 12 inches and the full length of the seam shall be taped.

Thrust restraint shall be provided at all pipe bends, tees, caps, valves, hydrants and at the end of all stub outs or dead end lines. Thrust restraint beyond the physical fitting may be provided by concrete blocking or mechanical restraint of pipe joints. If pipe joint restraint is used in lieu of concrete thrust blocks, the minimum distance for joint restraint along the pipe away from the fitting shall be determined utilizing EBAA Iron Thrust restraint calculations. This is available on line at [http://rcp.ebaa.com/ Restraint Length Calculator v5](http://rcp.ebaa.com/Restraint%20Length%20Calculator%20v5). In-line valves with a minimum of 20 feet of pipe are not required to be separately restrained.

The size and location of concrete blocking shall be as shown on the plans or in accordance with the City Standard Drawings. Thrust blocks shall be poured on firm, stable foundation material and all bearing surfaces shall be against undisturbed earth. Concrete for thrust blocks shall be made with modified Type II Portland cement and shall reach a minimum compressive strength of 3000 psi in 28 days. Reinforcing steel and bolts used to anchor valves, fittings, etc., to thrust blocks shall meet tensile requirements of ASTM Grade 40. All anchorage steel not embedded in concrete shall be factory epoxy coated or Cor-Ten steel.

Fire hydrants shall be dry blocked as well as mechanically restrained, as shown on the City Standard Details.

Valves and fittings shall be restrained by mechanically connecting them to the pipe or other fittings. Fitting to fitting connections may be made with a flange by flange connection or an integral ring anchoring fitting by mechanical joint connection. Pipe by fitting connections shall be restrained with a Megalug®, JCM®, Uniflange Series 1500®, Stargrip Series 4000® or other approved joint restraint. When using mechanical restraints, restraints shall also be used on the slip joints adjacent to mechanical restraint. Where a short piece of pipe is installed between a fitting and a valve or other fitting, the restraint may be provided by connecting the mechanical joints with 5/8" zinc-coated, all-thread, steel rod. The rod shall be connected to the mechanical joint fitting using tie-back bolts, not through the fitting's bolt holes. The rod shall be coated with an asphalt sealant. All mechanical restraints shall be encased with polyethylene in as outlined above.

Each gate valve shall be installed in a vertical position and set on a concrete support block as shown on the City Standard Details. An adjustable slip type valve box shall be set into position during backfilling operations. The upper section of the unit shall be placed in proper alignment and adjusted so that its top will be at final grade. The completed valve box shall be vertically centered over the valve operating nut. Each valve shall be checked for proper access and operation prior to paving.

Unless otherwise approved by the City Utilities Engineer, each butterfly valve shall be installed in a vault. The diameter of the vault shall be as detailed on the plans.

Hydrants shall be installed at the locations shown on the Construction Drawings. They shall be plumb and set so that the bottom of the pumper nozzle is no less than eighteen (18) inches and no more than twenty-two (22) inches above finished grade. The depth of the water line shall be adjusted so the fire line, from the main to the hydrant, can be installed horizontally and the fire hydrant set with the ground line within ½ inch of the finished ground level. If the depth of the water line cannot be adjusted because of conflicting utilities or other

constraints, an offset shall be installed on the fire line and rotated to achieve the proper bury depth of the hydrant or fire hydrant with a different barrel height shall be used.

A minimum of 1/4 cubic yard of washed gravel shall be placed around the base of the hydrant to insure proper drainage of the hydrant after use. All pipe and fittings between the water line and the fire hydrant shall be restrained with dry concrete thrust blocks behind the hydrant and mechanical restraints. The tee shall be restrained with concrete thrust block. Weep holes, which drain the hydrant, shall not be covered with concrete.

Where possible, underground water service pipes shall be laid not less than ten (10) feet horizontally from the building sewer drain. Where this separation is not possible, the service line shall be at least eighteen (18) inches above the top of the building sewer line.

If placed in a common trench with the sewer service, the water service line shall be on a solid shelf excavated to one side of the trench. Where a sewer service is proposed with less than 5 feet of cover, the water service line shall be constructed in a separate trench and the sewer service line shall be constructed with Schedule 40 PVC pipe.

Tapping saddles shall be used on PVC pipe. Taps shall be at 45° above the spring line of the pipe. If the tap is made while the main line is in service, a corporation stop shall be installed in the tap and turned so the T-handle will be on top. Corporation stops will be used in all cases.

The service line shall be installed from the main to the meter pit location shown on the Construction Drawings or designated by the Engineer. A meter pit shall be installed so the top of the pit is within ½ inch of the proposed final ground surface elevation. The top of the pit shall be higher than the back of the adjacent sidewalk with a minimum slope of ¼ inch per foot from the pit to the back of the sidewalk. A meter setter shall be installed in each meter pit so the top of the setter will be 20 inches (+/- 2") below the top of the pit.

The service line shall extend to the back of the multipurpose or utility easement and marked either by a 4"x 4" board or steel fence post buried vertically. The board or post shall extend 3 feet above the ground surface with the exposed portion painted blue. The end of the service line shall be capped with watertight a plug.

Installation on non-City water systems shall conform to the standards of that particular system. Meters will be installed by the company or organization operating the water main.

Vacuum breakers shall be required on all irrigation sprinkler systems, and any other connection to the service line, which presents a backflow or siphon potential, and contamination risk. All backflow prevention devices shall be installed in accordance with the Uniform Plumbing Code and manufacturer's recommendations.

For water services to medium and high risk installations, the assemblies shall be reviewed and

approved by the Engineer, or designated representative, prior to installation.

Existing lead and galvanized steel water service lines shall be replaced with approved water service line materials. Other service lines may be replaced as directed by the City. The new service lines shall be connected to the existing meter with the appropriate fittings. Excavation of the existing meter pit shall be done in a careful manner to keep the pit intact for continued use.

Water services to be relocated shall be carefully excavated and disconnected to preserve the integrity of the pit, meter and components. The relocated meter shall be reconnected to the customer's service line with the appropriate fittings.

For all service line reconnections and relocations the condition and configuration of the existing meter, fittings and pit shall be inspected by the City. The City may direct any or all of the components to be replaced or reconfigured to conform to current standards.

New water lines shall not be connected to existing mains in service until the new lines have been tested, disinfected, and accepted by the City. Where the connection of the new lines to old requires interruption of service, the Engineer and Contractor shall mutually agree upon a date and time for connections which will allow ample time to assemble labor and materials. The Contractor shall notify all water users affected at least 24 hours prior to service interruption.

To reduce the possibility of contamination of the domestic water supply in the event of a water line break or repair, the following construction techniques shall be used when a water line and a sanitary sewer line are installed in close proximity to each other. These requirements shall apply to main lines:

- If the sewer line is above and within 10 feet horizontally of the water line, the sewer line shall be installed through a steel or ductile iron casing pipe or encased in reinforced concrete as shown on the City Standard Drawings. The casing pipe or concrete encasement shall extend a minimum of 10 feet on either side of the water line, measured perpendicular to the water line.
- If the sewer line is 18" or less clear distance below and within 5 feet horizontally of the water line, the sewer line shall be installed through a steel, ductile iron or PVC casing pipe or capped with concrete as shown on the City Standard Drawings. The casing pipe or concrete cap shall extend a minimum of 10 feet on either side of the water line, measured perpendicular to the water line.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes.

Crossings of sewer and water lines shall not be at an angle less than 45 degrees nor shall a sewer line or water line be installed within 10 feet of each other unless approved by the Engineer.

To reduce the possibility of injury to workers in the event of an emergency repair, and to reduce possible damage to a City of Alamosa flow line, the following construction techniques shall be used when a water flow line and public/private utility are installed in close proximity to each other. These requirements shall apply to any potable or raw water flow line that is 18 inches in diameter or larger:

- A minimum clear distance of two (2) feet shall be required when the Utility is crossing either above or below the flow line.

- The public-private Utility shall be encased in a steel or PVC casing pipe with minimum wall thickness of ¼ inch for a distance of twenty (20) feet centered on the flow line.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes. Crossings of Water Flow Lines and public/private utility lines shall not be at an angle less than 45°. Excavation and backfill shall comply with section on "Utility Excavation and Backfill".

Water main and service pipe shall be checked for cracks and defects before installation, shall be cleaned and kept clean during laying operations, and shall be laid to provide a minimum of 4 feet of cover below finished or existing street grade, whichever is lower. All necessary cutting shall be done neatly and true, by means of an approved mechanical cutter.

River crossing pipe shall be bedded on even foundation and covered with at least 5 feet of natural ground. Pipe shall be assembled and tested on dry ground and pulled into place.

Valves, boxes and hydrants shall be installed where shown on the drawings or as directed by the Engineer. Valves, valve boxes, and hydrants shall be set plumb. Earth fill shall be carefully tamped around each valve box. Fire hydrants shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be inspected in opened and closed positions to insure that all parts are in working condition.

Joints at the corporation stop and at the curb stop shall be flared, made with standard flaring tools.

Testing

Water mains, force mains, siphons, irrigation systems and all other pipelines that will operate under pressure shall be tested for pressure maintenance in accordance with these specifications and AWWA C-600, Section 4. Although AWWA C-600 is for ductile iron pipe, the test procedures shall be used for PVC pipe also. Pavement or other permanent surfaces shall not be placed until all pressure and leakage tests are satisfactorily completed. If the section of pipe being tested includes components of an existing system or components installed by others, the testing shall be done so at the Contractor's risk.

Unless otherwise specified, the test pressure for all pipes shall be double the maximum operating pressure at the lowest elevation of the test section or the class designation of the pipe plus fifty (50) psi, whichever is less. The minimum test pressure for water lines and sewer force mains shall be 120 psi.

The maximum operating pressure within the City of Alamosa water distribution system is 65 psi.

The pipeline shall be filled with potable water at least twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly and all air expelled by means of taps at points of highest elevation. If temporary taps are installed to fill the line or release the air, the corporation stop shall be removed and the tap plugged when the disinfection and testing have been completed.

The total time for the pressure test shall be a minimum of two (2) hours for each section of pipeline.

Sterilization

These procedures describe methods of disinfecting newly constructed potable-water mains; mains that have been removed from service for planned repairs or for maintenance that exposes them to contamination; mains that have undergone emergency repairs because of physical failure; and mains that, under normal operation, continue to show the presence of *coliform* organisms. These disinfection procedures are based on the AWWA Standard for Disinfecting Water Mains (§C651-05 or the most current). The disinfecting agents discussed in this standard are chlorine solutions that may be derived from liquid chlorine (Cl₂), calcium hypochlorite (Ca(OCl)₂), or sodium hypochlorite (NaOCl). Combinations of free chlorine residual and contact time are provided.

The basic steps in nonemergency disinfection of water mains are the following;

- **Preventive Measures:** prevent the introduction of contaminated material into all new mains during the installation process.
- **Preliminary Flush:** all new mains shall be purged of contaminants by means of a full diameter flush.
- **Chlorination:** all new mains shall be disinfected by means of the tablet, continuous, or slug method and maintain the specified chlorine residual for the minimum required contact time.
- **Final Flush:** all new mains shall be dechlorinated by flushing the heavily chlorinated water from the main until the normal potable water chlorine residual is observed.
- **Bacteriological Testing:** confirm the effectiveness of the disinfection procedure through bacteriological testing, as specified in the American Public Health Association (APHA) "Standard Methods for the Examination of Water and Wastewater."

Preventive Measures

During construction, the interior as well as all sealing surfaces of pipe, fittings, and other accessories should be kept as clean as possible. Inspect the interior of all pipes prior to installation. If dirt enters the pipe, it should be removed and the affected interior of the pipe swabbed with a 1% chlorine solution. All openings in pipelines should be closed with watertight plugs whenever the trench is unattended. Sealing, lubricating, or gasket materials used in pipe installation should be stored and handled in a manner that avoids contamination and be suitable for use with potable water.

Preliminary Flushing of Mains

Before being chlorinated, the main should be completely filled with water to eliminate air pockets and then flushed to purge the line of dirt and debris. This is typically conducted after the completion of the leakage and pressure tests. Adequate drainage must be provided during flushing. Drainage should take place away from the construction area.

Ineffective removal of dirt and debris from lines prior to disinfection often leads to failed bacterial tests, requiring repeated disinfection. Preliminary flushing should be accomplished at a rate of at least 2.5 ft/sec and no more than 5 ft/sec.

Fittings and valves should be thoroughly cleaned before applying chlorine to a main. Special attention should be given to mechanical joints, fittings, and valves that may contain spaces that are difficult to chlorinate once they become filled with water.

Table 1 shows the required flow rate to obtain a velocity of 2.5 ft/sec in commonly used sizes of pipe. Flushing can be enhanced by the used of soft pigs to remove dirt, debris, and air from the main prior to disinfection. The use of pigs can also conserve water and is particularly useful when there is insufficient water supply to attain a 2.5 ft/sec minimum flushing velocity.

Flow Required (GPM) for Given Velocity				
Pipe Size (Inch)	Pipe Area (Sq. Ft.)	1 Ft/Sec	2.5 Ft/Sec	5 Ft/Sec
2	0.02	10	25	50
4	0.09	40	100	200
6	0.20	90	220	440
8	0.35	155	390	780
10	0.55	245	610	1220
12	0.79	350	880	1760
14	1.07	480	1200	2400
16	1.40	625	1570	3140

Preliminary flushing, however, should not be conducted if tablets or granules of calcium hypochlorite have been placed in the pipe during construction. In this case, special care must be exercised in ensuring that the main does not become contaminated with dirt or other materials during construction.

Flushing of water mains shall not be allowed after ambient temperature has exceeded 85°F without the prior approval of the building engineer.

Disinfecting Agent and Method of Chlorination

The forms of chlorine that may be used in the disinfection operations are liquid chlorine (AWWA B301), sodium hypochlorite solution (AWWA B300), or calcium hypochlorite granules or tablets (AWWA B300). Contact with organic material or high temperatures must be avoided due to the danger of fire or explosion. AWWA Standard §C651 describes three methods of chlorination for water mains: tablet, continuous and “slug.” The chlorine dose and minimum contact time for each AWWA method are summarized in Table 2. Recommendations for disinfection of small section of mains under emergency repair are also included in Table 2. Methods for measurement of free chlorine residual are summarized in Appendix A. Before any disinfection method is utilized, valves must be positioned so that the highly chlorinated water in the main being treated does not flow into water mains in active service.

Chlorination Method Used	Initial Chlorine Dose (mg/l)	Minimum Contact Time (hours)	Minimum Chlorine Residual Conc. (mg/l)
Nonemergency			
• Continuous	25	24	10
• Slug	100	3	50
Emergency			
• Premixed Solution or Hypochlorite Injection	300	0.25	100
• Swabbing	10,000 (1% Solution)		Swab thoroughly the interior of any pipes and fittings used in repairs

Factors to consider when choosing a method of chlorination include length and diameter of the main, type of joints present, equipment and materials necessary for disinfection, skills, and training of personnel, safety concerns, and whether the main must be put into service on a rapid basis. The continuous and slug methods require the use of appropriate chlorine feed equipment and the determination of the necessary chlorine feed rate for the chlorine solution. In long, large-diameter mains, the slug method has the potential for reduction in water and chemicals as compared to the continuous method.

The tablet method is convenient to use for mains with diameters less than 24 inches and does not require special chlorine feed equipment. There are, however important limitations with this method:

- 1) The use of the tablet method precludes preliminary flushing. Flushing of the lines is often necessary to remove dirt and debris and assists in the removal of air from the lines.
- 2) Calcium hypochlorite granules or tablets may be dislodged from the lines upon filling and accumulate at points of restriction.
- 3) The tablet method should not be used in large-diameter mains where a worker must enter the main for inspection due to the potential of toxic fumes.

Refer to AWWA §C651 for detailed procedures and specifications of the chosen chlorination method.

Final Flushing of Mains

After the applicable minimum retention period, highly chlorinated water should be flushed from the main until chlorine residual measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system. Care must be exercised when flushing water with high free chlorine residuals. Chlorine is toxic to fish and other aquatic life. Disposal of highly chlorinated water to storm sewers should be avoided without neutralization of the chlorine residual where the sewer discharges directly to a creek, river, or lake.

Flushing of water mains shall not be allowed after the ambient temperature reaches 85°F without the prior approval of the building engineer.

Bacteriological Testing

Standard Condition - after final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hr apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 ft of the new water main, plus one set from the end of the line and at least one set from each branch. Samples shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater; and shall show the absence of *coliform* organisms. A standard heterotrophic plate count (HPC) test is also required because new material does not typically contain *coliform* but does typically contain HPC bacteria.

Special Condition - if trench water has entered the new main during construction or if, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft, and the location shall be identified. Samples shall be taken of water that has stood in the new main for at least 16 hrs after final flushing has been completed.

Sampling Procedure - samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate, as required by Standard Methods of the Examination of Water and Wastewater. No hose or fire hydrant shall be used in the collection of samples. There should be no water in the trench up to the connection for sampling. The sampling pipe must be dedicated and clean and disinfected and flushed prior to sampling. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

A brief summary of bacteriological sampling procedures and analytical methods is provided in Appendix B.

Sample Results - if sample results from the lab indicate a measured HPC greater than 500 colony-forming units (cfu) per ml, flushing should be resumed and another *coliform* and HPC set of samples should be taken until no *coliforms* are present and the HPC is less than 500 cfu/ml.

Record of Compliance - the record of compliance shall be bacteriological test results certifying that the water sampled from the new water main is free of *coliform* bacteria contamination and is equal to or better than the bacteriologic water quality in the distribution system.

Re-disinfection - If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, the new main shall be rechlorinated by the continuous-feed or slug method until satisfactory results are obtained - that being two consecutive sets of acceptable samples taken 24 hrs apart.

Additional Protection Required

Where water main crosses over an existing or new sewer main:

- No additional protection needed if water main is at least 3 feet above sewer. (Intervening dirt must be left undisturbed).
- If the crossing is within 3 feet above the sewer main, a full length of water main must be centered over the sewer main. In addition, concrete shall be placed between the two pipes, with the amount to be stated in the plans.

Where water main crosses under an existing or new sewer main:

- Additional protection shall be provided by centering a full length of water main under the sewer main. In addition, concrete must be placed between the two pipes, with the amount to be stated on the plans.

Service Disruption

It shall be the responsibility of the Contractor to notify all affected parties of any disruption of service because of water service work. Notice shall be made at least twenty four hours prior to the disruption except in the case of emergencies, when the notice shall be made as soon as possible.

AGGREGATE BASE COURSE

Scope

The work covered by this section shall consist of furnishing and placing aggregate on a prepared sub grade.

Materials

Aggregate shall conform to Class 5 or 6, as specified in Section 703.03 of Colorado Department of Transportation Standard Specifications for Road and Bridge Construction.

Construction

Construction methods, procedures, and equipment shall conform to Section 304 of Colorado Department of Highways Standard Specifications.

Density Requirement

Gravel base course shall be compacted to 95% of maximum density at optimum moisture content in accordance with AASHTO T 180.

Concrete

Scope

This work consists of the construction of concrete trails, curb ramps, intersection corners, corner fillets, driveway sections, drainage pans, curbs, gutters, sidewalks and bituminous curbs in conformity with the lines and grades shown on the plans or established by the engineer.

Materials

Concrete for the construction of curbs, gutters, sidewalks, curb ramps, driveway approaches, corner fillets, drainage pans, median cover and trails shall be CDOT Class B, modified as outlined below:

28 day Field Compressive Strength	4000 psi
Minimum Cement	610 lbs/cy
Maximum Water/Cement Ratio	0.48
Entrained Air	6% ± 1%
Maximum Slump	4 inches
Fly Ash	Not to exceed 15% by weight of cement
Coarse Aggregate	No. 67 from AASHTO M-43
Fine Aggregate	AASHTO M6 Maximum 50% of total aggregate

Concrete mixes will be subject to sampling and testing at the batch plant or at the job site for compliance with the mix design and specifications as outlined above. The City hereby reserves the right to reject any load not deemed compliant with any specification herein.

Reinforcing steel shall conform to Section 602, Colorado Department of Transportation Standard Specifications.

Expansion joints shall be pre-formed, non-extruding type, ½ inch in thickness and AASHTO M-213 compliant.

Curing compound shall be an AASHTO M-148 and V.O.C. compliant, liquid membrane-forming, water based acrylic copolymer containing at least 16% solids. Safe Cure and Seal (J-18) distributed by Dayton Superior Construction Chemicals is an example of an approved curing compound.

Construction

Concrete shall be removed to neatly sawed edges to full depth for sidewalks and curb and gutter and shall be saw cut in straight lines either parallel to the curb or perpendicular to the alignment of the sidewalk or curb. Any removal shall be done to the nearest joint. Replaced sections may require doweling connections if required by the City.

When work is stopped for the day, walkways shall have adequate passage and safety signage and be opened for traffic. A walk lane shall be considered satisfactorily open only if it is surfaced with a

temporary asphalt or gravel surface. In the event the surface has been replaced in the same day as the excavation was made, the repaired areas should be properly barricaded to protect the concrete during the curing stage.

Removal and replacement shall be to existing joints or as directed by the City.

The concrete pavement shall be replaced with 4,000 psi concrete to match the finish and thickness of the existing pavement, but not less than eight (8) inches thick. All concrete construction shall be protected from vehicular traffic, including contractor vehicles, until the concrete has achieved eighty (80) percent of its ultimate strength. Concrete shall be coated and sealed with a uniform application of membrane curing compound applied in accordance with manufacturer's recommendations.

The use of quick curing concrete (3000 psi strength within 48 hours) shall be used on all arterial and collector streets when repair areas are less than 500 square feet or when temperatures are below 40° F. Quick curing concrete repairs may be opened to traffic within two (2) days or when the concrete has achieved eighty (80) percent of its ultimate strength.

Where existing cracks or damage are adjacent to the area being repaired the repair area shall include the cracked or damaged concrete. Pavement repairs shall include all areas of damage, including leak test holes, pot holes, equipment and/or material scaring of the exiting surface.

When repairing concrete, the removal perimeter shall be saw cut and replacement concrete shall be doweled into the old concrete as directed by the Engineer.

Joints shall be thoroughly cleaned of all foreign material then filled with a hot-poured elastic type joint filler conforming to M 173, ASTM D1190-80 or ASTM D1751-83, D1752-84, D3405-78, D3406-78, D3407-78 or silicone sealants or others as approved by the Engineer. Joint material shall be filled to within 1/2 inch of the surface. Excess material shall be scraped off to provide a smooth riding surface.

Curb and gutter shall be constructed in accordance with Section 609.03 of the Colorado Department of Transportation Standard Specifications except as otherwise specified herein.

Sidewalks and driveways shall be constructed in accordance with Section 608.03 of the Colorado Department of Transportation Standard Specifications except as otherwise specified herein.

Curing shall be accomplished by application of curing compound before initial drying of the exposed concrete surface, said curing compound shall be liquid membrane-forming type, and AASHTO M148 compliant, as outlined above.

Contraction joints and alternate-contraction joints shall be at 10-foot spacing on curb and gutter, and at intervals equal to the width of sidewalks or bikeways. Expansion joints shall be at lot lines where possible (not more than 75' spacing), at both ends of intersection radii and at other locations as required and shown on the plans. Construction joints shall be constructed as expansion joints with location to match the regular location of either contraction joints, alternate-contraction joints or expansion joints.

Where concrete is to be poured adjacent to a wall, or other similar structure, expansion material shall be installed along the entire length of the structure. If the structure has a jagged edge, a contraction joint inscribed in the new concrete along the structure shall suffice.

No water shall be placed on concrete surfaces during finishing operations. The contractor shall keep plastic sheeting or other waterproof covering available on the jobsite to cover and protect the surface of freshly placed concrete against rain and/or dust storms.

Surface finishing shall be minimized to prevent dilution and weakening of the concrete mixture at the surface.

It shall be the contractor's responsibility to protect new concrete against vandalism, vehicular damage and defacement of any kind until it has been officially accepted by the City. All damaged or defaced concrete shall be repaired or replaced, as directed by the engineer, at the contractor's expense.

The sub grade under all concrete shall be adjusted to optimum moisture content and uniformly compacted to no less than 95% of the maximum density determined in accordance with AASHTO T-99. Bed course material shall be placed on the prepared sub grade to the dimensions shown on the standard drawings and compacted to a minimum of 95% of the maximum density determined in accordance with AASHTO T-180. Bed course material shall meet the requirements of Section 703.07 of the Colorado Department of Transportation Standard Specifications except as otherwise specified herein.

Concrete shall be finished to a smooth and uniform surface, which shall at no point deviate from plan elevation more than one-fourth (1/4) inch. On sidewalks and paths, no low spots or depressions shall be detectable when tested with a straight edge laid transverse to the longitudinal centerline. Sections of sidewalk on which water ponds or does not drain from the surface, shall be removed and replaced at the contractor's expense. The face and top of curbs and the flow line of gutters shall not deviate more than 1/4 inch from a 10 ft. straight edge laid longitudinally along the concrete surface. The City Engineer and/or the Construction Inspector shall determine where surface tolerance testing is required. If testing is required, the Contractor shall furnish an approved 10 ft. straight edge and provide an operator to assist the Inspector. Surface tolerance shall be measured at all locations designated by the inspector.

Unless specifically specified herein, any references to the Colorado Department of Transportation Standard Specifications will refer to their 2005 edition of Standard Specifications for Road and Bridge Construction. In the event of inconsistencies between these specifications and those referenced, the more stringent and restrictive shall always apply unless previously agreed to in writing by the engineer.

Environmental Requirements

Cold Weather Concrete Placement

Special protection measures shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. Under no circumstances is concrete to be placed on frozen ground. The ambient temperature of the space adjacent to the concrete placement and surfaces to receive concrete shall be maintained at not less than 40 degrees F. The temperature of the concrete when placed shall not be less than 50 degrees F. Heating of the mixing water or aggregate shall be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Calcium chloride, in dilution form, may be used as an accelerator, and its amount shall not exceed 2% by weight of the cement. When no admixture is used, an approximate set time to temperature relationship shall be as follows:

Temperature (°F)	Time of Set (hours)
30	24.0
40	18.0
50	10.0
60	7.0
70	5.5
80	3.5

90	2.5
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Hot Weather Concrete Placement

The temperature of the concrete when placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. Where concrete operations permit, placement shall be scheduled to begin in the late afternoon, which permits the concrete to gain strength before being exposed to the adverse effects of high temperatures and rapid drying conditions. In no case shall the placing temperature exceed 95 degrees F.

When during concrete finishing operations, the air temperature, relative humidity and wind velocity result in an evaporation rate of 0.2 lb/ft²/hr or above, an approved evaporation reducer shall be applied to the concrete surface to help prevent plastic shrinkage cracks. The evaporation rate can be determined from an evaporation chart published in ACI 305R. When an evaporation retarder is used, the concrete shall not be worked or finished until all water within the retarding admixture has evaporated from the surface.

BITUMINOUS PRIME COAT AND TACK COAT

Scope

The work covered by this section shall consist of all necessary applications of bituminous material for priming gravel preliminary to paving or as tack coat between layers of paving.

Materials

Bituminous prime coat and tack coat shall conform to Table 702-3 of the Colorado Department of Transportation Standard Specifications

Construction

- A. Bituminous prime coat and tack coat shall be applied to conform to Section 407.0 of Colorado Department of Transportation Standard Specifications except as herein otherwise specified.
- B. Quantities shall be between 0.3 and 0.5 gallons per square yard for prime coat, between 0.1 and 0.2 gallons per square yard for tack coat, except as otherwise specified in the project plans and specifications

HOT BITUMINOUS PAVING

Scope

This work consists of hot mix asphalt (HMA) constructed on a prepared foundation in accordance with these specifications and the specific requirements of the type under contract. The placement of hot mix asphalt shall conform to the lines, grades, thickness and typical cross sections shown on the plans. Each course shall be compacted to the required density and approved before placement of the next course.

Hot mix asphalt patching generally consists of patching damaged areas in existing pavement, utility trenches, areas removed for placement of curb and gutter forms, and other areas designated on the plans.

Materials

Unless otherwise specified herein or on the project plans, hot bituminous paving shall be in compliance with Section 401 of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, 2005 edition.

Unless otherwise specified herein or on the project plans, aggregates shall be in compliance with Section 703-4 of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, 2005 edition, and shall be Grading S for hot bituminous paving.

Bituminous material shall be asphaltic cement with a penetration value of 120-150, unless otherwise directed by the engineer.

Construction

Bituminous pavement shall be **saw cut** to clean, straight lines and shall be perpendicular or parallel to the flow of traffic. For original excavation roll cutting or jack hammering is an acceptable means of removal. However, saw cutting to meet these standards shall be required prior to asphalt patching.

In existing pavement, all **excavations within 36" of the edge of the asphalt** shall require removal and replacement of that asphalt from the edge of road to the excavation.

Concrete pavement, cross pans, driveways, streets and alleys shall be removed to neatly sawed edges cut to full depth.

Any damage, even superficial, to the existing asphalt surface in the vicinity of the work shall be repaired at the expense of the Contractor, including but not limited to gouges, scrapes, outrigger marks, backhoe bucket marks, etc. A slurry seal type covering will be considered the minimum repair. Patching may be required, at the discretion of the Engineer.

The depth of asphalt patches in asphalt streets shall typically match the depth of the existing asphalt surface with a 4" minimum and an 8" maximum or as specified by the Engineer.

Asphalt shall be manufactured by an approved plant. The suppliers shall be licensed with the City of Alamosa and have current State scaling documents, and mix designs available upon request. **All paving specifications shall meet the current edition of the CDOT "Standard Specifications for Road and Bridge Construction".**

The asphalt patch area for street excavations that fall within the wheel path of the vehicular travel lane shall be increased in size to the center of the lane or adjacent lane. **In no circumstance will the edge of a patch area be allowed to fall within the wheel path.**

All street cuts shall be patched as per the guidelines of Section 4.

In streets that are **less than five (5) years old** the City reserves the right to deny any street excavation or require repairs that are over and above these specifications. Owner and Engineers are expected to use common sense and project forecasting to avoid additional requirements when working in newly repaved streets.

Following placement of the asphalt surface, the joints where the new asphalt abuts the old shall be sealed with a fog or painted coat of bitumen cement.

EXCEPTIONS - There may be situations where the patching standards are considered inappropriate. These guidelines shall be considered the minimum acceptable standards. However, the City understands that circumstances differ from site to site. Proposals and modification to the standards will be considered when they do not appear to interrupt the integrity of the street in question, in the opinion of the City. Work done in older streets which will require repaving regardless of the excavation should bring the governing bodies together to examine a cost sharing solution.

DISPUTE RESOLUTION - Mutual acceptance of these guidelines is expected to evolve over time with experience in the field. Disagreements over requirements and cost sharing are inevitable. In cases where agreement cannot be reached, the dispute shall not deter the Contractor from compliance to the specific Permit or guidelines provided by this document unless approved by the Engineer.

Unless otherwise specified herein or on the project plans, construction and limitations of hot bituminous paving shall comply with Section 401 of the current edition of Colorado Department of Transportation Standard Specifications for Road and Bridge Construction.

On overlay work, the asphalt shall be feathered on the outside two feet of the street to blend in with the gutter, and it shall be the contractor's sole responsibility to adjust the grades of any manhole lids, valve boxes and any other City owned appurtenance to within 1/2 inch of the finished street grade.

Asphalt Patching Requirements

GENERAL

Every street and street repair situation is unique. Design criteria and construction standards cannot address every situation but, in order to maintain some form of consistency, these standards have been developed. In most cases, they provide the minimum acceptable standards for construction or repair. Consequently, when strictly applied, they will provide the minimum acceptable product. Therefore, this criteria has been developed to maintain the same integrity of the street pavement and subsurface condition prior to its being cut for utility installations.

To achieve the goal of "Quality" or "Excellence" in street repairs, then these criteria shall be viewed as guidelines when used in conjunction with good planning and judgement. This will restore the street to an acceptable condition with minimal patching failures. In many cases, it will be necessary to **exceed** the minimum standards to achieve a quality repair.

Issues that shall be considered in a quality approach to street repairs are as follows (these criteria must all be balanced against the long-term maintenance needs of the utility):

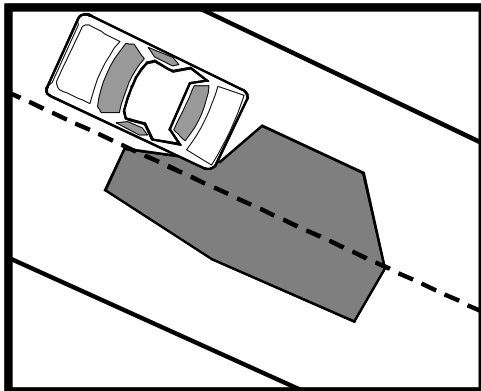
APPEARANCE

Does the final appearance of the street suggest the repairs were planned, or that they happened by accident?

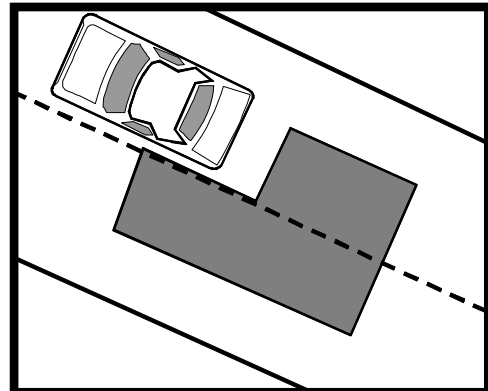
Consciously or not, the driving public "rates" the appearance of the street system -- including street repairs -- every day. Street repairs which are satisfactory from a functional point of view may produce a negative reaction from the public if they give the appearance of being poorly planned or executed.

The public's perception of street repairs is based primarily on shape, size, and orientation -- the geometry of a patch. Here are some guidelines for the geometry of a quality patch:

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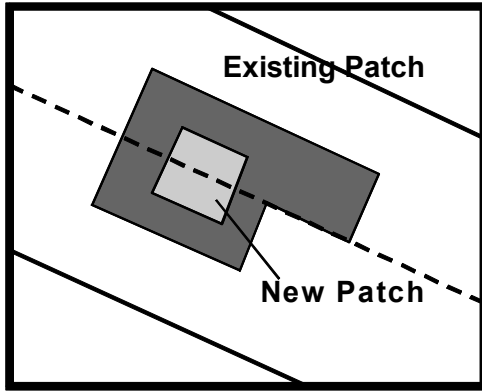


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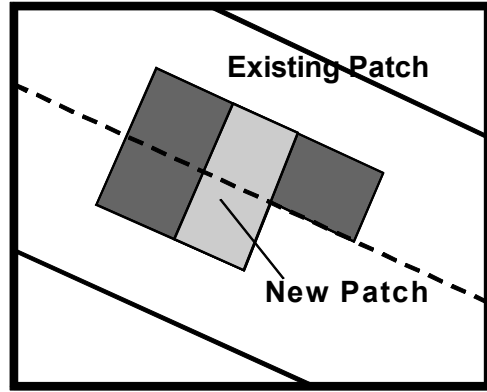


Existing pavements should be removed to clean, straight lines **PARALLEL** and **PERPENDICULAR** to the flow of traffic. Do not construct patches with angled sides and irregular shapes.

NOT ACCEPTABLE

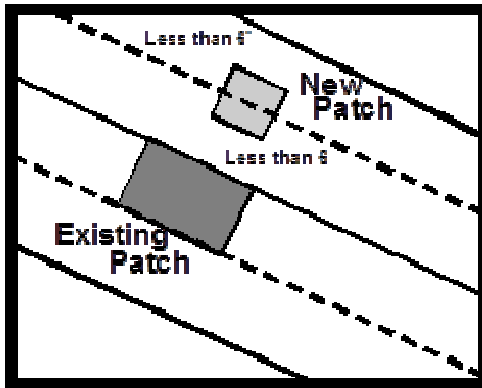


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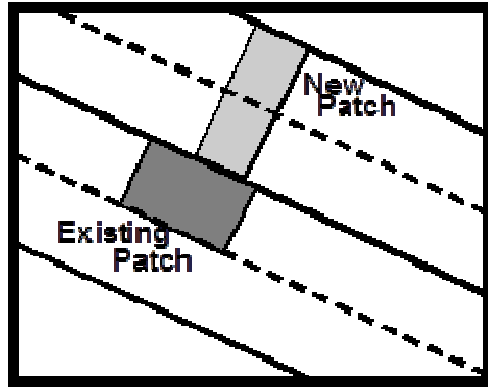


Avoid patches within existing patches. If this cannot be avoided, make the boundaries of the patches coincide.

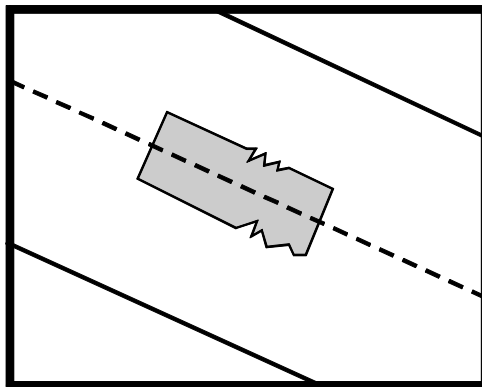
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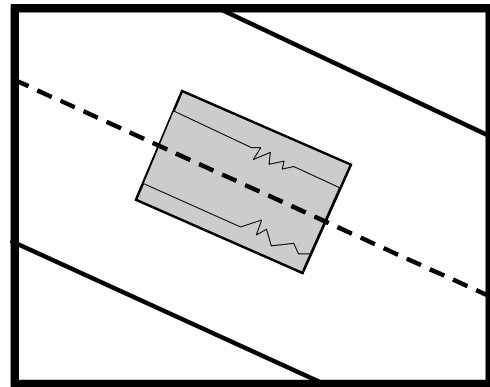
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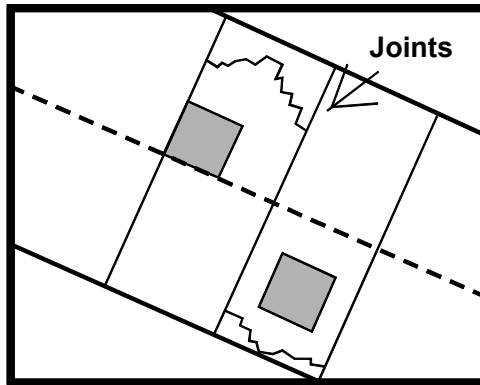
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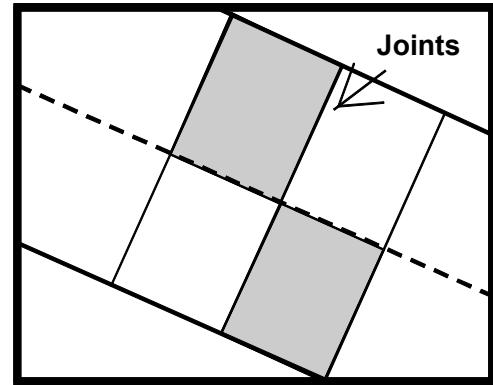
Do not leave strips of pavement less than one-half lane in width from the edge of the new patch to the edge of an existing patch or the lip of the gutter.

Asphalt and concrete pavements should be removed by **saw cutting** or grinding. **Avoid breaking away the edges** of the existing pavement or damaging the remaining pavement with heavy construction equipment.

NOT ACCEPTABLE

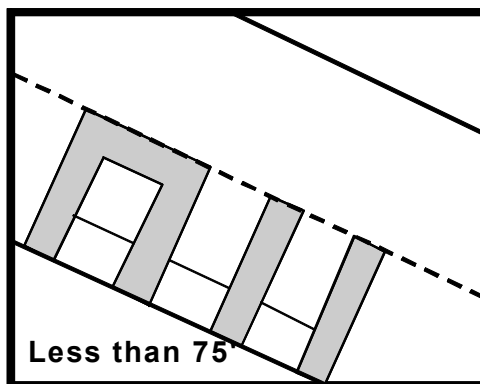


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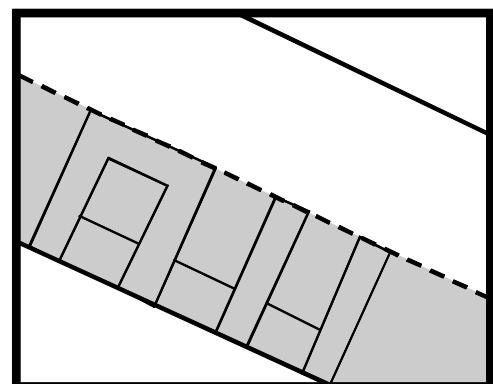


In concrete pavements, sidewalks and other public use areas where the surface is in good repair, **remove sections to existing joints**. In damaged concrete, the limits of removal should be determined in the field by a representative of the City.

NOT ACCEPTABLE



ACCEPTABLE



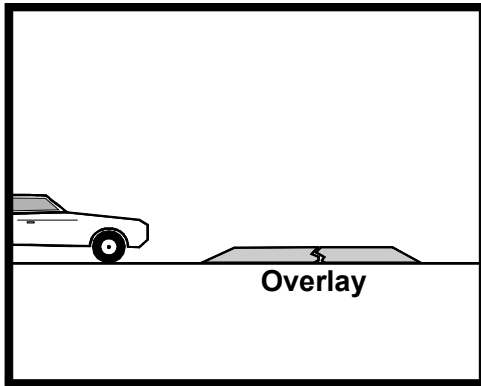
In the case of a **series of patches** or patches for service lines off a main trench, repair the pavement over the patches by **overlay** shall be required when the spacing between the patches is less than 75 feet (in cases where the existing pavement is in poor condition and may require overlay within the next few years, this requirement may be modified or waived by the Town).

RIDEABILITY

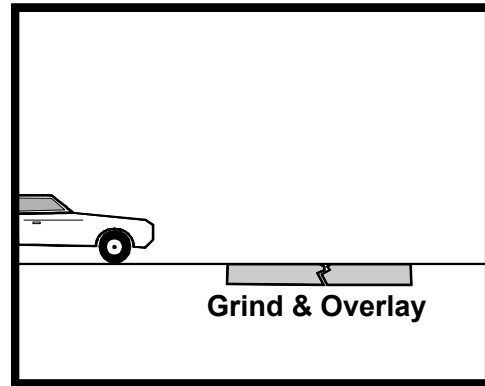
Are the transitions on and off of the repair smooth? Does the patch itself offer a smooth ride? Are the joints located outside of the normal wheel path?

COMPLETED STREET REPAIRS SHOULD HAVE RIDEABILITY AT LEAST AS GOOD AS, IF NOT BETTER THAN, THE PAVEMENT PRIOR TO THE REPAIRS. A driver may be able to see a street repair, but in the case of a quality repair, they should not be able to “feel” it in driving normally down the street.

NOT ACCEPTABLE

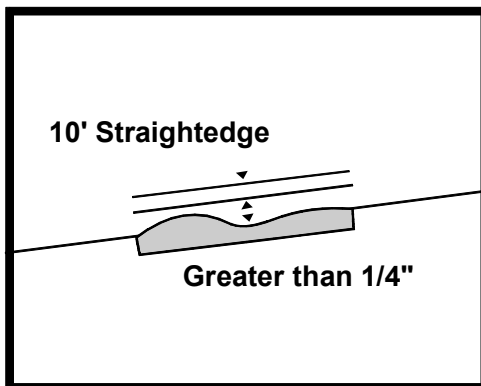


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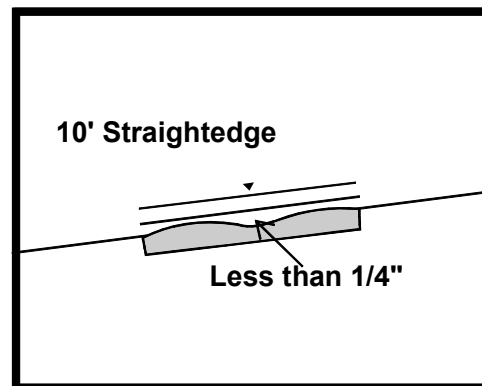


Do not construct asphalt overlays in such a manner that create a **bump** to the motoring public. If the leading edge of an overlay is substantially noticeable to a car it is likely to be significant to the snow plow trucks. The Town shall determine the rideability of the overlay. If the transition is not smooth the contractor shall remove and replace to feather out the leading edge to the satisfaction of the Town.

NOT ACCEPTABLE



ACCEPTABLE



Surface tolerances for street repairs should meet the standard for new construction. That is, the finished surface of the street repair, when tested with a ten (10) foot straightedge parallel to the centerline or perpendicular across joints, will show variations measured from the testing face of the straightedge to the surface of the street repair which do not exceed one-quarter (1/4) inch,

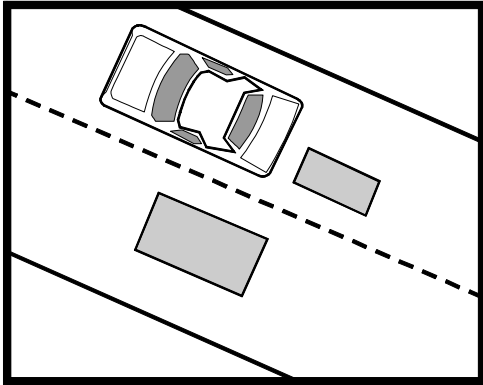
PAVEMENT MANAGEMENT

Is the repair consistent with the long-term pavement management strategy for the particular street?

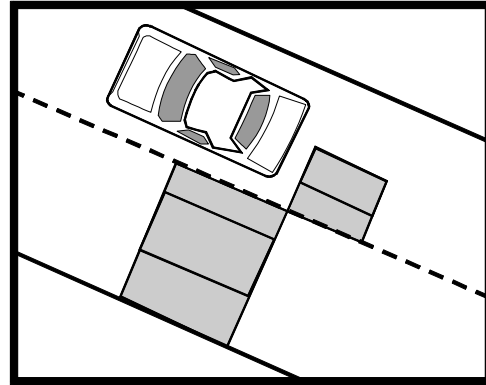
STREET REPAIRS SHOULD LEAVE A PAVEMENT IN A CONDITION AT LEAST AS GOOD AS, IF NOT BETTER THAN, THE CONDITION PRIOR TO THE REPAIRS.

In most cases, and particularly in the cases of extensive excavation and repairs, it is desirable to survey the existing pavement condition with a representative of the City prior to the work. After completion of the work, survey the pavement condition again to verify that the pavement condition has been maintained or improved.

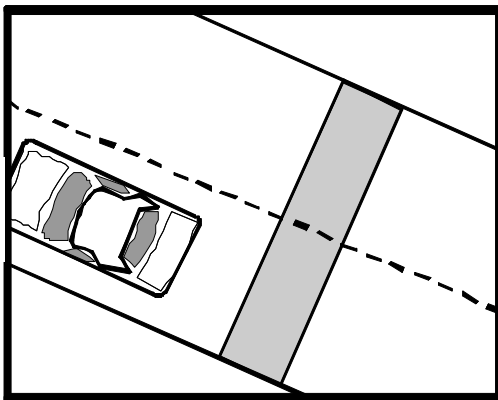
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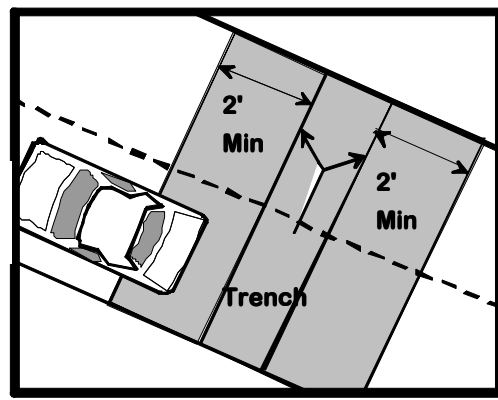
ACCEPTABLE



NOT ACCEPTABLE



ACCEPTABLE



In the case of minor repairs, these pavement surveys can be made by visual observation. However, in the case of major projects that involve excessive haul of materials or unusually heavy construction equipment or activity, non-destructive testing of the pavement condition before and after construction is required.

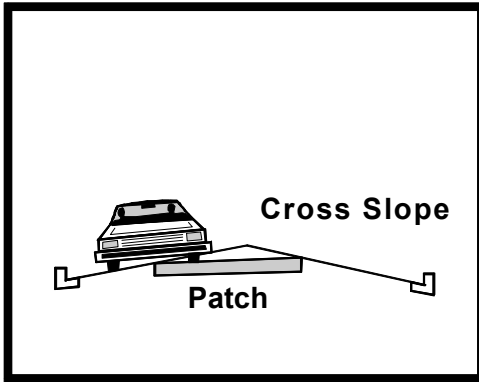
Consideration of pavement management issues may also identify opportunities for joint efforts between the utilities and the City.

For example, suppose the repair of a utility line requires an overlay on half of a street, and that the condition of the remaining half of the street might also warrant an overlay. We may decide at that point to overlay the entire street, with City's street authority and the utility splitting the cost of the overlay. In such a case, the utility may be able to save the cost of grinding half the street. The City's street authority will allocate a reasonable percentage of their annual overlay program to accommodate their share of these situations. This includes minor (2-3 block) maintenance projects and larger capital improvement projects (water main line extensions). Coordination for these types of cooperative repairs shall occur as far in advance of actual construction as possible.

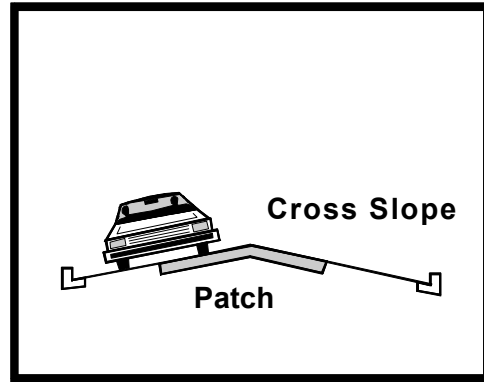
Transverse patches shall be replaced across the entire street width for a distance of two (2) feet minimum on both side of the trench, thus creating a 'T' shaped patch above the trench.

Do not allow the edges of patches to fall in existing wheel paths. The edges of patches parallel to the direction of traffic shall be limited to the boundaries of lanes or to the centerline of travel lanes.

NOT ACCEPTABLE



ACCEPTABLE



Patches should have a **smooth longitudinal grade** consistent with the existing roadway and crown. Patches should also have a cross slope or cross section consistent with the design of the existing roadway.

FUTURE MAINTENANCE

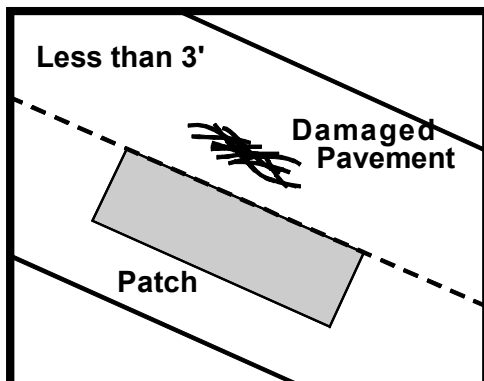
Will the repair pose any future maintenance problems or make future maintenance more difficult?

Excavations and street repairs, even well constructed street repairs, shorten a pavement's life. Several types of street distress, settlement, alligator cracking, and potholes, often show up around patches. Quality street repairs should **attempt to include adjacent minor damage** and reduce the chances of associated growth out to these types of distress.

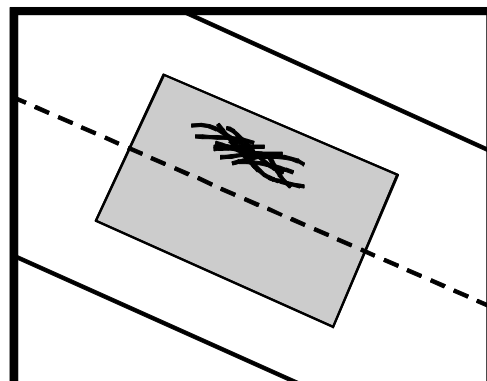
Avoid weakening or destroying the existing pavement around an excavation with heavy construction equipment, stockpiling or delivery of materials, etc. When damage does occur, remove the damaged pavement, extending the limits of the street repair, before replacing the pavement. Remember, **no stockpiling of backfill or road building materials is permitted on the pavement.**

When the proposed excavation falls within three feet of a section of failed pavement, the failed area shall be removed to sound pavement and patched. Scarring, gouging, or other damaged pavement adjacent to a patch shall be removed and the pavement repaired.

NOT ACCEPTABLE

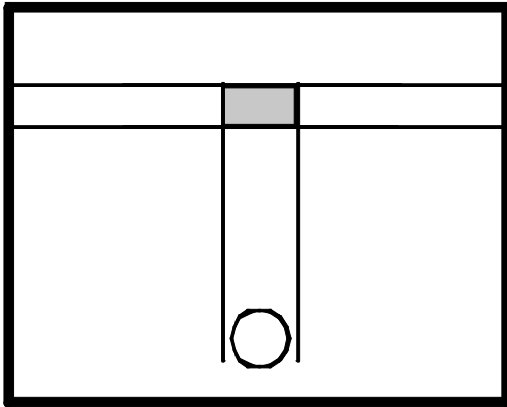


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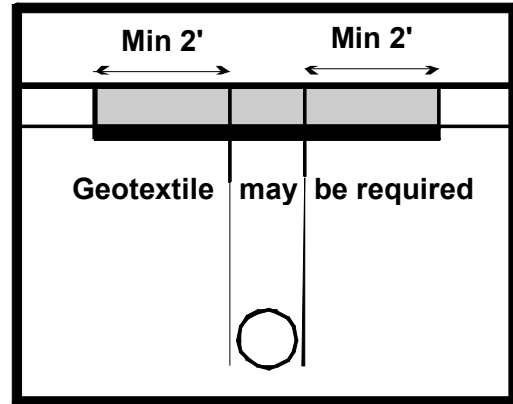


In the case of older pavement where the likelihood of cracking and potholes next to the patch is greater, it shall be necessary to **extend the "shoulders" of the pavement** beyond the two-foot minimum, when the adjacent deterioration is less than 3' away. Reinforce this area with a geotextile.

NOT ACCEPTABLE



ACCEPTABLE

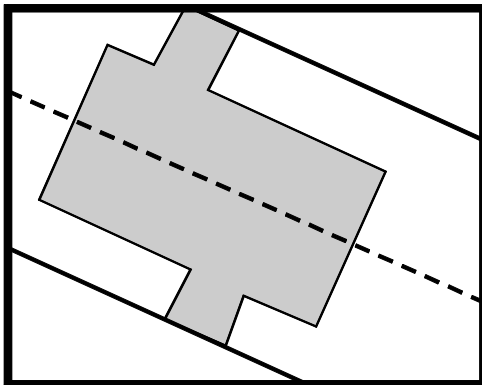


“T” cutting shall be required for all asphalt repairs in all streets.

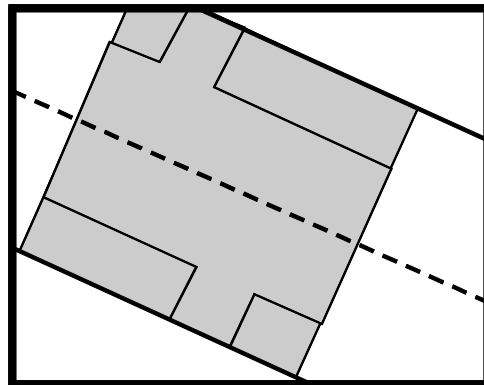
For patches in asphalt, a **tack coat** shall be applied to all edges of the existing asphalt before placing with the pavement.

After placing the new asphalt, all seams (joints) between the new and existing pavements shall be sealed with an asphalt tack coat or rubberized **crack seal** material.

NOT ACCEPTABLE



ACCEPTABLE



Avoid frequent changes in width of patches. For future maintenance, this simplifies removal of adjacent pavement failures.

INSPECTION

All construction work within the public rights-of-way shall be subject to inspection by the Engineer and certain types of work may have continuous inspection. It shall be the responsibility of the Contractor to provide safe access for the inspector to perform the required inspections.

It shall be the responsibility of the person performing the work authorized by the Permit to notify the Engineer or his authorized representatives that such work is ready for inspection. The Engineer requires that every request for inspection is to be received at least twenty-four (24) hours (not

including weekends and holidays) before such inspection is desired. Such requests may be in writing or by telephoning or faxing the Engineer.

The Engineer may make or require other inspections of any work as deemed necessary to ascertain compliance with the provisions of these Guidelines or the City's *Street Design and Construction Standards*, or Municipal Code. Any work performed without the required inspections shall be subject to removal and replacement at the Contractor's expense, regardless of the quality of the work.

Where large scale projects exceed the ability of the City to provide inspection, the contractor or utility company will incur the cost of a private inspection firm. This inspection firm will be mutually agreed upon by the Permit applicant and the City prior to issuance of the Permit.

TESTING

Description

The contractor is required to provide material testing for each phase of the work and at no cost to the City. The **independent geotechnical testing firm** chosen to perform this work for the Contractor must be qualified and identified on the Permit application.

Testing Frequencies

The number of density tests required may be increased if directed by the Engineer. The costs of any testing, as required, shall be borne by the Contractor. Proctors shall be determined prior to backfilling. Independent lab results shall be faxed to the City as soon as possible.

The horizontal frequencies of density tests are as follows:

Utility Mains - One test per 100 linear feet. Testing depths will vary so that all lifts are tested at the testers choice of location.

Service Lines - One test per each service.

Manholes and valve boxes, and Fire Hydrants: one per each lift, surrounding the appurtenance.

Following are the **minimum number of tests required for each construction activity**. These tests must be submitted to the Engineer on a daily basis as acquired and shall be hand delivered or faxed to the City.

Native or imported backfill: - One (1) test for every two (2) vertical feet and every one hundred (100) feet horizontally, or some fraction thereof with at least one (1) test per each lift.

Concrete: pavement, curbs, gutters and sidewalks – Testing to be conducted for every 100 cubic yards or portion thereof, with a minimum of one. Air, slump and 6 cylinders shall be the minimum testing.

ASPHALT PAVEMENT –

Asphalt content – One test per 500 tons or fraction thereof of mix produced, minimum of one test per job.

Gradation-Aggregate: one test per 500 tons or fraction there of, of mix produced, minimum of one test per job.

In-place density – One test per 500 tons or fraction thereof of mix placed, minimum of one test per job.

Aggregate **base course** materials – One test per 400 lane feet. No less than two (2) tests per excavation.

GEOTEXTILES

Scope

This work consists of furnishing and installing geotextiles for paving and aggregate sub grade applications.

Materials

The paving geotextile shall be constructed of nonwoven synthetic fibers, resistant to chemical attack, mildew and rot, and shall conform to the following:

Property	Requirement	Test Method
Grab Strength	80 lbs	ASTM D4632
Elongation (min)	50%	ASTM D4632
Asphalt Retention	0.2 gals / yd ²	Task Force 25 #8
Melting Point	300 °F	ASTM D276

The geotextile fabric for aggregate sub grade support applications shall be constructed of nonwoven synthetic fibers, resistant to chemical attack, mildew and rot, and shall conform to the following:

Property	Requirement	Test Method
Grab Strength	145 lbs	ASTM D4632
Puncture Strength	55 psi	ASTM D4833
Trapezoid Tear	75 lbs	ASTM D4533
Mullen Burst Strength	175 psi	ASTM 3786

Construction

Construction procedures shall conform to Section 420.03 - 420.04 of Colorado Department of Highways Standard Specifications.

The asphalt binder shall be applied to the pavement surface as recommended by the geotextile manufacturer.

BITUMINOUS SEAL COAT

Scope

The work covered by this section shall consist of furnishing and applying bituminous material and cover coat material on an existing surface.

Bituminous Material

Emulsified asphalt shall be polymerized or latex modified, and shall be rapid or medium set conforming to the requirement of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction section 702.03. Cover coat material shall meet the requirements of section 703.05 for the type specified.

Construction

Construction procedures and limitations shall conform to Section 409.04 - 409.08 of Colorado Department of Highways Standard Specifications except as otherwise specified.

Quantities for seal coat shall be 25 to 30 pounds of aggregate and 0.30 to 0.40 gallons of bituminous material per square yard. The City may adjust the rates of application within or outside of these limits if local conditions require such action to provide a satisfactory end product.

Temperatures for application shall conform to recommendations of the Asphalt Institute.

Contractor shall be required to remove excess, loose cover coat material from the completed work. The removal shall be completed within seven calendar days following the completion of the entire seal coat application operation.

PLANT MIXED SEAL COAT

Scope

Plant mixed seal coat shall consist of a mixture of mineral aggregate and bituminous binder, mixed at a central mixing plant, spread and compacted on the prepared surface of an existing pavement in accordance with these specifications.

Materials

Aggregate. Aggregate for plant mixed seal coat shall consist of clean hard, durable fragments of crushed stone, crushed gravel, or crushed slag. Ninety five percent (95%) by weight of the particles retained on the No. 4 sieve shall have at least two fractured faces when tested in accordance with Colorado Procedure 45. Aggregate passing the No. 4 sieve shall be the dust of fracture of crushing rock larger than 1/2 inch. The aggregate shall have a percentage of wear not more than 35 when tested in accordance with AASHTO T96. The aggregates for the mixture shall be graded and combined in such proportions that the resulting composite blend conforms to the following graduations:

Graduation Specifications for Plant Mixed Seal Coat		
Sieve Size or Designation	Range of Tolerances	Percent by Weight Passing Square Mesh Sieves
1/2"		100
3/8"		90 – 100
No. 4	+8	54
No. 8	+6%	33
No. 50	+6%	11
No. 200	+2%	5

Mineral Filler

Mineral filler shall conform to Section 703.06, Colorado Department of Transportation Standard Specifications for Road and Bridge Construction.

Hydrated Lime

Hydrated lime shall conform to Section 712.03, Colorado Department of Highways Standard Specification.

Bituminous material

Asphalt cement shall be PG 58-34 (polymerized) at an approximate content of 7.0 percent. The actual asphalt cement content shall be defined by the job-mix formula. The PF 58-34 (polymerized) shall be asphalt cement thoroughly blended with a minimum of two (2) percent by weight of polymers.

Miscellaneous

The bitumen range of tolerance shall be +0.3 percent.

The range of tolerance for the temperature of the mixture when emptied from the mixer shall be ±20°F.

The design mix shall have a minimum of retained strength of 75 when tested in accordance with Colorado Procedure L-5104.

Construction

Plant mixed seal coat shall be constructed in accordance with the requirements set forth in Section 401.07 - 401.20 except 401.17 of Colorado Department of Highways Standard Specifications.

Rolling

The seal coat shall be rolled in a longitudinal direction, beginning at the outside edge and progressing toward the center. Rolling shall be accomplished with a flat-wheel steel roller weighing no more than 10 tons. Rolling operations shall be conducted in such a manner that shoving, distortion, or stripping shall not develop beneath the roller. The amount of rolling shall be confined to only that necessary for consolidating the seal coat and bonding it to the underlying surface course. Excessive rolling shall be avoided.

ROCK RIP-RAP

Scope

The work covered by this section shall consist of the construction of rock rip-rap.

Materials

Rock rip-rap shall conform to Section 506.02 of Colorado Department of Highways Standard Specifications except as herein otherwise specified.

Rip-rap stone shall consist of sound durable field or quarry stone as nearly rectangular in shape as practical. Stone volume shall not be less than ½ cubic foot not more than 1 cubic foot in volume. Stone containing shale, unsound sandstone or any other material which shall readily disintegrate, shall not be used. Removed concrete may not be used as rock rip-rap.

Grout for grouted rip-rap shall consist of one part cement and three parts aggregate by volume. The Portland Cement shall be Type II and aggregate shall be two parts sand and one part gravel passing a 3/8" inch square mesh screen.

Construction

Construction procedures and limitations shall conform to Section 506.03 of Colorado Department of Highways Standard Specifications.

For grouted rip-rap, the joints shall be filled with grout and the surfaces swept with a stiff broom. Grouting shall not be done in freezing weather, except if proper insulation procedures are adhered to. The work shall be protected and kept moist during hot weather for at least three (3) weeks after grouting, or coated with a clear membrane curing compound.

MEASUREMENTS AND PAYMENTS

Method of measurement, basis of payment and limitations of incidental work shall be as follows:

- Cleanup of work sites to presentable condition is considered as incidental to all work items, and no payment for such cleanup shall be made.
- Each item is understood to include furnishing of all labor, equipment, materials, plant, tools and other items normally incidental to and required for complete installation or construction of the particular item complete in place and ready for use.
- Unless a bid item is listed in the proposal, no payment for site preparation shall be made for site preparation items. When a bid item exists, measurement and payment shall be as indicated by the proposal.
- Utility excavation and backfill are considered as incidental to the utility installation involved, and no payment for such earthwork shall be made.
- Excavation shall be measured and paid for by the cubic yard in original location by cross sectioning the area excavated.
- Embankment shall be measured and paid for by the cubic yard in final location as determined by the Engineer.
- Base preparation shall be measured and paid for by the square yard as determined by the Engineer.
- Spot sub grade reinforcement ordered by the Engineer shall be measured and/or paid for by compliance with the section of "Extra Work of the General Conditions".
- Sidewalk and driveway excavation and fill are considered as incidental to the work involved unless grade adjustment of over 6 inches is involved.
- Storm or sanitary sewer pipe shall be measured and paid for the linear foot measured from center to center of manholes and catch basins.
- Manholes, catch basins and inlets shall be measured by the actual number installed complete with bases, castings, and fillets, and including necessary gravel backfill.
- Water mains shall be measured and paid for by the linear foot of pipe installed measured through fittings.
- Water and sewer services shall be measured and paid for by the linear foot of pipe installed measured from the center line of the main, without extra compensation for plugs and caps.
- Water and sewer fittings shall be measured and paid for by the actual number of each type of fitting installed, without extra compensation for plugs and caps.
- Sewer risers shall be measured and paid for as service line.

- Concrete for thrust blocks on water mains and casing for sewer riser wyes shall be considered as incidental to installation of the utility and no payment for such concrete shall be made.
- Testing and sterilization of water mains and sewers is considered as incidental to installation of the utility, and no payment for such work shall be made.
- Aggregate base course shall be measured and paid for by the ton.
- Concrete curb and gutter shall be measured and paid for by the linear foot measured at the face of the curb and measured through driveways.
- Sidewalks and driveways shall be measured and paid for by the square foot.
- Concrete structures shall be measured and paid for by the units established in the bid proposal.
- Expansion joint material and curing compounds for concrete are considered as incidental to concrete construction, and no payment for these items shall be made.
- Rip-rap shall be measured and paid for by the square yard of rip-rap in place.
- Emulsified asphalt and liquid asphaltic materials shall be measured and paid for by the gallon.
- Hot bituminous paving and plant mixed seal coat shall be measured and paid for by the wet ton of material accepted in place. Payment shall not be made for quantities over 10% higher than the specified quantity, based on actual square, except by written order of the Engineer.
- Seal coat aggregate shall be measured and paid for by the ton of aggregate accepted in place.
- Blotter sand and coating aid for seal coat is considered as incidental to seal coat work, and no payment for such items shall be made.
- Back sloping shall be measured by the Engineer and shall be paid for by the unit price of excavation and embankment.
- Polyethylene to be wrapped around all iron fittings and appurtenances shall be considered as incidental to installation of the utility and no payment for such shall be made.
- Removal of asphalt mat (milling) shall be measured and paid by the square yard. Cleanup of fines and making the vertical cuts safe shall be considered as incidental and no payment for such work shall be made.
- Geotextile fabrics shall be measured and paid by the square yard in place.

APPENDIX A

CITY CONTACT PERSON

Entity	Name / Title	Address	Phone Numbers
City of Alamosa	Pat Steenburg Engineering Supervisor psteenburg@ci.alamosa.co.us	City of Alamosa Department of Public Works PO Box 419 Alamosa, Colorado 81101	Voice: 719-589- 6631 Fax: 719-589-3640 Cell: 719-588-5880

APPENDIX B

CITY OF ALAMOSA

PERMITTING FEE SCHEDULE FOR RIGHT OF WAY CONSTRUCTION

UTILITY INSPECTION PERMIT FEES

- Base Fee:** Permit applicants will be assessed a **\$25.00** fee for review and processing of the permit and associated documentation. This will apply to each permit submitted.
- Service Installations:** Service installations which do not disturb asphalt, concrete, or gravel surfaces, and do **not exceed a distance of ten (10') linear feet** within the right-of-way, **will not be assessed in addition to the base fee**. This would apply to service installations on the same side of the roadway, or for a single road bore to provide individual utility services.
- Linear Installations:** Installations parallel to the roadway and within the Right-of-Way but not within the paved or traveled way will be assessed at a rate of **\$0.10 per linear foot** plus the base fee. This rate will apply to underground (bore) installations only.
- Street Cuts:** A flat fee of **\$200.00 will be assessed for cutting asphalt** on all paved or chip-sealed roadway surfaces. If the asphalt to be cut is less than thirty-six (36) months old, a Fee of \$5.00 per square foot will be charged in place of the flat fee (if the \$5.00 per square foot fee is less than \$200.00, The \$200.00 fee will apply).
- A flat fee of \$50.00 will be assessed for cutting gravel, or native material roadways and rights of way.

Notes:

- These fees in no way release the applicant from restoring roadways to original or better condition. The street cut fees are in addition to the base fee and linear footage fees. All fees are cumulative.
- Fees will not be charged for utility relocations due to City capital improvement projects.
- Fees will not be charged to governmental agencies, tax based agencies or utility districts.
- This fee structure governs the cost of the Construction Guidelines they are an appendix to.

APPENDIX C

Quality Assurance/Quality Inspection




Required Quality Assurance (QA), Quality Control (QC) and Inspection

Portland Cement Concrete

Test Required	Test Procedure	Test Frequency		City Engineer Inspection Required
		Part Time Inspection	Full Time Inspection	
Compressive Strength (4 Cylinders / Set)	AASHTO T22 & T23	1 Set / 100 CY		
Air Content	AASHTO 152 6% ± 1%	1 / 100 CY		
Slump	AASHTO T119 4" Max	1 / 100 CY		

Required Quality Assurance (QA), Quality Control (QC) and Inspection

Sub grade, Base Course and Structural Fill

Test Required	Test Procedure	Test Frequency		City Engineer Inspection Required
		Part Time Inspection	Full Time Inspection	
Compaction of sub grade and embankment under curbs, gutters, sidewalks and trails	AASHTO T99 and T310 95% Min. Relative Compaction	1 / 200 LF	1 / 400 LF	
Compaction of sub grade and embankment under roadways	AASHTO T99 and T310 95% Min. Relative Compaction	3 / 300 LF		
Compaction of aggregate base course under concrete curbs, gutters and/or sidewalks	AASHTO T180 and T310 95% Min. Relative Compaction	1 / 200 LF		
Compaction of aggregate base course under concrete fillets and drain pans	AASHTO T180 and T310 95% Min. Relative Compaction	1 / fillet 1 / 50 LF of Pan	1 / Fillet 1 / 100 LF of Pan	
Compaction of aggregate base course materials under roadways	AASHTO T180 and T310 95% Min. Relative Compaction	3 / 300 LF		
Compaction of structural backfill	AASHTO T180 and T310 95% Min. Relative Compaction	1 for each 2 feet of vertical depth / 100 LF of structure perimeter		
Gradation of aggregate base course	CDOT Table 703-2	1 / 5000 Ton		

Required Quality Assurance (QA), Quality Control (QC) and Inspection

Hot Mix Asphalt

Test Required	Test Procedure	Test Frequency		City Engineer Inspection Required
		Part Time Inspection	Full Time Inspection	
Asphalt Content (QC)	CP42-95 method A or E, or CPL 5120	1 / 1000 ton 1 / day min.		
Gradation of Aggregate (QC)	CP 31-95	1 / 1000 Ton		
Air Voids (<i>Pa</i>)	AASHTO T269 2.8% to 5.2%	1 / 1000 Ton		
Voids in Mineral Aggregate (VMA)	CP 48-95	1 / 1000 Ton		
Percent Relative Compaction	CP51 & 81 92% to 96%	1 / 300 LF	1 / 500 LF	

STANDARD DETAILS