

STANDARD CONSTRUCTION SPECIFICATIONS

AND

STANDARD DETAILS

FOR

CITY OF PUEBLO, COLORADO

DEPARTMENT OF PUBLIC WORKS

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PREFACE

The specifications contained herein have been prepared by the Department of Public Works of the City of Pueblo in accordance with Title XII of the 1970 Code of Ordinances, and adopted by Resolution Number 8155 and revised by Resolution Number 9225, Resolution Number 10129 and Resolution Number 10349 of the City Council.

These specifications shall apply to the construction of all public improvements within the public right-of-way of the City of Pueblo, City owned property, and to those improvements on private property which have been made a requirement of any subdivision improvement agreement.

Methods of measurement and payment specified herein shall only apply to City contracts.

Where the term "Engineer" is used in these specifications it shall mean the Director of Public Works or his authorized representative.

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ABBREVIATIONS

Whenever in these specifications the following terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as follows. Reference to a specific standard or specification shall mean the latest edition or amendment in effect on date of invitation to bid. In those cases where work is being performed which is not contracted for directly by the City, then the latest standard in effect at the time the work is being done shall apply.

AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	Americans with Disabilities Act of 1990
ADAAG	Americans with Disabilities Act Accessibility Guidelines
AI	Asphalt Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWS	American Welding Society
CDOT	Colorado Department of Transportation
CRS	Colorado Revised Statutes, 1973 as amended
CRSI	Concrete Reinforcing Steel Institute
MUTCD	Manual of Uniform Traffic Control Devices
ISSA	International Slurry Surfacing Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
UL	Underwriter's Laboratories
WWPA	Western Wood Products Association

MEASUREMENT AND CALCULATED QUANTITY ACCURACY

All quantities for payment shall be field measured (where applicable), calculated and rounded to the degree of accuracy given below.

UNIT	ACCURACY
Lump Sum (%)	X.
Each	X.
Linear Foot	X.X
Square Feet	X.X
Square Yard	X.X
Cubic Yard	X.X
Gallon	X.
Ton	X.X
Acre	X.X

Rounding of numbers shall be as follows;

0.1 thru 0.4 - round down to zero

0.5 - round up if it makes the whole number even, down if the whole number is even

0.6 thru 0.9 - round up to next whole number

Examples: 93.3 rounds to 93

93.5 rounds to 94

94.5 rounds to 94

93.7 rounds to 94

ARTICLE 4

CONCRETE

4.1 - GENERAL

4.1.01 - DESCRIPTION

This work shall consist of furnishing, placing, and finishing concrete, concrete reinforcing and all related items in accordance with these specifications and conforming to the lines, grades, and dimensions shown on the drawings (approved by the Engineer) or the City Standard Details. Concrete shall consist of Portland cement, fine and coarse aggregates, additives or admixtures when specified, and water, mixed in the proportions approved by the Engineer.

4.1.02 - SUBMITTALS

- (a) GENERAL - Concrete submittals outlined below are required on all City contracts and any other project within the public right-of-way. All ready-mix suppliers furnishing concrete for placement within any City right-of-way shall furnish to the City once every two years, concrete mix designs for concrete intended to be used for placement within the right-of-way.
- (b) MIX DESIGN – Unless a mix design has been previously approved as required under section (a) above, the Contractor shall submit copies of all concrete mix designs to the Engineer for approval prior to placing any concrete. Separate mix designs shall be submitted for each type of concrete to be used in the project. Submittals shall include all information used in designing mixes, including admixture manufacturer's information.
- (c) SHOP DRAWINGS - Submit shop drawings of all concrete reinforcing, embedded items, anchor bolts with setting diagrams, and miscellaneous related items. Drawings shall show the size, configuration, pertinent dimensions, number, exact position, and spacing of reinforcement and the location of all openings, framing, or special conditions affecting the work. All shop drawings shall be original drawings produced by the Contractor or supplier and shall not be reproductions of the Contract Documents

4.1.03 - QUALITY ASSURANCE

- (a) PLANT ACCESS - The Engineer shall be offered access to the ready mix batching plant at all times that the work is in progress. If required by the Engineer, samples of all concrete ingredients may be taken at the plant.
- (b) RECORD OF WORK - The Contractor shall keep a written record listing approximate locations, time and date of placement of all concrete for the project. Such record shall be kept until completion of the project and shall be available to the Engineer for review at any time.
- (c) SAFETY - The Contractor shall assume all responsibility for the safety of the formwork and shall provide all necessary design, construction, materials and maintenance to produce the required concrete work safely.

4.2 - MATERIALS

4.2.01 - CONCRETE MATERIALS

- (a) GENERAL: All concrete shall be ready-mixed conforming to AASHTO M 157. No jobsite mixed concrete will be permitted unless written permission is granted by the Engineer.
- (b) CEMENT: Type II (6 Sack) is required for all sidewalks, driveways, curb and gutter, drainage pans, headwalls, and wingwalls. Type II (7 Sack) (in lieu of type V cement) will be acceptable for cast-in-place inlets, and cast-in-place manhole bases. Type V (6 Sack) is required for all *precast* box culverts, inlets, manhole bases, manhole barrel sections, and manhole cone sections.
- (c) FLY ASH: Use of fly ash (**Class F**) for a partial substitute (15% maximum by weight) for Type II or Type V cement may be used with written permission from the Engineer. Fly ash shall conform to the requirements of ASTM C 618 –**Class F**. Cement containing **Class C** fly ash shall not be used for any concrete for use wherever these specifications are applicable.
- (d) FINE AGGREGATE: Natural sand conforming to AASHTO M 6. Gradation shall be in compliance with designation M6 in Table 4.1, Concrete Aggregate Gradation Table.
- (e) COARSE AGGREGATE: Gravel or crushed stone conforming to AASHTO M 80. Gradation shall be in compliance with designation M67 in Table 4.1, Concrete Aggregate Gradation Table.

Table 4.1
Concrete Aggregate Gradation Table
(Percent Passing Sieve Sizes)

Sieve Size	Fine Aggregate No. M6	Course Aggregate No. M67
1"	---	100
3/4"	---	90-100
1/2"	---	---
3/8"	100	20-55
#4	95-100	0-10
#8	---	0-5
#16	45-80	---
#50	10-30	---
#100	2-10	---

- (f) AIR ENTRAINING AGENT: Conform to AASHTO M154.
- (g) CHEMICAL ADMIXTURE: Conform to AASHTO M194. The use of Calcium Chloride as an accelerator is prohibited.
- (h) WATER: Water used in mixing, curing, or other applications shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter, or any other

substance injurious to the finished product. Water known to be of potable quality may be used without further testing.

(i) CURING COMPOUND:

Curing compound shall be a water based liquid membrane that meets or exceeds the requirements of AASHTO M-148 Type I. All clear curing compounds shall contain a fugitive red dye for verification of application. All other curing compounds will require approval from the Engineer.

4.2.02 - CONCRETE REINFORCING

- (a) WELDED WIRE FABRIC (WWF): The use of welded wire fabric (WWF) as a substitute for reinforcing bars is not allowed. If used where reinforcing is not required, welded wire shall conform to AASHTO M 55.
- (b) #3 thru #18 REINFORCING BARS: Conform to AASHTO M 31 Grade 60 (ties and stirrups may be Grade 40). Epoxy coated reinforcing shall conform to AASHTO M 284.

4.2.03 - CONCRETE MIX DESIGN

Mixes shall be proportioned to produce a concrete with good consistency and workability conforming to the following requirements;

Minimum 28 day compressive strength	4000psi
Air Content	6% ± 2%
Minimum cement content per cubic yard	564 LBS. (6 sack)
Slump	3" - 5" (max.)

Seven (7) sack concrete required by other sections of these specifications shall conform to the following requirements:

Minimum 28 day compressive strength	4500psi
Air Content	6%+/-2%
Minimum cement content per cubic yard	658 LBS (7 sack)
Slump	4" (max)

4.2.04 - CONCRETE MIX DESIGN (Flowable Fill)

Extra lean concrete (Flowable Fill) used as trench backfill and for subgrade stabilization shall conform to the following recommended mix design;

Cement content per cubic yard	47 LBS. (0.50 sack)
Water	39 GALS.
Coarse Aggregate	1700 LBS.
Fine Aggregate	1845 LBS.

Actual quantities for each material may vary to achieve the desired result, however the maximum cement content shall not exceed the amount shown above.

For applications beneath precast elements such as catch basins, the cement content may be increased to a maximum of 188 pounds (2 sacks) and an accelerator may be used.

The inspector may require the flowable fill to be mechanically vibrated to ensure proper placement around pipes and structures.

Proof-rolling with a loaded dump truck shall be required to verify density and stability prior to paving if directed by the Engineer.

4.2.05 - FIELD TESTING

When directed by the Engineer, fresh concrete shall be sampled and tested in accordance with AASHTO methods and procedures. Field testing may be done by either an independent testing firm or by Public Works personnel. Tests may include slump, unit weight, air content and compressive strength. Failure of the concrete to pass any of the above tests may be cause for rejection of the load. The Contractor shall furnish the concrete for the tests at no expense to the City. The expense of testing the concrete shall be paid by the City.

Compressive strength tests shall consist of six (6) standard 6 inch diameter by 12 inch high test cylinders cast and cured in accordance with AASHTO T 23. Unless otherwise directed by the Engineer, one cylinder shall be broken at the end of 3 days, two cylinders shall be broken at the end of 7 days, two shall be broken at the end of 28 days, and the remaining cylinder shall be stored until its disposition is determined by the Engineer. The Engineer reserves the right to stop all future concrete work when the 3, 7 or 28 day tests indicate unsatisfactory results, until, in his opinion, proper corrective measures have been taken to ensure quality concrete in future work or all corrections deemed necessary have been made.

If the 28 day compressive strength tests produce results less than the specified required minimum compressive strength, then any concrete represented by those tests shall be removed and replaced at the Contractor's expense. In lieu of removal, the Contractor has the option of having additional strength tests taken by an approved laboratory at his expense to satisfy the Engineer that the concrete in question has achieved the required strength. The location, number and type of tests shall be subject to review by the Engineer prior to start of testing.

4.3 - CONSTRUCTION REQUIREMENTS

4.3.01 - EXAMINATION

Provide ample notice (24 hours minimum) to the Engineer to allow for the examination of all forms and reinforcing before concrete is placed and to observe the placement of all concrete. Concrete may not be placed until approval has been given by the Engineer.

4.3.02 - PREPARATION

Do not begin concrete work until all operations are complete enough to allow placement to be carried on as a continuous operation for the entire section that is to be placed. Clean all equipment for mixing and transporting concrete. Forms shall be cleaned of all debris and ice and shall be wetted (except in freezing weather) and coated as specified under Section 4.3.03 CONCRETE FORMWORK. If water accumulates in the forms it shall be pumped out and the subgrade reinspected before concrete is deposited. The finish top surface of vertical members shall be clearly marked on the form walls.

4.3.03 - CONCRETE FORMWORK

- (a) DESIGN AND CONSTRUCTION: Forms shall conform to the shape, lines and dimensions of the members shown on the drawings and shall be substantial and

sufficiently tight to prevent leakage of mortar. Properly brace or tie to maintain position, shape or lateral stability, and provide sufficient strength to carry construction operations and material dead loads without deflection. Forms shall be so designed as to be capable of needed adjustments and shall be carefully watched as work proceeds with all faults promptly corrected. Where finished concrete is to remain exposed, joints shall be regularly spaced and held to a minimum both horizontally and vertically. The use of earth as a form will not be allowed unless specifically detailed on the drawings. Lap forming with dressed lumber or plywood will not be allowed.

- (b) **CONSTRUCTION JOINTS:** Use construction joints at all temporary stopping of concrete placement or as shown on the drawings. Submit to the Engineer for approval the locations of all such joints desired for construction. Leave joints rough and provide longitudinal or vertical keys at least 1-1/2 inch deep (walls only). Install continuous waterstop or dowels where shown on the drawings.
- (c) **SLABS ON GRADE:** Where concrete slabs are deposited on earth, care shall be taken to obtain a smooth level surface so slabs will be of uniform thickness as required throughout. Lightly moisten the subgrade prior to placing concrete.
- (d) **FORM COATING:** Coat the surface of all formwork prior to each pour. Apply in strict accordance with the manufacturer's directions. Apply coating prior to the placement of reinforcement. Promptly remove any excess coating material. Remove coatings of dust from contact surfaces prior to depositing concrete.
- (e) **REMOVAL:** Remove forms in such a manner as to ensure the complete safety of the concrete. Forms in general may be removed from vertical surfaces after 24 hours from the time of placing the concrete and 72 hours for horizontal surfaces (i.e.- structural slabs). Additional time may be required as specified in Section 4.3.06(a) **COLD WEATHER PLACEMENT** or when directed by the Engineer. Any damages or injuries resulting from premature formwork removal are the sole responsibility of the Contractor.
- (f) **BACKFILL:** Backfill shall not be placed against new concrete until it has achieved sufficient strength to resist the stresses caused by the backfill operations. In general, the minimum compressive strength of the concrete should be 3000 PSI in order to begin backfilling. Backfill shall be placed in such a manner as to prevent damage to the newly placed concrete. Any concrete damaged during backfilling operations shall be removed and replaced at the Contractor's expense.

4.3.04 - CONCRETE REINFORCING

- (a) **MATERIALS:** see Section 4.2.02
- (b) **CLEANING:** Reinforcement shall be free from rust scale, oil, ice or other substances which will reduce or destroy the bonding capacity.
- (c) **BENDING:** Reinforcing shall be bent cold. Bars shall be full length required and accurately bent to details. All bent bars shall be manufactured in accordance with the recommendations of the Concrete Reinforcing Steel Institute (CRSI). Bars shall not be field bent unless shown on the drawings or when permitted by the Engineer.
- (d) **PLACING:** Reinforcement shall be accurately located in the formwork and held securely in place using supports, chairs, spacers, tie wire or other devices to ensure against displacement during the placement of concrete. Bar supports and spacers

which rest against earth or an exposed surface shall be plastic, plastic coated or hot dipped galvanized.

- (e) COVER: All reinforcing shall be protected by concrete cover. Minimum cover thickness shall be in accordance with ACI requirements or as shown on the drawings.
- (f) SPLICES: Splices for reinforcing shall be done in strict conformance to ACI guidelines. In general continuous bars shall lap 36 bar diameters unless otherwise directed. Do not splice near maximum stress locations or where noted on drawings. All lap splices must be reviewed by the Engineer. Welded wire fabric shall be lapped one full mesh and tied securely. Provide bent bars at all wall intersections.

4.3.05 - DELIVERY, STORAGE AND HANDLING

- (a) HAULING EQUIPMENT: All concrete shall be transported in a transit-mix truck capable of providing continuous agitation. Each load shall be accompanied by a batch plant ticket with the following minimum information;

- Supplier Name
- Date
- Truck Number
- Project Name
- Time Batched
- Cubic Yards Batched
- Type, and amount of cement
- Design Mix Designation
- Destination

- (b) HAULING TIME: Discharge all concrete transported in a truck mixer, agitator or other transportation device within ninety (90) minutes after the mixing water has been added. A reduction in the time allocated to discharge shall be as specified under Section 4.3.06(b) HOT WEATHER PLACEMENT.
- (c) RETEMPERING: Retempering of concrete or mortar which has partially hardened by remixing with or without additional materials, shall not be permitted.
- (d) PLACEMENT: Concrete shall be placed in horizontal layers of uniform thickness. Minimum layer thickness should be 4 inches for flatwork and 6 inches for walls and footings. Concrete shall not be moved horizontally over ten (10) feet within forms or in slabs. The height of free fall of concrete shall be a maximum of five (5) feet unless concrete is confined by closed chutes or pipes.
- (e) COMPACTION: Concrete shall be consolidated by using a mechanical vibrator capable of producing a frequency of 10,000 cycles per minute and shall be of sufficient amplitude to cause plasticity and compaction of the concrete. Vibrators must be used in such a manner that segregation of aggregates and formation of latence are avoided.

4.3.06 - ENVIRONMENTAL CONDITIONS

- (a) COLD WEATHER PLACEMENT: Concrete shall not be placed when the air temperature is 40 degrees Fahrenheit (°F) or below unless adequate measures will be taken by the Contractor to protect the concrete from freezing. If concrete is placed under these conditions the water or aggregate, or both, shall be heated so

that the concrete immediately after placing shall have a temperature of between 60 to 80°F. In no case shall concrete be deposited on frozen subgrade. Any concrete placed when the ambient temperature is below 40 °F shall be at the Contractor's risk, regardless of any prior verbal authorization.

Adequate precautions shall be taken for such protection of all concrete after it is placed in position as will prevent the temperature of the deposited concrete from falling below 50°F for three (3) days. All formwork shall remain in place for a minimum of 72 hours after depositing concrete.

When the low temperatures for 72 hours after placement are predicted by the National Weather Service to be below 35°F, concrete shall be protected by the use of insulated blankets in good condition of adequate thickness and layers according to the following schedule:

35°F > Low Temperature > 25°F - requires one blanket for 72 hours

15°F < Low Temperature ≤ 25°F - requires two blankets for 72 hours

Low Temperature ≤ 15°F - concrete placement not allowed without additional heat
Care shall be taken to secure the blankets to prevent movement under high winds. Attention shall be given to the edges and corners as they are most susceptible to freezing. The use of straw with polyethylene sheeting will not be permitted as a means of thermal protection.

All concrete showing injury or damage by freezing shall be removed and replaced at the Contractor's expense.

- (b) **HOT WEATHER PLACEMENT:** When the air temperatures are expected to exceed 100°F, the Contractor shall obtain approval from the Engineer on the procedures to be used in protecting, depositing, finishing and curing of concrete. A concrete retarding agent may be used upon approval of the Engineer. The use of fog sprays is prohibited. The time allowed for hauling and placement shall be reduced to sixty (60) minutes. Concrete shall not be placed when the temperature of the mix exceeds 90°F. Any concrete placed when the ambient temperature is 100 degrees F or greater will be at the contractor's risk, regardless of any prior verbal authorization.

4.3.07 - PROTECTION

Concrete which has been placed shall be protected from any vibrations, jarring movement, traffic, environmental damage, vandalism, or any external stresses that may cause damage to it, until it has sufficiently cured and been placed into service. Any concrete showing signs of damage shall be removed and replaced at the Contractor's expense.

4.3.08 - CURING

- (a) **LIQUID MEMBRANE:** As soon as all surface water sheen has disappeared from the concrete surface, the surface shall be covered with a continuous, uniform, water impermeable coating (curing compound). It shall contain a colored pigment which will clearly show that the surface has been properly coated and sealed. All exposed surfaces of concrete including edges, etc., after removal of the forms, shall be covered with an impervious membrane. Curing compound shall not be used on surfaces to which concrete is to be bonded.

Application of the curing compound shall be done with a pressure sprayer at the rate of application recommended by the liquid membrane manufacturer. A minimum of one (1) gallon of compound per 200 square feet of exposed surface shall be used.

- (b) POLYETHYLENE SHEETING: Polyethylene sheeting may be used as a method of curing for homeowners, only, doing work adjacent to their own property.

4.3.09 - PATCHING

Patch all voids, tie holes, honeycombs, or damaged areas. Cut or chip out large defective areas a minimum of 1 inch deep and patch as required. Add white cement to patching grout as required to match color of existing concrete where patches are exposed to view.

When allowed by the Engineer, spalls in curb and gutter or sidewalk shall be patched with an approved epoxy grout. Grout color shall match that of concrete being patched.

4.4 MEASUREMENT AND PAYMENT

Concrete will be measured and paid by one of the following units; cubic yard, square feet, linear foot or lump sum depending upon the use and as defined by the applicable Article or the Bid Schedule.

ARTICLE 5

CONCRETE CURB & GUTTER

5.1 - GENERAL

5.1.01 - DESCRIPTION

This work shall consist of the removal and satisfactory disposal of all materials taken from within the limits of the work, excavation and the construction of embankments and fill areas, preparation of subgrade and construction of concrete curb, curb and gutter, or gutter, to the lines, grades, and dimensions shown on the drawings, in accordance with these specifications.

5.2 - MATERIALS

5.2.01 - CURB & GUTTER MATERIALS

- (a) CONCRETE: Conform to the requirements of ARTICLE 4, "CONCRETE", except when slip forms are used a lesser slump will be permitted.
- (b) EXPANSION DOWELS: Smooth steel dowels conforming to AASHTO M 183 with gage metal or PVC sleeves. Size, number and spacing as noted on the drawings.
- (c) EXPANSION JOINT MATERIAL: Pre-molded expansion joint material conforming to all the requirements of AASHTO M 213. Placement shall be as noted on the drawings and shall extend through the depth of the concrete. Expansion joint material shall be ½" thick unless noted otherwise on the drawings.

5.3 - CONSTRUCTION REQUIREMENTS

5.3.01 - PERMITS

All curb and gutter construction requires that a permit be obtained from the office of the Director of Public Works prior to start of construction. Permits will only be issued to Contractor's possessing a valid Concrete Specialty License. When curb and gutter construction is incidental to a site upon which a building permit has been issued, that Contractor who was issued the building permit may be issued a permit for curb and gutter at the discretion of the Director of Public Works.

5.3.02 - SAWCUTTING

All concrete removal shall be to a sawcut joint unless it can be demonstrated that an existing joint is of such character that removal can be accomplished to a neat line. Sawcutting will be done to a depth equal to at least ½ the depth of the concrete. In no case will a piece of concrete curb/gutter or crossspan be left which is closer than five feet to the nearest control joint.

5.3.03 - EXCAVATION

Excavation will include excavation of all materials encountered. Excavation shall be made to subgrade elevations and to a width equal to the width of the concrete to be placed plus one foot (1') beyond the outer edges of the concrete to be placed.

No excavation shall be made below the specified elevation except to remove soft or saturated soils, organic matter or other unsuitable material as ordered by the Engineer. In the event the Contractor does excavate below the specified elevation, and said excavation was not directed by the Engineer, he shall replace the excavated material with material satisfactory to the Engineer and shall thoroughly compact the same at his own expense.

If, after the excavation has been made to subgrade for the full width required, the top six (6") inches of the cut have a relative density of less than that required by Article 9 – EARTHWORK (COMPACTION), it shall be reworked to obtain such density.

5.3.04 - EXCAVATION OF UNSUITABLE MATERIAL

Whenever excavation below the specified elevation to remove soft or saturated soils, organic matter, or other unsuitable material is ordered by the Engineer, the Contractor shall remove same and replace with material acceptable to the Engineer. The replacement material shall be placed in layers not to exceed six inches (6") in thickness and each layer shall be thoroughly compacted before the next layer is placed.

5.3.05 - EMBANKMENTS

Embankments shall be constructed of suitable excavated, borrow or select materials approved by the Engineer placed in successive layers, not greater than six inches (6") in thickness, parallel to the finished subgrade. Each layer of embankment placed shall contain the amount of moisture necessary to obtain a minimum density outlined in Article 9 – EARTHWORK (COMPACTION), when thoroughly compacted with the proper equipment.

In fill sections the material shall be placed for the full width of the concrete to be placed plus two feet (2') beyond the outer edges of the concrete to be placed and shall slope to the existing ground on a two-to-one (2:1) slope.

5.3.06 - SUBGRADE PREPARATION

The subgrade shall be constructed to have the uniform density required under Article 9 - EARTHWORK (COMPACTION) for a width of at least equal to that of the proposed concrete plus one foot (1') on each side in cuts and two feet (2') on each side in fills. The subgrade shall be brought to an elevation and cross section such that after being compacted, the surface will be at the required elevation.

5.3.07 - FORMWORK

Formwork shall conform to the requirements set forth under Article 4 - CONCRETE, Section 4.3.03 - CONCRETE FORMWORK with shapes conforming to City of Pueblo standards.

Steel forms or surfaced lumber of a height not less than the designed depth of the adjacent concrete shall be used on the back of the curb and on the front edge of the gutter on all straight sections of curb and gutter shown on the plans. Flexible forms shall be used for curves having radius of less than 150 feet.

The face of the curb shall be formed with a fixed form conforming to the dimensions shown on the plans. Forms shall be set with upper edge to correct line and grade and shall be firmly held in place by adequate stakes and bracing. They shall have no less than 3 staking points per each 10 feet of length with means for locking the form to each stake.

For small jobs where curb and gutter is being removed and replaced, and permission is given by the Engineer, the asphalt edge may be used as the face form for the gutter if the edge of the asphalt is vertical, straight, and without jagged intrusions. If any overbreakage occurs, the Contractor shall form across the overbreak and patch the asphalt using hot bituminous pavement or "Poly Perm Patch" as manufactured by Vance Brothers Inc., or approved equal. Where large amounts of overbreakage occurs (more than 25% of the linear footage of replacement), the Contractor shall cut and remove the asphalt, form the gutter lip, and replace the asphalt as outlined under Section 5.3.16.

Forms with height greater than the thickness of the concrete may be used if the upper edge is set accurately to line and grade and the subgrade is excavated to meet the bottom edge of the forms in a slope not steeper than one inch vertical to four horizontal. The extra concrete required for the extra depth shall be furnished by the Contractor without extra compensation.

Under no condition shall the forms be blocked up with stones, broken concrete, chunks of dirt, wood or similar deleterious materials and the fill then made under and between the forms.

When curb and gutter machines are used, the mold shall conform to the required template.

5.3.08 - TOLERANCES

Finished horizontal concrete surfaces shall not vary from a true plane by more than 3/16 inch in 10 feet and the upstanding face shall not vary from a true plane by more than 1/4 inch in 10 feet. Any concrete not adhering to these tolerances may be rejected by the City and shall be replaced by the Contractor at his expense.

5.3.09 - REMOVAL OF FORMS

The forms (except "face" forms) shall not be removed until 24 hours (minimum) after the concrete has been placed. Upon removal all honey-combed places and other minor defects shall be filled with mortar composed of one part of Portland cement and two parts of fine aggregate.

The back of the curb and the face of the gutter concrete surfaces shall be cured in conformance with the requirements of Article 4, CONCRETE.

5.3.10 - PLACING CONCRETE

The subgrade shall be lightly moistened just prior to placing concrete in the forms. After placement, the concrete shall be consolidated to reduce voids and porous places.

5.3.11 - FINISHING

The concrete shall be struck off and finished true to cross-section. As soon as the concrete has attained sufficient hardness, face forms shall be removed and the concrete finished with a float. Final finish shall be obtained with a brush or broom. The edges shall be rounded with edging tools.

5.3.12 - JOINTS

Joints of the various types shall be constructed as shown on the standard details. Tooled contraction joints shall be a minimum of one inch (1") deep or a depth of one quarter (1/4) the thickness of the section, whichever is greater. Concrete adjacent to the joint on either side shall have a rounded edge as shown on the drawings.

All joints shall be made perpendicular to the surface of the curb and gutter, and when tested with a straight-edge, the face across any joint shall not vary from the straight-edge by more than 1/8 inch. The curb and gutter shall be divided into sections of length by contraction joints as shown on the standard details. These sections shall be separated by carefully placed sheet steel divider templates set perpendicular to the surface of the concrete. The templates shall be three-sixteenths (3/16) inch thick and shall conform to the sections shown on the details.

Expansion joints shall be constructed where shown on the details and at intervals of not more than 200 feet using premolded filler. In addition, smooth dowels shall be required at expansion joints where shown on the standard details.

5.3.13 - MARKING

All new curb and gutter shall have the name of the contractor and the year of construction (only) impressed therein using block letters not less than one inch (1") high and one-quarter inch (1/4") deep. One impression shall be made at each end of the curb and gutter being installed and at intervals of not more than fifty feet (50').

5.3.14 - PROTECTION AND CURING OF CONCRETE

The concrete shall be protected and cured in accordance with the requirements of Article 4 - CONCRETE.

5.3.15 - BACKFILLING AFTER CONSTRUCTION

In fill sections, a two foot minimum wide berm shall be constructed against the back of the curb or sidewalk if applicable and sloped to the existing ground at a two to one slope, unless shown otherwise on the drawings.

In cut sections, a level bench shall extend from the back of the curb a distance of seven feet before the cut slope extends to daylight, or as shown on the drawings. The void behind the back of the curb and gutter shall be backfilled after the removal of the back form and the concrete has attained a minimum strength of 3000 psi. Care should be exercised during this operation so that the alignment or grade of the sections shall not be disturbed. Any that are shifted, cracked, or in any way damaged, shall be removed and replaced by the Contractor at his own expense.

5.3.16 - ASPHALT PATCH

Where asphalt and base have been removed for the gutter face form, the patch shall have a minimum width of twelve inches (12"). The patch shall be constructed using asphalt conforming to the requirements of Article 10 and having an asphalt thickness equal to that of the adjacent street except that a minimum thickness of six inches (6") shall be maintained. For patches greater than two feet (2') in width the Contractor may use an equivalent pavement patch design provided by the Public Works Department.

5.3.17 - SITE RESTORATION

Restoration of the area behind the curb and gutter shall include but not be limited to replacing sod, shrubs, gravel, asphalt, concrete, irrigation components, and other landscaping items. Restoration is considered subsidiary to the curb and gutter construction and shall not be paid as a separate item, unless noted otherwise in the Special Provisions.

5.3.18 - REMOVAL OF OBSTRUCTIONS

Wherever an existing driveway or entrance walk must be removed to provide space for forms, the Contractor shall remove same to the nearest joint, or as the Engineer may direct. A sawed joint shall be required for said removal. Replacement will be done on a unit price basis.

5.3.19 - TREE ROOTS

Whenever a section of curb and gutter is being replaced that has been uplifted by a tree root, the root shall be cut a distance of 12" behind the curbhead to prevent the damage from reoccurring. Any roots within six inches (6") of finished subgrade shall also be removed. If in the opinion of the Engineer, the cutting of the root may seriously injure the tree, then the Engineer may order the removal of the tree. Except for City contracts with a tree removal bid item, the cost for tree removal shall be at the adjacent property owner's expense. Prior to cutting the tree root, the Engineer shall be consulted to determine the proper removal of the root and/or tree.

5.4 - METHOD OF MEASUREMENT

The contract quantities of curb, double gutter, or combined curb and gutter to be paid for under this item shall be the number of linear feet measured in place, completed and accepted. Curb or combined curb and gutter shall be measured along the front face of the curb. Double gutters shall be measured along the centerline of the gutter.

The contract quantities to be paid for curb and gutter and square pans at street intersections shall be as outlined in the table given below. These calculated quantities provide for a two foot (2') wide strip of the square pan along the face of the curb to be included as the curb and gutter pay item. Quantities for curb and gutter and square pans having different radii than those listed shall be adjusted accordingly.

PAY ITEM	CORNER RADIUS		
	15'	20'	25'
Curb & Gutter	23.5 L.F.	31.3 L.F.	39.2 L.F.
7" Reinforced Concrete	62.0 S.F.	104.0 S.F.	156.0 S.F.

The contract quantities to be paid for square pans at alley intersections having a 6 foot radius shall be 13.8 sq. ft. of seven inch (7") reinforced concrete and 9.4 lin. ft. of curb and gutter for each alley intersection square pan completed and accepted.

The contract quantity to be paid for eight foot wide gutter shall be the number of square feet of seven inch (7") reinforced concrete, measured in place, completed and accepted.

Removal of concrete curb, double gutter, curb and gutter, and seven inch (7") reinforced concrete shall be field measured prior to removal and measured by the same method as for installation. Sawcutting to remove concrete to a neat line shall be considered incidental to the removal item and will not be paid for separately.

Replacement for unsuitable materials excavated will be measured in the field and a volume calculated in cubic yards or will be done by weight of select materials as evidenced by weight tickets.

5.5 - BASIS OF PAYMENT

The contract footages (lineal foot or square feet), measured as provided above, shall be paid for at the Contract Unit Prices for "Concrete Curb", "Concrete Double Gutter", "Curb and Gutter", or 7" Reinforced Concrete as set forth in the "Request for Quotations". Said prices and payment shall be full compensation for all excavation, embankments, furnishing, placing and compacting select material base, subgrade preparation, concrete forms, furnishing and placing materials, curing, backfilling, compaction, site restoration, disposal of surplus materials, and for all labor, equipment, tools, and incidentals necessary to complete construction.

The contract footages (linear foot or square feet), measured as provided above, shall be paid for at the Contract Unit Prices for "Removal of Concrete Curb", "Removal of Curb and Gutter", or "Removal of 7" Reinforced Concrete" as set forth in the "Request for Quotations". Said prices and payment shall be full compensation for labor and equipment necessary to perform all sawcutting, removal and disposal of all materials to the limits established by the Engineer.

If the existing subgrade soils are unsuitable, the Engineer shall be notified immediately after curb and gutter removal for verification. The Contractor shall be compensated for all removal and replacement of unsuitable material as outlined below.

The contract volume or weight, measured as provided above, shall be paid for at the contract unit prices per cubic yard or ton for "Subgrade Stabilization" as set forth in the "Request for Quotations". Said prices and payment shall be full compensation for excavation and disposal of unsuitable subgrade materials, furnishing, placing and compacting suitable replacement material and for all labor, equipment, tools and incidentals necessary to complete the construction. If no bid item exists for "Subgrade Stabilization" the price shall be negotiated.

Any soils that become soft or saturated after removal of curb and gutter will be replaced at no cost to the City.

ARTICLE 6
CONCRETE SIDEWALK AND DRIVEWAYS

6.1 - GENERAL

6.1.01 - DESCRIPTION

The work covered by this section of the Specifications shall consist of the removal and satisfactory disposal of all materials taken from within the limits of the work, construction of concrete sidewalk and driveways to the lines, grades, and dimensions shown on the drawings, as hereinafter specified, and as directed by the Engineer.

6.2 - MATERIALS

6.2.01 - CONCRETE MATERIALS

- (a) CONCRETE: Conform to the requirements of Article 4 - CONCRETE.
- (b) EXPANSION JOINT MATERIAL: Pre-molded expansion material conforming to the requirements of AASHTO M 213. Placement shall be as noted on the drawings and shall extend through the depth of the concrete.

6.2.02 - ALTERNATIVE SIDEWALK MATERIALS

- (a) GENERAL: If the owner of a property wishes to construct a sidewalk adjacent to his property using materials other than plain concrete as described in Article 4 - CONCRETE, then that property owner must obtain a Revocable Permit and receive written permission from the Director of Public Works prior to constructing the sidewalk. The property owner agrees to remove and replace the sidewalk with plain concrete if instructed by the Director of Public Works. In addition, any construction projects administered by the City which requires sidewalk removal, the sidewalk material replacement will be at the discretion of the Director of Public Works and the City will only pay for the cost of plain concrete. Additional costs for alternative materials will be paid for by the adjacent property owner. All sidewalks constructed using alternative materials shall be in conformance with one of the following material subsections and with all applicable sections of Article 6 - CONCRETE SIDEWALK AND DRIVEWAYS.
- (b) COLORED CONCRETE: Shall be a chemical admixture added to the concrete that is uniform and colorfast. Rate of admixture shall be in accordance with the manufacturer's recommendations. All other provisions of Article 4 - CONCRETE remain in effect.
- (c) EXPOSED AGGREGATE CONCRETE: Shall contain a water reducing agent and a surface applied mortar retarder. Following mortar washoff, the surface shall be sprayed with a continuous uniform coating of water-impermeable membrane.
- (d) BRICK PAVERS: Shall conform to either ASTM C902 for fired clay pavers or ASTM C936 for concrete paving units. Minimum thickness shall be 2 ½ inches. All units for sidewalk paving shall be manufactured exclusively for paving. No brick or concrete block units for wall construction will be permitted. Paving edges shall be confined by a sturdy permanent side form constructed of 1-1/2" thick redwood or treated lumber, or a steel plate form.

Pavers shall be set on a minimum layer of 4" of Class 6 Base Course with a ½" masonry sand setting bed. At driveways, pavers shall be placed upon a 4" thick concrete base with a ½" mortar setting bed. Units shall be set flush to provide a smooth walking surface. After all pavers are set flush to grade, a dry 50/50 mixture of fine masonry sand and cement shall be swept into the joints across the entire surface of pavers.

- (e) FLAGSTONE: Shall be a natural stone material having a minimum thickness of 2". Flagstone shall be placed on a layer of Class 6 Base Course or concrete as described above in Section 6.2.02 (d). The finished surface of the sidewalk shall be relatively smooth. When measured with a straightedge the maximum variation shall not exceed 3/8 inch.
- (f) OTHER MATERIALS: If written permission is given by the Director of Public Works to use materials for public sidewalks other than those listed in this section, they shall be installed as instructed by the Director.

6.3 - CONSTRUCTION REQUIREMENTS

6.3.01 - PERMITS

All sidewalk and driveway construction within the right-of-way requires that a permit be obtained from the office of the Director of Public Works prior to start of construction. Permits will only be issued to Contractors who possess a valid Concrete Specialty License or to the owner of the property upon which the sidewalk fronts provided that they can demonstrate they possess the skills and tools necessary to construct the concrete work in accordance with these specifications. Additionally, if construction of sidewalk or driveway is incidental to construction on a site which a building permit has been issued, a Class C or above Contractor who holds the building permit for that site may be issued a permit for the sidewalk or driveway construction at the discretion of the Director of Public Works.

6.3.02 - EXCAVATION AND EMBANKMENT

When filling is necessary to bring the walk to grade, the fill shall be deposited and compacted in layers of not more than six inches (6") . The top of all fills shall extend beyond the walk on each side at least one foot (1') and the sides shall have a slope not steeper than 4:1 (horizontal:vertical). The distance from edge of cuts at the base shall be at least one foot (1') from the nearest edge of the walk.

If, after the excavation has been made to subgrade for the full width required, the top six inches (6") of the cut have a relative density of less than that required by Article 9 – EARTHWORK - (COMPACTION), it shall be reworked to obtain such density.

6.3.03 - REMOVAL OF OBSTRUCTIONS

Wherever an existing driveway or entrance walk must be removed to provide space for forms, the Contractor shall remove same to the nearest joint, as the Engineer may direct. A sawed joint shall be required for said removal. Replacement will be done on a unit price basis.

6.3.04 - EXCAVATION OF UNSUITABLE MATERIAL

Whenever excavation below the specified elevation to remove saturated soils, organic matter, or other unsuitable material is ordered by the Engineer, the Contractor shall remove same and replace with material acceptable to the Engineer. The replacement material shall be placed in layers not to exceed six inches (6") in thickness and each layer shall be thoroughly compacted before the next layer is placed.

6.3.05 - TREE ROOTS

Whenever a section of sidewalk is being replaced that has been uplifted by a tree root, the root shall be cut a distance of twelve inches (12") away from the sidewalk to prevent the damage from reoccurring. Any roots within six inches (6") of finished subgrade shall also be removed. If in the opinion of the Engineer, the root cutting will seriously injure the tree then the Engineer may order the removal of the tree. Except for City contracts with a tree removal bid item, the cost for tree removal shall be at the adjacent property owner's expense. Prior to cutting, the Engineer shall be consulted to evaluate whether the root alone or the entire tree must be removed.

6.3.06 - SUBGRADE PREPARATION

All unsuitable areas or material shall be removed and replaced with approved material and compacted to the required density given in Article 9 – EARTHWORK - (COMPACTION). The subgrade shall be brought to an even surface before any concrete is placed.

6.3.07 - FORMWORK

In general all formwork shall conform to the requirements given in Article 4 - CONCRETE, Section 4.3.03 - CONCRETE FORMWORK

Steel or surfaced lumber shall be used to form the free edges for all sidewalk and driveway construction. Forms shall be straight and true to grade and alignment and shall be firmly held in place. Forms shall have no less than three (3) staking points per each ten feet (10') of form length with means for securing the form to each stake.

Flexible forms shall be used on curves having a radius of less than 150 feet.

6.3.08 - PLACEMENT, PROTECTION AND CURING

Conform to the requirements set forth in Article 4 - CONCRETE.

6.3.09 - FINISHING

In all cases the walk shall be constructed in one course. The surface shall be struck off to the established grade by means of a straight edge. The surface shall then be finished true to grade with a wooden or metal float and afterwards roughened lightly with a broom or brush. Broom marks shall be transverse to the traveled way. The surface of the concrete shall be free from depressions exceeding 1/4"(inch) in 5 feet.

6.3.10 - CONTRACTION JOINTS

Joints shall be constructed at the spacing and locations shown on the plans and/or details. The walk shall be cut with a marking tool or template forming a groove at least one-fourth (1/4) the thickness of the slab, but not greater than two inches (2") deep, so that the walk is divided into sections. Location of construction joints shall be in conformance with the Standard Details. The slabs shall be rounded on all surface edges to a radius of one-quarter inch (1/4").

6.3.11 - EXPANSION JOINTS

Strips of pre-molded expansion joint material one-half inch (1/2") thick shall be placed perpendicular to the side forms to the full width and depth of the walk or driveway at least once in every one-hundred feet (100') of walk, or as shown on the standard details, drawings, or as directed by the Engineer. Similar joints shall be provided when new walk abuts other concrete walk or structures. Expansion joints shall be placed between an attached sidewalk and the curb and gutter at each of the following cases:

- (a) Where the walk is in a confined area such as between foundation walls, retaining walls, etc.
- (b) Between concrete sidewalk and any fixed structure.
- (c) At any special situation as directed by the Engineer.
- (d) See Standard Details for additional locations.

6.3.12 - CONTRACTOR'S STAMP

All new sidewalk shall have the name of the Contractor and the year of construction (only) impressed therein using block letters not less than one inch (1") high and one-quarter inch (1/4") deep. One impression shall be made at each end of the sidewalk being installed and at intervals of not more than fifty feet (50').

Property owners and General Building Contractors without stamps shall scribe their initials or company name and date into the fresh concrete as legibly as possible, using a pointed scribe.

6.3.13 - SLOPE

Forms shall be set so that the walk shall have a slope toward the street of one-quarter inch (1/4") per foot of width or as directed by the Engineer.

6.3.14 - ADJUSTMENTS

Whenever any adjustment of the grade, or joint spacing are necessary or advisable in order to have the walk conform to existing abutting walk or other abutting structures, the adjustment shall be made only with the approval and under the direction of the Engineer.

6.3.15 - THICKNESS

The concrete walks constructed under these specifications shall have a minimum thickness of four inches (4"). At driveways the thickness shall be increased to six inches (6"). At public alleys the thickness shall be seven inches (7") and reinforced with reinforcing steel. Reinforcing may be used at driveways at the discretion of the owner.

6.3.16 - SITE RESTORATION

Restoration of the area adjacent to the sidewalk and driveway shall include but not be limited to replacing sod, shrubs, gravel, irrigation components, and other landscaping items. Restoration is considered subsidiary to the sidewalk and driveway construction and shall not be paid as a separate item.

6.4 - METHOD OF MEASUREMENT

The contract quantity to be paid for under this item shall be the number of square feet of concrete of the specified thickness, measured in place, completed and accepted.

Removal of concrete sidewalk and driveway shall be field measured prior to removal. The contract quantity to be paid for removal shall be the number of square feet of concrete removed to the limits defined to the Engineer.

Replacement for unsuitable materials excavated will be measured in the field and a volume calculated in cubic yards or will be done by weight per ton of select materials used to fill the excavation as evidenced by weight tickets.

6.5 - BASIS OF PAYMENT

The square feet of sidewalk as measured above shall be paid for at the contract unit prices per square foot of the specified thickness. Said prices and payment shall be full compensation for all excavation, tree root or shrub root removal, concrete forms, furnishing and placing materials, curing (including cold weather protection), backfilling, compaction, disposal of surplus materials, site restoration, and for all labor, equipment, tools and incidentals necessary to complete the construction.

The contract price for removal shall include all labor and equipment necessary to sawcut, demolish, load, haul and dispose of all materials within the limits defined by the Engineer.

If the existing subgrade soils are unsuitable, the Engineer shall be notified immediately after curb and gutter removal for verification. The Contractor shall be compensated for all removal and replacement of unsuitable material as outlined below.

The contract volume or weight, measured as provided above, shall be paid for at the contract unit prices for "Subgrade Stabilization" as set forth in the "Request for Quotations". Said prices shall be full compensation for excavation and disposal of unsuitable materials, furnishing, placing and compacting suitable replacement material and all labor, equipment, tools and incidentals necessary to complete the construction. If no bid item exists for "Subgrade Stabilization" the price shall be negotiated.

Any soils that become soft or saturated after removal of sidewalk or driveway will be replaced at no cost to the City.

ARTICLE 7

CONCRETE PAVEMENT

7.1 - GENERAL

7.1.01 - DESCRIPTION

The work covered by this section of the Specifications shall consist of the removal and satisfactory disposal of all materials taken from within the limits of the work, construction of concrete pavement to the lines, grades, thickness, and typical cross sections shown on the plans and as directed by the Engineer.

7.2 - MATERIALS

7.2.01 - CONCRETE MATERIALS

- (a) CONCRETE: Conform to the requirements of Article 4 - CONCRETE.
- (b) EXPANSION DOWELS: Smooth steel dowels conforming to AASHTO M 183 with gage metal sleeves. Size, number and spacing as noted on the drawings.
- (c) EXPANSION JOINT MATERIAL: Pre-molded expansion joint material conforming to the requirements of AASHTO M 213. Placement shall be as noted on the drawings and shall extend through the depth of the concrete. Expansion joint material shall be ½" thick unless otherwise noted on the drawings.
- (d) JOINT SEALING COMPOUND: Where joints are required to be sealed, sealing material shall be of the silicone type matching the color of the concrete pavement and applied per the manufacturer's specifications.

7.3 - CONSTRUCTION REQUIREMENTS

7.3.01 - SUBGRADE PREPARATION

Subgrade preparation shall conform to the applicable provisions of Article 9 – EARTHWORK. All unsuitable material shall be removed and replaced with approved material and compacted to the required density. The subgrade shall be brought to an even surface before any concrete is placed.

7.3.02 - FORMWORK

In general all formwork shall conform to the requirements given in Article 4 - CONCRETE, Section 4.3.03 - CONCRETE FORMWORK

All side forms shall be made of metal of at least a depth equal to edge thickness of the pavement. The sections shall have a length of at least ten feet, except on curves of less than 150 foot radius, where other materials may be used. Forms with a height of eight or more inches shall have a base width of at least eight inches.

Other forms shall have a minimum base width of six inches. When set to grade and staked in place, the maximum deviation of the top surface of any section from a straight line shall not exceed 1/8 inch.

The method of connection between sections shall be such that the joint formed shall be free from play or movement in any direction. The bracing and support must be ample to prevent the deflection of the forms under the pressure of the concrete or the weight or thrust of the machinery operating on the forms.

Flexible metal forms may be used only when specifically provided for on the plans with the exception that their use is herein approved for all curves having a radius of less than 150 feet. Forms shall be equal in depth to the edge thickness of the pavement. Forms shall be held by stakes and securely braced at any point where necessary so that no movement will result from pressure of the concrete or the weight of machinery operating on the forms.

7.3.03 - VIBRATORS

Vibratory equipment shall be capable of frequencies of not less than 10,000 vibrations per minute, in air, and shall produce vibration in vertical and horizontal planes and insure downward vibration of an intensity as great as in other directions to provide thorough vibration through the full depth of the concrete. The unit shall be adjustable to the approximate cross section of the finished surface. Vibration shall not be used as a means to cause concrete to flow or run into position in lieu of placing, and shall not be prolonged to the point where segregation occurs.

7.3.04 - FINISHING EQUIPMENT

The Contractor shall provide mechanical equipment of either the slip form or form paving type which will strike off, consolidate, and finish the pavement to the required cross section.

If it is necessary to operate one or both sets of wheels on the previously placed concrete, they shall be rubber-faced and shall be adjusted so that bearing on concrete will not be less than 3 inches from the edge of the pavement.

7.3.05 - PLACEMENT AND CURING

Conform to the requirements set forth in Article 4 - CONCRETE.

Concrete paving machines weighing more than 5,000 pounds shall not be utilized on freshly poured concrete slabs for adjacent and abutting pours until 72 hours have elapsed. This time requirement shall be increased to 7 days when the concrete paving machine weighs more than 30,000 pounds.

7.3.06 - FINISHING

MACHINE FINISHING

The pavement shall be struck off, consolidated and finished with mechanical equipment in such a manner that after final finishing, it shall conform to the pavement cross section shown on the plans. Hand finishing will be permitted in narrow widths, areas of irregular dimensions, and in the event of a breakdown of the mechanical equipment, to finish the concrete already deposited on the grade.

FINAL SURFACE FINISH

The final surface finish of the pavement shall have a uniform, skid-resistant texture. The method of texturing shall be approved by the Engineer, and he may require changes in the final finishing procedure as required to produce the desired final surface texture.

7.3.07 - JOINTS

Transverse and longitudinal joints shall be constructed to the dimensions and at the spacing shown on the plans. Transverse joints shall extend the entire width of the pavement and shall match curb joint spacing. Joints shall be sawed after the concrete has hardened.

Sawing of joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling and before uncontrolled cracking occurs. All joints shall be completed within 24 hours from the time the concrete was poured.

CONSTRUCTION JOINTS

All longitudinal joints may be construction joints at the Contractor's option. Transverse construction joints shall be installed whenever the placing of concrete is suspended a sufficient length of time that the concrete may begin to harden.

JOINT SEALING

All expansion joints and the joints between the curb and gutter and concrete pavement shall be sealed before the pavement is exposed to traffic, including construction traffic. Prior to sealing, all foreign material shall be removed from all joints and the joints shall be thoroughly dry.

7.3.08 - CONTRACTOR'S STAMP

All new concrete pavement shall have the name of the contractor and the year of construction impressed therein using block letters not less than one inch (1") high and one-quarter inch (1/4") deep. One impression shall be made at intervals of not more than fifty feet (50').

7.3.09 - SURFACE AND THICKNESS TOLERANCES

The surface of the concrete pavement shall be free from depressions exceeding 3/16 inch in ten (10) feet, when tested with a straight edge. Thickness shall be within $\pm 1/4$ inch.

7.3.10 - PROTECTION FROM TRAFFIC

The pavement shall be closed to traffic after the concrete is placed until it reaches a compressive strength of 3000 psi. This does not include the sawing and sealing equipment or other light miscellaneous equipment.

7.3.11 - PATCHING

Remove the material to the depth and extent required as directed by the Engineer. Prepare the subgrade to the requirements of Article 9 - Earthwork. Depth or thickness of the Class 6 aggregate base shall be 6 inches and the concrete pavement shall be 7 inches, or as necessary to match the existing conditions, whichever is greater. Dowel the new concrete into the existing concrete as directed by the Engineer.

7.4 - METHOD OF MEASUREMENT

The contract quantity to be paid for under this item shall be the number of square yards of concrete pavement of the specified thickness, measured in place, completed and accepted. When curb and gutter and concrete pavement are poured monolithically the two feet (2') of pan shall be included in the curb and gutter item.

Replacement for unsuitable materials excavated will be measured in the field and a volume calculated in cubic yards or will be done by weight of select materials as evidenced by weight tickets.

7.5 - BASIS OF PAYMENT

The square yards of contract concrete pavement as measured above shall be paid for at the contract unit prices per square yard of the specified thickness. Said prices and payment shall be full compensation for all related earthwork as defined in Article 9 - EARTHWORK, concrete forms, furnishing and placing materials, curing (including cold weather protection), jointing, joint sealing, backfilling, compaction, disposal of surplus materials, site restoration, and for all labor, equipment, tools and incidentals necessary to complete the construction. When curb and gutter and concrete pavement are poured monolithically the two feet (2') of pan shall be paid for under the curb and gutter item.

If the existing subgrade soils are unsuitable, the Engineer shall be notified immediately after removal of existing pavement surface for verification. The Contractor shall be compensated for all removal and replacement of unsuitable materials as outlined below.

The contract volume or weight, measured as provided above, shall be paid for at the contract unit prices per cubic yard or ton for "Subgrade Stabilization" as set forth in the "Request for Quotations". Said prices and payment shall be full compensation for excavation and disposal of unsuitable subgrade materials, furnishing, placing and compacting suitable replacement material and for all labor, equipment, tools and incidentals necessary to complete the construction. If no bid item exists for "Subgrade Stabilization" the price shall be negotiated.

Any soils that become unsuitable, due to the introduction of excess moisture from any source, following the removal of existing pavement or surfacing will be replaced at no cost to the City.

ARTICLE 8

AGGREGATE BASE CONSTRUCTION

8.1 – GENERAL

8.1.01 – DESCRIPTION

The construction of aggregate bases shall consist of furnishing, placing and compacting approved base and/or sub-base material to form a stable foundation for subsequent construction. Aggregate base construction shall conform with the lines, grades, and cross sections shown on the plans and as staked by the Engineer and shall comply with these specifications.

8.2 – MATERIALS

Aggregate for base or sub-base material shall be composed of crushed stone, crushed gravel, or natural gravel which conforms to the quality requirements of AASHTO M 147. The use of recycled asphalt product (RAP), crushed slag or Fly-Ash blended with Class 6 aggregate base may be used if approved by the Director of Public Works. At least 50% by weight of the material retained on the No. 4 sieve, and larger, shall have at least one fractured face. This material shall also conform to the following gradation requirements.

SIEVE SIZE	% PASSING (BY WEIGHT)	
	Sub-base	Base Course
	CLASS 1	CLASS 6
2½"	100	---
2"	95-100	---
1½"	---	---
1"	---	---
¾"	---	100
No. 4	30-60	30-65
No. 8	---	25-55
No. 200 (AASHTO T-11)	3-15	3-12
Liquid Limit (AASHTO T-89)	35 max.	30 max.
Plasticity Index (AASHTO T-90)	6 max.	6 max.

The aggregate shall have a Los Angeles Abrasion Test (AASHTO T 96) percentage of wear not exceeding 45% (excluding Class 1). Class 1 material shall have a minimum "R" value of 69, or a minimum CBR of 40 when tested in accordance with AASHTO T 190 or T 193, respectively. Class 6 material shall have a minimum "R" value of 77, or a minimum CBR of 60.

8.3 – CONSTRUCTION REQUIREMENTS

8.3.01 – PROOF ROLLING

Prior to placing any base material, the subgrade shall be proof rolled in accordance with Article 9 – EARTHWORK (PROOF ROLLING). Any unsuitable areas shall be corrected to the satisfaction of the Engineer.

8.3.02 – HAULING AND PLACING

Care shall be exercised in the hauling and placing of base/sub-base course materials to avoid segregation of the coarse and fine aggregates and to avoid contamination of the base/sub-base course materials with undesirable materials. The base/sub-base course material shall be placed on the prepared subgrade in lifts of sufficient quantity to conform to the thickness specified on the approved plan and profile. If the required compacted depth of the base or sub-base course material exceeds six inches (6”), it shall be constructed in two (2) or more layers of approximately equal thickness. The maximum compacted thickness of any one lift shall not exceed six inches (6”).

The Contractor shall be responsible for ensuring that their hauling operations do not cause excessive track out of dirt/mud onto paved streets adjacent the work zone. If instructed by the Engineer, all tracked out material shall be promptly removed by the Contractor at his sole expense.

8.3.03 – COMPACTION

All base and sub-base course material shall be compacted to a minimum dry density of 95% of Modified Proctor AASHTO T180 (ASTM D 1557) at a moisture content near optimum. Water shall be applied during placement and thoroughly mixed to achieve the required compaction.

8.3.04 – SURFACE AND THICKNESS TOLERANCES

The surface of the base of sub-base course shall be smooth and true to the established crown, grade and thickness. Spot checks should not vary more than one-half inch (½) up or down from the calculated elevation (plan grade). Any areas not within these tolerances shall be reworked until compliance is achieved.

8.3.05 – QUALITY CONTROL

Prior to start of placement of aggregate base materials, the Contractor shall furnish to the Engineer two (2) copies of recent (within past six months) test reports on the proposed materials. Test reports shall include the following tests:

Hveem Stabilometer (“R” value)	AASHTO T 190
Gradation analysis	AASHTO T 88
Atterberg Limits (LL & PI)	AASHTO T 89 & T 90
Proctor curve (Modified)	AASHTO T 180

All testing shall be paid for by the Contractor except field moisture/density testing which shall be provided by the City. In general, a minimum of one moisture/density test will be taken for each 200 feet of roadway being constructed. If in the opinion of the Engineer, the materials being used do not appear to conform to the approved test reports, then the Contractor shall provide such testing as required to verify the quality of the materials. Verification material tests that pass will be paid for by the City; however, any failing tests will be paid for by the Contractor.

8.4 – METHOD OF MEASUREMENT

Unless used as replacement for unsuitable material, aggregate base course construction described herein will not be measured as a separate pay item, but will be considered as incidental to the item which it applies (i.e. – Asphalt Paving, etc.). Where used as replacement for unsuitable material, measurement shall be volume in cubic yards or by the ton as evidenced by weight tickets for each truckload or fraction thereof.

8.5 – BASIS OF PAYMENT

Unless noted otherwise in Article 2-SPECIAL PROVISIONS, aggregate base course will not be paid for as a separate pay item. However, base course material, when directed by the Engineer, used as replacement for unsuitable material will be paid as “Subgrade Stabilization” and shall include all costs associated with the excavation, removal and disposal of unsuitable materials and all costs associated with furnishing, placing and compacting the aggregate base material. If no bid item exists for “Subgrade Stabilization”, the price shall be negotiated.

ARTICLE 9

EARTHWORK

9.1 - GENERAL

9.1.01 - DESCRIPTION

The work covered by this section of the specifications shall consist of the removal and satisfactory disposal of all materials taken from within the limits of the work, construction of embankments and fill areas, and preparation of the subgrade, as specified herein, and as directed by the Engineer.

9.2 - MATERIALS

9.2.01 - EMBANKMENT MATERIALS

Embankment material shall consist of earth, sand or gravel free from organic matter, frozen soil, ice, snow, mud or other deleterious material. All fill material shall be approved by the Engineer prior to placement.

9.3 - CONSTRUCTION REQUIREMENTS

9.3.01 - CLEARING AND GRUBBING

All areas to be cleared for earthwork shall be stripped of all organic matter (grasses, weeds, trees, roots, and any other vegetative material) prior to the start of excavation or embankment operations. Any trees or shrubs to remain within the clearing limits shall be flagged by the Engineer. If stated on the drawings, the Contractor shall stockpile the stripped materials at a location designated by the Engineer for future use. When a site is not designated, the Contractor must dispose of the material off site. If shown on the drawings, the stripped materials shall be placed along landscaped areas as directed by the Engineer.

After clearing and grubbing is complete, the Contractor shall notify the Engineer for his approval of the clearing and grubbing prior to subsequent earthwork operations.

9.3.02 - DUST PREVENTION

During construction and until final acceptance by the Engineer the Contractor shall be responsible for controlling dust emissions in the construction area. No earthwork activities shall be performed when the wind speed exceeds thirty miles per hour (30 MPH). Whenever conditions exist that create airborne soil particles, the Contractor shall at his expense, wet all disturbed areas as often as necessary to control the dust. All fill areas shall be compacted daily to the specified compaction. Any mud or dirt carry out onto paved surfaces shall be cleaned up daily and when directed by the Engineer. Failure by the Contractor to comply with the above may result in the Engineer issuing a stop-work order until the problems are corrected. Any dust control or clean-up done by City crews will be back charged to the Contractor.

When a building permit is issued for a structure and the site disturbance is greater than 1000 square feet but less than or equal to 1 acre, a sign-off at Pueblo Regional Building Department is required. Areas of land disturbance greater than 1 acre but less than 25 acres require an **Emission Permit Application: Land Development/Construction Activity**. The permits are available at the Pueblo City and County Health Department and are to be secured by the Contractor.

9.3.03 – EROSION AND SEDIMENT CONTROL

All construction activities disturbing more than 1 acre will require a *General Permit for Stormwater Discharges Associated With: Construction Activity* issued by the “Colorado Dept of Health, Water Quality Control Division, Permits and Enforcement Section”. A Stormwater Management Plan (SWMP) is required as a condition of obtaining said permit. A copy of the Construction Activity Permit and the Stormwater Management Plan shall be submitted to the City of Pueblo Stormwater Management Dept. for review.

In addition to the SWMP, an erosion control plan stating “Best Management Practices” (BMPS) to control erosion, sediment, and stormwater quality during and after the construction activity shall be submitted to the City of Pueblo for review. The erosion control plan shall be prepared in accordance with the provisions set forth in The City of Pueblo’s *Storm Drainage Design Criteria and Drainage Policies Manual*.

Guidance for engineers, contractors, and developers in the selection, design, and maintenance of “Best Management Practices” to improve stormwater run-off quality can be found in Volume 3 of the *Urban Storm Drainage Criteria Manual*.

9.3.04- BURNING

Burning to remove or dispose of materials will not be permitted.

9.3.05- REMOVAL OF STRUCTURES AND OBSTRUCTIONS

All existing physical features which conflict with the new construction shall be removed by the Contractor and disposed of properly at a site acceptable to the Engineer. These shall include but not be limited to; asphalt or concrete paving, base course, miscellaneous concrete flatwork, curb and gutter, sidewalk, foundations, culverts and headwalls, fences, abandoned utilities, and any other items not intended to remain. Where required to obtain a straight line without jagged edges, the removal shall require sawcutting. Sawcuts shall be a minimum of 1/4 the thickness of material (or deeper) to obtain a clean straight face.

Unless specifically noted otherwise on the drawings or in the Special Provisions, sawcuts shall be considered subsidiary to the removal item and will not be paid for separately. If any items are removed or damaged by the Contractor beyond the limits of demolition shown on the drawings or as marked in the field, they shall be replaced by the Contractor at no expense to the City.

9.3.06- BASES OF CUTS AND FILLS

Bases of all excavations and embankments (cuts and fills) shall be scarified to a depth of six inches (6") and compacted to the requirements of Section 9.3.10 - COMPACTION, unless otherwise directed by the Engineer.

In roadway sections where full depth asphalt paving or concrete pavement is to be placed directly upon soil subgrade without benefit of any base course, the subgrade shall be scarified to a depth of twelve inches (12") and compacted to the requirements of Section 9.3.10 - COMPACTION. If the subgrade is an embankment having a depth less than or equal to six inches (6"), the base of the fill shall be scarified to a depth of twelve inches and compacted prior to fill placement. For embankments having a depth greater than six inches (6"), a minimum of six inches (6") of scarification and compaction of the base of fill is required.

9.3.07- EXCAVATION

Excavation (Common or Unclassified) shall consist of the excavation of all materials of whatever character. All excavation shall be made to the elevations and lines shown on the drawings and as directed by the Engineer.

No excavation shall be made below subgrade elevation except to remove any soft or saturated soils, organic material or other unsuitable materials as ordered by the Engineer. Any over excavation not ordered by the Engineer shall be replaced with suitable material and compacted by the Contractor at no cost to the City.

Whenever excavation is necessary to remove unsuitable material, it shall be replaced with material acceptable to the Engineer in accordance with Section 9.3.09 - EMBANKMENT of these Specifications.

9.3.08- ROCK or MAN-MADE OBSTRUCTION EXCAVATION

Rock will be defined as any naturally occurring or man-made material in such a form that it cannot be readily removed using the equivalent of a 165 hp/40,000lb operating weight track-type tractor (bulldozer) with a ripper or a 188hp/63,000lb operating weight hydraulic excavator (crawler mounted backhoe) with "rock teeth" without a significant loss of production. It also includes boulders exceeding one-half (½) cubic yard in volume.

Whenever rock material is encountered in an excavation, the Contractor shall immediately notify the Engineer for field verification. The Engineer shall measure and document the limits of the rock prior to excavation. Any rock removed prior to notification will not be considered for payment.

Blasting for rock excavation will only be allowed with the written permission from the Engineer and Fire Chief. The Contractor shall exercise the utmost care to protect the public from harm and to avoid property damage. Blasting shall be done by a State licensed blaster. The Contractor shall comply with all laws, ordinances, insurance, bonding, and applicable safety code requirements and regulations and shall be responsible for all damage caused by the blasting operations.

9.3.09- EMBANKMENT

Before placing the fill material, the existing ground shall be prepared as outlined in Section 9.3.01 - CLEARING AND GRUBBING and 9.3.06 - BASES OF CUTS AND FILLS. Prior to placing new embankment, the recompacted subgrade shall be proof rolled as defined in Section 9.3.14 PROOF ROLLING.

Place fill material in uniform lifts having a maximum loose thickness of eight inches (8"). Fill shall be free from frozen soil, snow, ice, mud, rubbish, organic material, and large rock. Maximum rock size shall be limited to three inches (3") for fills less than one foot (1') thick and to a maximum size of eight inches (8") for deeper fills except that rock larger than three inches (3") are not permitted within twelve inches (12") of the finished subgrade. Areas to be landscaped shall be free from surface rock larger than one inch (1").

9.3.10- COMPACTION

The Contractor shall employ whatever equipment and methods that are necessary to obtain the moisture and required density. All soils within the compaction limits beneath roadways, alleys, sidewalks and driveways shall be compacted to either ninety-five percent (95%) of the maximum dry density as defined by AASHTO T 99 (Standard Proctor) or ninety percent (90%) of the maximum dry density as defined by AASHTO T 180 (Modified Proctor). Compaction limits are from finished subgrade to six inches (6") below the base of cuts and fills (12" below full depth asphalt or concrete pavement). Moisture content for all compacted soils shall be within $\pm 2\%$ of optimum unless field observation verifies that the soils are unstable at lesser moisture contents. In those cases, the Engineer shall establish a minimum moisture content.

If requested by the Contractor and/or Developer, and written permission is granted by the Director of Public Works, backfill for utility trenches may be consolidated using water induced settlement techniques (jetting/puddling). This method of trench backfill consolidation shall only be allowed in those special locations where a failure history exists for trenches using conventional engineered controlled fill. As a condition of permission to use jetting/puddling, the Contractor and/or Developer must agree in writing to provide a full and complete three (3) year warranty from the final acceptance date, that shall include repair of any surface amenities to the complete satisfaction of the City which may include a full width asphaltic overlay if warranted.

Where backfill for utility trenches within the roadway section are consolidated using jetting/puddling, the moisture and density requirements within the trench compaction limits stated above shall not apply; however, the compaction limits for the finished roadway subgrade as outlined under Article 9 – EARTHWORK (COMPACTION) shall apply.

9.3.11- QUALITY CONTROL

Field testing for moisture content and dry density of the compacted soil will be done by the City. The Contractor may retain the services of an independent testing firm to perform the testing at his expense. Frequency and location for the tests will be at the City's discretion. In general, a minimum of one test per foot of fill and/or along the bases of cuts and fills, will be taken for each 200 feet of roadway being constructed.

Any areas where the field test indicates that the soil does not meet the moisture or density specification shall be wetted or dried as necessary, and reworked until the requirements are satisfied.

Except for City projects, the Contractor shall provide the Engineer with a soil classification, including a sieve analysis, plasticity index and a Proctor curve for each of the different soils to be encountered at the site. Copies of all field moisture/density testing performed by independent testing firms shall be submitted to the City. Cost for these tests shall be paid for by the Contractor.

9.3.12- BORROW

When the quantity of suitable excavated material required for the embankment and subgrade preparation is greater than the quantity that can be obtained from the excavation in the project, the Contractor shall make-up the deficiency from borrow pits. The borrow material shall be obtained from sources selected by the Contractor subject to approval of the Engineer. All material shall be clean and free from any environmental hazards. The Contractor shall obtain the written permission from the owner to procure borrow material, shall pay all royalty and other charges involved and shall bear all the expenses of developing the sources, including right-of-way for hauling.

9.3.13- EXCESS MATERIAL

All excavated material not required for the construction of embankments or for backfilling, including unsuitable material that has been removed at the direction of the Engineer, shall become the property of and be properly disposed of by the Contractor, unless otherwise stated in the Special Provisions.

9.3.14- PROOF ROLLING

Proof rolling with a rubber tired roller having an operating weight of at least 9 tons per axle (or comparable heavy equipment) will be required prior to the construction of the pavement and beneath curb and gutter. Proof rolling shall be done after the specified compaction has been obtained and verified by field testing. Areas found to be weak and those areas which failed shall be reworked to obtain the specified density at the Contractor's expense.

Following reworking, any areas that need to be removed because of soft soils below the compaction limits (from finished subgrade to six inches (6") below the base of cuts and fills or 12" for full depth asphalt paving) as evidenced through proof rolling will be replaced with suitable material as directed by the Engineer. This work will be paid for as "Remove Unsuitable Material". If no bid item exists, the price shall be negotiated before the work is performed. Any areas that need to be reworked which are within the compaction limits shall be done at the Contractor's expense.

9.3.15- REMOVAL OF UNSUITABLE MATERIAL

Whenever excavation below the specified elevation to remove soft or saturated soils, organic matter, or other unsuitable material is ordered by the Engineer, the Contractor shall remove same and replace with material acceptable to the Engineer. The replacement material shall be placed in layers not to exceed six inches (6") in thickness and shall be thoroughly compacted before the next layer is placed. The replacement material shall be re-tested in accordance with Section 9.3.14.

9.3.16- GRADING

All areas within the project area, including excavated and fill sections, shall be finished to a smooth and uniform surface conforming to the typical sections specified. Spot checks of finish grades shall not be more than 0.10 foot above or below the plan grade. Where bituminous or concrete surfacing materials are to be placed directly on the subgrade, the subgrade shall not vary more than 0.05 foot from the plan grade and the arithmetic average of ten random spot elevations taken along a 100 foot length of roadway shall be within ± 0.02 foot of the plan grades. Provide rounding at top and bottom of banks and at other breaks in grade.

9.4 - METHOD OF MEASUREMENT

In general, excavation and embankment will not be measured or paid for as a separate bid item but will be considered subsidiary to a bid item such as hot bituminous pavement, sidewalk, driveway, curb & gutter, etc..

When paid for as a separate bid item, excavation and embankment will be measured by the volume of embankment in cubic yards based on the cross sections and calculations by the Engineer. When paid for as a separate bid item, borrow shall be measured in cubic yards in its original position using the method of end areas.

Volume for unsuitable material shall be the actual measurements of the excavation required to remove the objectionable material computed to cubic yards. When the unsuitable material is replaced by aggregate base course, measurement shall be by the volume in cubic yards or by the ton and fraction thereof as evidenced by weight tickets for each truckload placed.

Rock excavation shall be measured as the actual volume in cubic yards of verified rock removed to the limits established by the Engineer.

9.5 - BASIS OF PAYMENT

No payment will be made for excavation and/or embankment unless noted otherwise in the Special Provisions. When paid for, embankment will be paid for per cubic yard as compacted in place material measured in accordance with Section 9.4. All costs associated with Clearing and Grubbing, Removal of Obstructions, Excavation, Embankment, Dust Control, Compaction, Grading and all related work shall be included in the cost for Embankment.

Payment for excavation to remove unsuitable material beyond the compaction limits shall be full compensation for all costs associated with the complete removal and disposal including hauling and landfill fees if necessary, and the replacement with suitable material.

Rock excavation will include all costs associated with the removal and disposal of rock as defined in this Article. Payment for rock excavation will be for actual costs of documented labor and equipment associated with rock removal plus 15% mark-up. Rates for equipment shall not exceed the rental rates used by the Colorado Department of Transportation.

ARTICLE 10

HOT BITUMINOUS PAVEMENT

10.1 – GENERAL

10.1.01 - DESCRIPTION

The construction of hot bituminous pavement shall consist of furnishing a mixture of mineral aggregate and bituminous binder, mixed, hauled, spread, compacted and finished in reasonably close conformance with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Engineer.

10.2 – MATERIALS

10.2.01 – SUBMITTALS

Asphalt suppliers furnishing asphalt for placement within any City right-of-way shall provide to the City, once every two years, asphalt mix designs for asphalt intended for use within the City right-of-way.

10.2.02 - ASPHALT CEMENT

Asphalt cement for the pavement mixture shall be PG 64-22 unless otherwise specified in the Article 2 - Special Provisions and shall conform to the requirements of Table 2 of AASHTO M 226. The cement shall be homogeneous, free from water, and show no tendency to foam when heated to three hundred forty seven degrees Fahrenheit (347°F). The spot test shall be negative for all grades when conducted with a naphthaxylene solvent containing not more than 10% xylene by volume.

Asphalt cement shall not be heated during the process of its manufacture, storage or during construction, to a temperature so as to cause the formation of carbonized particles. At no time shall the temperature of the asphalt cement be raised above three hundred seventy five degrees Fahrenheit (375°F) after loading in a tank for transportation from the refinery to the purchaser.

Written certification of compliance with these specifications shall be provided to the Engineer. The Engineer may, in the absence of written certification, require that samples of the asphalt cement be delivered to an approved testing laboratory to ensure compliance with these specifications. Costs for testing shall be paid for by the Contractor.

10.2.03 - ASPHALT AGGREGATES

The course and fine aggregates for hot bituminous pavement mixtures shall be graded and combined in such proportions that the resulting composite blend meets the grading requirements of the job mix formula. The job mix formula, with the aggregate tolerances, shall be within the master range set forth in the following table;

Master Range Table for Hot Bituminous Pavement

Sieve Size	Percent By Weight Passing Square Mesh Sieves			
	Grading G	Grading C	Grading CX	Grading F
1 1/2"	100			
1"				100
3/4"	63-85	100		
1/2"	46-78	70-95	100	
3/8"		60-88	74-95	
#4	22-54	44-72	50-78	
#8	13-43	30-58	32-60	45-85
#30	4-22	12-34	12-34	
#200	1-8	3-9	3-9	7-13

Grading of the aggregate shall be Grading C unless otherwise specified in Article 2 - SPECIAL PROVISIONS.

Coarse aggregate shall have a "Los Angeles Abrasion Test" (AASHTO T-96) percentage of wear not exceeding 45%. The aggregate shall be free from clay balls, organic matter, or other deleterious substances. At least 60% of the aggregate retained on the No. 4 sieve, and larger, shall have at least two (2) fractured faces.

10.2.04 - ASPHALT AGGREGATE MIXTURE (JOB MIX FORMULA)

The Contractor shall furnish to the Engineer, a mix design from an approved independent testing laboratory, of the hot bituminous pavement he proposes to use. This job mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature for the mixture at the discharge point at the plant. The job mix formula shall also give recommended temperatures for delivery and compaction. The job mix formula shall be determined a minimum of once per year, or when the asphalt supplier or aggregate characteristics change. After the job mix formula has been established, all mixtures furnished for respective projects shall conform thereto within the following range of tolerances:

Maximum Size	± 0%	
Passing No. 8 and larger sieves	± 8%	
Passing No. 30	± 6%	
Passing No. 200	± 2%	
Asphalt Content	± 0.5%	
Discharge Mix Temperature	± 20°F	

After the project is under contract, the job-mix formula may be changed by the Engineer for either of the following reasons:

- (a) Change in the job-mix formula will produce material of equal or better quality and will provide for more efficient pit operations.
- (b) Change in the job-mix formula will produce material of equal or better quality and will result in a cost savings to the City through an adjustment in unit price.

Asphalt mix designs containing reclaimed asphalt pavement (RAP) materials will only be allowed with written approval from the Director of Public Works.

10.2.05 - PRIME COAT

- (a) Description: When indicated in the bid proposal or the plans, all prepared or existing surfaces ready for asphaltic surfacing shall be primed with a cut-back asphaltic oil in accordance with these specifications, or as directed by the Engineer.
- (b) Surface Preparation: Before applying the prime coat, all loose material shall be removed from the surface as directed by the Engineer. The portion of the surface prepared for treatment shall be dry and in satisfactory condition.
- (c) Liquid Asphalt: The cut-back liquid asphalt shall be MC-70 and shall satisfy the requirements of ASTM 2027. MC-250 may be used under certain conditions with written permission of the Engineer.
- (d) Placing: The prime coat shall be placed by means of an approved pressure distributor capable of applying the prime coat uniformly to the surface to be treated in the required quantity and maintain the specified rate of the entire load regardless of changes in grade. Before application, the liquid asphalt shall be heated to the proper viscosity for spraying, however, the temperature shall not exceed 130°F. The rate of application shall be 0.3 gallons per square yard or as directed by the Engineer. The prime coat shall not be applied when the surface is wet or when the air temperature is less than 40°F, or when precipitation is imminent. The prime coat shall be carefully applied. If excessive amounts of curbs, sidewalks, driveways, or other structures are sprayed with liquid asphalt, they shall be cleaned to the satisfaction of the Engineer at the Contractor's expense. The prime coat shall be allowed to cure for a minimum of 24 hours prior to paving operation. If after the curing period, the prime coat has not penetrated the base materials, and the surface must be used by traffic, a suitable blotter material shall be applied in amounts needed to absorb excess liquid asphalt. The blotter material shall be a dry sand.

10.2.06 - TACK COAT

- (a) Description: Existing asphalt surfaces receiving an asphalt overlay, existing vertical concrete surfaces such as curb and gutter, crosspans and manholes, or between layers of multi-course asphaltic pavement structure, shall receive a tack coat consisting of an emulsified asphalt in accordance with these specifications at the locations shown on the plans, or as directed by the Engineer. Tack coat may be eliminated between successive lifts if the Contractor protects the surface from contamination.
- (b) Surface Preparation: Before applying the tack coat, surfaces shall be thoroughly cleaned of all dirt and other debris to ensure adequate bond between tack surface and asphaltic mat. The surface of the existing asphalt must be completely dry before placing tack coat.
- (c) Liquid Asphalt: The liquid asphalt used for tack coat shall be an emulsified asphalt grade CSS-1h or SS-1h and shall satisfy the requirements of AASHTO M 140 or M 208. Residue penetration test values shall be between 40 and 120. Other emulsified asphalts may be used upon written permission of the Engineer.
- (d) Placing: Refer to Section 10.2.05 (d). The rate of application shall be 0.1 gallons per square yard and shall provide a uniform and even coating of the surface. The surface shall be allowed to cure to permit drying and setting of the tack coat prior to the paving operation.

10.3 - CONSTRUCTION REQUIREMENTS

10.3.01 – PAVING CONSTRUCTION RELEASE

Prior to placing any new asphalt paving (except patching or overlay) for any City street, either Public or Private, the Contractor shall submit a signed Paving Construction Release form for review and approval by the City.

10.3.02 - MIXING PLANT

The requirements of this section shall be the same as Section 401.08 “Bituminous Mixing Plant” of the Standard Specifications for Road and Bridge Construction by the Colorado Department of Transportation, latest edition. For plant inspection, the Engineer or approved laboratory shall have full right to enter at any time and conduct necessary tests to ensure compliance with these specifications.

10.3.03 - HAULING EQUIPMENT

Trucks used for hauling the hot bituminous pavement mixture shall be equipped with tight, clean, smooth metal beds. The beds shall be coated with an oil or other approved material to prevent the mixture from adhering to the beds. Each load shall be covered with a tarp to protect it from inclement weather conditions when directed by the Engineer. Each truck shall be numbered and it’s Gross Vehicle Weight (GVW) and tare clearly visible.

10.3.04 - PAVING MACHINES

Unless otherwise permitted by the Engineer, the mixture shall be spread by means of a self-propelled laydown machine equipped with a screed or strike-off assembly and capable of spreading and finishing the hot bituminous pavement mixture to the line, grade, and crown as shown on the plans.

The paving machine shall be equipped with an automatic control system which will control the elevation of the screed and which is automatically actuated by a system of sensor operated devices which sense and follow reference lines or surfaces on one or both sides of the machine as required.

The screed shall be maintained at the proper elevation at each end by controlling the elevation of one end and automatically controlling the transverse slope or by controlling each end independently, as directed by the Engineer.

The automatic control system shall be capable of working with the following items and shall be furnished with the machine:

- (a) Ski-type device at least 30 feet in length
- (b) Short ski or short shoe

The screed or strike-off assembly shall effectively produce a finished surface of required evenness and texture without tearing, shoving or gouging the mixture. Two qualified operators shall be on the screed at all times during operation.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with the satisfactory laying of the mixture.

10.3.05 – ROLLERS

Unless permission is otherwise given, rollers shall be steel wheeled and pneumatic tire type and be in good condition, capable of reversing without backlash. They shall weigh not less than eight (8) tons. All rollers shall have a water system capable of keeping the wheels properly moistened to prevent adhesion to the wheels.

The number, weight and type of rollers shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The minimum number of rollers shall be two. Heavy equipment or rollers shall not be allowed to stand on freshly placed pavement.

Compaction equipment for asphalt patches may be conventional walk-behind or small ride-on compactors of sufficient type and size as necessary to achieve the compaction requirements of Section 10.3.09.

10.3.06 - PAVING SURFACE

After the pavement base has been prepared, it shall be made ready for paving by clearing any loose material off as directed by the Engineer. Paving on wet or frozen subgrade/base will not be permitted. When shown on the plans or where indicated in the Special Provisions, a prime coat shall be applied as specified in Section 10.2.05. A tack coat shall be used between courses of pavement in accordance with Section 10.2.06. Prior to placing any pavement surface, the prepared base/subgrade shall be approved by the Engineer for compaction, grade, crown, etc.

10.3.07- DELIVERY TEMPERATURE

The minimum and maximum delivery temperatures of the asphalt to the jobsite shall be as follows:

	Minimum	Maximum
For mixes not containing rubberized asphalt	- 235°F	285°F
For mixes containing rubberized asphalt	- 260°F	285°F

Asphalt above or below the above temperatures may be rejected.

10.3.08 - SPREADING AND FINISHING

The mixture shall be laid upon the approved base surface and struck off-to the required grade and elevation with the following exceptions:

- (a) The mixture shall be placed and compacted so the finished elevation of the asphalt is 3/8" inch above the lip of the gutter.
- (b) When spill curb & gutter is encountered, the mixture shall be placed and compacted flush with the lip of the gutter.

Pavers shall be used to distribute the mixture over the entire surface except where hand placing is necessary.

On the areas where the use of mechanical pavers cannot be used, the mixture shall be spread, raked and luted by hand tools.

When production and delivery of the mixture can be maintained, pavers may be used in echelon to place the wearing course in adjacent lanes.

The material shall be placed in a maximum compacted thickness of three inches (3") and a minimum compacted thickness of twice the diameter of the aggregate, unless otherwise directed by the Engineer.

10.3.09 - COMPACTION

After the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly compacted by rolling. Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the street centerline, each pass overlapping one-half the roller width, gradually progressing to the crown of the street. When paving adjacent to a previously placed lane, the longitudinal joint shall be rolled first followed by the regular rolling procedure.

When paving along curves having superelevation, rolling shall begin at the low side and progress towards the high side.

Rolling shall continue until all roller marks are eliminated. Final rolling shall be done with a steel wheeled roller. Use of vibratory rollers with the vibrator on will not be permitted during surface course final rolling.

Pavement other than Grading F shall be compacted to a density of 92% to 96% of the maximum theoretical density, determined according to AASHTO T 209. Grading F shall be compacted to a density of 90% to 95% of the maximum theoretical density. Testing to ensure compliance shall be supplied and paid for by the City. In general, one test for every 1000 square yards of paving with a minimum of one test shall be provided at each location.

Any mixture that becomes loose or broken, mixed with soil, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding areas.

10.3.10 - JOINTS

The longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed. If directed, the joints shall be coated with tack coat material.

Transverse joints shall be formed by cutting through the previously laid course to expose the full depth of the course and coated with tack material. Transverse joints on successive layers shall be offset by a minimum of twelve inches (12").

Longitudinal joints on successive layers shall be offset by a minimum of six inches (6"). The joints in any pavement layer shall not fall in a wheel track. The joints in the top layer of a new pavement not built on top of an existing pavement shall be located as follows:

- (a) For two-lane roadways, at the centerline of the pavement and at the outside edge of the travel lanes.
- (b) For roadways of more than two lanes, at the lane lines and at the outside edge of the travel lanes.

10.3.11 - WEATHER LIMITATIONS

Hot bituminous pavement shall be placed only on properly constructed surfaces that are free from water, snow, or ice. The bituminous mixtures shall be placed in accordance with the temperature limitations of Table 10-1 and only when weather conditions permit the pavement to be properly placed and finished, as determined by the Engineer.

Table 10.1
Placement Temperature Limitations
Air and Surface Temperature

Compacted Layer Thickness (Inches)	Minimum (degrees F)	
	Top Layer of Pavement	Layers Below Top Layer
1 or less	60	50
> 1 to 3	50	40

Note: Air temperature is taken in the shade

When it is in the public interest and approved by the Engineer, minimum temperature requirements may be waived for placing prime coats and layers of bituminous mixtures. However, pavement operations will be suspended when density requirements are not met. Approval to place asphalt at reduced temperatures does not limit the Contractor's warranty requirements.

10.3.12 - SURFACE AND THICKNESS TOLERANCES

The surface of the finished pavement shall be free from depressions exceeding 3/16 inch in ten (10) feet, when tested with a straight edge. All depressions exceeding the specified tolerances shall be corrected by removing the defective work and replacing it with new material as directed. The surface shall be smooth and true to the established crown and grade, free from areas of course aggregate showing at the surface. Layer thickness shall be within $\pm 25\%$ on lower lifts and $\pm 1/4"$ on the surface lift.

10.3.13 – VERIFYING THICKNESS

If the thickness of the asphalt is suspected to be less than the specified thickness, then at the discretion of the Engineer, coring of asphalt may be required by the contractor at his expense, to determine quality and thickness of asphalt/ base. If discrepancies are found, areas may be rejected by the Engineer and replaced by the contractor at his expense.

10.3.14 - PROTECTION OF PAVEMENT

The Contractor shall arrange the work in such a manner as to cause a minimum of inconvenience to the traveling public and the abutting property owners. The Contractor shall provide all necessary Traffic Control as required for the safe and successful completion of the work. Newly placed asphalt shall be protected from traffic until it has been compacted and cooled.

10.3.15 - PATCHING

Remove the material to the depth and extent required in accordance with the Special Provisions or the Standard Detail, whichever applies. Prepare the subgrade to the requirements of Article 9 – EARTHWORK. Depth or thickness of the base course and hot bituminous pavement shall be as defined on the drawings, Special Provisions, or as necessary to match the existing conditions, whichever is greater. Construction of patches shall conform to all applicable sections of this article. Spreader boxes may be used to place asphalt for patches. Compaction Equipment for asphalt patches may be conventional walk-behind or small ride-on compactors of sufficient type and size as necessary to achieve the compaction requirements of section 10.3.09.

10.3.16 – PAVING AROUND MANHOLES

Manholes are to be paved over and brought up to grade after paving is completed. The setting of concrete rings to plan elevation prior to paving is not allowed. A film of bond breaking solution shall be applied prior to paving. Contractor is required to reveal manhole lids to ensure that the range of adjustments is within the required 12" maximum before paving.

10.4 - METHOD OF MEASUREMENT

The quantity of hot bituminous pavement to be paid for shall be measured by one of the following as determined by the Bid Proposal:

- a) The number of square yards of pavement of the specified thickness complete in place as measured in the field and accepted by the Engineer.

- b) The number of tons of asphalt delivered and placed in accordance with the plans and specifications and accepted by the Engineer. Individual weight tickets for each truckload from state certified scales shall be furnished to the Inspector, signed by the driver and include the following information:

Date
Time Dispatched
Gross Weight
Tare Weight
Net Weight
Project
Destination
Truck No.
Asphalt Mix Type
State allowable Gross Vehicle Weight (GVW)

Asphalt delivered in trucks that exceed the rated GVW will be used but the excess over GVW will not be paid for. Any material delivered to the site without a weight ticket will not be paid for.

Except for sewer trenches, patching shall be measured by the square yards of asphalt completed and accepted by the Engineer, unless otherwise stated in the bid schedule or Article 2 - SPECIAL PROVISIONS. The limits of the patch shall be marked by the Engineer in advance of demolition and any removal beyond these limits will not be considered for payment. Patching of sewer trenches shall conform to Article 12 - SANITARY SEWER.

10.5 - BASIS OF PAYMENT

Hot bituminous pavement will be paid for at the unit price per square yard or ton as set forth in the Bid Proposal. This payment shall be full compensation for all related earthwork as defined in Article 9 - EARTHWORK, all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and these specifications. The payment shall be full compensation for aggregate base construction, materials hauling, prime (when specified) and/or tack coats applied and placing and compacting asphalt in accordance with these specifications.

The unit price for asphalt patching shall include all labor and materials to construct a complete patch, including but not limited to, traffic control, cutting the asphalt, removing the existing asphalt material and base, and removal of any excess or unsuitable subgrade soils and replacement (if necessary) to a depth of six inches (6") below the finished subgrade elevation. It shall also include applying tack coat, replacement of base materials, constructing asphalt surface in two inch (2") lifts and sealing the joint between new patch and existing asphalt with tack oil after the patch is made.

ARTICLE 11

ASPHALTIC OVERLAY

11.1 – GENERAL

11.1.01 - DESCRIPTION

Asphaltic overlay shall consist of furnishing, placing, and compacting a mixture of mineral aggregate and asphalt cement binder onto the prepared surface of an existing roadway pavement in accordance with these specifications.

11.2 - MATERIALS

11.2.01 - ASPHALT CEMENT

The asphalt cement for the pavement mixture shall conform to the requirements of AASHTO M 226, and shall be PG64-22 unless specified otherwise in Article 2 - Special Provisions. The asphalt cement content shall be approximately, $5.5\% \pm 0.5\%$ by weight of the mixture for CX Modified. The actual asphalt cement content shall be determined by the Job Mix Formula submitted and approved for the project. The asphalt shall be homogeneous, free from water and show no tendency to foam when heated to three hundred forty seven degrees Fahrenheit (347°F). The spot test shall be negative for all grades when conducted with a naphthaxylene solvent containing not more than 10% xylene by volume.

Asphalt cement shall not be heated during the process of its manufacture, storage or during construction to a temperature so as to cause the formation of carbonized particles. At no time shall the temperature in storage be more than ten degrees Fahrenheit (10°F) below the actual flash point of the asphaltic cement, nor shall the temperature of the asphalt cement be raised above 375°F after loading in a tank for transportation from the refinery to the purchaser.

Written certification of compliance with these specifications shall be given to the Engineer. The Engineer may, in the absence of written certification require that random samples of the asphalt cement be delivered to an approved testing laboratory for testing to ensure compliance with these specifications, at the Contractor's expense.

11.2.02 - EMULSIFIED ASPHALT

Liquid asphalt for tack coat shall be an emulsified asphalt grade CSS-1h or SS-1h and shall satisfy the requirements of AASHTO M 140 or M 208. Residue penetration test values shall be between 40 and 120. Other emulsified asphalts may be used upon written permission of the Engineer.

11.2.03 – ASPHALT MIX DESIGN (CX – MODIFIED)

At least 85% of the aggregate shall be crushed rock. The aggregate for the job mix formula shall have a minimum of 75% by weight of the material retained by the #4 and larger sieves with two fractured faces. A fifty blow Marshall test for stability with a minimum stability of 2500 shall be used. No Reclaimed Asphalt Pavement (RAP) will be allowed in the mix design. The asphaltic cement used for this mix design shall be PG64-22 or equivalent. This job mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature ($\pm 20^\circ$ F) for the mixture at the discharge point at the plant. The job mix formula shall also give recommended temperatures for delivery and compaction. The job mix formula shall be determined a minimum of once every two years, or when the asphalt supplier or aggregate

characteristics change. After the job mix formula has been established, all mixtures furnished for respective projects shall conform thereto within the range tolerances of the following table, Paragraph 11.2.04 (Aggregate). Test will be randomly taken by an independent laboratory (laboratory different from the laboratory used by the Contractor). Split samples will be available to the Contractor for his own analysis at a laboratory of his choice. Asphalt that has been determined to not comply with the Job Mix Formula shall be removed, disposed, and new asphalt laid at the total expense of the Contractor. The Contractor shall at his own expense provide the City documents of the results of Asphalt Mix test per the following schedule:

0 – 500 Tons----- 1Test ----- 1 Test during first 500 tons
 500 – 10,500 Tons ----- 1 Test per each 2000 tons----- 5 Test during next 10,500 tons
 10,500 – 35,500 tons ----- 1 test per each 5000 tons ----- 4 test during next 20,000 tons

A total of 10 tests at Contractor’s Expense are required at the designated intervals (tonnage). No two tests may be performed within 500 tons of another required tests unless retesting for a failed (out of spec.) test. The locations of the tests shall be determined by the City. The City may also take additional test at their expense. Any asphalt test that does not comply with the mix design will require an immediate retest at the Contractors expense.

11.2.04 – AGGREGATE CX-MODIFIED

The course and fine aggregate for hot bituminous CX Modified pavement mixtures shall be graded and combined in such proportions that the resulting composite blend meets the grading requirements of the job mix in the following tables:

Master Range Table for Hot Bituminous Pavement Grade CX Mod.

Percent by weight passing square mesh sieves

Sieve	% Passing	Tolerance
1/2"	100%	0
3/8"	74-95%	+ 8%
#4	50-78%	+ 8%
#8	32-60%	+ 8%
#30	12-34%	+ 6%
#200	3-9%	+ 2%

11.2.05 - JOB MIX FORMULA

The Contractor shall furnish to the Engineer a mix design from an approved testing laboratory of the CX Modified that he proposes to use. The job mix formula shall be within the range as shown in the table above.

11.2.06 - CRACK SEALANT

Crack sealant material shall meet the requirement of ASTM D3405-78. Along with the bid, the Contractor shall submit a material safety data sheet and material specification report for the material that he intends to use.

11.3 - CONSTRUCTION REQUIREMENTS

11.3.01 – CONSTRUCTION SCHEDULES

The Contractor shall submit a detailed and complete schedule at the pre-construction conference showing the route and order of asphalt removal, asphalt patching, overlay, raising of manholes, and concrete removal and replacement. Any street adjacent to a school shall not be resurfaced while school is in session. The contractor shall schedule the work so that **no** construction shall take place on the city streets within six blocks of the perimeter of the fairgrounds on weeks prior to and during the Colorado State Fair, the Pueblo County Fair, or during High School Graduation ceremonies.

11.3.02 - TRAFFIC CONTROL

The Contractor shall submit a traffic control plan prepared by a Certified Traffic Control Supervisor, covering all phases of the proposed construction at the preconstruction conference for approval by the Traffic Engineer.

All traffic control procedures, signing, lighting and barricades shall conform to the "Manual on Uniform Traffic Control Devices", and shall be set up and maintained by a Certified Traffic Control Supervisor.

The Traffic Control Supervisor shall be certified as a Worksite Traffic Supervisor by the American Traffic Safety Services Association (ATSSA) or Colorado Contractors Association (CCA). A copy of the Traffic Control Supervisor's Certification shall be provided to the Engineer at the pre-construction conference.

The Contractor shall provide all barricades, flagmen, control devices, etc., as are necessary to control traffic and protect the areas under construction. Also, he must provide all devices required to ensure that the project areas are free from parked vehicles when he intends to work on that street. A minimum of 24 hours advance warning must be given. Notify the Engineer immediately if any vehicles are parked along the path of the proposed operation so that appropriate measures can be taken.

11.3.03 - MIXING PLANT

The requirements of this section shall be the same as Section 401.08 "Bituminous Mixing Plant" of the Standard Specifications for Road and Bridge Construction by the Colorado Department of Transportation, latest edition. For plant inspection, the Engineer or approved laboratory shall have full right to enter at any time and conduct necessary tests to ensure compliance with these specifications.

11.3.04 - HAULING EQUIPMENT

Trucks used for hauling the asphaltic concrete mixture shall be equipped with tight, clean, smooth metal beds. The beds shall be coated with an oil or other approved material to prevent the mixture from adhering to the bed. Each load shall be covered with canvas or other suitable material of sufficient size to protect the mixture when directed by the Engineer. Each truck shall be numbered with its Gross Vehicle Weight (GVW) and tare clearly visible on the outside of the truck.

11.3.05 - PAVING MACHINES

Bituminous pavers shall be a self-propelled unit provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in widths applicable to the specified typical section and thicknesses shown on the plans or specified.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

The paving machine shall be equipped with an automatic control system which will control the elevation of the screed and which is automatically actuated by a system of sensor operated devices which sense and follow reference lines or surfaces on one or both sides of the machine as required. The screed shall be maintained at the proper elevation at each end by controlling the elevation of one end and automatically controlling the transverse slope or by controlling each end independently, as directed.

The automatic control system shall be capable of working with the following items and they shall be furnished with the machine:

- a. Ski-type device at least 30 ft. in length
- b. Short ski or short shoe

The screed or strike-off assembly shall effectively produce a finished surface of required evenness and texture without tearing, shoving or gouging the mixture. Two qualified operators shall be on the screed at all time during operation.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture.

11.3.06 - ROLLERS

Rollers shall be steel wheeled and pneumatic tire type and be in good condition, capable of reversing without backlash. They shall weigh not less than eight (8) tons. All rollers shall have a water system capable of keeping the wheels properly moistened to prevent adhesion of the mixture to the wheels.

11.3.07 - PAVING SURFACE

The pavement shall be clean and dry prior to overlay. All sweeping shall be accomplished by the Contractor unless otherwise stated in the Contract Documents. Equipment shall be a self-contained street sweeper and not a power broom. The Contractor shall properly dispose of all sweeping material and shall keep all sidewalks, gutters, and lawns free from debris.

All organic matter (weeds, grass, etc.) growing in cracks in the streets shall be removed by the Contractor, unless otherwise stated in the Contract Documents, with a systemic herbicide (Round-Up or approved equal) two (2) weeks prior to placing any crack sealant, paving fabric, or asphaltic overlay. The herbicide shall be applied with a hand-held sprayer. All weed stems and stubble shall be removed.

11.3.08 - WEATHER LIMITATIONS

Asphaltic overlay shall not be applied when it is raining or immediately after a rainfall. Operations will be suspended when it begins to rain and only that asphalt being unloaded or in the hopper may be placed. Asphaltic overlay shall not be applied when the ambient temperature, taken in the shade, is below 60°F.

11.3.09 - TACK COAT (FOR STREETS TO BE OVERLAYED WITHOUT FABRIC)

After sweeping, the pavement surface will be inspected by the Engineer. If satisfactory, the existing pavement shall receive a tack coat of emulsified asphalt. The material shall be uniformly applied with a pressure distributor. The rate of application shall be 0.1 gallons per square yard (min.).

Tack coat shall be applied in such a manner as to offer the least inconvenience to traffic and to permit one-way traffic without pick-up or tracking of the bituminous material. Tack coat shall not be applied after sunset, in cold weather (below 60°F), or on wet pavement. The surface shall be allowed to cure to permit drying and setting of the tack coat prior to the paving operation. When traffic is maintained, not more than ½ of the width of the section shall be treated in one application, or sufficient width shall be left to adequately handle traffic. Bituminous material shall not be placed on any surface where traffic will travel on the freshly applied material.

11.3.10 - SPREADING, FINISHING AND COMPACTION

Material shall be spread to obtain the minimum one inch (1") compacted thickness unless specified otherwise in the contract documents. The asphaltic overlay coat mixture shall be dumped directly into the laydown machine hopper. Dumping the mixture onto the pavement ahead of the laydown machine will not be permitted. The laydown machine shall be used to spread the mixture either over the entire width or over such partial width as may be designated.

The asphaltic overlay shall be rolled in a longitudinal direction, beginning at the outside edge and progressing towards the center. Rolling operations shall be conducted in such a manner that shoving, distortion, or stripping will not develop beneath the roller. The amount of rolling shall be confined to only that necessary for consolidating the asphaltic overlay and bonding it to the underlying surface course. Excessive rolling shall be avoided. Final rolling shall be done with a steel wheeled roller.

11.3.11 - TREE BRANCHES

The Contractor shall trim any overhanging tree branches that are in his way and shall haul them off and properly dispose of them at his expense.

11.3.12 - OPEN GRATE INLETS

The Contractor shall cover all open grate inlets that are encountered within the project to insure that asphalt does not drop into the inlets.

11.3.13 - JOINTS

Transverse joints shall be formed by cutting through the previously laid course to expose the full depth of the course. Additional care shall be taken to avoid rough longitudinal joints. A coating of tack coat material shall be used on contact surfaces of all joints just before additional mixture is placed.

11.3.14 - REMOVAL OF ASPHALT MAT (COLD PLANING)

Removal of the asphalt mat (cold planing) shall consist of removing asphalt from each lane as shown on the typical section, unless otherwise directed by the Engineer. Removal shall be done by the use of an approved planing machine or grinder capable of removing, in one pass, a layer of bituminous material three inches (3") in depth. The planing machine shall be equipped with an automatic control system which will control the elevation of the drum and which is automatically actuated by a system of sensor-operated devices which shall sense and follow a uniform grade. Removal of asphalt mat shall be done in such a manner as to ensure a level riding surface. If a manhole and/or valve box is encountered, the asphalt shall be removed around the manhole to allow for the thickness of overlay. The finished planed surface shall be uniform and irregularities shall not vary more than ½ inch across the width.

All removed asphalt mat will become the property of the City, and shall be delivered to a designated site, within a three (3) mile radius of the site, for stockpiling. The Contractor shall contact the Engineer prior to hauling any removed material to find out the specific stockpile location.

At the completion of the day's work, vertical cuts greater than one inch (1") will not be allowed to remain in the areas being planed and the roadway shall be left in a stable condition acceptable to the Engineer.

It is the responsibility of the Contractor to locate all manholes, valves, monument boxes, or other metallic features whether exposed or hidden from view. No claims for damages will be allowed for failure of the Contractor to locate these objects.

11.3.15 - ASPHALT PATCH CONSTRUCTION

The Contractor shall schedule the asphalt patching to coordinate with the asphalt mat removal and asphaltic overlay schedule. Where asphalt patching occurs in an area to be cold planed, the cold planing shall be done before the asphalt patch. Asphalt patching is to be done prior to crack sealing.

Patch design shall be as noted on the drawings or as specified in Article 2, SPECIAL PROVISIONS. Patching shall conform to Article 10 - HOT BITUMINOUS PAVEMENT (PATCHING).

11.3.16 - CRACK SEALING

Crack sealing, when specified, shall follow cold planing and patching operations. After the street has been crack sealed a curing period shall be observed in accordance with the manufacturers recommendations.

The material shall be proportioned, blended and heated and applied in accordance with approved manufacturer's specifications. Mixing of different manufacturer's brands or different types of sealant shall be prohibited.

The Contractor shall use a hot compressed air lance and band-aid squeegee operation. The hot compressed air lance shall supply super-heated air at high velocity (minimum of 2800 FPS at 2800°F) to the crack area, using approved methods and techniques to provide clean bonding faces which are free of moisture, dirt, clay materials, latence and organic materials in the crack and immediate area surrounding the crack.

All cracks to be sealed shall have a minimum width of one quarter inch (1/4"). Any material used to seal cracks less than 1/4 " will not be paid for unless specifically approved by the Engineer in advance. The squeegee shall produce a band of uniform thickness and width with anchor (wipe) zones on either side of the band.

Freshly placed sealant shall be protected from vehicular traffic until it has cured enough that it will not track by vehicular or pedestrian traffic.

11.3.17 - PAVING FABRIC

After sweeping, the pavement surface will be inspected by the Engineer. If satisfactory, where shown on the plans, the Contractor shall furnish and install the paving fabric according to the manufacturer's recommendations. The fabric shall be of non-woven synthetic fibers; resistant to chemical attack; mildew and rot resistant; and shall meet the following requirements:

PROPERTY	REQUIREMENT
Tensile Strength - lbs.	90 minimum *
Elongation at break - %	50 minimum
Asphalt Retention - gal./sy.yd.	0.20 minimum
Melting Point - °F	300 or greater

- Minimum value in weaker direction. All numerical values represent minimum average roll values.

The material used to impregnate and seal the fabric, as well as bond it to both the base pavement and overlay, shall be PG64-22. The asphalt sealant shall be heated to a range from 290°F to 325°F and shall be evenly applied with a distributor truck at an approximate rate of .25 gallons/square yard. The Engineer and/or manufacturer's representative may slightly vary the rate in order to achieve a maximum absorption without bleeding. The manufacturer's representative shall be present to supply information on the appropriate method of installation.

The fabric shall be placed into the asphalt sealant with a minimum of wrinkling prior to the time the asphalt sealant has cooled and lost tackiness. As directed by the Engineer, wrinkles or folds shall be slit and laid flat. Brooming and/or pneumatic rolling will be required to maximize fabric contact with the pavement surface. Transverse joints shall be lapped in the direction of paving to prevent pickup by the paver. A second application of asphalt sealant to fabric overlaps shall be required if in the judgement of the Engineer it is needed to ensure proper bonding of the double fabric. Tack coat shall be applied at the joints before the next roll of fabric is placed. Overlap of fabric at joints shall be from one inch (1") to three inches (3") and the width of the tack coat shall be the same. The gap between the asphalt edge and fabric shall be six inches (6") min. and twelve inches (12") max.

Placement of asphaltic overlay shall closely follow fabric laydown. The temperature of the mix shall not exceed 325°F. In the event asphalt bleeds through the fabric causing construction problems before the overlay is placed, the affected areas shall be blotted by spreading sand or hot mix. Turning of the paver and other vehicles shall be gradual and kept to a minimum.

11.3.18 - RAISING MANHOLES

After the asphaltic overlay has been applied, all manhole rings and covers for sewer and access vaults shall be raised to be flush with the surrounding pavement. Raising of manhole rings and covers shall be done to conform to the Standard Details and all applicable provisions of Articles 12 and/or 13 shall be followed.

All manhole rings shall be adjusted by the Contractor. Existing rings and covers shall be used, unless light weight castings are encountered. The Contractor shall remove all light weight castings and replace them with heavy duty castings. The Contractor shall deliver all light weight manhole castings to the City storage yard, paid for as Furnish and Adjust Manhole to Grade.

All manholes having ring and covers less than or equal to one quarter inch 1/4" below the surrounding pavement need not be raised, but shall be cleaned of any residual asphalt. The surrounding asphalt shall be blended to provide a smooth driving surface over said ring and cover.

All manhole locations shall be the responsibility of the contractor. No locations shall be marked on the curbs with paint. The use of Rubber I.D. Locators, or equivalent shall be included under bid item ("Adjust Manholes to Grade").

Asphalt for patching around manholes shall be grading CX Modified.

11.3.19 - ADJUSTMENT OF VALVE AND MONUMENT BOXES

All valve (water and gas) and top flange monument boxes are the responsibility of the Contractor to adjust. The Board of Water Works and Natural Gas Company shall be furnished with a schedule of paving at the pre-construction conference. The Board of Water Works, Natural Gas Company and the City will have crews break loose and reference their valves/monuments in advance of paving, but will require the Contractor to set them to grade and pave around them. The above work shall not be a pay item, but shall be included with the cost of the asphaltic bid item. Due to the potential liability of not having access to the water valves to isolate a water main break, a monetary penalty of Fifty Dollars (\$50) per valve box will be assessed for each valve box not raised before breakdown rolling.

11.3.20 - LEVELING COURSE

- (a) By Hand: In areas where asphalt is to be placed using shovels, use Grade F mix as specified under Article 10.
- (b) By Machine: Use Hot Bituminous Asphalt mix as specified under Article 10 for streets to receive a leveling course that is to be placed using a lay-down machine.

11.4 - METHOD OF MEASUREMENT

- (a) Asphaltic overlay shall be measured by the actual tons placed and accepted by the Engineer. The Contractor shall furnish a weight ticket to accompany each load to the paving site. Each ticket shall contain the following information:

Date
Time Dispatched
Gross Weight
Tare Weight
Net Weight
Project
Destination
Truck No.
Asphalt Mix Type
State Allowable Gross Vehicle Weight (GVW)

Asphalt delivered in trucks that exceed the rated GVW will be used but the excess will not be paid for.

- (b) Removal of Asphalt Mat: Removal of asphalt mat (cold planing) will be measured in square yards, completed to the required depth and accepted by the Engineer.
- (c) Asphalt Patching: Asphalt patching shall be measured by the square yards of asphalt completed and accepted by the Engineer. The limits of the patch shall be marked by the Engineer in advance of demolition and any removal beyond these limits will not be considered for payment.
- (d) Crack Sealing: Crack sealing shall be measured by the ton and fraction thereof for material placed and accepted by the Engineer. Documentation of material used shall be done on a daily basis and shall be based upon a count of empty boxes and compared against the remaining stockpiled material.
- (e) Paving Fabric: Payment for the fabric shall be by the square yard of surface area covered and shall be field measured before the overlay is installed.
- (f) Sweeping: Sweeping shall not be measured separately but shall be paid as a separate item based upon the number of tons of asphaltic overlay placed.
- (g) Traffic Control: see Basis of Payment
- (h) Raising manholes: Each manhole raised or furnished and/or adjusted to surrounding street grade will be paid for at the unit bid price. Any manhole not raised will not be paid for. Work to expose manhole rings and covers not raised will not be measured separately.
- (i) Leveling Course: The asphalt materials placed for leveling shall be measured by the actual tons placed and accepted by the Engineer.

The Contractor shall furnish a weight ticket containing the information required under Section 11.4 (a) to accompany each load to the paving site.

11.5 - BASIS OF PAYMENT

- (a) Asphaltic overlay: The unit price per ton shall be full compensation for tack coating, furnishing, hauling, placing, rolling and all other work incidental to a complete installation of the seal coat. Verification of the number of tons placed shall be done on a daily basis.
- (b) Removal of Asphalt Mat: Payment for cold planing shall be considered as full compensation for all labor and materials required to accomplish the work to the satisfaction of the Engineer. It shall include all clean-up, including sweeping of loose chips, any required traffic control and delivery costs of the removed material to the designated stockpile locations.
- (c) Asphalt Patching: The unit price shall include all labor and materials to construct a complete patch, including but not limited to, traffic control, cutting the asphalt, removing existing asphalt material and base, removal of excess material to subgrade, scarifying and recompacting the subgrade and/or removal and replacement (if unsuitable) to a depth of six inches (6") below the finished sub-grade elevation. It shall also include, applying tack coat, replacement of base materials, constructing asphalt surface in two inch (2") lifts and sealing the joint between new patch and existing asphalt with tack oil after the patch is made.
- (d) Crack Sealing: Payment shall be full compensation for all labor and materials necessary to complete this work in accordance with these specifications. It shall include traffic control, crack preparation, furnishing and placing the sealant, and any items incidental to the proper completion of the work.
- (e) Paving Fabric: The unit price shall include furnishing the fabric, asphalt sealant and all labor, equipment and traffic control necessary to place the fabric.
- (f) Sweeping: Payment for sweeping prior to installation of asphaltic overlay shall be full compensation for all work necessary to accomplish the task to the satisfaction of the Engineer. It shall include any required traffic control or disposal costs. All cost for sweeping associated with removal of asphalt mat (cold planing) shall be included with that item.
- (g) Traffic Control: Payment for traffic control for all overlay and leveling courses shall be by the tons of asphalt placed. Payment for all other traffic control for operations such as cold planing, installing paving fabric, patching, crack sealing, sweeping, and adjusting manholes to grade shall be included in the bid item and will not be a separate pay item.
- (h) Raising Manholes: Payment for raising manhole rings and covers and/or furnishing and adjusting manhole castings shall be for each one raised and accepted. It shall include all incidentals including traffic control, cutting, asphalt removal, adjustment rings, grouting, and asphalt patching. Work to expose manhole rings and covers not raised will not be paid separately.
- (i) Leveling Course: Payment for leveling courses shall be full compensation for all labor and materials necessary to accomplish the work in accordance with these specifications.

ARTICLE 12

SANITARY SEWERS

12.1 - GENERAL

12.1.01 - DESCRIPTION

The work covered by this section of the specifications consists of the furnishing of all labor, supplies, equipment and materials and performing all operations in connection with the construction of sanitary sewers and appurtenances, as shown on the plans, as herein specified and directed by the Engineer.

12.1.02 - PLANS AND DATA

Profiles of the ground are shown on the plans for the work. The Contractor must satisfy himself regarding the character of the material to be excavated and the work to be done.

12.1.03 - SOURCE OF SUPPLY

Materials complying with these specifications will be accepted from any source of supply. The Engineer reserves the right to reject the entire output of any source from which it is impossible to secure a continuous supply of satisfactory material or a source where conditions are such that the use of unfit material can be prevented only by extraordinary methods.

The Engineer may require the taking and testing of preliminary samples of material from any source before that source is approved for delivery.

The Contractor shall be held responsible for the care and storage of materials delivered on the work site or purchased for use thereon. Any material that has been delivered on the work site and has become damaged before actual incorporation in the work may be rejected by the Engineer even though it may previously have been accepted. Stored material will be so located as to facilitate thorough inspection.

Materials which do not meet the requirements of these specifications will be rejected, and will be promptly removed from the work site.

12.2 - MATERIALS

12.2.01 - POLYVINYL CHLORIDE (PVC) PIPE

Polyvinyl chloride pipe shall be unplasticized polyvinyl chloride manufactured specifically for sanitary sewage and with an integral bell. All PVC pipe for diameters not exceeding fifteen inches (15") will conform to ASTM D3034 Standard Specifications. A minimum wall dimension ratio (ratio of the average specified outside diameter to the minimum specified wall thickness) shall be SDR 35. All PVC pipe for diameters eighteen inches (18") through twenty-seven inches (27") shall conform to ASTM F679 Standard Specifications. A minimum wall dimension ratio will be SDR 35 (minimum wall thickness T-1, Table 1, ASTM F679).

The bell end of all pipe shall contain a confined elastomeric gasket conforming to ASTM F477 and will be tested in accordance with ASTM D3212 Standard Specifications. PVC pipe shall not be exposed to ultraviolet light longer than six (6) months. Any discoloration of the pipe material will be evidence of ultraviolet damage and may be reason for rejection and removal from the project.

All PVC sewer pipe, six inches (6") in diameter or larger, shall be an integral green tint in color. Lightly tinted pipe will not be acceptable. Contractors shall install all PVC pipe with the identification markings on top so as to be visible from above. All pipe shall have a home mark on the spigot to indicate proper penetration when the joint is made.

Connections to an existing PVC pipe, for extensions or repairs, shall be made with a double bell coupling when a bell end does not exist, (ie. plain end to plain end connection). After it has been laid and backfilled, and prior to the placing of surface improvements, all PVC pipe shall be tested by the Contractor by means of a certified mandrel (go-nogo device).

12.2.02 - CAST IRON PIPE (CIP)

Cast Iron Pipe will not be allowed.

12.2.03 - DUCTILE IRON PIPE (DIP)

Ductile Iron Pipe shall be centrifugally cast, grade 60-42-10 iron conforming to ASTM A746 and ANSI A21.51 Standard Specifications. Thickness class for buried pipe shall be as determined by ANSI A21.51, Tables 51.1 and 51.2. Ductile Iron Pipe shall have rubber gasket push-on joints and shall have a polyethylene lining.

Polyethylene lining material shall conform to ASTM D1248 Standard Specifications, compounded without an inert filler except 3% carbon black to resist ultraviolet rays. The polyethylene shall be chemically bonded to the interior of the pipe. The lining shall have a nominal thickness of 40 mils and a minimum thickness of 35 mils.

Each piece of pipe shall be checked for holidays by the manufacturer. Holiday testing shall conform to ASTM G62 standard specifications.

Field cutting and coating of the cut pipe shall be made in accordance with the manufacturers recommendations. In no case shall polyethylene-lined pipe be cut with a torch.

An approved pipe bonding and cathodic protection system will be required on all buried ductile iron pipe.

12.2.04 - VITRIFIED CLAY PIPE (VCP) - EXTRA STRENGTH

Vitrified clay pipe will be allowed only when prior written approval is obtained from the Engineer.

12.2.05 - CONCRETE MANHOLES

Unless otherwise specified on the plans, or approved by the Engineer, manholes shall be constructed of precast concrete barrels and cones with cast-in-place concrete bases. Bases may be precast if placed on six inches (6") of compacted gravel bedding extending a minimum of twelve inches (12") around the base or the width of the excavation-which ever is greater. In the event severe groundwater conditions are encountered, the thickness of the gravel bedding below the manhole base shall be increased to twelve inches (12"). Alternate construction methods may be required as approved by the Engineer on a case by case basis. The concrete channel and bench within precast bases shall be poured on site after the sewer pipe is set to grade. Where possible, manhole channel shall be sewer pipe with the upper portion removed. Precast concrete barrels and cones shall conform to ASTM C478 Standard Specifications except that the wall thickness may be either wall A or wall B as described in ASTM C76 Standard Specifications. Provide eccentric cones for all manholes greater than six feet (6') deep, and flat lids for manholes six feet (6') deep or less as shown on the drawings. Manholes shall conform to the Standard Details shown on the plans.
Concrete

used in the construction of all sanitary sewer structures shall conform to those portions of ARTICLE 4 - CONCRETE, which are applicable.

All joints in the manhole barrel, cone, grade adjustment rings, and flat top sections shall be sealed with a preformed flexible plastic sealing compound conforming to Federal Specification SS-S-00210 (GSA-FS6). All joint surfaces shall be cleaned prior to applying the sealant. The outside of the manhole joints shall be wrapped with a butyl adhesive tape sealant that conforms to Federal Specification SS-S-00210 (GSA-FS6).

All pipe penetrations in cast-in-place concrete bases shall utilize two strips of the above mentioned preformed flexible plastic sealing compound, placed around the pipe, as a water stop. All pipe penetrations in precast concrete bases shall be provided with a resilient rubber connector in conformance with ASTM C923. When connection to an existing manhole is allowed a water stop and non-shrink grout shall be used at all pipe penetrations.

12.2.06 - MANHOLE STEPS

Manhole steps shall be made of minimum ½-inch steel bar conforming to ASTM A615 Grade 60 encapsulated in copolymer polypropylene. Steps shall meet the approximate dimensions as shown on the Standard Detail and shall conform to ASTM C478.

The installed steps shall be located so as to provide a continuous ladder with steps equally spaced vertically in the assembled manhole at sixteen inches (16"), plus or minus ¾ inch. The vertical alignment of steps shall not exceed 3" inches when measured from the top step to the bottom step. They shall be capable of withstanding a force of 350 pounds, applied at any place on the step and in any direction which projects from the point of application through a diameter of the step cross-section at that point, with no permanent deformation resulting.

12.2.07 - MANHOLE RING AND COVER ADJUSTMENT

- (a) BRICK - Brick may be used in the adjustment of existing brick manholes and those cases where specified on the plans, or by the Engineer. Contractor shall use whole bricks; broken or partial pieces of brick will not be acceptable. Brick to be used in the construction of manholes and other sanitary sewer appurtenances shall conform to the requirements of ASTM C32, Grade MM or C216, Type FBS Specifications for Sewer and Manhole Brick.
- (b) CONCRETE GRADE RINGS - Reinforced concrete grade rings may be used in the adjustment of manhole rings. Grade rings shall have a minimum thickness of two inches (2") and maximum thickness of six inches (6"). Total adjustment height shall not exceed the tolerances as shown on the Standard Details.

12.2.08 - MORTAR

Mortar for brick work shall be standard premixed mortar conforming to ASTM C387 or proportion one part Portland cement and two parts sand (by volume). The sand or fine aggregate shall meet the requirements of AASHTO M6 or M45 as applicable. Fine aggregate for mortar shall consist of natural sand having durable grains, free from injurious amounts of silt, shale, coal, organic matter or other deleterious materials.

When tested by means of laboratory sieves the fine aggregate shall conform to the following requirements:

SIEVE SIZE	AASHTO M6* PERCENT PASSING	AASHTO M45** PERCENT PASSING
No. 4	95 to 100	100
No. 8	---	95 to 100
No. 16	45 to 80	70 to 100
No. 30	---	40 to 75
No. 50	10 to 30	10 to 35
No. 100	2 to 10	---
No. 200	---	2 to 15

* For joints greater than ½ inch.

** For joints less than ½ inch.

12.2.09 - MANHOLE RING AND COVERS

Iron castings shall conform to the requirements of AASHTO M306. Gray iron used in the casting shall conform to AASHTO M105, Class 35B, unless otherwise specified.

Castings shall be boldly filleted at angles and the risers shall be sharp and perfect. Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes or other defects in positions affecting their strength for services intended. The ring and covers for manholes and all sanitary sewer appurtenances shall be straight and shall fit properly together so that traffic will not cause them to rattle. Rough spots, which prevent a suitable fitting, shall be removed by grinding. Manhole castings shall be Neenah R-1706, Deeter 1258, East Jordan Ironworks 2430 or approved equal. Manhole covers shall be lettered "SANITARY". See City Standard Details for additional information.

12.2.10 - REINFORCING STEEL

Reinforcing steel shall meet the requirements of ARTICLE 4 - CONCRETE, SECTION 4.2.02 - CONCRETE REINFORCING.

12.2.11 - BEDDING FOR PIPE

- (a) CLASS "A" BEDDING - Class "A" bedding shall be defined as that method of bedding by which additional supporting strength of the pipe is attained by supporting the pipe with a continuous concrete cradle. The lower part of the pipe shall be bedded in a continuous cradle constructed of concrete conforming to those portions of ARTICLE 4 - CONCRETE, which are applicable.
- (b) CLASS "B" BEDDING - Class "B" bedding shall be a well-graded crushed stone or slag. When tested by means of laboratory sieves it shall conform to the following requirements: (AASHTO M43, NO. 67 gradation)

SIEVE SIZE	PERCENT PASSING
1 in.	100
¾ in.	90 to 100
⅜ in.	20 to 55
No. 4	0 to 10
No. 8	0 to 5

When crushed gravel or stone is used, at least 50 percent, by weight, of the particles retained on the No. 4 sieve and above shall have at least two (2) fractured faces.

- (c) REINFORCED CONCRETE ARCH AND ENCASEMENT – Concrete and reinforcement for an arch or encasement shall conform to those portions of ARTICLE 4 – CONCRETE, which are applicable.

12.2.12 - TRENCH STABILIZATION MATERIAL

Backfill for unstable subgrade conditions shall be select material as approved by the Engineer. Contractor shall submit a sample and sieve analysis for Engineer's review and approval prior to delivery of the materials to the site.

12.2.13 - BACKFILL MATERIALS

Subject to the provisions specified herein, the material removed from the project excavations may be used as backfill. All organic material, rubbish, debris, and other objectionable materials shall be removed from the site and shall not be considered acceptable for backfill.

- (a) INITIAL BACKFILL - The specified selected material for the initial backfill (from the spring line of the pipe to a plane one foot (1') above the top of the pipe) in the "pipe zone" shall be Class "B" bedding material, unless stated otherwise on the plans. The initial backfill shall be carefully and simultaneously placed on each side of the pipe for the full width of the trench.
- (b) BACKFILL ABOVE THE PIPE ZONE - The material for backfill above the pipe zone (from the top of the bedding to a plane two feet (2') above the top of the bedding) shall be free from rocks, stones, concrete, or asphalt greater than three inches (3") in any dimension. If the Contractor cannot prevent rocks from accumulating at the top of the bedding during the backfill operation, then the Engineer may require an additional twelve inches (12") of Class "B" bedding or select material be provided at no cost to the City. Material for the backfill from a plane two feet (2') above the bedding to the top of ground shall be free from rocks, stones, concrete or asphalt greater than eight inches (8") in any dimension. All Material shall be well graded which can be consolidated with a minimum of voids.
- (c) IMPORTED BACKFILL MATERIAL - When a shortage of satisfactory backfill material occurs from a cause which is not the fault of the Contractor, as verified by the Engineer, the Contractor shall furnish all necessary suitable material. The imported backfill material shall be inspected and approved by the Engineer prior to import.

12.2.14 - SEWER SERVICE LINES

Sewer service lines shall be four inches (4") in diameter unless otherwise specified on the plans, or by the Engineer. Material for sewer service lines shall be PVC having a minimum wall dimension ratio with an SDR rating of 35 meeting the requirements of ASTM D3033 or D3034 or better. Sewer services shall be connected to the main, not the manhole, and shall be a wye fitting or a tee fitting when the diameter of the service line exceeds one-half ($\frac{1}{2}$) the diameter of the sanitary sewer main.

An approved wye or tee saddle may be used when the diameter of the service line is less than or equal to one-half ($\frac{1}{2}$) the diameter of the sanitary sewer main.

12.3 - CONSTRUCTION REQUIREMENTS

12.3.01 – RESERVED

12.3.02 - WATER LINE CROSSINGS

Where sanitary sewer mains cross water mains, the sewer pipe shall be a minimum of eighteen inches (18") clear distance vertically below the water main. If this clear distance is not feasible, the pipe section must be designed and constructed so as to protect the water main. Minimum protection shall consist of the installation of an impervious and structural sewer. For example:

- (a) **REINFORCED CONCRETE ENCASEMENT** - The sanitary sewer pipe shall be reinforced with a reinforced concrete encasement. The encasement shall be at least six inches (6") thick and extend a distance of ten feet (10') either side of the water main. See Section 12.3.11 - PIPE BEDDING LIMITS, REINFORCED CONCRETE ENCASEMENT.
- (b) **JOINT CENTERING** - The sewer shall be constructed such that one length of pipe, at least eighteen feet (18') long, shall be centered over the water main. Joints between the sewer pipe and special length pipe (18' section of pipe) shall be encased in a concrete collar at least six inches (6") thick and extending at least six inches (6") either side of the joint.

In all cases, proper soil compaction, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of either pipe.

12.3.03 - RAILROAD AND HIGHWAY CROSSINGS

At all railroad and highway crossings extreme care shall be exercised to safeguard life and property. All sewer work under and adjacent to railroads and highways shall be accomplished to the satisfaction of a representative of the railroad company and/or Colorado Department of Transportation (CDOT) and the Engineer. The Contractor shall obtain at his own expense all permits, bonds, and insurances necessary for the execution of his work, and/or required by the appropriate railroad or CDOT. Contractor shall submit a plan for approval for crossing railroads or highways unless otherwise shown on drawings.

12.3.04 - EXCAVATION - GENERAL

All excavation for sewer and/or manhole construction will be considered as unclassified excavation. The contractor shall make his own estimate of the type and extent of the various materials which will be encountered in the excavation.

All excavation shall be done by open cut from the surface except when boring is expressly herein permitted or directed in writing by the Engineer. Trenches shall be excavated along the lines and to the grades established by the Engineer. In no case, without previous written consent from the Engineer, shall more than five hundred feet (500') or one (1) block whichever is less, of trench be opened in one place in advance of the completed and backfilled sewer. All open cuts shall be backfilled and barricaded at the end of each day except the unfinished end of the conduit may be left unbackfilled to permit continuation the next working day.

Width of the trenches shall be kept to a minimum, but provide safe and adequate space for workmen. Contractor shall be responsible for protecting existing utilities and property. Contractor shall comply with all Local, State and Federal Health and Safety requirements including but not limited to deposition of cut, sloping, and/or bracing. The cost to meet these safety requirements shall be included in the respective bid items.

The Contractor shall barricade all excavations and ditch lines as specified in the Manual on Uniform Traffic Control Devices (MUTCD). The Engineer may require additional barricades at his

discretion. At the end of each day the Contractor shall remove all excess excavated material from travel ways, and thoroughly clean all streets, alleys, driveways, and sidewalks affected by the excavation. If it becomes necessary to accomplish this, all streets, driveways, alleys (if asphalt), and sidewalks shall be swept or washed as needed.

12.3.05 - TRENCH EXCAVATION - WIDTH AND DEPTH

The width of the trench shall provide adequate space for workmen to place, joint the pipe, and bed the pipe properly.

The minimum width of the trench from a plane four inches (4") below the pipe to a plane twelve inches (12") above the pipe shall be a minimum of nine inches (9") clear on each side from the undisturbed edge of the trench wall to the outside diameter of the pipe. This minimum trench width shall be used for measurement of trenches in rock.

The trench from a plane four inches (4") below the pipe to a plane twelve inches (12") above the pipe shall be excavated so the trench walls are as close to vertical as possible. The maximum trench width within this zone will not be limited but shall be kept as narrow as possible.

When using a movable trench support, care shall be exercised not to disturb the pipe location, jointing and bedding material. Any voids left in the bedding material by support removal shall be carefully filled with additional bedding material and properly tamped. The width and slope of the trench from a plane twelve inches (12") above the pipe to the top of the ground shall be determined by the Contractor. Considering factors shall include, but not be limited to; all safety requirements; type of material being excavated; equipment used; widths of dedicated right-of-ways; and adjacent structures, property and utilities.

The trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipe. Except in ledge rock, water bearing earth, or where a special pipe bedding is called for in the contract documents, the rough excavation of trenches shall extend no less than four inches (4") nor more than six inches (6") below the bottom of the pipe.

Correction of a trench grade that is too low shall be done by compacting select material of the types designated by the Engineer, over the entire width of the trench to 95% of AASHTO T99. Such work required due to over excavation will not be included for payment.

12.3.06 - HANDLING EXCAVATED MATERIAL

The material excavated from trenches, which is suitable for backfill, shall be kept so as not to significantly alter drainage flow patterns, endanger the work and to be of as little inconvenience as possible to the traveling public and the occupants of the abutting properties. Free access must be maintained at all times to driveways, fire hydrants, water valves, gas valves, existing manholes, etc., in the vicinity of the work.

Where lines are located in alleys or in any other case where the Contractor proposes to deposit material on private property, written permission shall be obtained from the owner of the property prior to placing any material on the property. The Contractor shall be held responsible for any damage to private property.

Materials encountered during clearing of the right-of-way and excavation of the trench such as rubbish, organic material, abandoned foundations and any other material which are not satisfactory for use as backfill in the opinion of the Engineer, shall be removed from the site and disposed of by the Contractor at his own expense.

12.3.07 - UNSTABLE SUBGRADE

Where unstable subgrade conditions are encountered, as determined by the Engineer, the Contractor may be required to excavate below subgrade elevation and backfill the unstable area with material as per Section 12.2.12 - TRENCH STABILIZATION MATERIAL. The material approved by the Engineer shall be used to an elevation four inches (4") below the bottom of the pipe. The extra depth of excavation and backfill shall be as ordered by the Engineer, and only when ordered by the Engineer.

If the unstable condition is a result of the Contractor not properly protecting his work from surface water infiltration, or from sewer or water lines damaged or broken by the Contractor, the cost shall be borne by the Contractor. If the unstable soil condition is the result of ground water infiltration and other causes beyond the control of the Contractor, the extra foundation material ordered by the Engineer will be paid for.

12.3.08 - TRENCHES IN ROCK

Rock will be defined as any naturally occurring or manmade material in such a form that it cannot be readily removed using the equivalent of a 165hp/40,000lb operating weight track-type tractor (bulldozer) with a ripper or a 188hp/63,000lb operating weight hydraulic excavator (crawler mounted backhoe) with "rock teeth" without a significant loss of production. It also includes boulders exceeding one-half ($\frac{1}{2}$) cubic yard in volume.

Whenever rock material is encountered in an excavation, the Contractor shall immediately notify the Engineer for field verification. The Engineer shall measure and document the limits of the rock prior to excavation. Any rock removed prior to notification will not be considered for payment. After rock has been measured, trenching shall continue by such means as may be necessary, to a depth of six inches (6") below the outside bottom of the pipe, and to a width in conformance to Section 12.3.05 - TRENCH EXCAVATION - WIDTH & DEPTH.

Blasting for rock excavation will only be allowed with the written permission from the Engineer and Fire Chief. The Contractor shall exercise the utmost care to protect the public from harm and to avoid property damage. Blasting shall be done by a State licensed blaster. The Contractor shall comply with all laws, ordinances, insurance, bonding, and applicable safety code requirements and regulations and shall be responsible for all damage caused by the blasting operations. Signals warning persons of danger shall be given before any blast.

Blasting shall be controlled as not to make any excavation unduly large or irregular. Excessive blasting or overshooting shall not be permitted. The Engineer shall have authority to order any method of blasting discontinued which leads to overshooting or is dangerous to the public or destructive to property or to natural features. Approved blasting blankets shall be used for all blasting.

12.3.09 - QUICKSAND AND GROUNDWATER INFILTRATION

Should running sand, quicksand or groundwater be encountered, the work shall be pushed with utmost vigor. Groundwater encountered in trench or manhole excavations shall be drained to sumps, through sub-drains, or by other methods to keep the water level below the bottom of the bell of the pipe while joints are being made. Dispose of the water in a manner to prevent damage to adjacent property. Drainage of groundwater through any sanitary sewer pipeline is prohibited. All dewatering and trench stabilization methods and type of equipment used shall be approved by the Engineer.

If dewatering and trench stabilization is required as a result of the Contractor not properly protecting his work from surface water infiltration, or from sewer or water lines damaged or broken by the Contractor, the cost shall be borne by the Contractor. In the event such work is required through no fault of the Contractor, it shall be considered extra work and a price shall be negotiated.

12.3.10 - EXCAVATION FOR STRUCTURES

Excavation for manholes, and miscellaneous structures shall consist of the removal of all material necessary for construction of the work in conformity with the plans and these specifications.

If rock is encountered, the excavation shall be done in such a manner as to allow the rock to be exposed and prepared for receiving the concrete. All loose and disintegrated rock or thin strata shall be stripped to a clean bed acceptable to the Engineer and in conformance to all applicable items as described in Section 12.3.08 - TRENCHES IN ROCK.

Whenever the footing is to rest on any excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation (subgrade), and the final finishing of the surface shall not be done until just before the footing is to be placed. Correction of any over excavated areas shall be at the Contractor's sole expense.

Whenever the subgrade soil is not sufficiently firm, the Contractor is to furnish and compact, according to the direction of the Engineer, select material, as may be required and in conformance to all applicable items as described in Section 12.3.07 - UNSTABLE SUBGRADE.

After each excavation is completed, the Contractor shall notify the Engineer, who shall make an inspection of the depth of the excavation and character of the foundation material. No concrete shall be placed until after the Engineer has approved the depth of the excavation and character of the foundation material.

12.3.11 - PIPE BEDDING LIMITS

Unless stated otherwise on the plans or details or ordered by the Engineer, all pipe shall be bedded in accordance with Class "B" bedding as described below. All classes of bedding shall be properly tamped around the lower half of the pipe (haunches) and horizontally away from the pipe in both directions to the undisturbed trench walls.

- (a) CLASS "A" CONCRETE CRADLE BEDDING - The lower part of the pipe exterior shall be bedded in Class "A" bedding material having a thickness under the pipe of one-fourth (1/4) the outside diameter of the pipe or a minimum of four inches (4"), whichever is greater, and extending up the sides of the pipe for a height equal to one-fourth (1/4) of the outside diameter of the pipe. The cradle shall have a minimum width equal to the outside diameter of the pipe plus eight inches (8") and it shall be constructed monolithically without horizontal construction joints. Backfill above the cradle, extending twelve inches (12") above the top of the pipe and the full width of the trench shall be Class "B" bedding material.
- (b) CLASS "B" BEDDING - The sewer pipe shall be set on a minimum of four inches (4") of Class "B" bedding material carefully shaped to fit the lower part of the conduit exterior for a width of at least 60% of the pipe breadth and for the entire pipe length. After setting the sewer pipe, Class "B" bedding shall be added and properly tamped around the lower half of the pipe (haunches) for the full width of the trench, and the bedding shall be consolidated carefully without disturbing the pipe alignment or grade. Additional Class "B" bedding material shall be added up to a minimum of twelve inches (12") above the top of the pipe for the full width of the trench.
- (c) REINFORCED CONCRETE ENCASEMENT - Concrete encasement shall consist of a minimum thickness of six inches (6") around the pipe. This encasement shall be formed

on both sides to produce a rectangular shape and shall be reinforced as shown on the Standard Detail. When required, it shall extend a minimum distance of ten feet (10') on each side of a water main crossing or at the location and the dimensions as shown on the plans. Backfill adjacent to the encasement, extending the full width of the trench shall be class "B" bedding.

- (d) **REINFORCED CONCRETE ARCH** – The pipe shall be embedded in class "B" bedding material having a minimum thickness of four inches (4") between the barrel and the bottom of the trench excavation and extending to the Springline (Springline means the pipe cross-section horizontal centerline of the pipe) of the pipe. The top of the pipe shall be covered with reinforced concrete arch having a minimum thickness of ¼ the outside diameter or four inches (4") minimum measured at the crown of the pipe and having a minimum width equal to the outside diameter plus eight inches (8"). When required, it shall be extended at the location and the dimensions as shown on the plans. Backfill adjacent to the concrete arch, extending the full width of the trench, shall be class "B" bedding.

12.3.12 - PIPE LAYING

Pipe shall be protected during handling against impact shocks and free fall. Proper methods shall be used for handling and placing pipe to avoid spalling or breaking and to avoid unnecessary disturbance of the bedding surface in the trench bottom. Pipe shall be kept clean at all times and no pipe shall be used in the work which does not conform to these specifications. Pipes shall be laid to a true line and at uniform rates of grade between manholes as shown on the plans. The laying of the pipe in prepared trenches shall commence at the lowest point with the spigot ends pointing in the direction of flow. No pipe shall be laid in water or when trench conditions are unsuitable for such work.

The Contractor shall take every precaution necessary to prevent dirt, debris or surface water from entering the existing lines or new construction. Contractor shall exercise reasonable diligence in preventing sewage from seeping into the ground during the removal and replacement of any sanitary sewer main. Best management practices shall be utilized to prevent such seepage of sewer water, which shall include, but are not limited to, the following:

- Minimize the amount of time sewer water is allowed to remain in trench.
- Channel water from old pipe to new pipe with a temporary pipe, impervious trough or gutter, whenever practical.

All bypass pumping, temporary connections or other work needed to comply with this requirement shall be considered incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe.

Service line wyes shall be placed on the sewer main at points shown on the plans or where directed by the Engineer. The service lines shall be extended to the right-of-way line. All shall be per the requirements of Section 12.3.15. - **SANITARY SEWER SERVICE LINE INSTALLATIONS.**

ALIGNMENT

All pipe shall be laid to the lines and grades given by the Engineer with joints close and even, butting all around. They shall be carefully centered, and shall not deviate more than one inch (1") from line so that when laid will form a sanitary sewer with a uniform invert and a straight alignment unless a specified curve alignment is shown on the plans.

The grade of the pipe shall be obtained by the use of batter boards and a "top line," batter boards with a double string line having a minimum of four feet (4') separation, a laser beam, or by the use of surveying instruments approved by the Engineer. The grade shall not be obtained by placing a carpenter's level on individual pipes.

If batter boards are used, the Contractor shall at all times where pipe laying is in progress, maintain batter boards for a distance covering at least three grade stakes. The elevation of the batter boards shall be determined from the depth of cut as given by the Engineer, and the Contractor shall keep on each crew a person whose duty it shall be to see that the batter boards are in proper place at all times. It is not intended that these requirements shall make it necessary for the Contractor to keep a person especially for this purpose, but to provide that a competent person shall be with each crew at all times whose duty it shall be to attend to the placing of the batter boards and the giving of grades to the pipe layer.

If a method other than batter boards is used, the instrument used shall be operated continuously under the supervision of a qualified foreman or superintendent. The pipe grade shall be checked by an alternate method at fifty foot (50') intervals and upon request of the Engineer.

All PVC pipe shall be tested with a certified mandrel (go-nogo device) prior to construction of surface improvements.

VERTICAL TOLERANCE

All pipe shall be installed within the following range of tolerances. Any pipe not within the specified spot elevation tolerance shall be relaid.

PIPE GRADE TOLERANCE TABLE

PIPE DIAMETER (inches)	GRADE (S) in PERCENT	
	S ≤ 0.50	S > 0.50
8	±0.02 Ft.	±0.04 Ft.
10 - 15	±0.03 Ft.	±0.04 Ft.
18 or larger	±0.04 Ft.	±0.04 Ft.

In no case shall a section of pipe be accepted if it does not possess a positive grade (i.e., - no flat or adverse sections).

JOINTING PIPE

All pipe joints shall be made in the manner and under the conditions described under the various types of joints for the work. Preparatory to making pipe joints, all surfaces of the portion of the pipe to be jointed shall be cleaned. All pipe joints shall be water tight when completed.

- (a) **ELASTOMERIC GASKET JOINTS** - The assembly of the gasketed joint shall be performed in general conformance with the recommendations of the pipe manufacturer. The Contractor shall provide a suitable method of installation to insure the pipe being entered is true and concentric with the previously laid pipe so as to prevent injury to the elastomeric gasket. When jointed, pipe shall form a smooth and true pipeline.

Mechanical methods shall be employed, if necessary, to pull or push the pipe together with sufficient force to compress the gasket sufficiently to make a watertight joint.

- (b) **SOLVENT CEMENTED JOINTS** - Solvent cemented joints are not allowed on eight inch (8") diameter and larger pipes unless otherwise approved by the Engineer, in writing. If approved, assembly shall be made in accordance with ASTM D2855 standard practice. Remove dirt and mud from bell and spigot. Apply primer liberally to outside of spigot and inside of coupling. Immediately apply cement and make joint by shoving home with 1/4 rotation (within a minute).

- (c) OTHER TYPE JOINTS - If any other type of joint is proposed to be used, it shall conform to the requirements of these specifications that apply, and the Contractor shall obtain written approval of the Engineer for its use. Connections to unlike materials must also be pre-approved, in writing, and may require Class "A" bedding (concrete cradle) at the connection joint.

12.3.13 - BACKFILLING

The line, grade, joints and bedding of the sanitary sewer shall be inspected and approved by the Engineer before backfilling operations commence.

If Class "A" Concrete Cradle Bedding or Reinforced Concrete Encasement has been constructed, no backfilling shall commence until the concrete has either attained a compressive strength of 2000 pounds per square inch, or seven (7) days have elapsed.

After the initial backfill (bedding) has been carefully placed in the pipe zone to at least one foot (1') above the top of the pipe, the remainder of the trench shall be backfilled and compacted. Depositing of the backfill material shall be done so that impact of falling material will not injure the pipe or structures.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the contract. The Contractor shall make his own determination in this regard.

The Contractor shall employ whatever equipment and methods that are necessary to obtain the moisture and required density. All soils within the compaction limits shall be compacted to either ninety-five percent (95%) of the maximum dry density as defined by AASHTO T99 (Standard Proctor) or ninety percent (90%) of the maximum dry density as defined by AASHTO T180 (Modified Proctor). Moisture content for all compacted soils shall be within plus or minus 2% of optimum unless field observation verifies that the soils are unstable at lesser moisture contents. In those cases, the Engineer shall establish a minimum moisture content.

On all sewer installations, compaction tests shall be made by an approved independent testing laboratory, and shall identify the location and depth of the test, the date of the test, the Maximum Standard Proctor density and optimum moisture content of the soil, and give the percent of compaction and moisture content of the backfill material at the test location. Compaction tests shall be made at a depth of three feet (3') above the top of the pipe and at two foot (2') intervals in depth, up to and including the surface. Testing shall be done at a minimum of one location for every 250 feet of main line trench or fraction thereof and at every manhole or similar structure. Where excavations for service lines branch off the main trench, every fourth service line trench shall be tested.

All test locations shall be randomly spaced as directed by the Engineer. These tests shall be made at the expense of the Contractor and are intended to give the Contractor and City an indication of the effectiveness of the compaction procedure and shall not relieve the Contractor of any provisions of this specification. **All Compaction tests shall be submitted and accepted by the City prior to construction of any surface improvements.**

If any compaction test should fail to meet the requirements of this section, at least two (2) additional locations shall be tested along the trench, at locations designated by the Engineer, to determine the extent of the non-compliance. After the extent of non-compliance has been determined, that section of trench shall be re-compacted and retested at a minimum of two (2) locations as directed by the Engineer. If the failure occurs at a service lateral, another lateral shall be tested in addition to the extent of non-compliance testing requirements.

In the event of settlement or subsidence of a particular excavation or any part thereof, the Contractor shall be responsible for all repaving, overlay and repair costs occasioned thereby for a period of two (2) years after the project/subdivision acceptance date.

If requested by the Contractor and/or Developer, and written permission is granted by the Director of Public Works, backfill for utility trenches may be consolidated using water induced settlement techniques (jetting/puddling). This method of trench backfill consolidation shall only be allowed in those special locations where a failure history exists for trenches using conventional engineered controlled fill. As a condition of permission to use jetting/puddling, the Contractor and/or Developer must agree in writing to provide a full and complete three (3) year warranty from the final acceptance date, that shall include repair of any surface amenities to the complete satisfaction of the City which may include a full width asphaltic overlay if warranted.

Where backfill for utility trenches within the roadway section are consolidated using jetting/puddling, the moisture and density requirements within the trench compaction limits stated above shall not apply; however, the compaction limits for the finished roadway subgrade as outlined under Article 9-EARTHWORK (COMPACTION) shall apply.

12.3.14 - MANHOLE CONSTRUCTION AND ADJUSTMENT

Manhole bases and barrels shall be constructed of the material as specified in Section 12.2 - MATERIALS, unless otherwise specified on the plans or by the Engineer. Contractor shall wait a minimum of twenty-four (24) hours before setting manhole barrel sections, on cast-in-place bases. No backfilling shall commence around manhole bases until the concrete has either attained a compressive strength of 2000 pounds per square inch, or seven (7) days have elapsed.

The flow channel shall be made to conform in slope and shape to that of the sewer pipe and wherever possible, the lower one-half of the sewer pipe shall be used for the invert of the open flow channel. At intersections with other lines, channels shall be formed with a sweeping curve to minimize turbulence.

Unless otherwise specified on the plans or specifications, all manhole channels shall be constructed with a minimum elevation drop as shown:

Horizontal Deflection Angle of Sewer Pipe at MH	Minimum Drop
0°	0.10' *
Between 0° & 45°	0.20'
45° to 90°	0.30'

Changes in direction at intersections of sewers shall not be greater than 90 degrees.

* The minimum drop at a manhole with a 0 degree pipe deflection can be less than 0.10 feet when the grades of the pipe entering and exiting the manhole are the same and the pipe is laid continuous through the manhole, using the bottom half of the pipe as the channel.

Connection to an existing manhole shall be made so the inlet flowline is above the existing concrete manhole base. When connection to an existing manhole is allowed, the contractor shall cut into the existing manhole to install the new sewer pipe and provide a water stop and non-shrink grout for a water tight connection. A concrete channel shall be formed within the existing manhole to provide a smooth discharge from the new pipe to the existing channel.

A drop manhole shall be constructed when the difference between the elevation of the inlet and outlet flowlines is two feet (2') or greater.

When pipe is used as the channel in manholes, no pipe joint shall be allowed in the manhole unless otherwise specified on the plans. Dead end manholes shall have a channel extended a minimum of three feet (3') inside the manhole at the same grade as the sewer pipe.

All manhole ring and covers in streets to be paved shall initially be constructed to a height to top of subgrade or twelve inches (12") below the proposed finished pavement grade, whichever is less. When adjusted to a finished pavement grade, the manhole ring and cover shall be so constructed that the top of the manhole ring and cover will be flush ($\pm 1/4"$) with the replacement pavement or the grade established by the Engineer, and shall have at least one (1) four inch (4") thick precast concrete adjustment ring. Adjustment rings shall not exceed twelve inches (12") in height.

Manhole steps shall be installed as specified on the plans or Standard Details. Care shall be taken to ensure that steps line up between precast concrete barrel and cone sections. Vertical alignment of steps shall not exceed 3" inches when measured from the bottom step to the top step. .

All materials used in brickwork (brick, sand, cement, and water for mortar) shall conform to the requirements Section 12.2 - MATERIALS, of these specifications.

All courses of brick shall be kept level and true to line. No partial brick shall be used where whole brick will fit. The brick shall, if ordered, be thoroughly wet just before laying and completely bedded in mortar in one operation.

The outside of all brickwork shall be well plastered with a three-eighth inch (3/8") thick coat of mortar.

12.3.15 - SANITARY SEWER SERVICE LINE INSTALLATIONS

Service lines shall be installed from the main to the right-of-way line or as shown on plans. Connections to manholes is prohibited unless otherwise approved by the Engineer. Lines shall be inspected and approved by the Engineer or designated entity.

Service lines shall be connected to the sewer main so the flowline is at or above the spring line of the pipe for 8" and 10" sewer mains and in the top 1/4 of the pipe for 12" and larger sewer mains. Service lines shall not be connected to the City mainline manholes unless otherwise approved by the Engineer.

Sewer service lines shall not protrude into the interior of the sanitary sewer main. Service lines shall connect to the sanitary sewer main in a manner that creates a watertight joint and provides a smooth, continuous interior pipe surface.

All service lines shall be placed on a slope of one-fourth inch (1/4") per one foot (1') from the main to the property line, unless otherwise specified on the plans, standard details or in writing by the Engineer.

The ends of all service lines shall be plugged and marked for location with a 2" x 4" board or other suitable marker extending two feet (2') above grade and three feet (3') below grade in addition to a three inch (3") wide green plastic tape tied to the end of the service line and extending to a point six inches (6") above the ground surface. The Contractor shall assist the Engineer in measurements and locations of constructed service lines and submit "as built" plans.

Bedding shall meet the requirements of Class "B" as per Section 12.2.11 - BEDDING FOR PIPE, and Section 12.3.11 - PIPE BEDDING LIMITS and the backfill material shall be similar to that required for sanitary sewer mains as per Section 12.2.13 - BACKFILL MATERIAL. All backfill shall be consolidated by the requirements of Section 12.3.13 - BACKFILLING.

12.3.16 - TESTING AND INSPECTION

No surface improvements shall be constructed over the new sanitary sewer until all testing and televised inspection of the pipe is accepted by the City unless otherwise authorized by the City. The Contractor shall conduct the testing and be responsible for furnishing all equipment and labor for testing. The Engineer shall verify the accuracy and acceptability of the equipment used and witness all tests.

Any sanitary sewer line where infiltration or exfiltration tests show leakage in the sewer line and manholes exceeding fifty (50) gallons per inch diameter, per mile, per day or pipe deflection exceeds five percent (5%) of the inside diameter, will not be accepted. After acceptable backfilling but before construction of surface improvements over any sewer line, tests shall be run to determine whether these limits are exceeded. At the direction of the Engineer, the section between the first two (2) manholes of all projects may be tested before further construction to permit initial observation of the quality of the construction workmanship. Tests shall also be conducted at any time during the course of construction that the quality of the workmanship is questionable in the opinion of the Engineer. The type of test conducted shall be at the Engineer's option. Whenever the rate of infiltration, exfiltration or deflection is found to exceed the allowable amounts, the Contractor shall stop construction. The Contractor may then be required to provide at his own expense, televised or photographic visual inspection of the interior of the pipe to help determine the reason for failing the testing. The Contractor shall make appropriate repairs by methods approved by the Engineer, and shall retest the sewer until it is satisfactory. No compensation shall be paid to the Contractor for testing, televising, photographing, repairing, or reconstruction to comply with the allowable amounts.

All gravity sewers will be inspected by closed-circuit television, by the City, after other utility installations and acceptance of all testing, but prior to construction of surface improvements over the new sewer unless otherwise authorized by the City. The Contractor shall thoroughly clean all sewers prior to televising by the City. The City requires five (5) working days advance notice for scheduling the televising and will be allowed five (5) working days to complete the television inspection.

INFILTRATION

In areas where excessive groundwater is encountered, an infiltration test or pneumatic pressure test will be required. An excessive amount of groundwater for testing purposes is defined as the amount of groundwater needed to produce in excess of two feet (2') of hydrostatic pressure on the crown of the pipe along the entire test section. The Contractor will be required to prove this by installing manometer tubes at the ends of the test section in the manholes. The determination of groundwater elevation (installation of manometer tubes) shall be in accordance with Section 8, of the Uni-Bell Plastic Pipe Association - Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe (Uni-B-6). If infiltration is less than the allowable amount, the Contractor will still be required to stop any obvious individual leaks that may be observed by the Engineer when so directed.

- (a) **INFILTRATION TEST** - Infiltration tests shall be made by plugging the end of the sewer section being tested at the upper manhole to prevent the entry of water. The amount of infiltration shall then be measured by placing an approved weir in the lower part of the outlet end of the test section. The time for the test shall be of such duration as necessary to achieve stable flow over the weir, but in no case less than two hours. Determination of flow will be made by the direct reading of a calibrated weir or by hydraulic calculations taken at ten-minute intervals beginning after the first hour of lapsed time.
- (b) **PNEUMATIC PRESSURE TEST** - In preparation for a pipe acceptance test using low pressure air, all pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be sealed at both ends with the pneumatic

plugs to be checked. The plugs, installed in accordance with the manufacturer's recommendations, shall hold against a pressure of 5 psig without bracing and without movement of the plugs out of the pipe. However, during actual testing, the Contractor should internally or externally brace the plugs as an added safety precaution. Plugs found acceptable by this testing shall be placed in the test installation and low pressure air introduced into the sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe but not greater than 9 psig. The level of groundwater back pressure shall be determined by averaging the reading of groundwater manometer tubes installed at the manholes of the section of pipe being tested. The air pressure correction, which must be added to a 3.5 psig test starting pressure, shall be calculated by dividing the average vertical height, in feet of groundwater above the invert of the pipe to be tested by 2.31. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period the air hose from the control panel to the air supply shall be disconnected and the pressure shall be decreased to 3.5 psig (plus any required air pressure correction) for the start of timing. The portion of line being tested shall be termed "Acceptable" if the time shown, for the given diameters in the following table, elapses before the air pressure drops 0.5 psig from the test starting pressure.

Pipe Diameter (Inches)	Minimum Time (Min:Sec)	Length (L) for Minimum Time (Feet)	Time for Longer Length (Seconds)
8	3:47	298	0.760L
10	4:43	239	1.187L
12	5:40	199	1.709L
15	7:05	159	2.671L
18	8:30	133	3.846L
21	9:55	114	5.235L
24	11:20	99	6.837L
27	12:45	88	8.653L

Contractors testing equipment shall have 3/8 inch standard female fitting to accommodate the City inspector's gauge and a regulator or a relief valve set no higher than 9 psig to avoid over-pressurizing.

EXFILTRATION

Except in areas where excessive amounts of groundwater are encountered, the Contractor shall measure the rate of exfiltration by either a hydrostatic pressure test or a pneumatic pressure test (as outlined above).

- (a) **HYDROSTATIC PRESSURE TEST** - The section to be tested shall be prepared by plugging the lower end of the section and the inlet sewer or sewers of the upper manholes and filling the pipe and upstream manhole with water to a depth of two feet (2') above the top of pipe at the upstream manhole of the test section or two feet (2') above the normal ground water level at the upstream manhole of the test section, whichever is higher. The maximum internal pipe pressure at the lowest end shall not exceed twenty-five feet (25') of head of water or 10.8 PSI. Only after the test section has been acceptably isolated and filled with water can the test period begin. The period shall be two hours in duration. Leakage by exfiltration shall be determined by measuring the drop in the water level in the upstream manhole at the end of the test period. The exfiltration test time period may be extended beyond the minimum two-hour period when necessary to effectively determine the source of leakage when test results are unsatisfactory.

DEFLECTION TESTING

All PVC pipe less than twenty-four inches (24") in diameter shall be tested for deflection, after backfilling, by the Contractor by means of a certified mandrel (go-nogo device). The diameter of the mandrel shall be five percent (5%) less than the inside diameter of the sewer pipe. The mandrel shall be pulled through all installed pipe. All testing shall be under the direction of the Engineer.

Pipe shall be removed, replaced and retested if maximum deflection exceeds five percent of the pipe's nominal internal diameter. Pipe shall be retested for deflection by the City of Pueblo prior to the end of the two year warranty period. Any pipe showing a deflection in excess of five percent (5%), after testing by the City, shall be removed and replaced by the Contractor.

ACCEPTANCE

Acceptance of the pipe in the tested section will be granted by the Engineer only after all defects such as poor alignment, misplaced pipe, and broken pipe have been remedied, and prescribed testing satisfactorily completed. Acceptance of the pipe does not relieve the Contractor of responsibilities imposed by all other sections of these specifications.

Work accomplished under this section will not be measured, nor will it be paid for directly. This work will be considered as incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe.

12.3.17 - CLEANING SEWERS AND APPURTENANCES

The sewers and all appurtenances shall be thoroughly cleaned at the Contractors expense under the direction and to the satisfaction of the Engineer before final acceptance of the work. In the event the City has to perform any cleaning, the Contractor will be charged for the actual cost of labor, equipment, and materials plus 100 percent for the work.

12.3.18 - REPLACING SIDEWALKS, CURB AND GUTTER, BASE COURSE, PAVING, ETC.

Where sidewalks, curb and gutter, culverts, etc., are removed within the limits of the work, the Contractor shall compact the backfill as specified under the applicable Article, and shall then replace sidewalks, curb and gutter, culverts, etc., in accordance with prevailing City Specifications for the class of work involved. Sidewalk and curb and gutter removals shall be in accordance with Section 14.3.02. Where grassed areas are encountered, the Contractor shall replace all sod with sod of similar characteristics to that adjacent.

GRAVEL SURFACED STREETS OR ALLEYS

When trenches are excavated in streets or alleys which have only a gravel surface, Contractor shall replace such surfacing on a compacted backfill with gravel conforming to ARTICLE 8 - AGGREGATE BASE CONSTRUCTION, CLASS 6, equal in depth to that which originally existed or a minimum thickness of two inches (2"). The surface shall conform to the street or alley grade as set by the Engineer. Where the completed surface settles below finished grade, additional gravel base course material shall be placed and compacted immediately to restore the roadbed surface to finished grade.

CONCRETE AND BITUMINOUS PAVEMENT REMOVAL AND REPLACEMENT

When concrete pavement is removed, the removal shall be to an existing joint or to a sawed joint which is made prior to removal.

The final edges of asphalt removed and replaced shall be along a straight line neatly sawed to a depth which allows the pavement to be removed with no disturbance to the asphalt left in place.

The edges of pavement (either concrete or asphalt) removal and replacement shall extend one foot (1') beyond the edge of the excavation required for pipe installation. The edges of the pavement

shall be clean, straight and free from jagged intrusions and loose pieces. If the edges of the pavement are not straight, the Contractor shall saw cut back to a point where a straight edge can be maintained or overlay the asphalt patch with a minimum of 3/4" thick asphaltic overlay extending two feet (2') beyond the edges of the asphalt patch. Concrete or asphalt removed from the trench surface shall not be used in the initial backfill, and all pieces exceeding eight inches (8") in any dimension shall be removed from the site.

BITUMINOUS SURFACED STREETS

When trenches are excavated in streets having a bituminous surface, the Contractor shall replace such surfacing as follows:

- (a) Construct a gravel base course having a minimum compacted thickness equal to that of original base course, or six inches (6"), whichever is greater.
- (b) Place hot bituminous pavement wearing surface having a minimum compacted thickness equal to the original pavement, or three inches (3"), whichever is greater. Four inches (4") asphaltic concrete shall be required on all City bus routes.

All the foregoing materials and methods of application shall comply with ARTICLE 8 - AGGREGATE BASE CONSTRUCTION and ARTICLE 10 - HOT BITUMINOUS PAVEMENT. The gravel base course shall be placed immediately following consolidation of the trench backfill, and the finished grade of the gravel surface shall be carefully maintained until the pavement is placed.

Outside of trench areas, the Contractor shall restore damaged bituminous surfaced streets to the condition which existed prior to construction. The Contractor shall make these repairs at his own expense if the damage is a result of his operations.

CONCRETE PAVED STREETS

When trenches are excavated in streets constructed of concrete, the Contractor shall replace said concrete with an equivalent concrete pavement. Said concrete pavement shall have a minimum thickness conforming to ARTICLE 7 - CONCRETE PAVEMENT and shall be placed on six inches (6") of Class 6 base conforming to ARTICLE 8 - AGGREGATE BASE CONSTRUCTION.

Outside of trench areas, the Contractor shall restore damaged concrete surfaced streets to the condition which existed prior to construction. The Contractor shall make these repairs at his own expense if the damage is a result of his operations.

CONCRETE CURB AND GUTTER, SIDEWALK, DRIVEWAY, ALLEY PAN AND DIP REMOVAL

Concrete curb and gutter, sidewalks, driveways, alley pans and dips shall be removed to the limits designated by the Engineer. All joints (except expansion joints) shall be saw cut prior to removal unless otherwise directed by the Engineer. Any concrete broken or disturbed by the Contractor outside of the designated limits shall be replaced at the expense of the Contractor at no cost to the project. Sawing shall be considered incidental and subsidiary to the pipe line excavation.

CITY RESERVES RIGHT TO DO REPAVING OR RESURFACING OF STREETS

The City reserves the right to do the repaving or resurfacing of the streets even though the Proposal lists quantities for doing such work. The Engineer may direct the Contractor to omit any portion or all of this repaving or resurfacing, in which case the Contractor shall not be entitled to any adjustment or allowance in contract prices.

HOT BITUMINOUS ASPHALT OR CONCRETE UNAVAILABLE OR INCLEMENT WEATHER ON COMPLETION OF BACKFILL

Upon completion of backfill operations, if hot bituminous asphalt or concrete is unavailable or the weather is inclement, a temporary asphalt surface - cold mix or other approved material - having a two inch (2") minimum thickness shall be installed immediately on the surface of the trench, cut, or hole in an asphalt or concrete street, walk, curb and gutter, etc. before the Contractor leaves the

excavation site or continues the trench to the next block, intersection, or alley, unless otherwise allowed by the Engineer. Cold mix asphalt and its placement shall be furnished at the Contractor's expense and shall not be a pay item.

As soon as hot bituminous asphalt or concrete becomes available, the temporary asphalt surface shall be removed and replaced with permanent asphalt or concrete in accordance with prevailing City construction and material specifications for the class of work involved by the Contractor.

12.4 - METHOD OF MEASUREMENT

Method of measurement for sanitary sewer construction shall be as follows:

- (a) Manholes - Each manhole constructed of various sizes shall be counted for payment by the contract unit.
- (b) Sanitary Sewer Pipe - The length of sanitary sewer pipe of various sizes and types shall be measured in linear feet along the alignment of the centerline of the pipe from center of manhole to center of manhole unless connection is made to an existing stub.
- (c) Service Lines - The length of service lines of various sizes shall be measured in linear feet along the alignment of the centerline of the pipe for actual pipe installed.
- (d) Reconnect Service Lines - Each service line reconnected to the sanitary sewer main shall be counted for payment.
- (e) Earthwork, Excavation, Trenching and Backfilling - Unless otherwise specified, these items will not be measured for separate payment but will be considered as incidental to the item to which it applies and shall be included in the unit price for that item, unless rock is encountered as described in section 12.3.08 - TRENCHES IN ROCK.
- (f) Rock Excavation - Rock excavation shall be measured for payment by the cubic yard. In measuring the number of cubic yards of rock excavation, the width of the trench excavated will be multiplied by the average depth from the surface of the rock to a point six (6) inches below the outside bottom of the sewer pipe. This result multiplied by the length of the trenched rock and divided by twenty-seven (27) will give the number of cubic yards allowed for payment.
- (g) Trench Stabilization Material - Approved material used to stabilize the subgrade shall be measured for payment by the ton as evidenced by weight tickets for each truckload or fraction thereof.
- (h) Imported Backfill Material - Approved backfill material to replace unsatisfactory material shall be measured for payment by the ton as evidenced by weight tickets for each truckload or fraction thereof.
- (i) Class "A" Concrete Cradle Bedding - Concrete cradle bedding shall be measured for payment by the linear foot.
- (j) Class "B" Pipe Bedding - Pipe bedding will not be measured for separate payment but will be considered as incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe.
- (k) Reinforced Concrete Encasement - Reinforced concrete encasement shall be measured for payment by the linear foot.

- (l) Gravel Surface Replacement - Aggregate base to replace the gravel lost during excavation on gravel surfaced streets or alleys will not be measured for separate payment but will be considered as incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe.
- (m) Sidewalk and Driveway Replacement - Sidewalk and driveway replacement shall be measured for payment in square feet of concrete of the specified thickness measured in place, completed and accepted.
- (n) Curb and Gutter Replacement - Curb and gutter replacement will be measured for payment in accordance with all applicable items as described in ARTICLE 5 - CONCRETE CURB & GUTTER, Section 5.4 - Method of measurement.
- (o) Curb and Gutter, Sidewalk, Driveway, Alley Pans, Dips, and Concrete and Bituminous Pavement Removal - The removal and disposal of curb and gutter, sidewalk, driveway, alley pans, dips, and concrete and bituminous pavement will not be measured for separate payment but will be considered as incidental to the pipe and structure items and all costs in connection therewith shall be included in the unit price for that item, unless otherwise noted in the bid schedule.
- (p) Concrete Pavement Replacement - Concrete pavement replacement shall be measured for payment on the linear foot basis of the specified thickness, completed and accepted, measured in place along the centerline of the sewer main or service lines.
- (q) Hot Bituminous Pavement Replacement - Hot bituminous pavement replacement shall be measured for payment on the linear foot basis of the specified thickness, completed and accepted, measured in place along the centerline of the sewer main or service lines.
- (r) Concrete Alley Pan, Dip or Double Gutter Replacement - The replacement of concrete alley pans, dips, and double gutters shall be measured for payment in square feet of concrete of the specified thickness, measured in place completed and accepted.

12.5 - BASIS OF PAYMENT

All costs in connection with the proper, safe and successful completion of the work, including furnishing all materials, equipment, supplies, and appurtenances; equipment and tools; and performing all necessary labor and supervision to fully complete the work in accordance with these specifications and the standard details, shall be included in the unit and lump sum prices bid. All work not specifically set forth as a pay item in the Proposal shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid. In the event that there is no unit price shown in the proposal, the price will be negotiated.

Basis of payment for sanitary sewer construction shall be as follows:

- (a) Manholes - Manholes will be paid for at the contract unit price per manhole and this shall include the ring and cover castings and adjustment sections, precast sections, steps and all items incidental to complete the manhole , in accordance with these specifications and the Standard Details.
- (b) Sanitary Sewer Pipe - Sanitary sewer pipe will be paid for at the contract unit price for the various sizes and types, installed complete in place. Said price shall include all excavation, shoring, bedding, joint materials, plugs, bypass pumping, temporary connections, connection to existing manholes, and other materials, to construct in accordance with these specifications and the Standard Details. No payment will be

made for pipe until backfilling, compaction tests, deflection (go-nogo) test, exfiltration and/or infiltration tests have been accepted by the Engineer.

- (c) Service Lines and Reconnect Service Lines - Service lines and reconnection of service lines will be paid for at the contract unit price and shall be full compensation for placed and accepted pipe, including all fittings, plugs and markers in accordance with these specifications.
- (d) Rock Excavation - Rock excavation will be paid for at the contract unit price and shall include the payment for any additional foundation or bedding material required and disposal of the rock removed which will not meet the requirements for backfill.
- (e) Trench Stabilization Material - Trench stabilization material will be paid for at the contract unit price and shall include all work to furnish the approved material and disposal of the unsuitable material.
- (f) Imported Backfill Material - Imported backfill material will be paid for at the contract unit price and shall include all work to furnish the suitable material and disposal of the unsuitable material.
- (g) Class "A" Concrete Cradle Bedding - Payment for Class "A" Concrete Cradle Bedding, will be paid for at the contract unit price, complete in place.
- (h) Reinforced Concrete Encasement- Reinforced concrete encasement will be paid for at the contract unit price, complete in place.
- (i) Sidewalk and Driveway Replacement- Sidewalk and driveway replacement will be paid for at the contract unit price, complete in place.
- (j) Curb and Gutter Replacement - Curb and gutter replacement will be paid for at the contract unit price complete in place.
- (k) Concrete Pavement Replacement - Concrete pavement replacement will be paid for at the contract unit price and shall include furnishing and placing concrete pavement, and base under the new concrete, if required.
- (l) Hot Bituminous Pavement Replacement - Hot bituminous pavement replacement shall be paid for at the contract unit price, complete in place.
- (m) Concrete Alley Pan, Dip or Double Gutter Replacement - The replacement of concrete alley pans, dips, and double gutters shall be paid for at the contract unit price, complete in place. Said unit price shall include replacement with the specified thickness of concrete, reinforcing bars and base material, if required.

12.6 PRIVATE SEWERS

12.6.01 – DESCRIPTION

The information covered by this specification consists of construction standards, inspections, and minimum requirements for "Private Sewers." The term "Private Sewers" as used in these specifications shall mean a building sewer which receives the discharge from more than one (1) building drain and conveys it to a public sewer and is installed and maintained by an approved designated authority. Private sewers are not part of the public sanitary sewer system.

12.6.02 - PLANS AND DATA

Profiles of the ground or a detailed utility plan shall be shown on the plans for the work. The Contractor must satisfy himself regarding the character of the material to be excavated and the work to be done.

12.6.03 - MATERIALS

The requirements for Section 12.2 – MATERIALS are applicable to private sewers. It is the intent of this section to include Section 12.2 by reference and all provisions are applicable as though they were listed herein, unless specifically excepted or modified. In addition, cleanout covers (when required) shall withstand H-20 loading in traffic areas.

12.6.04 – CONSTRUCTION REQUIREMENTS

Many portions of Section 12.3 are applicable to private sewers; however, there are some exceptions and discrepancies. It is the intent of this section to include Section 12.3 by reference and all provisions are applicable as though they were listed herein, unless specifically excepted or modified. All references to the negotiation of “extra work” are deleted for private sewers.

Section 12.3.08 – TRENCHES IN ROCK is amended to read as follows:

Whenever rock material is encountered, as defined in Section 12.3.08, the Contractor shall immediately notify the Engineer. The Engineer will then direct the Contractor as deemed necessary.

Section 12.3.11(b) – CLASS “B” BEDDING is amended to read as follows:

The sewer pipe shall be set on a minimum of four inches (4”) of Class “B” bedding material carefully shaped to fit the lower part of the conduit exterior for a width of at least 60% of the pipe breadth and for the entire pipe length. After setting the sewer pipe, Class “B” bedding shall be added and properly tamped around the lower half of the pipe (haunches) for the full width of the trench, and the bedding shall be consolidated carefully without disturbing the pipe alignment or grade. For eight inch (8”) diameter and larger pipe, additional Class “B” bedding material shall be added up to a minimum of twelve inches (12”) above the top of the pipe for the full width of the trench.

Section 12.3.16 – TESTING AND INSPECTION, delete all references to the City televising the sanitary sewer main.

12.6.05 – PERMITS AND FEES

Prior to installing any private sewer main, the Contractor shall obtain a permit from the Regional Building Authority. An inspection fee shall be assessed to all private sewers. The fee shall be paid prior to the issuance of the permit and the amount shall be in accordance with the fee schedule established by the Regional Building Authority. If a private sewer is installed without obtaining a permit, the Contractor will be required to pay two (2) times the regular fee schedule and/or will be required to pothole the sewer at various locations as directed by the Engineer. Cut sheets shall be submitted for review and approval to the City of Pueblo – Department of Public Works, two (2) working days prior to the start of construction.

ARTICLE 13

STORM SEWERS

13.1 - GENERAL

13.1.01 - DESCRIPTION

The work covered by this specification consists of furnishing all labor, equipment, tools, materials necessary to install storm sewer pipe and appurtenances as shown on the plans and as specified herein. The term "Storm Sewer" as used in these specifications also applies to "Culverts" and all provisions apply unless noted otherwise.

13.1.02 - PLANS AND DATA

Profiles of the ground are shown on the plans for the work. The Contractor must satisfy himself regarding the character of the material to be excavated and the work to be done.

13.2 - MATERIALS

13.2.01 - PIPE MATERIALS

For 36 inch diameter and smaller pipe sizes, the storm sewer may be constructed of either Nonreinforced Concrete Pipe (NRCP), Reinforced Concrete Pipe (RCP), High Density Polyethylene (HDPE) with smooth interior, or Polyvinyl Chloride (PVC). Where designated as "RCP" or "NRCP" on the drawings, **only the type of pipe designated will be allowed.**

For pipe sizes larger than 36 inches in diameter, **only RCP will be allowed.**

When plastic pipe with end sections is to be installed, the end section shall be steel or reinforced concrete pipe (RCP) approved by the Engineer. Concrete collars will be required to join the end section to the plastic pipe. Plastic flared end sections are not acceptable.

13.2.02 - REINFORCED CONCRETE PIPE (RCP) and NONREINFORCED CONCRETE PIPE (NRCP)

Concrete pipe shall be made using Type V cement or a 7-sack mix design and shall be a minimum of Class III unless shown otherwise on the drawings, and shall conform to the following AASHTO designation;

A. Storm Drain and Sewer Pipe (NRCP)	M 86
B. Storm Drain and Sewer Pipe (RCP)	M 170
C. Precast Manhole Sections	M 199
D. Arch Pipe	M 206
E. Elliptical Pipe	M 207
F. Joints, Using Rubber Gaskets	M 315
G. Precast Reinforced Concrete Box Sections	M 259

Prior to pipe laying operations, the Contractor shall submit a letter from the pipe manufacturer certifying that the minimum areas of steel (RCP) and concrete strengths are in compliance with the applicable AASHTO specification and strength classification. The pipe manufacturer's facility shall be certified annually by the American Concrete Pipe Association. Representatives from the City

shall be allowed full access to the facility to observe all phases of the pipe manufacturing process and to review all records pertaining to pipe testing. The City reserves the right to reject pipe based upon visual observations of apparent defects or departures from the tolerance standards.

Joints for storm drains or manholes shall be either bell and spigot or tongue and groove. Jointing material for concrete pipe shall be a preformed, flexible plastic sealing compound which conforms to Federal Specification SS-S-00210 (GSA-FS6) "Sealing Compound Preformed Plastic for Expansion Joints and Pipe Joints". The sealant shall be made of top grade vulcanized butyl rubber which is compressible and has a tacky surface for adherence to the joint. The material shall be capable of being installed in the temperature range from zero to one-hundred degrees Fahrenheit (0 - 100°F).

13.2.03 - HIGH DENSITY POLYETHYLENE PIPE (HDPE)

High density polyethylene pipe shall have a smooth interior wall (Type S) and shall conform to AASHTO M 294. Joints shall be a gasketed bell and spigot fitting. Acceptable products are "HI-Q Sure-Lok ST" as manufactured by Hancor, Inc., "Pro-link ST" as manufactured by Advanced Drainage Systems, Inc. or an approved equal. The joining of pipe shall be in strict conformance with the manufacturer's recommendations or the Contract Documents, whichever is more stringent. Only pipe diameters 15" through 36" will be allowed. Installation of High Density Polyethylene pipe (HDPE) must meet the following conditions described below:

- (a) Contractors installing HDPE pipe must provide the City with a letter from the pipe manufacturer certifying that they have been trained in proper installation procedures of their product.
- (b) Where there are discrepancies between HDPE pipe installation specifications and City of Pueblo Standard Specifications, the more stringent specifications will apply.
- (c) Where HDPE pipe enters a manhole, flowable fill must be used to ensure proper support beneath the pipe. Flowable fill must be installed to the spring line of the highest HDPE pipe and within the area of manhole excavation.
- (d) Upon completion of installation and backfill, the contractor must demonstrate that the pipe has not deflected more than 5% of the pipe diameter, including manufacturing tolerances.
- (e) HDPE pipe may not be used in or adjacent to a street that has classification as a Collector or higher designation.
- (f) The maximum allowable height of backfill as measured from the top of pipe to finished grade shall be limited to ten feet (10').

13.2.04 - POLYVINYL CHLORIDE (PVC)

Polyvinyl chloride pipe shall have a diameter to wall thickness ratio of not less than 35 (SDR 35) and shall conform to ASTM D3034 (for 15 inch diameter pipe and smaller) or ASTM F679 (for pipe diameters between 18 to 27 inches).

Where Polyvinyl Chloride pipe enters a manhole, flowable fill must be used to ensure proper support beneath the pipe. Flowable fill must be installed to the spring line of the highest PVC pipe and within the area of manhole excavation.

13.2.05 - PIPE BEDDING

Bedding for storm sewer pipe shall be Class "B" as defined in Article 12 - SANITARY SEWERS, Section 12.2.11 Class "B" Bedding Material. Limits for bedding around the pipe shall be as shown on the Standard Details.

13.2.06 - CONCRETE MANHOLES

The requirements for storm sewer manholes shall be the same as those for sanitary sewers as defined in Article 12, Section 12.2.05, except:

- (a) Special manholes may be required for larger diameter pipes as noted on the Contract Drawings or in the Standard Details.
- (b) The wrapping of joints outside of the manhole with a butyl adhesive tape sealant is not required.

13.2.07 - INLETS

Inlets (Catch Basins) shall be constructed of cast-in-place concrete in accordance with the standard detail of the type and size shown on the drawings. Precast concrete inlets may be used when approved by the Engineer with the added requirements shown on the "Pre-Cast Inlet Detail". Shop drawings for all precast inlets must be submitted to the Engineer for approval prior to installation. If differing site conditions require modifications to the precast inlet, the cost to modify or replace the inlet will be borne solely by the contractor. Inlets fabricated prior to the completion of the inlet piping will be at the contractor's risk.

13.2.08 - BRICK

Brick may only be used for modifications to existing brick structures. Brick to be used in the construction of manholes shall conform to the requirements of AASHTO M 91, Grade MM "Specifications for Sewer and Manhole Brick".

13.2.09 - CONCRETE GRADE RINGS

Reinforced concrete grade rings may be used in the adjustment of manhole castings. Grade rings shall have a minimum thickness of two inches (2") and a maximum thickness of six inches (6"). Total adjustment height shall not exceed the tolerances as shown on the Standard Details.

13.2.10 - MORTAR

The requirements for mortar to be used in storm sewer construction shall be the same as those for sanitary sewers as defined in Article 12, Section 12.2.08.

13.2.11 - CASTINGS AND MANHOLE RING & COVERS

The requirements for iron castings to be used in storm sewer manhole construction shall be the same as those for sanitary sewers as defined in Article 12 - SANITARY SEWERS, Section 12.2.09 with the following exception: The informational logo "No Dumping / Drains to River" shall be cast on the covers. Other castings shall be as shown on the Standard Details.

13.2.12 - RIP-RAP

Rip-rap shall consist of hard, dense, sound, rough fractured stone as nearly cubical as practicable. Thin slab type stones and flaking rock shall not be used. The stone shall have a specific gravity of at least 2.5. Concrete rubble is not acceptable for use as rip-rap unless approved by the Engineer.

Stones shall be well graded in order that the voids can be filled. At least fifty percent (50%) of the mass shall be stones equal to or larger than the stone size called for on the plans. Stone size shall not be larger than the thickness of the rip-rap layer.

Rip-rap shall be placed to conform to the plan details. The larger size stones composing the rip-rap material shall be placed first and roughly arranged in close contact. The spaces between the larger stones shall then be filled with smaller stone of suitable size, so placed as to leave the surface evenly stepped, conforming to the contour required. The material may be machine placed with sufficient hand work to accomplish requirements of this specification.

Excavation for rip-rap shall be made to a neat line. Allowance will not be made for work outside of the neat line.

13.2.13 - FILTER MATERIAL

Class A filter material shall consist of free draining sand, gravel, slag, or crushed stone. The material shall be uniformly graded from coarse to fine and shall meet the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
3"	100
3/4"	20 - 90
No. 4	0 - 20
No. 200	0 - 3

13.2.14 - FILTER FABRIC

Filter fabric shall be a nonwoven polypropylene material conforming to the minimum performance specifications outlined below and designed for use under rip-rap. Acceptable products are Supac 4NP manufactured by Phillips 66 , TS 420 manufactured by Advanced Drainage Systems, Inc., or an approved equal.

Min. Thickness (mils) ASTM D1777	40
Min. Grab Strength (md/cd, %) ASTM D4632	50
Min. Grab Elongation (md/cd, %) ASTM D4632	50
Min. Burst Strength (psi) ASTM D3786	155
Min. Puncture Strength (lbf) ASTM D4833	55
Min. Permeability (cm/sec) ASTM D4491	0.2
Max. A.O.S. (Std. Sieve) ASTM D4751	35

13.3 - CONSTRUCTION REQUIREMENTS

Many portions of Article 12 - SANITARY SEWERS, Section 12.3 - CONSTRUCTION REQUIREMENTS are applicable to storm sewer construction; however, there are numerous exceptions and discrepancies. It is the intent of this section to include Section 12.3 - CONSTRUCTION REQUIREMENTS by reference and all provisions are applicable as though they were listed herein, unless specifically excepted or modified.

13.3.01 - STORM SEWER CROSSINGS

Section 12.3.01 does not apply to storm sewer construction.

13.3.02 - WATER LINE CROSSINGS

All provisions of Section 12.3.02 are applicable.

13.3.03 - RAILROAD AND HIGHWAY CROSSINGS

All provisions of Section 12.3.03 are applicable.

13.3.04 - EXCAVATION - GENERAL

All provisions of Section 12.3.04 are applicable.

13.3.05 - TRENCH EXCAVATION - WIDTH AND DEPTH

All provisions of Section 12.3.05 are applicable.

13.3.06 - HANDLING EXCAVATED MATERIAL

All provisions of Section 12.3.06 are applicable.

13.3.07 - UNSTABLE SUBGRADE

All provisions of Section 12.3.07 are applicable.

13.3.08 - TRENCHES IN ROCK

All provisions of Section 12.3.08 are applicable.

13.3.09 - QUICKSAND AND GROUNDWATER INFILTRATION

All provisions of Section 12.3.09 are applicable except that the following sentence be added; "Drainage of ground water during construction through any storm sewer pipeline will be allowed."

13.3.10 - EXCAVATION FOR STRUCTURES

All provisions of Section 12.3.10 are applicable.

13.3.11 - PIPE BEDDING LIMITS

All provisions of Section 12.3.11 are applicable except that the following sentence shall be added to the CLASS "A" - CONCRETE CRADLE BEDDING and CLASS "B" BEDDING subsections; "For reinforced concrete pipe (RCP), the bedding may be terminated at the springline (mid-depth) of the pipe."

13.3.12 - PIPE LAYING

All provisions of Section 12.3.12 are applicable except the fourth paragraph pertaining to service wyes.

ALIGNMENT

All provisions are applicable with the following modifications; delete the last sentence and replace with the following - "All PVC and HDPE pipe installations shall be tested with an approved mandrel (go-nogo) device prior to street paving."

VERTICAL TOLERANCES

All provisions are applicable.

JOINTING PIPE

All provisions are applicable.

13.3.13 – BACKFILLING

All provisions of Section 12.3.13 are applicable except that Class "B" bedding is not required above the springline of reinforced concrete pipe. Also, add the following sentence to the sixth paragraph after the last sentence; "An additional compaction test is required for each inlet pipe run and may be taken along the pipe or at the inlet at the discretion of the Engineer."

13.3.14 - MANHOLE CONSTRUCTION AND ADJUSTMENT

All provisions of Section 12.3.14 are applicable except that drop manholes are not required unless specified on the drawings.

13.3.15 - SANITARY SEWER SERVICE LINE INSTALLATIONS

Section 12.3.15 does not apply to storm sewer construction.

13.3.16 - TESTING AND INSPECTION

Replace section 12.3.16 - TESTING AND INSPECTION with the following;

Prior to acceptance or payment, the Contractor must provide compaction test results to the City for the backfill compaction tests required in Section 12.3.13 - BACKFILLING. All PVC and HDPE storm sewer pipe shall undergo a deflection (go-nogo) test using a five percent (5%) deflection rigid mandrel, performed in the presence of an inspector.

Pipe shall be removed, replaced and retested if maximum deflection exceeds five percent of the pipe's internal diameter. Pipe shall be retested for deflection by the City of Pueblo prior to the end of the two year warranty period. Any pipe showing a deflection in excess of five percent shall be removed and replaced by the Contractor, at his expense.

All storm sewers will be inspected by closed-circuit television, by the City, after other utility installations and acceptance of all testing, but prior to construction of surface improvements over the new sewer unless otherwise authorized by the City. The Contractor shall thoroughly clean all sewers prior to televising by the City. The City requires five (5) working days advance notice for scheduling the televising and will be allowed five (5) working days to complete the television inspection.

Acceptance of the pipe will be granted by the Engineer only after all defects such as poor alignment, mislaid pipe, and broken or damaged pipe have been remedied, and the prescribed testing has been satisfactorily completed. Acceptance of the pipe does not relieve the Contractor of the responsibilities imposed by all other sections of these specifications.

13.3.17 - CLEANING SEWERS AND APPURTENANCES

All provisions of Section 12.3.17 are applicable.

13.3.18 - REPLACING SIDEWALKS, CURB AND GUTTER, BASE COURSE, PAVING, ETC.

All provisions of Section 12.3.18 are applicable.

13.4 - METHOD OF MEASUREMENT

Method of measurement for storm sewer construction shall be as follows:

- (a) Inlets and Manholes - Each inlet or manhole constructed will be counted for payment by the contract unit.
- (b) Storm Sewer Pipe - The length of storm sewer pipe of various sizes and types shall be measured in feet along the centerline of acceptably laid storm sewer from inside of wall to inside of wall of manholes and/or inlets, or to end of pipe (excluding flared end sections).
- (c) Rip-rap - Shall be measured by the ton as evidenced by weight tickets or by the cubic yard as measured in the field. Method shall be determined by the bid schedule.
- (d) Flared End Section - Flared end sections shall be counted and paid for as each unit installed.

13.5 - BASIS OF PAYMENT

Basis of payment for storm sewer construction shall be as follows:

- (a) Inlets and Manholes - Payment for inlets and manholes shall be full compensation to construct the complete unit in accordance with these specifications and the Standard Details. It shall include the ring and cover castings, concrete adjustment rings or brick, and all items incidental to the manhole or inlet.
- (b) Storm sewer pipe - Storm sewer pipe will be paid for at the contract unit price for the various sizes and types, installed complete in place. Said price shall include all joint materials, plugs, and other materials to construct in accordance with these specifications, and the standard details. It shall include but not be limited to all costs associated with excavation, shoring, bedding, pipe placement, backfill, compaction, water for compaction, clean-up, landscape restoration, etc.. No payment will be made for pipe until backfilling, compaction tests, deflection (go-nogo) test have been accepted by the Engineer.
- (c) Rip-rap - Payment for this item shall be full compensation for all labor and material to furnish and install the rip-rap, including filter fabric and filter material, and excavation, in accordance with these specifications. Class A filter material shall be included in the bid price for rip-rap and not paid for separately.
- (d) Flared End Section - Payment for this item shall be full compensation for all labor and materials to furnish and install the flared end section, including excavation, backfill, coupling adapters and necessary grading to match to a channel or ditch flowline.

ARTICLE 14

EXCAVATION WITHIN PUBLIC RIGHT OF WAY

14.1 - GENERAL

14.1.01 - DESCRIPTION

This section of the Specifications shall govern the removal and satisfactory disposal of all excavated materials, backfill and compaction, and the replacement of sidewalks, driveways, curb and gutter, cross pans, aggregate base, paving, sod or other landscaping material associated with any excavation within the public right of way, including new subdivisions. These Specifications have been promulgated in accordance with Chapter 6, Title XII of the 1971 Code of Ordinances.

14.2 - MATERIALS

14.2.01 - CONSTRUCTION MATERIALS

- (a) CONCRETE: Conform to the requirements of Article 4 - CONCRETE.
- (b) CONCRETE CURB & GUTTER: Conform to the requirements of Article 5 - CONCRETE CURB & GUTTER.
- (c) CONCRETE SIDEWALK AND DRIVEWAYS: Conform to the requirements of Article 6 - CONCRETE SIDEWALK AND DRIVEWAYS.
- (d) CONCRETE PAVEMENT: Conform to the requirements of Article 7 - CONCRETE PAVEMENT.
- (e) AGGREGATE BASE: Conform to the requirements of Article 8 - AGGREGATE BASE CONSTRUCTION.
- (f) FLOWABLE FILL: Conform to the requirements of Article 4-CONCRETE (FLOWABLE FILL)
- (g) HOT BITUMINOUS PAVEMENT: Conform to Article 10 - HOT BITUMINOUS PAVEMENT.
- (h) ASPHALTIC OVERLAY: Conform to Article 11 - ASPHALTIC OVERLAY.

14.3 - CONSTRUCTION REQUIREMENTS

14.3.01 PERMITS

Any excavation within the public right of way, including new subdivisions, shall require an excavation permit. This permit shall be obtained from the City Streets Division office at 310 E. "D" Street. Permit fees shall be in accordance with the latest fee schedule, adopted by the City Council. Permits will only be issued to Contractors licensed under the Provisions of Chapter 4, Title XII, of the Code

of Ordinances to do excavation work, and who post bonding and insurance certificates as required by sections 12-6-10 and 12-6-11 of the Code of Ordinances. Permits (“no fee”) may also be issued to the Pueblo Board of Water Works and School District 60; however, contractors working for either agency are not exempted from the permit fees.

If the work involves removal and replacement of existing concrete features (curb & gutter, sidewalk, crossspan, etc.), then a concrete permit must also be obtained from the Public Works Department. Permits will only be issued to licensed concrete contractors.

14.3.02 – PAVEMENT IMPACT FEES

Where pavement removal is associated with an excavation permit, the applicant shall pay all Pavement Impact Fees as required by Section 12-6-4.1 Pavement Impact Fee of the Pueblo Municipal Code of Ordinances, unless otherwise waived by the Director of Public Works.

14.3.03 - PAVEMENT, SIDEWALK AND CURB & GUTTER REMOVAL

When concrete pavement, curb & gutter, cross pans or sidewalk are removed, the removal shall be to an existing joint or to a sawed joint which is made prior to removal. All existing joints other than expansion joints shall be sawed prior to removal. A sawed joint will not be permitted within five (5) feet of an existing joint. Where water service line renewals cross existing curb and gutter sections that have been previously saw-cut to less than the five foot (5') minimum distance to a joint, these sections shall be removed and replaced to meet the five foot (5') minimum requirement to a joint.

The final edge of asphalt removal for the one foot (1') cut back shall be along a straight line sawed to full depth, prior to removal of the pavement, unless otherwise approved by the Engineer.

The edges of the concrete or asphalt paving shall extend one foot (1') beyond the excavation except where flowable fill is used as backfill.

The final edge of asphalt removal for the one foot (1') cutback shall be cut along a straight line, in an approved manner, to allow removal without disturbing adjacent asphalt or concrete. When the adjacent asphalt or concrete has been disturbed by the removal process, the Permittee shall replace all disturbed asphalt or concrete as directed by the Engineer.

14.3.04 – EXCAVATION AND DIRECTIONAL BORING

No excavation or directional bore shall be made without prior notification of *all* utility companies and the City Department of Public Works. All excavations shall be done by open cut from the surface or by an approved method of trenchless technology.

In open cut excavations, all excavated material determined to be saturated shall be removed from the site daily.

The width of all trenches shall be kept to a minimum, but provide adequate space for workers and safety devices. All Federal, State, and Local regulations pertaining to worker safety and health shall be followed.

In existing paved areas, all telecommunication and cablevision installation shall be done using directional boring unless otherwise approved by the Engineer. Equipment to be used and method of installation shall be presented to the Engineer for approval, prior to any installation.

14.3.05 - CONSTRUCTION TRAFFIC CONTROL AND PUBLIC SAFETY

The Permittee shall submit to the City’s Traffic Engineer for approval a traffic control plan (TCP) prepared by a Certified Traffic Control Supervisor. No work shall begin which will affect traffic or pedestrians without implementing an approved traffic control plan. The Permittee shall also provide all barricades, lights, control devices, flagmen, etc., as required on the approved traffic control plan, to control traffic and to protect the areas under construction.

All traffic control procedures, signing, lighting, and barricades shall conform to the latest edition of the Manual on Uniform Traffic Control Devices, and shall be set up and maintained by a Certified Traffic control Supervisor.

The Permittee shall also provide all devices necessary to ensure that the public is adequately warned and protected from any hazardous conditions caused by the Permittee’s activities that take place outside the limits of the traffic control plan. These devices may include barricades, lighting, signing, and/or temporary fencing.

14.3.06 - BACKFILLING MATERIAL

Backfill material shall be free from rubbish, cinders, organic material, or frozen material and shall not be saturated. Backfill material shall be free from stones, concrete or asphalt chunks larger than eight (8) inches in diameter. When, in the opinion of the Engineer, material is deemed unsatisfactory for use as backfill it shall be removed from the site daily.

Place fill material in uniform lifts having a maximum loose thickness of eight inches (8"). Fill shall be free from frozen soil, snow, ice, mud, rubbish, organic material, and large rock. Maximum rock size shall be limited to three inches (3") for fills less than one foot (1') thick and to a maximum size of eight inches (8") for deeper fills except that rock larger than three inches (3") are not permitted within twelve inches (12") of the finished subgrade. Areas to be landscaped shall be free from surface rock larger than one inch (1").

If there is a shortage of satisfactory backfill material, the Permittee shall furnish select material meeting the following gradation:

SELECT MATERIAL GRADATION

<u>Standard Sieve Size</u>	<u>Percent By Weight Passing Sieve</u>
2 ½ inch	100
2 inch	95 - 100
No. 4	30 - 65
No. 200	3 - 15
Liquid Limit	35 Maximum
Plastic Index	6 Maximum

14.3.07 - COMPACTION REQUIREMENTS

All backfill material shall be compacted to at least ninety five percent (95%) of maximum standard Proctor density (AASHTO T99) or ninety percent (90%) of maximum modified Proctor density (AASHTO T180). Moisture content of all compacted backfill soils shall be within ±2% of optimum unless field observation verifies that the soils are unstable at lesser moisture contents. In those cases, the Engineer shall establish a minimum moisture content.

The Permittee shall provide compaction tests to the Engineer per the following schedule:

Testing for sanitary or storm sewers shall be in accordance with the provisions of Article 12 or Article 13, whichever applies.

Testing for all other utility excavations shall be done at a minimum on one location for every 250 feet, or fraction thereof, of main line trench and at every manhole or similar structure. Compaction tests at manholes or similar structures are to be in addition to the mainline compaction test requirements. One fourth or 25% of all lateral or service line trenches are to be tested per the requirements of this section.

Tests at each location shall be made at a depth of two feet (2') above the pipe or other utility and at two foot intervals in depth, up to and including the surface. For utility installations where pipe bedding is used, the test at each location shall be made at a depth of two feet (2') above the bedding material and at two foot intervals in depth, up to and including the surface. **All test locations shall be directed by the Engineer.**

If any compaction test should fail to meet the requirements of this section, at least two (2) additional locations shall be tested along the trench, at locations designated by the Engineer, to determine the extent of non-compliance. After the extent of non-compliance has been determined, that section of trench shall be recompacted and retested at a minimum of two (2) locations as directed by the Engineer. If the failure occurs at a service lateral, another lateral shall be tested in addition to the extent of non-compliance testing requirement.

Modifications to the above testing schedule may be made at the discretion of the City's Director of Public Works.

In lieu of the above compaction testing schedule, the Permittee may choose one of the following options:

- 1) Backfill with flowable fill meeting the requirements of ARTICLE 4, Section 4.2.04 of these Specifications; or
- 2) Backfill with Class 6 Aggregate Base material meeting the requirements of ARTICLE 8, section 8.2 of these Specifications and compact, at optimum moisture content, in lifts no greater than 6 inches using a manually operated impact rammer.

Option (2) above will not be allowed without testing if the Permittee has a history of three or more pavement failures per year where this method was used.

All compaction tests shall be made by an approved, independent soils testing laboratory, and shall identify the location and depth of the test, the date of the test, the maximum Proctor density and optimum moisture content of the soil, and give the percent of compaction and moisture content of the backfill material at the test location. Copies of all compaction tests shall be submitted to the City.

Compaction tests may be waived at the discretion of the Engineer for "after hours" emergency repair work.

Compaction tests must be submitted to the Engineer for review prior to the placement of any asphalt. Prior to any pavement replacement, the backfill shall be proof rolled in the presence of the Engineer with a loaded, single axle dump truck weighing approximately 12 tons or an equivalent piece of heavy equipment that will produce a similar wheel load (with a minimum tire pressure of 70 psi). Any backfill that shows signs of instability shall be removed, replaced, compacted and

retested by the Permittee. In addition to the specified proof-rolling, the contractor shall provide either compaction test results from an independent soils testing firm, or a written statement from the testing agency stating that all tests per City of Pueblo Specifications have been conducted and that all the tests, or re-tests per the specifications have met the requirements of the specifications.

Base course compaction directly beneath the asphalt pavement, to a depth shown on approved construction drawings or six inches (6") minimum, whichever is greater, shall be compacted to 95% of a modified Proctor as specified in Article 8 – AGGREGATE BASE CONSTRUCTION.

In the event of settlement or subsidence of a particular excavation or any part thereof, the Permittee shall be responsible for all repaving and repair work as directed by the Engineer, for the period of two (2) years after the excavation is backfilled and resurfaced.

14.3.08 - PUDDLING OR WATER JETTING

If requested by the contractor and/or Developer, and written permission is granted by the Director of Public Works, backfill for utility trenches may be consolidated using water induced settlement techniques (jetting/puddling). This method of trench backfill consolidation shall only be allowed in those special locations where a failure history exists for trenches using conventional engineered controlled fill. As a condition of permission to use jetting/puddling, the Contractor and/or Developer must agree in writing to provide a full and complete three (3) year warranty from the final acceptance date, that shall include repair of any surface amenities to the complete satisfaction of the City which may include a full asphaltic overlay if warranted.

Where backfill for utility trenches within the roadway section are consolidated using jetting/puddling, the moisture and density requirements within the trench compaction requirements stated shall not apply; however, the compaction limits for the finished roadway subgrade as outlined under Article 9 – EARTHWORK (COMPACTION) shall apply.

14.3.09 - REPLACEMENT OF SIDEWALKS, CURB & GUTTER, GUTTER, AGGREGATE BASE, PAVING, SOD OR OTHER LANDSCAPING MATERIAL

- (a) Where sidewalks, curb & gutter, gutter, aggregate base, paving, sod or other landscaping materials are removed or disturbed within the limits of the work, the Permittee shall replace said items in accordance with current City material and construction specifications for the work involved immediately on completion of backfill.
- (b) When trenches, cuts or holes are excavated in streets having a bituminous surface, the Permittee shall replace such surfaces in accordance with Article 10, Section 10.3.15 - PATCHING.
 - 1) Construct Class 6 aggregate base in accordance with Article 8 - AGGREGATE BASE. The minimum compacted thickness shall be equal to the thickness of the original base course or six inches (6"), whichever is greater.
 - 2) Construct hot bituminous pavement in accordance with Article 10 - HOT BITUMINOUS PAVEMENT. The minimum compacted thickness shall be equal to the thickness of the original pavement or three inches (3"), whichever is greater. On all bus routes, the minimum compacted thickness shall be four inches (4"). If full depth asphalt is used the minimum compacted thickness shall be five inches (5"), or as directed by the Engineer.

- (c) When trenches, cuts, or holes are excavated in concrete streets or gutters, they shall be replaced on Class 6 aggregate base having a compacted thickness of six inches (6") plus concrete having a thickness equal to the original concrete or seven inches (7"), whichever is greater. Concrete pavement shall comply with Article 7 - CONCRETE PAVEMENT.
- (d) When trenches are excavated in streets or alleys which have only a gravel surface, the Permittee shall replace such surfaces to the Engineer's grade, on a satisfactory compacted backfill with a compacted gravel surfacing material equal in depth to that of the original gravel or two inches (2") minimum. The gravel shall conform to Class 6 aggregate according to Article 8 - AGGREGATE BASE CONSTRUCTION.
- (e) All landscaping shall be replaced to the same conditions as encountered prior to excavation.

14.3.10 - HOT BITUMINOUS PAVEMENT OR CONCRETE UNAVAILABLE OR INCLEMENT WEATHER ON COMPLETION OF BACKFILL

If hot bituminous pavement or concrete is unavailable or weather is inclement upon completion of backfill, a temporary asphalt surface of cold mix or other approved material, having a thickness of two inches (2") shall be installed immediately on the surface of the trench, cut, or hole in an asphalt street, concrete street, paved alley, sidewalk, curb & gutter or other disturbed concrete surface. Such surfaces shall be installed before trenching continues into the next block, intersection or alley, unless otherwise allowed by the Engineer. In addition, cold mix may be allowed with the approval of the Street Maintenance Supervisor, in situations where traffic considerations dictate.

14.3.11 - REPLACEMENT OF TEMPORARY ASPHALT SURFACE

As soon as hot bituminous asphalt or concrete become available, the temporary asphalt surface shall be removed and replaced with hot bituminous pavement or concrete pavement as applicable. The replacement shall be done within two weeks (2) of material availability unless otherwise approved by the Engineer. Hot bituminous pavement shall comply with Article 10 - HOT BITUMINOUS PAVEMENT and concrete pavement shall comply with Article 7 - CONCRETE PAVEMENT.

14.3.12 - RESTORATION AND CLEAN UP

All areas disturbed or affected by the Permittee's activities shall be restored to at least the same condition as before the Permittee's activities began. The Permittee shall document initial conditions of the work site with photographs or video tape. In lieu of this documentation, the Permittee shall restore the work site as directed by the Engineer. The Permittee shall remove all excess material and debris from the work site and adjacent affected areas, and shall leave all such areas in a neat and clean condition immediately upon completion of the work.

14.3.13 - ACCEPTANCE OF WORK

Work not acceptable to the Engineer shall be removed and replaced or otherwise repaired in an acceptable manner by the Permittee.

14.3.14 - CORRECTIVE WORK DONE BY THE CITY

The City reserves the right to perform all corrective work necessary to eliminate a safety hazard or public nuisance in the event that the Permittee refuses to or delays to repair an excavation or correct deficiencies upon notice to do so.

The determination of the necessity during the excavation and warranty periods for the City to do emergency work, repairs, or correct deficiencies shall rest entirely on the Engineer. Such emergency work or repair may include but not be limited to barricading, providing detour signing, repair of trench cave-ins, backfill, compaction and street resurfacing, surface restoration and cleanup. Work done by the City shall be invoiced to the Permittee for the actual cost of labor, equipment and materials plus three-hundred per cent (300%) or the same amount shall be recovered from the Permittee's bond by action of the City Attorney.

14.3.15 - AUTHORITY OF THE ENGINEER

The opinion of the Engineer shall be absolute and final, in all cases of dispute which may arise as to the proper method to be employed in repairing any cut, trench or hole, during construction and/or the warranty period, and the acceptability of the final repair and cleanup.

Streets that have been constructed or resurfaced within five (5) years of the date of any excavation shall be resurfaced by the permittee to the extent required by the Engineer. The permittee may also be required to mill the edge of the pavement prior to resurfacing, at the discretion of the Engineer.

ARTICLE 15

EMULSIFIED ASPHALT SLURRY SEAL

15.1 – GENERAL

15.1.01 – DESCRIPTION

The slurry seal shall consist of a mixture of an approved emulsified asphalt, mineral aggregate, water, and specific additives proportioned, mixed and uniformly spread over a properly prepared surface as directed by the Engineer. The complete slurry seal shall leave a homogeneous mat, adhere to the prepared surface, and have a friction resistant surface texture throughout its service life.

15.2 – MATERIALS

15.2.01 – EMULSIFIED ASPHALT

The emulsified asphalt shall conform to grade **CQS-1h1** (Cationic Quick Setting Emulsified Asphalt with Latex Polymer). CQS-1h1 shall be an emulsified blend of asphalt, water, styrene-butadiene rubber (SBR) latex emulsifiers. The emulsion shall be pumpable and suitable for use in slurry seal mixing and spreading equipment and suitable for application through a distributor truck. The emulsion shall contain a minimum of one percent (1.0%) by weight of styrene-butadiene rubber (SBR) polymer solids based on weight of residual asphalt. The polymer shall be added as SBR latex by high shear mixing by co-milling or post-milling. The cement-mixing test is waived.

15.2.02 – QUALITY TESTS

	AASHTO TEST METHOD	ASTM TEST METHOD	QUALITY	SPECIFICATIONS
TEST ON EMULSION				
	AASHTO T59	ASTM D244	Residue After Distillation	60% Minimum
TEST ON EMULSION RESIDUE				
	AASHTO T49	ASTM 2397	Penetration at 77°F (25°C)	40-90*

*Climate Conditions should be considered when establishing this band.

Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance to assure that it is the same as that used in the mix design.

15.2.03 – AGGREGATE

The mineral aggregate used shall be the type and grade specified for the particular use of the slurry seal. The aggregate shall be manufactured crushed stone such as granite, slag, limestone or other high-quality aggregate, or combination thereof. To assure the material is totally crushed, 100% of the parent aggregate will be larger than the largest stone in the gradation to be used.

15.2.04 – QUALITY TESTS

When tested according to the following tests, aggregate will meet these requirements.

AASHTO TEST NO.	ASTM TEST NO.	QUALITY	SPECIFICATIONS
AASHTO T176	ASTM D2419	Sand Equivalent	45 Minimum
AASHTO T104	ASTM C88	Soundness	15% Maximum using Na ₂ SO ₄ or 25% Maximum using MgSO ₄
AASHTO T96	ASTM C131	Abrasion Resistance	35% Maximum

The abrasion test is to be run on the aggregate before it is crushed. The aggregate should meet approved polished values.

15.2.05 – GRADING

When tested in accordance to AASHTO T27 and ASHTO T11, the target (mix design) aggregate gradation (including the mineral filler) shall be within one of the following bands.

SIEVE SIZE	TYPE I PERCENT PASSING	TYPE II PERCENT PASSING	TYPE III PERCENT PASSING	STOCKPILE TOLERANCE
3/8 (9.5mm)	100	100	100	
#4 (4.75mm)	100	90-100	70-90	± 5%
#8 (2.36mm)	90-100	65-90	45-70	± 5%
#16 (1.18mm)	65-90	45-70	28-50	± 5%
#30 (600um)	40-65	30-50	19-34	± 5%
#50 (330um)	25-42	18-30	12-25	± 4%
#100 (150um)	15-30	10-21	7-18	± 3%
#200 (75um)	10-20	5-15	5-15	± 2%

The job mix (target) gradation shall be within the gradation band for the desired type. After the target gradation has been submitted, then the percent passing the sieve shall not vary by more than the stockpile tolerance and still remain within the gradation band.

The aggregate will be accepted at the job location or stockpile. The stockpile shall be accepted based on five-gradation tests according to AASHTO T2. If the average of the five tests is within the gradation tolerances, then the materials will be accepted. If the tests show the material to be out of tolerance the Contractor will be given the choice to either remove the material or blend other aggregates with the stockpile material to bring it into specifications.

Materials used in blending must meet the quality test before blending and must be blended in a manner to produce a consistent gradation. This may require a new mix design.

Screening shall be required at the stockpile if there are any problems created by having oversized materials in the mix.

15.2.06 – MINERAL FILLER

Portland cement, hydrated lime, limestone dust, fly ash, or other approved filler meeting the requirements of ASTM D242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate.

15.2.07 – WATER

The water shall be free of harmful salts and contaminants.

15.2.08 – ADDITIVES

Additives may be used to accelerate or retard the break-set of the slurry seal or to improve the resulting finished surface. The use of additives in the slurry mix (or individual materials) shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the Engineer. If specified, carbon black shall be added to the slurry mixture at a minimum of 2% to a maximum of 3% based on the weight of the emulsion. The product shall be Mono-Chem Permablack 115A, 2847A or equal as approved by the Engineer.

15.2.09 – MIX DESIGN

The Contractor shall submit to the Engineer for approval a complete mix design prepared and certified by the laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate gradation that the Contractor will provide on the project.

Recommended tests and values are as follows:

ISSA= (International Slurry Surfacing Association)

ISSA TEST NO.	DESCRIPTION	SPECIFICATIONS
ISSA TB106	Slurry Seal Consistency	
ISSA TB-139 (For quick-traffic systems)	Wet Cohesion 30 Min. Minimum (Set) Wet Cohesion 60 Min. Minimum	12 kg-cm Minimum 20 kg-cm Minimum
ISSA TB109 (For heavy-traffic areas only)	Excess Asphalt by LWT Sand Adhesion	50g/ft ² Maximum (538 g/m ² Maximum)
ISSA TB-114	Wet Stripping	Pass (90% Minimum)
ISSA TB-100	Wet-Track abrasion Loss, One-hour Soak	75g/ft ² (807 g/m ²)
ISSA TB-113	Mix Time**	Controllable to 180 Seconds Minimum

** The mixing test and set time should be preformed at the highest temperature expected during construction.

The wet- track abrasion test is used to determine the minimum asphalt content.

The mixing test is used to predict how long the material can be mixed in the machine before it begins to break. It is more for information to be used by the Contractor than for the quality of the end product. It is, however, a good field test to check for consistent sources of material, both emulsified asphalt and aggregate.

The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) (usage), and asphalt emulsion based on the dry weight of the aggregate.

All component materials used in the mix shall be representative of the materials proposed by the contractor to be used on the project.

The percentages of each individual material required shall be shown in the laboratory report. Adjustments may be required during the construction, based on the field conditions. The Engineer will give final approval for all such adjustments.

The Engineer shall approve the mix design and all slurry seal materials and methods prior to use. The component materials shall be within the following limits:

COMPONENT MATERIALS	LIMITS
Residual Asphalt	Type I: 10-16% Type II 7.5-13.5% Type III 6.5-12% (Based on dry weight of aggregate)
Mineral Filler	0.5-2.0% (Based on dry weight of aggregate)
Additives	As needed
Water	As needed to achieve proper mix consistency (Total mix liquids should not exceed the loose aggregate voids. ISSA T106 should be used to check optimum liquids.)

15.3 – CONSTRUCTION REQUIREMENTS

15.3.01 GENERAL

Before work begins, the contractor shall submit a signed mix design covering the specific materials to be used on the project. This design will be performed by a laboratory that has experience designing Emulsified Asphalt Slurry Seal surfacing. After the mix design has been approved, no substitution will be permitted unless approved by the Engineer.

The International Slurry Surfacing Association (ISSA) can provide a list of laboratories experienced in testing slurry seal materials for mix designs.

15.3.02 – RATE OF APPLICATION

The slurry seal mixture shall be of proper consistency at all times so as to provide the application rate required by the surface condition. The average application rate, as measured by the Engineer, shall be in accordance with the following table:

AGGREGATE TYPE	LOCATION	SUGGESTED APPLICATION RATE
Type I	Parking Areas Urban and Residential Streets Airport Runways	8-12 lb/yd ² (4.3-6.5 kg/m ²)
Type II	Urban and Residential Streets Airport Runways	14-18 lb/yd ² (7.6-9.8 kg/m ²)
Type III	Primary and Interstate Routes	18-30 lb/yd ² (9.8-16.3 kg/m ²)

Application rates are affected by the weight of the aggregate the gradation of the aggregate, and the demand of the surface to which the slurry is being applied. ISSA Technical Bulletin 112 gives a method to determine expected application rates.

15.3.03 – TOLERANCES

Tolerances for individual materials as well as the slurry seal mixture are as follows:

- a) After the design residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.
- b) The percentage of aggregate passing each sieve shall be within stockpile tolerance range as stated.
- c) The percentage of aggregate passing shall not vary from the high end to the low end of the specified range of any two successive sieves.
- d) The slurry consistency shall not vary more than ± 2 inches from the job mix formula after field adjustments.
- e) The rate of application, shall not vary more than ± 1 lb/sq yd while remaining within the design application rate.

15.3.04 – MIXING EQUIPMENT

All equipment, tools and machines used in performance of this work shall be maintained in satisfactory working condition at all times to ensure a high – quality product.

The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled, slurry seal mixing machine of either truck-mounted or continuous-run design. Continuous-run machines are those that are equipped to self-load materials while continuing to lay slurry seal. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving mixer and to discharge the mixed product on a continuous-flow basis. The machine shall have sufficient storage capacity for aggregate emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls.

If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speeds during the application of the slurry seal. It shall be equipped with self-loading device, opposite-side driver stations, and forward and reverse speed controls

15.3.05 – PROPORTIONING DEVICES

Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt and additive) shall be provided and properly marked.

The proportioning devices are usually revolution counters or similar devices and are used in material calibration and determining the material output at any time.

15.3.06 – SPREADING EQUIPMENT

The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as the final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform, highly textured mat.

15.3.07 – AUXILIARY EQUIPMENT

Suitable surface preparation equipment, traffic control equipment, hand tools and any other support equipment shall be provided as necessary to perform the work.

15.3.08– CALIBRATION

Each mixing unit to be used in performance of the work shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be acceptable, provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

15.3.09 – VERIFICATION

Each machine will make test strips after calibration and prior to construction. Test strips shall be a portion of the project. Samples of the slurry seal will be taken and verification made as to mix consistency and proportioning. Verification of rate application will also be made. Upon failure of any of these tests, additional test strips, at no cost to the City, will be required until each unit is authorized to work. Any unit failing to pass the tests after the third trial will not be permitted to work on the project. Test strips must be accepted or rejected within 24 hours after application.

15.3.10 – WEATHER LIMITATIONS

The slurry seal shall not be applied if either the pavement or the air temperature is below 50° F and falling, but may be applied when both pavement and air temperature are above 45°F and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

15.3 11– NOTIFICATION AND TRAFFIC CONTROL

All homeowners and businesses affected by the paving shall be notified one day in advance of the surfacing. Suitable tow-away signs may be posted prior to the surfacing. Should work not occur on the specified day, a new notification will be distributed.

15.3.12 – TRAFFIC CONTROL

Suitable methods shall be used by the contractor to protect the slurry seal from damage from all types of vehicular traffic. Opening to traffic does not constitute acceptance of work. The Engineer shall be notified of the methods to be used.

In areas that are subject to an increased rate of sharp-turning vehicles, additional time may be required for a more complete cure of the slurry seal mat to prevent damage. Slight tire marks may be evident in these areas after opening but will diminish over time with rolling traffic. If these areas are not severely rutted, they should be considered as normal characteristics of a slurry seal and should be accepted.

15.3.13– SURFACE PREPARATION

Immediately prior to applying the slurry seal, the surface shall be cleared of all loose material, oil spots, vegetation, and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing. The city will clear the streets of loose material, oil spots, vegetation, and other objectionable material. Manholes, valve boxes, drop inlets, and other surface entrances shall be protected from the slurry seal by a suitable method. The Contractor shall protect the manholes, valve boxes, drop inlets, and other surface entrances and also remove protection as the project is completed. The Engineer shall approve the surface preparation prior to surfacing.

When required by local conditions, the surface shall be pre-wetted by fogging ahead of the spreader box.

The rate of application of the fog spray shall be adjusted during the day to suit the temperature, surface texture, humidity, and dryness of the pavement. The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided.

No lumping, balling, or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate, shall be left in the finished surface. If excess oversize develops, the job will be stopped until the contractor proves to the engineer that the situation has been corrected. Some situations may require screening the aggregate just prior to loading it into the units going from the stockpile area to the lay-down operation.

15.3.14 – TACK COAT

Normally, tack coat is not required unless the surface to be covered is extremely dry and raveled, or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt/three parts water.

The emulsified asphalt should be the same as used in the mix. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gal / sq yd. The tack coat shall be allowed to cure before application of the slurry seal.

15.3.15 – CRACKS

It is advisable to pre-treat cracks in the pavement surface with an acceptable crack sealer prior to application of the slurry seal.

15.3.16 – JOINTS

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The contractor shall provide suitable width-spreading equipment to produce a

minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd-width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of six inches shall be allowed for overlap of longitudinal lane line joints.

15.3.17 – MIX STABILITY

The slurry seal shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water and emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate. Spraying of additional water into the spreader box will not be permitted.

15.3.18 – HANDWORK

Areas, which cannot be reached with slurry seal machine, shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be hand worked shall be lightly dampened prior to mix placement and the slurry worked immediately.

Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

15.3.19 - LINES

Care shall be taken to ensure straight lines along gutters and shoulders. No run –off on these areas will be permitted. Edges at intersections will be kept straight to provide good appearance.

15.3.20 - ROLLING

Rolling is usually not necessary for slurry seal surfacing on roadways. Airports and parking areas should be rolled by a self-propelled, 10-ton pneumatic roller with a tire pressure of 50 PSI, equipped with a water spray system. The surfaced areas shall be subjected to a minimum of two (2) full coverage passes by the roller.

Rolling should not commence until the slurry has cured enough so that it will not pick up on the tires of the roller.

15.3.21 - CLEANUP

All areas, such as manhole access, gutters and intersections, shall have the slurry seal removed as specified by the Engineer. The Contractor shall remove any debris associated with the performance of the work on a daily basis.

15.3.22 – QUALITY CONTROL INSPECTIONS

To insure quality, inspectors assigned to projects must be familiar with the materials, equipment and application of the slurry.

Local conditions and specific project requirements must be considered when determining the parameters of field inspections.

The contractor will permit the Engineer to take samples of the aggregate and asphalt emulsion used in the project at the Engineers discretion. Gradation and sand equivalent tests may be run on the

aggregate and residual asphalt content tests on the emulsion. Test results will be compared to specifications. Tests will be run at the expense of the buyer.

Samples of the slurry seal will be taken directly from the slurry unit(s) at a minimum rate of one sample per mixing unit per day's use. Consistency and residual asphalt content tests may be made on the samples and compared to the specifications. Test will be run at the expense of the buyer. The buyer must notify the contractor immediately if any test fails to meet specifications.

15.4 METHOD OF MEASUREMENT

The quantity of slurry seal to be paid for as specified in the Bid Proposal:

The number of square yards of slurry seal of the specified thickness complete in place as measured in the field and accepted by the Engineer.

15.5 – BASIS OF PAYMENT

Slurry seal surfacing will be paid for at the unit price per square yard as set forth in the Bid Proposal. This payment shall be full compensation for all related work as defined in Article 15 – Slurry Seal, all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and these specifications. The payment shall be full compensation for slurry materials, hauling of materials, (when specified) tack coats applied and placing and smoothing of the slurry in accordance with these specifications.

ARTICLE 16

ADA REQUIREMENTS WITHIN RIGHTS-OF-WAY

16.1 – GENERAL

16.1.01 – DESCRIPTION

The construction of accessible curb ramps, sidewalks, trails and other pedestrian facilities shall comply with the specifications contained within this Article or as specified in Appendix A of 28 CFR Part 36, ADA Accessibility Guidelines, For Buildings and Facilities, commonly known as ADAAG, whichever is more stringent. In those cases where existing conditions conflict with any provision(s) of the ADAAG, a documented determination of technical unfeasibility may be made by the Director of Public Works, or the Director's authorized representative.

16.2 – MATERIALS

Materials for construction of any improvements covered under this Article shall comply with the applicable sections contained within these Articles. Any material proposed for use other than concrete, aggregate base course, or asphaltic concrete must be approved in writing by the Director of Public Works, prior to use.

16.2.01 – CONCRETE, AGGREGATE BASE COURSE, ASPHALT

For specifications governing concrete, aggregate base course and/or asphalt, see Articles 4, 8 and/or 10.

For ADA designated accessible trails, use of alternative base course approved by the Director of Public Works may be used. Material shall be installed to provide a firm, stable and slip resistant surface. When tested using a Rotational Penetrometer in accordance with the proposed standardized test method ANSI/RESNA Surface/WD Section 1: Determination of Firmness and Stability, the maximum penetration value shall be less than or equal to 0.30 inches.

16.2.02 – TACTILE WARNING BANDS

Materials and/or acceptable manufacturer's products listed below are approved for use. Note that alternate products must be approved in writing by the Director of Public Works prior to installation. Contractor must provide a complete submittal of the proposed alternate material for review, including a product sample.

- a. New installations: Use a manufactured insert, tile red in color, that is cast integrally with the concrete. Acceptable product is Armor-Tile as manufactured by Engineered Plastics, Inc. (www.armor-tile.com) (1-800-682-2525), or approved equal.
- b. Retrofit installations: Use either a retrofit mat attached to the concrete with adhesive and mechanical fasteners (Armor-Tile, see a. above) or a preformed thermoplastic mat (www.flintrading.com) (1-336-475-6600), or approved equal. Color of either product shall be tile red in color.

16.3 – CONSTRUCTION REQUIREMENTS

16.3.1 – SURFACE REQUIREMENTS

The surface of any accessible route shall be firm, stable and slip-resistant. All horizontal concrete surfaces along the accessible route shall receive a uniform surface roughening treatment consisting of a light broom finish.

16.3.2 – MINIMUM CLEAR WIDTH

The minimum clear (unobstructed) width of any accessible route shall be thirty-six inches (36”), not including curb head. Any utility fixtures (poles, mailboxes, fire hydrants, pedestals, transformers, etc.) encroaching into the minimum clear width must be relocated or the sidewalk shall be widened as required to provide the minimum clear width.

16.3.3 – SIDEWALK WIDTHS

Sidewalks shall have a minimum width, not including curb head, of sixty inches (60”) for residential areas and seventy-two inches (72”) for commercial areas and around schools. At locations where the sidewalk detaches from the curb head for the sole purpose of providing a level pathway around a drive apron, the width of that section may be forty-eight inches (48”).

16.3.4 – CHANGES IN LEVEL

Vertical changes in level up to ¼ inch are permitted without treatment along designated accessible routes. Changes in level ¼ inch to ½ inch must be beveled with a slope no greater than 1:2. Changes in level greater than ½ inch where the slope is more than 5% must be treated as a curb ramp or ramp.

16.3.5 – CROSS SLOPE

Except at street intersections, the accessible route shall provide a maximum cross slope, measured perpendicular to the normal direction of travel, of 1:50 (2%), including the gutter flowline slope.

16.3.6 – GRADIENT

Grades for sidewalks and designated accessible trails shall be in accordance with the applicable sections of ADAAG (see ADAAG Manual table 15.3.3. a.). Whenever possible, the running slope of the sidewalk should be a maximum of 1:20 (5%). When topography and roadway design considerations make this criterion unfeasible, the gradient may match the adjoining roadway gradient.

16.3.7 – CURB RAMPS

Grade: Grades for curb ramps shall be a maximum grade of 1:12 (8.33%), except that for existing conditions where a 1:12 slope is unfeasible, grades may be increased to a maximum of 1:10 (10%) for a vertical rise up to six inches (6”). The Director of Public Works must approve all grades that exceed the 1:12 (8.33%) slope.

Cross Slope: The maximum cross slope shall be 1:50 (2%), including the gutter Flowline slope.

Width: The minimum width shall be four feet (4').

Landings: There shall be a landing at the top of each curb ramp having a minimum dimension of forty-eight inches (48") and a maximum cross slope of 1:50 (2%).

Edges: The sides along all diagonal curb ramps shall be tapered with a slope not greater than 1:10 (10%), except in those locations where the taper may become part of the traveled path (not accessible route), then the slope shall be reduced to 1:12 (8.33%).

Transitions: The foot of the curb ramp shall be flush with the gutter. The slope of the adjoining gutter and asphalt roadway shall not exceed 1:20 (5%) for a minimum distance of forty-eight inches (48"). The gutter lip shall be flush with the street pavement.

Locations: All new street corner construction, where both of the adjacent street widths are 36 feet wide or narrower, a single diagonal street ramp may be used. Optionally, paired ramps may also be used.

At locations where a street corner or other location is being retrofitted with a curb ramp, and the adjacent street widths are 36 feet wide or narrower, curb ramps may be either diagonal or paired, whichever is most practicable..

At those locations where at least one of the adjacent streets are greater than 36 feet wide, paired ramps shall be constructed, unless otherwise approved by the Director of Public Works.

Tactile Warning Bands: There shall be a tactile warning band at the toe of every curb ramp that meets the requirements of 16.2.02.

16.4 – METHOD OF MEASUREMENT

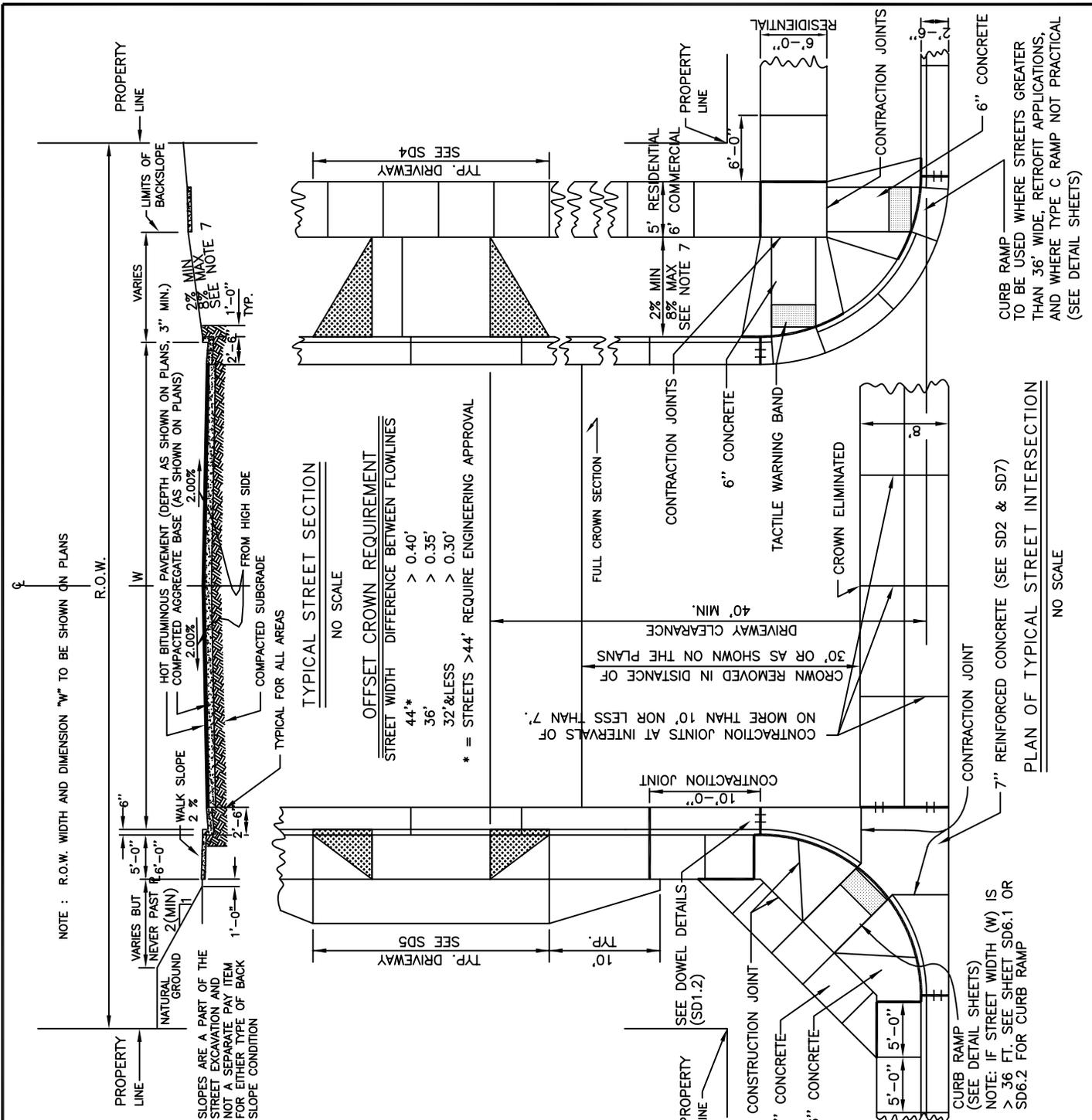
Method of measurement shall be as described under the applicable Article for each material used.

For "Tactile Warning Bands", the measurement shall be either of the following; Square Feet (SF) or Each (EA). If so specified in the project specifications, they may be considered incidental to the surrounding concrete bid item and not considered as a separate pay item.

16.5 – BASIS OF PAYMENT

Basis of payment for ADA requirements outlined under this Article shall be complete compensation for the construction of each item as described under the applicable Article for each material used.

The unit price established under the Method of Measurement section above for "Tactile Warning Bands" shall include all costs to furnish and install each "Tactile Warning Band". Any work associated with the construction of "Tactile Warning Bands" not specified is considered subsidiary to the item and will not be paid for separately.



- NOTES :
1. ALL UTILITY FIXTURES ENCRANCHING ON CONSTRUCTION ARE TO BE MOVED BY OTHERS.
 2. 1/2" EXPANSION JOINTS SHALL BE PLACED AT INTERVALS OF NOT MORE THAN ONE HUNDRED (100) FEET OR AT DRIVE CUTS AT TOP OF SLOPES IN SIDEWALKS.
 3. DOUBLE GUTTER EXPANSION JOINTS SHALL BE PLACED NOT MORE THAN 200' APART.
 4. ALL CURB AND GUTTER AND DOUBLE GUTTER EXPANSION JOINTS SHALL BE DOWELED AS SHOWN IN THE DETAILS.
 5. CURB & GUTTER EXPANSION JOINTS SHALL BE PLACED NOT MORE THAN 200' APART AND BETWEEN CURB & GUTTER AND WALK AT POINTS WHERE SIDEWALK ABUTS BUILDING.
 6. SEE CURB RAMP DETAILS SD6.1 THRU SD6.5 FOR ADDITIONAL REQUIREMENTS.
 7. ADA REQUIREMENTS CONTROL MAXIMUM RISE FROM CURB HEAD. MAY EXCEED 8% WITH PERMISSION OF THE ENGINEER

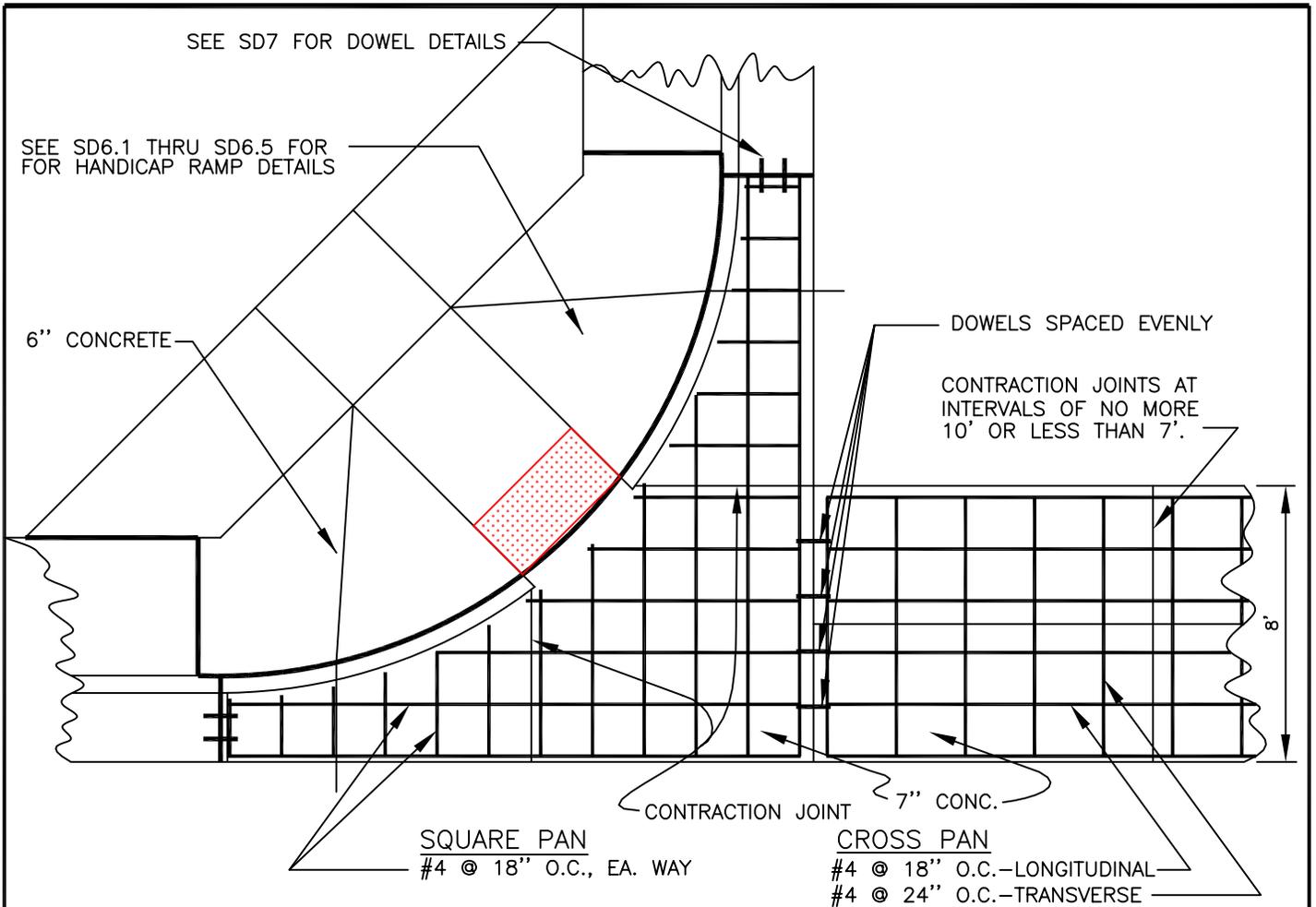
CITY OF **PUEBLO** COLORADO

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
211 East "D" St. 81003
(719) 553-2295
FAX (719) 553-2294

TYPICAL STREET INTERSECTION

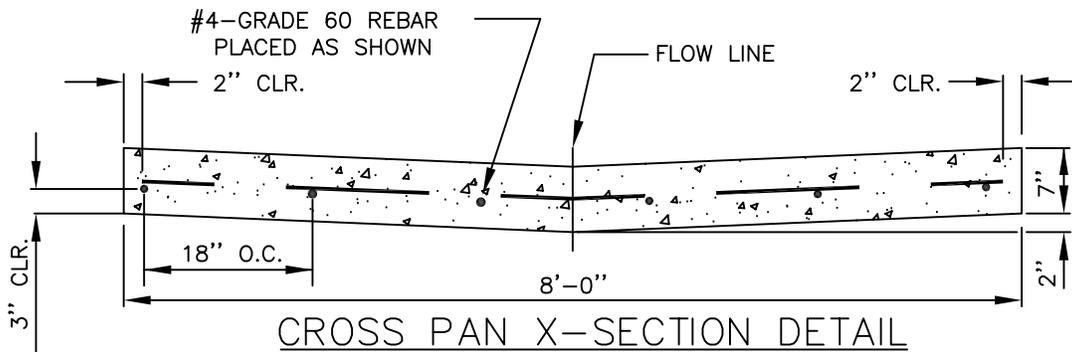
Drawn By: A.C.M.	Date: 2/05/04	SHEET: SD1
Checked By: MB	Approved By: MB	

FILENAME: SD1
REV: 3-28-05
REV: 5-24-04



PLAN OF TYPICAL SQUARE PAN AND CROSS PAN

SCALE: 1" = 5'



CROSS PAN X-SECTION DETAIL

SCALE: 1" = 3'-0"

NOTES :

1. THE CONTRACTOR SHALL USE #4-GRADE 60 REINFORCING BARS.
2. ALL REINFORCING SHALL BE SECURELY TIED AND PROPERLY SUPPORTED USING APPROVED CHAIRS.
3. DOUBLE GUTTER EXPANSION JOINTS SHALL BE PLACED NOT MORE THAN 200' APART.
4. ALL CURB AND GUTTER AND DOUBLE GUTTER EXPANSION JOINTS SHALL BE DOWELED AS SHOWN IN THE DETAILS. (SEE SD7 FOR DOWELED DETAILS)
5. SEE CURB RAMP DETAILS FOR CONSTRUCTION AND EXPANSION JOINT LOCATIONS AT CORNERS.

CITY OF



COLORADO

DEPARTMENT OF PUBLIC WORKS

ENGINEERING DIVISION

211 East "D" St. 81003

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**SQUARE PAN AND
CROSS PAN DETAIL**

Drawn By: A.C.M.

Date: 2/18/04

SHEET: SD1.2

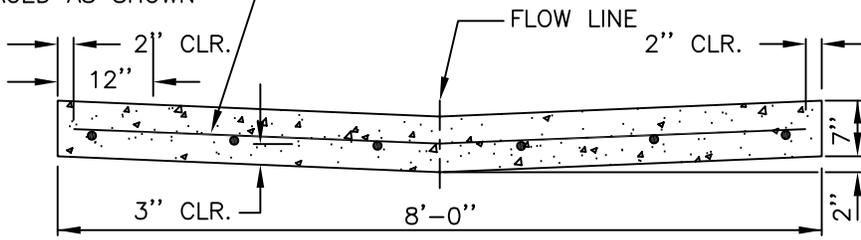
Checked By: M.B.

Approved By: M.B.

FILENAME: SD1-2

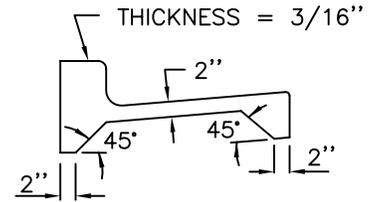
REV: 5-24-04

#4 @ 18" O.C. LONGITUDINAL
 #4 @ 24" O.C. - TRANSVERSE
 PLACED AS SHOWN



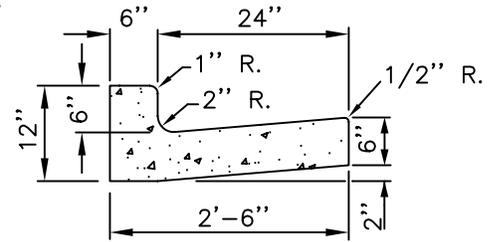
CROSS PAN DETAIL

SCALE: 1" = 2'-0"



TEMPLATE

SCALE: 1" = 2'-0"

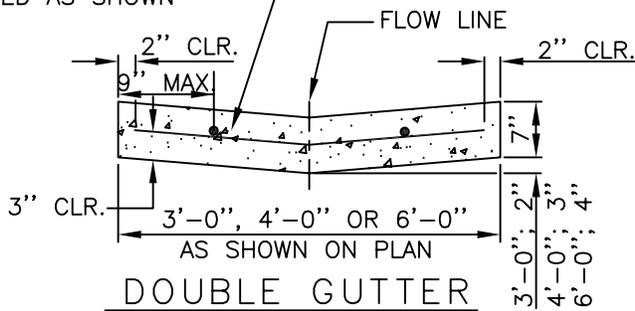


STANDARD CURB & GUTTER

SCALE: 1" = 2'-0"

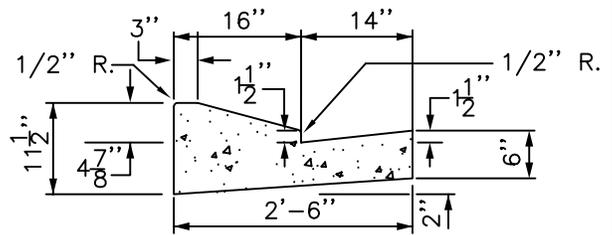
#4 @ 18" O.C. LONGITUDINAL
 (2 BARS REQ'D FOR 3'-0" GUTTER)
 (3 BARS REQ'D FOR 4'-0" GUTTER)
 (4 BARS REQ'D FOR 6'-0" GUTTER)

#4 @ 24" O.C. - TRANSVERSE (6'-0" DOUBLE GUTTER ONLY)
 PLACED AS SHOWN



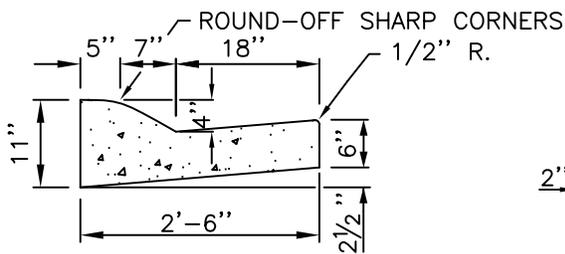
DOUBLE GUTTER

SCALE: 1" = 2'-0"



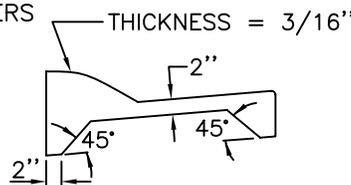
MODIFIED RAMP CURB & GUTTER

SCALE: 1" = 1'-0"



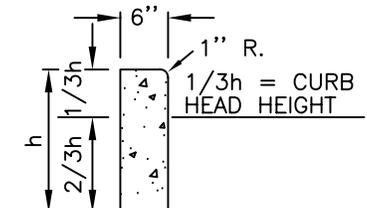
ROLLED CURB & GUTTER

SCALE: 1" = 2'-0"



TEMPLATE

SCALE: 1" = 2'-0"

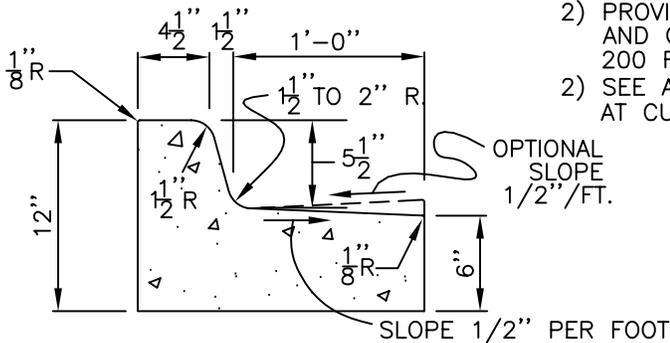


6" CURB HEAD

SCALE: 1" = 2'-0"

NOTE:

- 1) PROVIDE 2-#4 REINFORCING BARS IN GUTTER SECTIONS AT ALLEYS - SEE SD4
- 2) PROVIDE TOOLED CONTRACTION JOINTS @ 10' O.C. ALL CURB AND GUTTER SHALL HAVE DOWELED EXPANSION JOINTS AT 200 FEET O.C.-MAX.
- 2) SEE APPLICABLE DETAILS FOR GUTTER SLOPE MODIFICATIONS AT CURB RAMPS.



CURB & GUTTER TYPE 2

SECT. 1-B

SCALE: 1" = 1'-0"

FILENAME: SD2 Rev: 5-24-04

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211 East "D" St. 81003
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CONCRETE CURB AND GUTTER
 DOUBLE GUTTER AND CROSS PAN

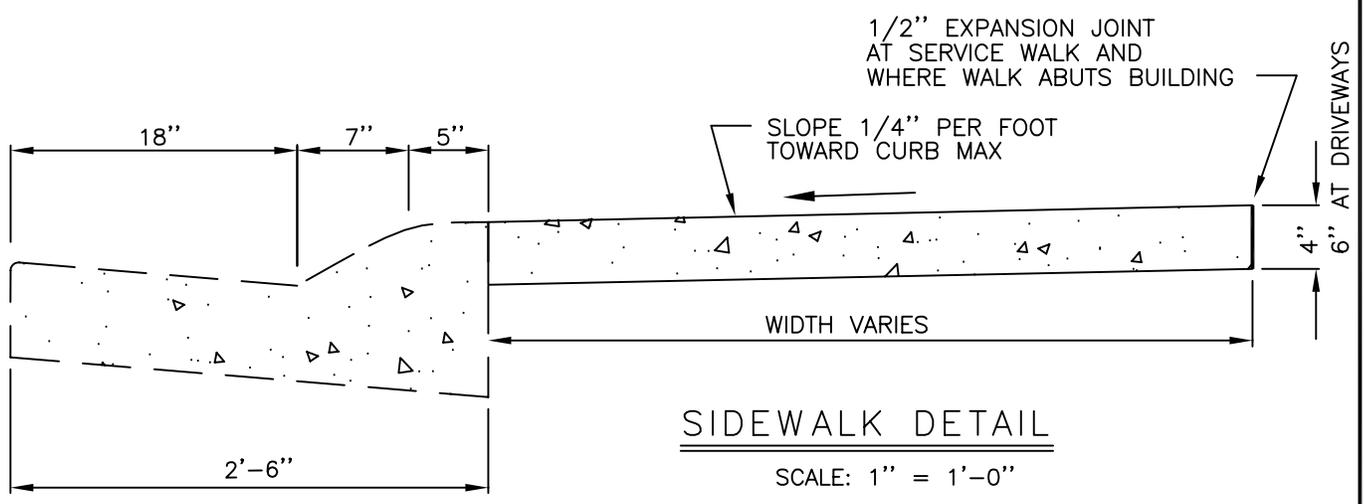
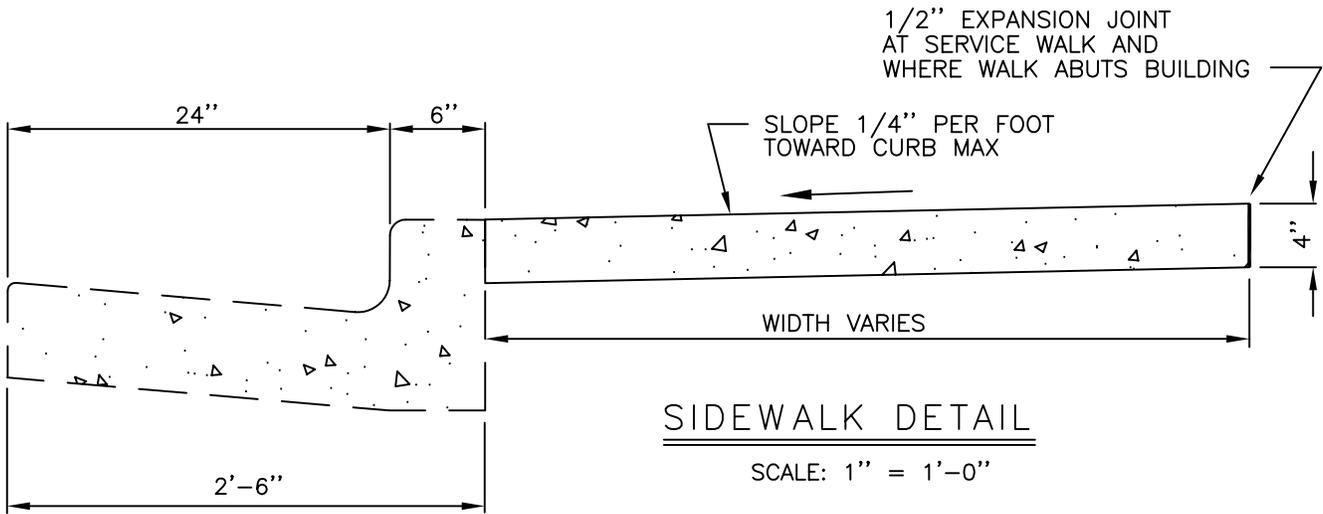
Drawn By: A.C.M.

Date: 2/05/04

SHEET: SD2

Checked By: MB

Approved By: R.P.M.



NOTE:

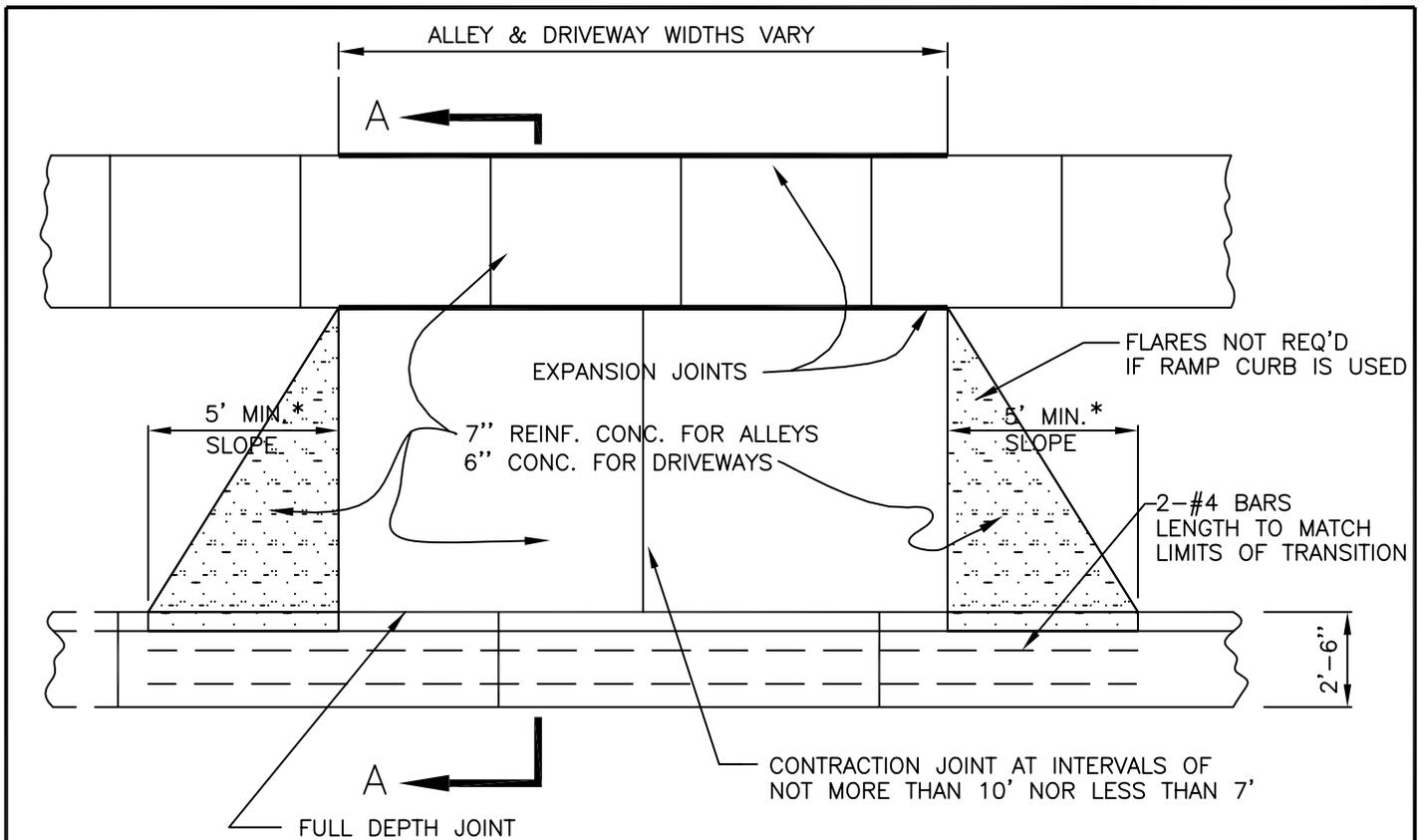
- 1) THAT PORTION OF ANY WALK AT DRIVEWAY CROSSING OR AT ANY PROBABLE CROSSING MUST BE AT LEAST 6" THICK. THIS REGULATION APPLIES TO ALL NEW SIDEWALK CONSTRUCTION AND ALL SIDEWALK REPLACEMENT
- 2) 1/2" EXPANSION JOINTS SHALL BE PLACED AT INTERVALS OF NOT MORE THAN ONE HUNDRED (100) FEET OR AT DRIVE CUTS AT TOP OF SLOPES IN SIDEWALKS.
- 3) CONTRACTION JOINTS ARE TO BE AT 5' UNLESS OTHERWISE DIRECTED BY THE CITY

CITY OF  COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	ATTACHED SIDEWALK DETAILS

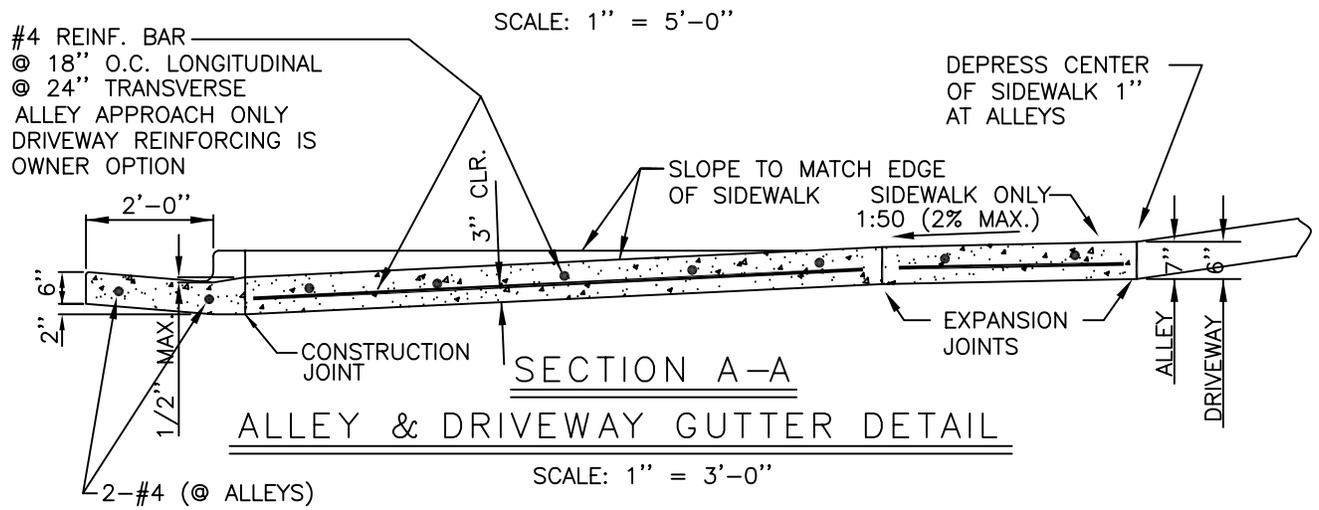
Drawn By: A.C.M.	Date: NOV-1995	SHEET: SD3
Checked By: N.W.	Approved By: R.P.M.	

FILENAME: SD3

Rev: 12/16/99



PLAN OF TYPICAL ALLEY APPROACH & DRIVEWAY DETAIL
FOR SETBACK WALK



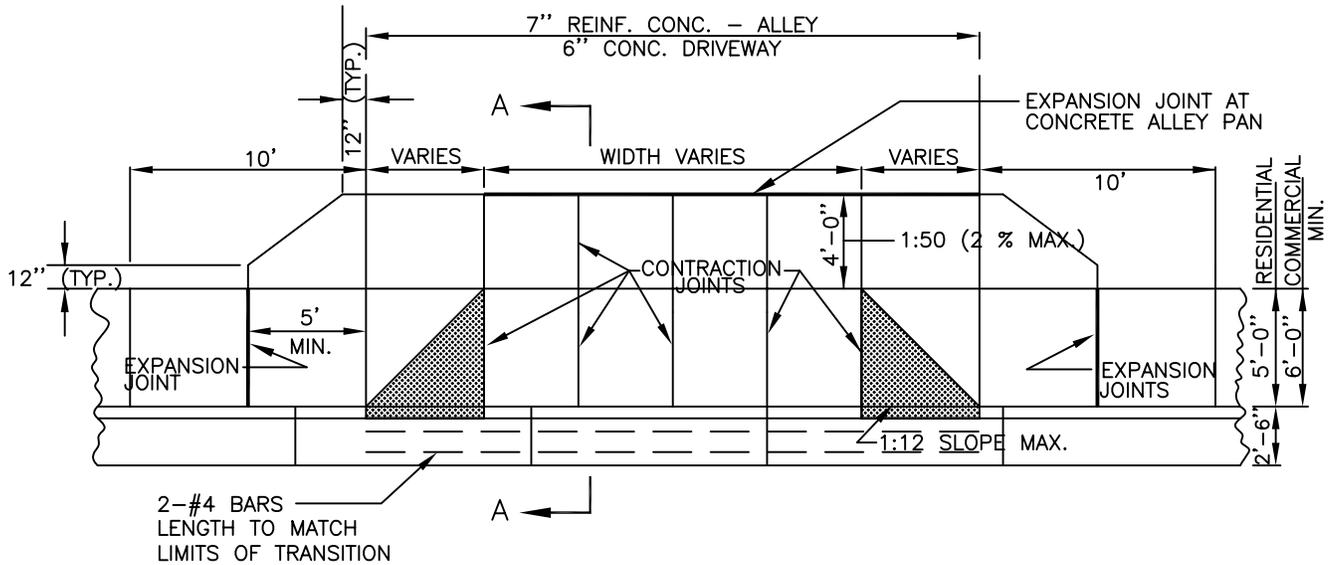
SECTION A-A
ALLEY & DRIVEWAY GUTTER DETAIL

NOTE:
* - MAY BE REDUCED WITH PERMISSION (2' MIN.)
(NOT REQUIRED AT RAMP CURB)

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	TYPICAL ALLEY APPROACH & DRIVEWAY DETAIL FOR SETBACK WALK

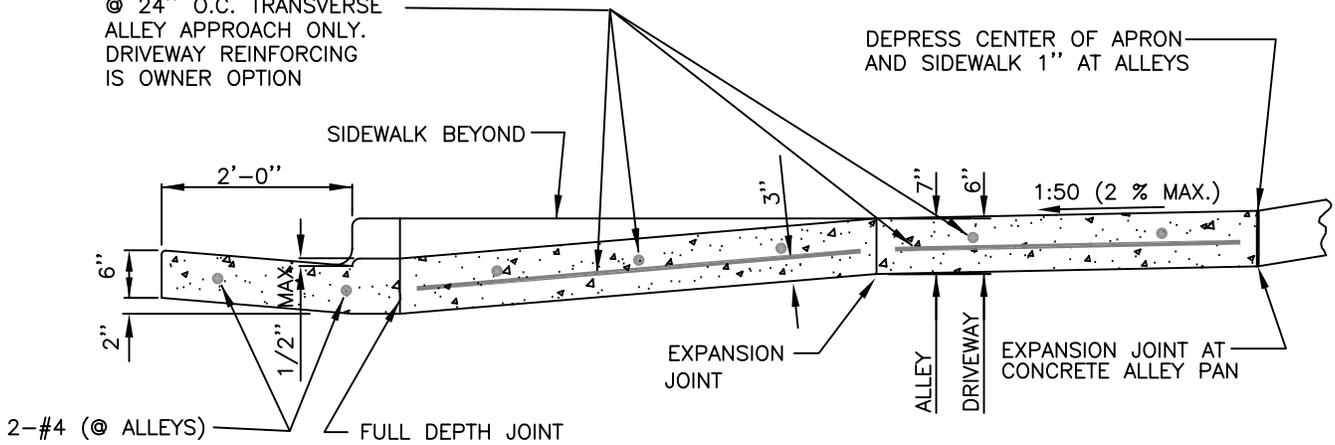
Rev: 3-28-05	Drawn By: A.C.M.	Date: 2/05/04	SHEET: SD 4
Rev: 5-24-04	Checked By: MB	Approved By: MB	

FILENAME: SD4



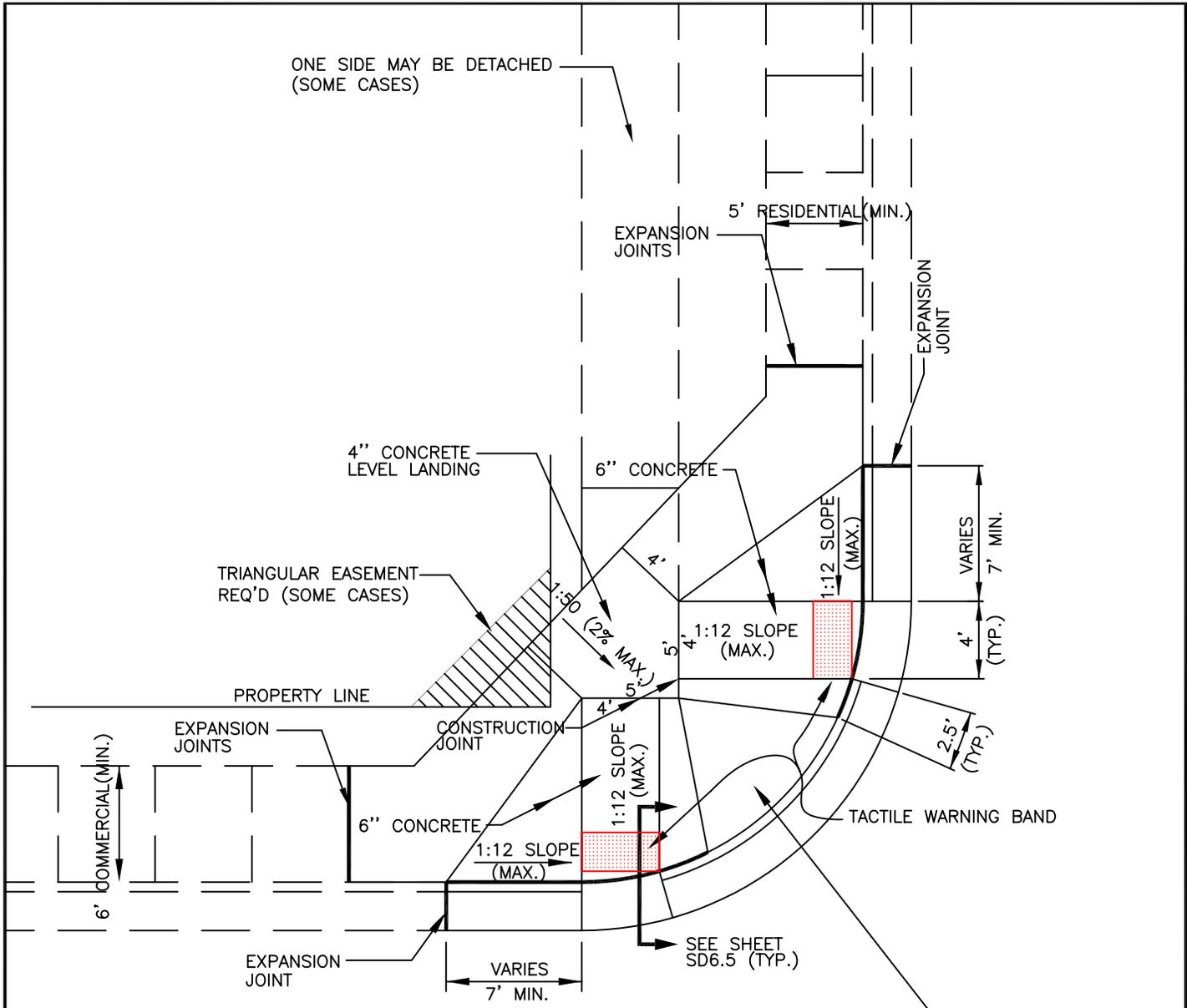
**PLAN OF TYPICAL ALLEY APPROACH & DRIVEWAY DETAIL
FOR ATTACHED WALK**
SCALE: 1" = 8'-0"

NO.4 REBAR
 @ 18" O.C. LONGITUDINAL
 @ 24" O.C. TRANSVERSE
 ALLEY APPROACH ONLY.
 DRIVEWAY REINFORCING
 IS OWNER OPTION



**SECTION A-A
ALLEY & DRIVEWAY GUTTER DETAIL**
SCALE: 1" = 2'-0"

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294	
	TYPICAL ALLEY APPROACH & DRIVEWAY DETAIL FOR ATTACHED WALK	
REV: 3-28-05 REV: 5-24-04	Drawn By A.C.M. Checked By: MB	Date: 2/05/04 Approved By: MB
FILENAME: SD5	SHEET: SD5	



TYPE A RAMP

N.T.S.

TYPE A RAMP TO BE USED IN STREETS GREATER THAN 36' WIDE, IN RETROFIT APPLICATIONS, AND WHERE TYPE C RAMP NOT PRACTICABLE

LANDSCAPING OR OTHER NON WALKING SURFACE (CONCRETE SOME CASES)

NOTES:

ALL CURB RAMPS SHALL BE CONSTRUCTED TO CONFORM TO THE APPLICABLE PROVISIONS OF APPENDIX A OF 28CFR PART 36 (ADAAG) LATEST EDITION.

RAMP SLOPES SHALL NOT BE STEEPER THAN 1:12. DIMENSIONS AND OR ARRANGEMENTS SHOWN SHALL BE MODIFIED AS NECESSARY TO MEET THIS REQUIREMENT.

LOCATION OF RAMPS MAY BE ADJUSTED TO FIT FIELD CONDITIONS AS DIRECTED BY THE ENGINEER.

THE FLOWLINE GRADIENT AT THE GUTTER, THE ENTIRE WIDTH OF EACH RAMP, SHALL NOT EXCEED 2.00%

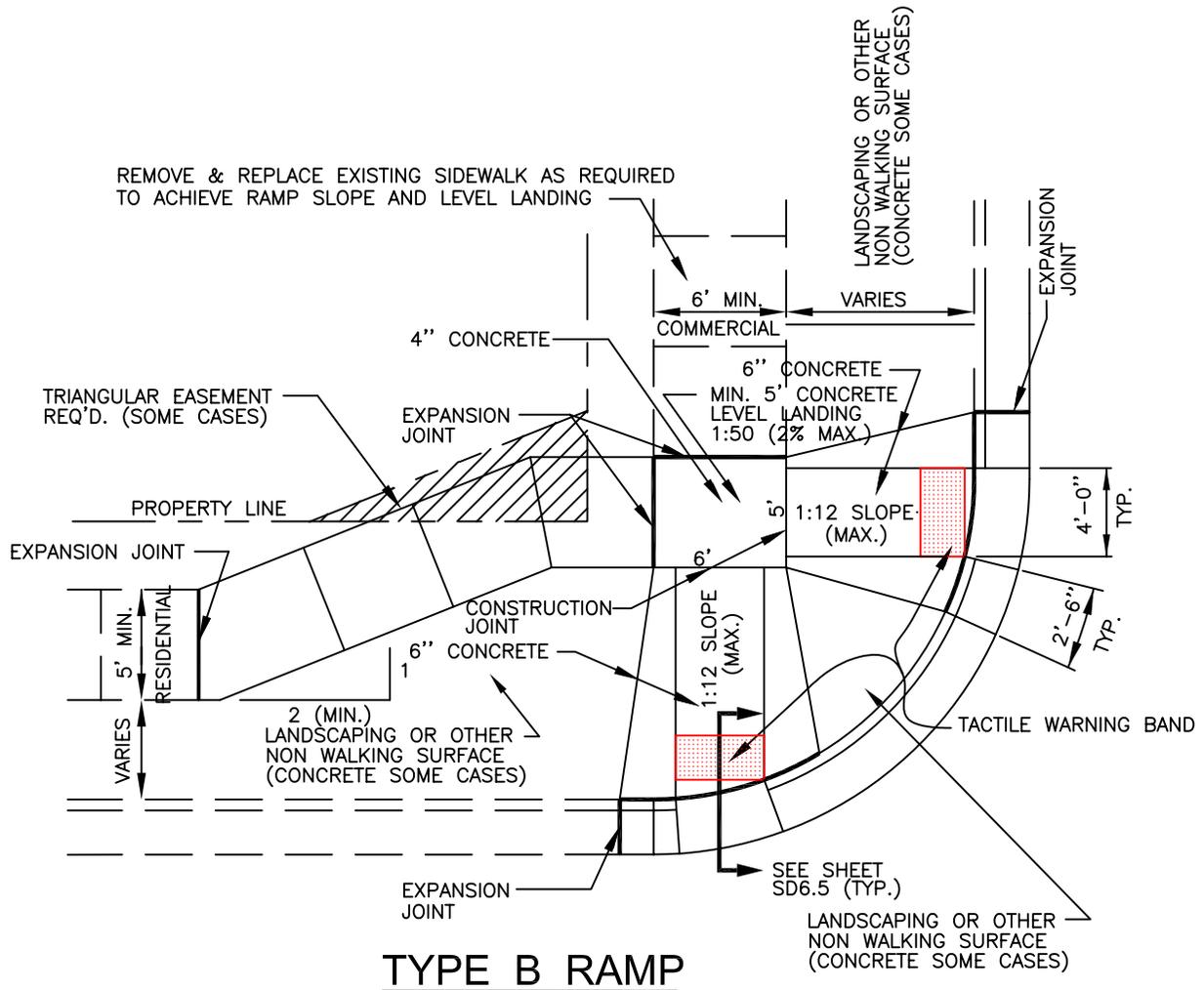
CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION
	211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294

CURB RAMP DETAILS

Drawn By: A.C.M.	Date: 5/24/04	SHEET: SD6.1
Checked By: MB	Approved By: MB	

FILENAME: SD6e

Rev: 5-24-04



TYPE B RAMP

N.T.S.

TYPE B RAMP TO BE USED IN STREETS GREATER THAN 36' WIDE, IN RETROFIT APPLICATIONS, AND WHERE TYPE C RAMP NOT PRACTICABLE

NOTES:

ALL CURB RAMPS SHALL BE CONSTRUCTED TO CONFORM TO THE APPLICABLE PROVISIONS OF APPENDIX A OF 28CFR PART 36 (ADAAG) LATEST EDITION

RAMP SLOPES SHALL NOT BE STEEPER THAN 1:12. DIMENSIONS AND OR ARRANGEMENTS SHOWN SHALL BE MODIFIED AS NECESSARY TO MEET THIS REQUIREMENT.

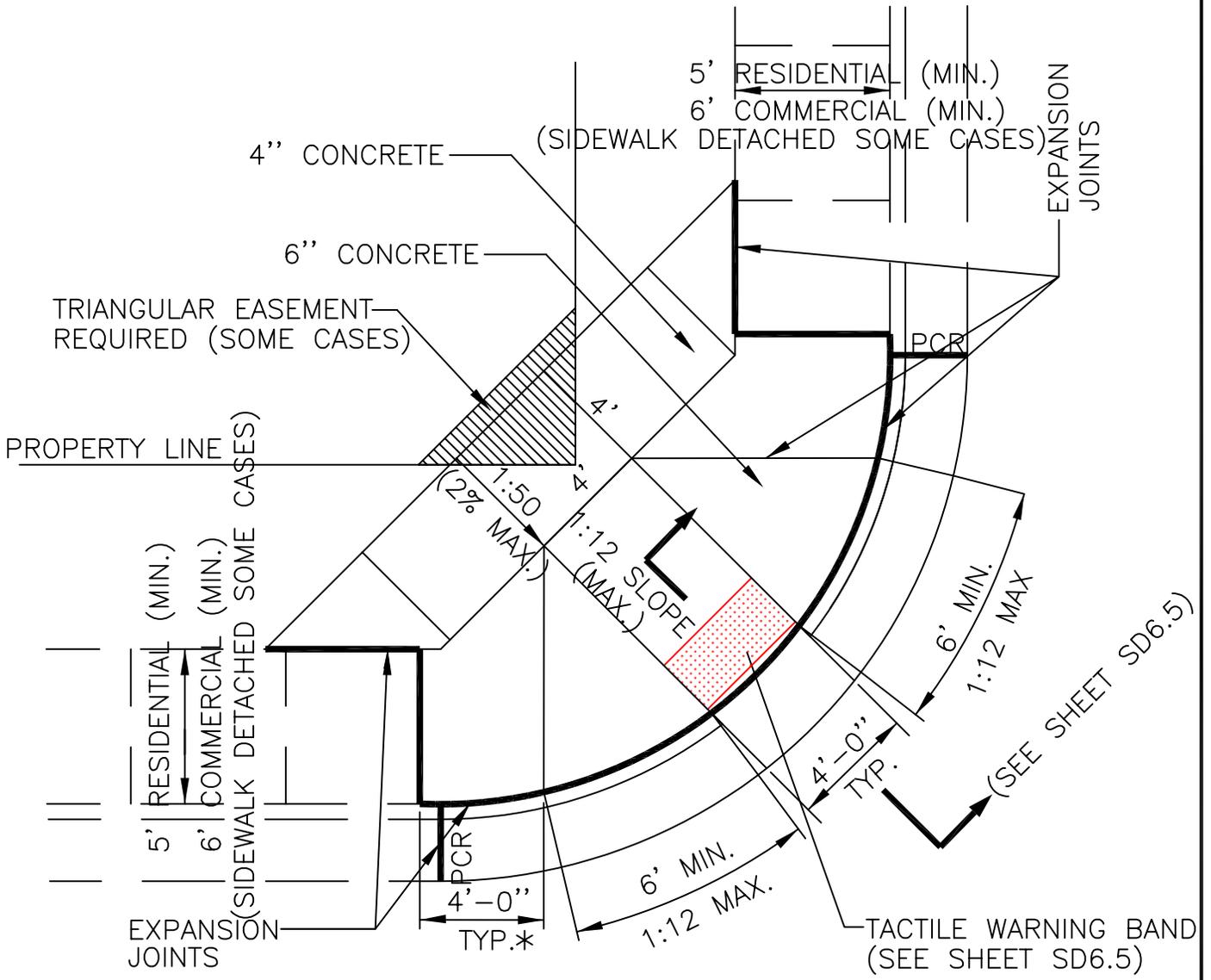
LOCATION OF RAMPS MAY BE ADJUSTED TO FIT FIELD CONDITIONS AS DIRECTED BY THE ENGINEER.

THE FLOWLINE GRADIENT AT THE GUTTER, THE ENTIRE WIDTH OF EACH RAMP, SHALL NOT EXCEED 2.00%

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	SEE SHEET SD6.5 (TYP.)

CURB RAMP DETAILS

Drawn By: A.C.M.	Date: 5/24/04	SHEET: SD6.2
Checked By: MB	Approved By: MB	



TYPE C RAMP

N.T.S.

* - WILL EXTEND BEYOND PCR.

NOTES:

ALL CURB RAMPS SHALL BE CONSTRUCTED TO CONFORM TO THE APPLICABLE PROVISIONS OF APPENDIX A OF 28 CFR PART 36 (ADAAG) LATEST EDITION

RAMP SLOPES SHALL NOT BE STEEPER THAN 1:12. DIMENSIONS AND/OR ARRANGEMENTS SHOWN SHALL BE MODIFIED AS NECESSARY TO MEET THIS REQUIREMENT.

LOCATION OF RAMPS MAY BE ADJUSTED TO FIT FIELD CONDITIONS AS DIRECTED BY THE ENGINEER.

THE FLOWLINE GRADIENT AT THE GUTTER, THE ENTIRE WIDTH OF EACH RAMP, SHALL NOT EXCEED 2.00%

CITY OF



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CURB RAMP DETAILS

Drawn By: A.C.M.

Date: 5/18/04

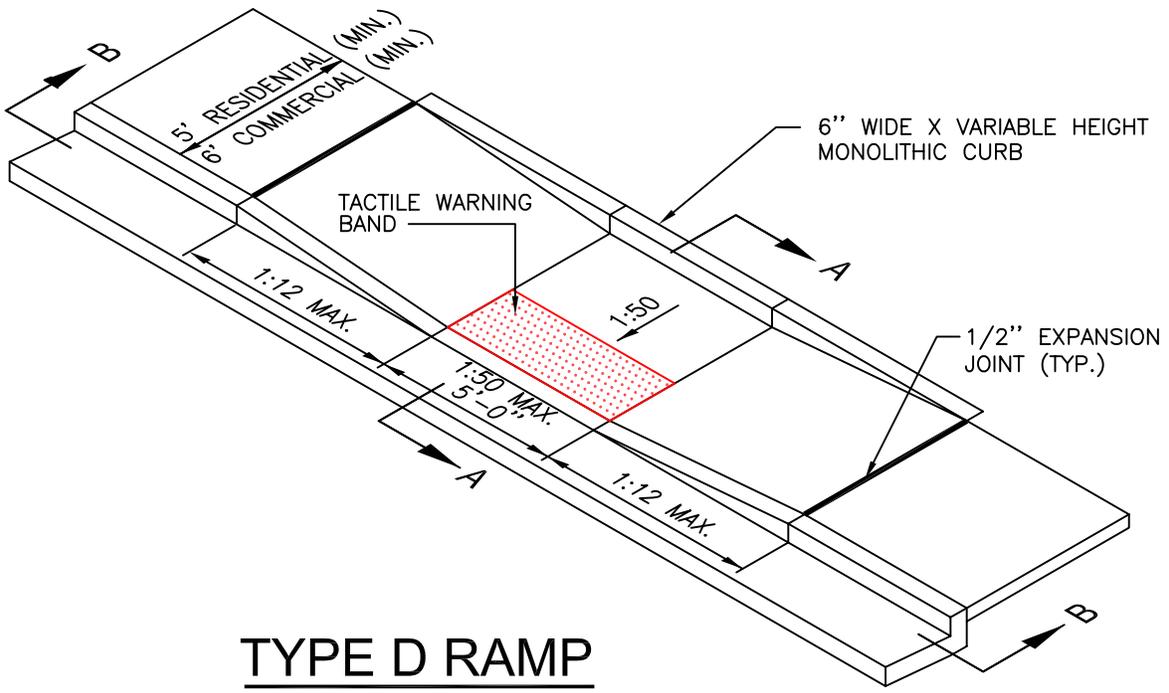
SHEET: SD6.3

Checked By: MB

Approved By: MB

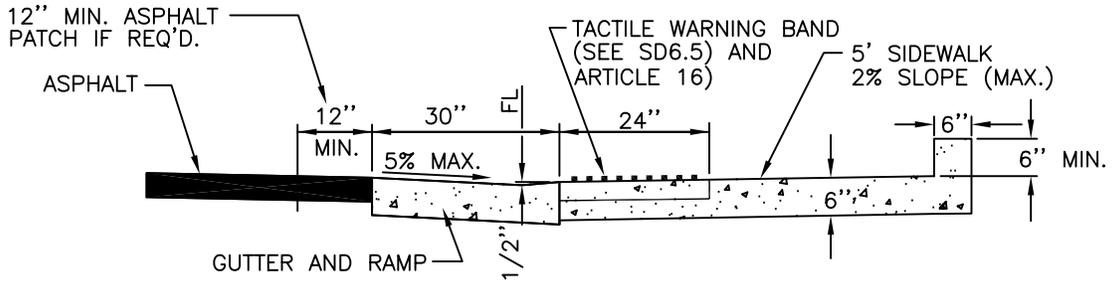
FILENAME: SD6c

Rev: 5-24-04



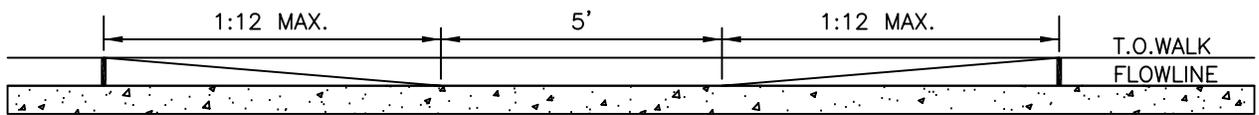
TYPE D RAMP

N.T.S.



SECTION A-A

N.T.S.



SECTION B-B

N.T.S.

NOTES:

ALL CURB RAMPS SHALL BE CONSTRUCTED TO CONFORM TO THE APPLICABLE PROVISIONS OF APPENDIX A OF 28 CFR PART 36 (ADAAG) LATEST EDITION

RAMP SLOPES SHALL NOT BE STEEPER THAN 1:12. DIMENSIONS AND/OR ARRANGEMENTS SHOWN SHALL BE MODIFIED AS NECESSARY TO MEET THIS REQUIREMENT.

LOCATION OF RAMPS MAY BE ADJUSTED TO FIT FIELD CONDITIONS AS DIRECTED BY THE ENGINEER.

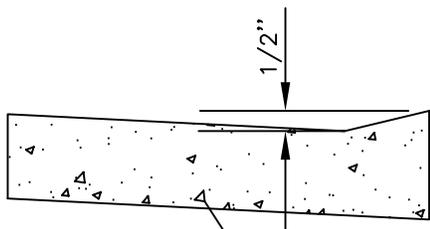
THE FLOWLINE GRADIENT AT THE GUTTER, THE ENTIRE WIDTH OF EACH RAMP, SHALL NOT EXCEED 2.00%

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	<p style="text-align: center;">CURB RAMP DETAILS</p>

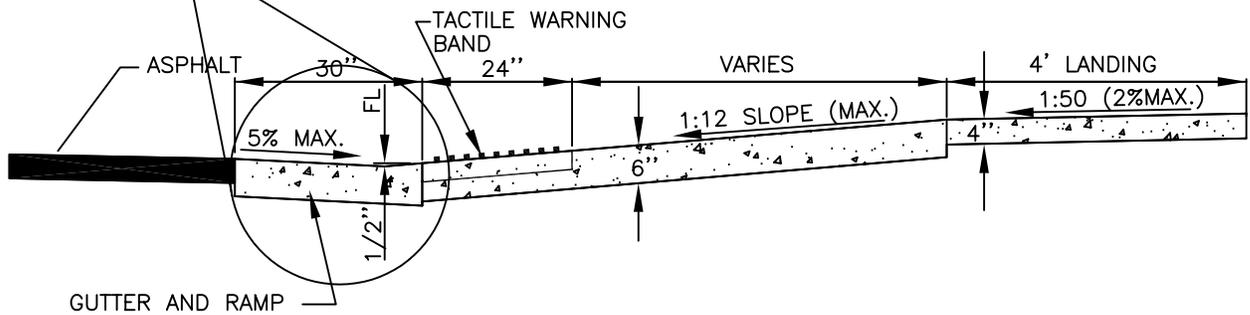
Drawn By: A.C.M.	Date: 5/18/04	SHEET: SD6.4
Checked By: MB	Approved By: MB	

FILENAME: SD6d

Rev: 5-24-04



TACTILE WARNING BAND SHALL BE 24" WIDE AT THE BOTTOM OF EACH RAMP (UNLESS SHOWN OTHERWISE) AND SHALL EXTEND THE FULL WIDTH OF THE RAMP. SEE DETAIL SD6.1 THRU SD6.4



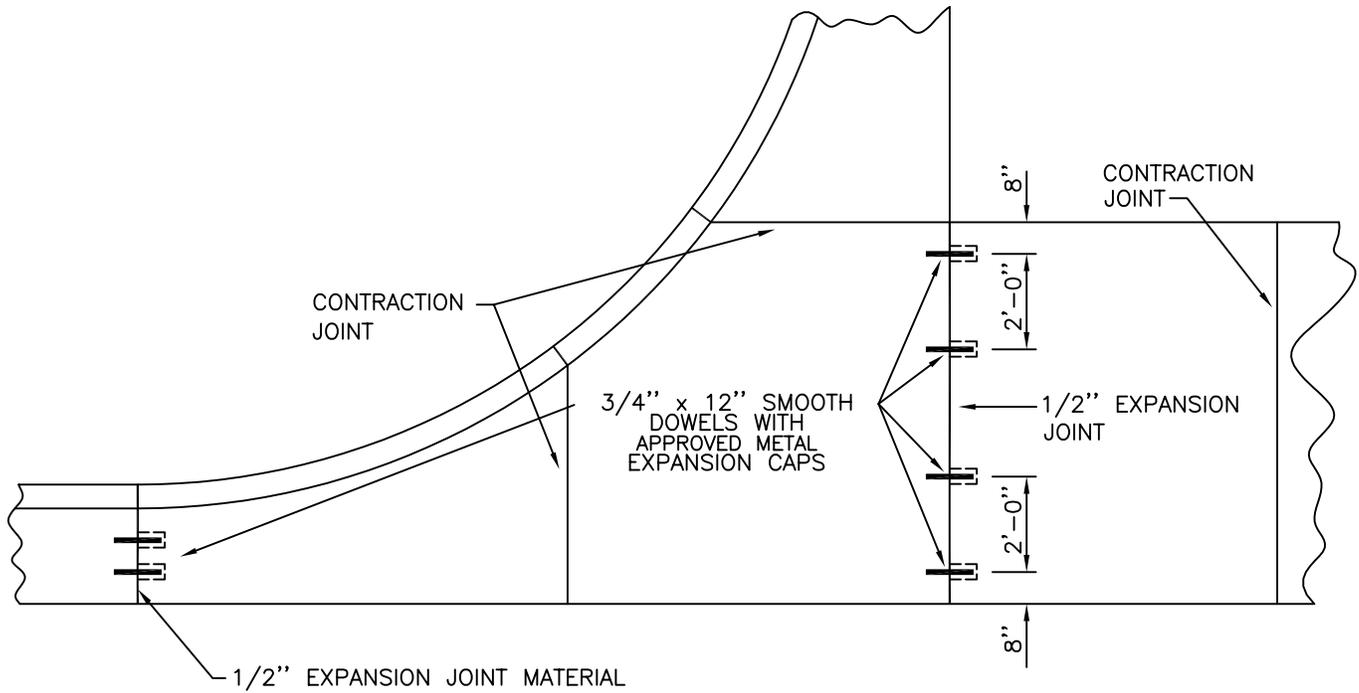
SECTION A-A - (TACTILE WARNING BAND)

N.T.S.

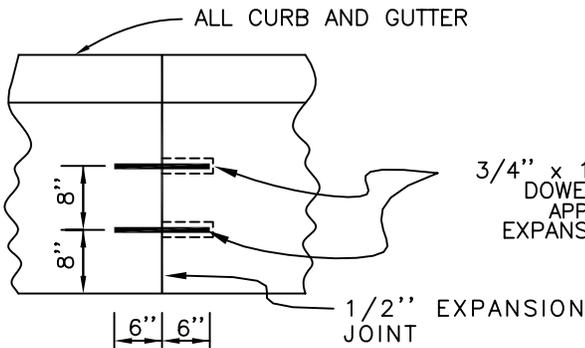
NOTE:

TACTILE WARNING BAND MATERIAL SHALL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION. (SEE ARTICLE 16)

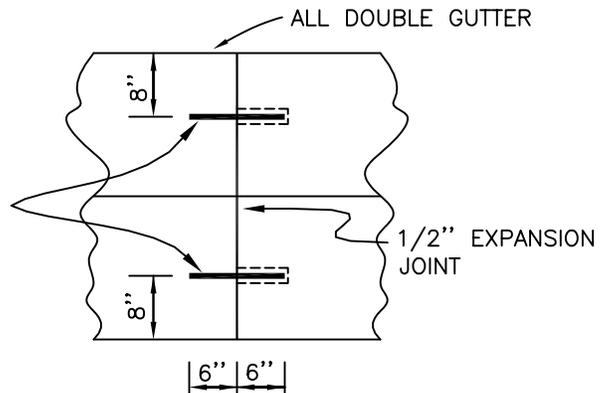
CITY OF  COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	CURB RAMP DETAILS TACTILE WARNING BAND
Drawn By: A.C.M. Date: 5/18/04	SHEET: SD6.5
Checked By: MB	Approved By: MB



SQUARE PAN AND
CONCRETE DIP
SCALE: 1" = 4'-0"



CURB AND GUTTER
SCALE: 1" = 2'-0"



DOUBLE GUTTER
SCALE: 1" = 2'-0"

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EXPANSION JOINT DETAILS

Drawn By: A.C.M.

Date: NOV-1995

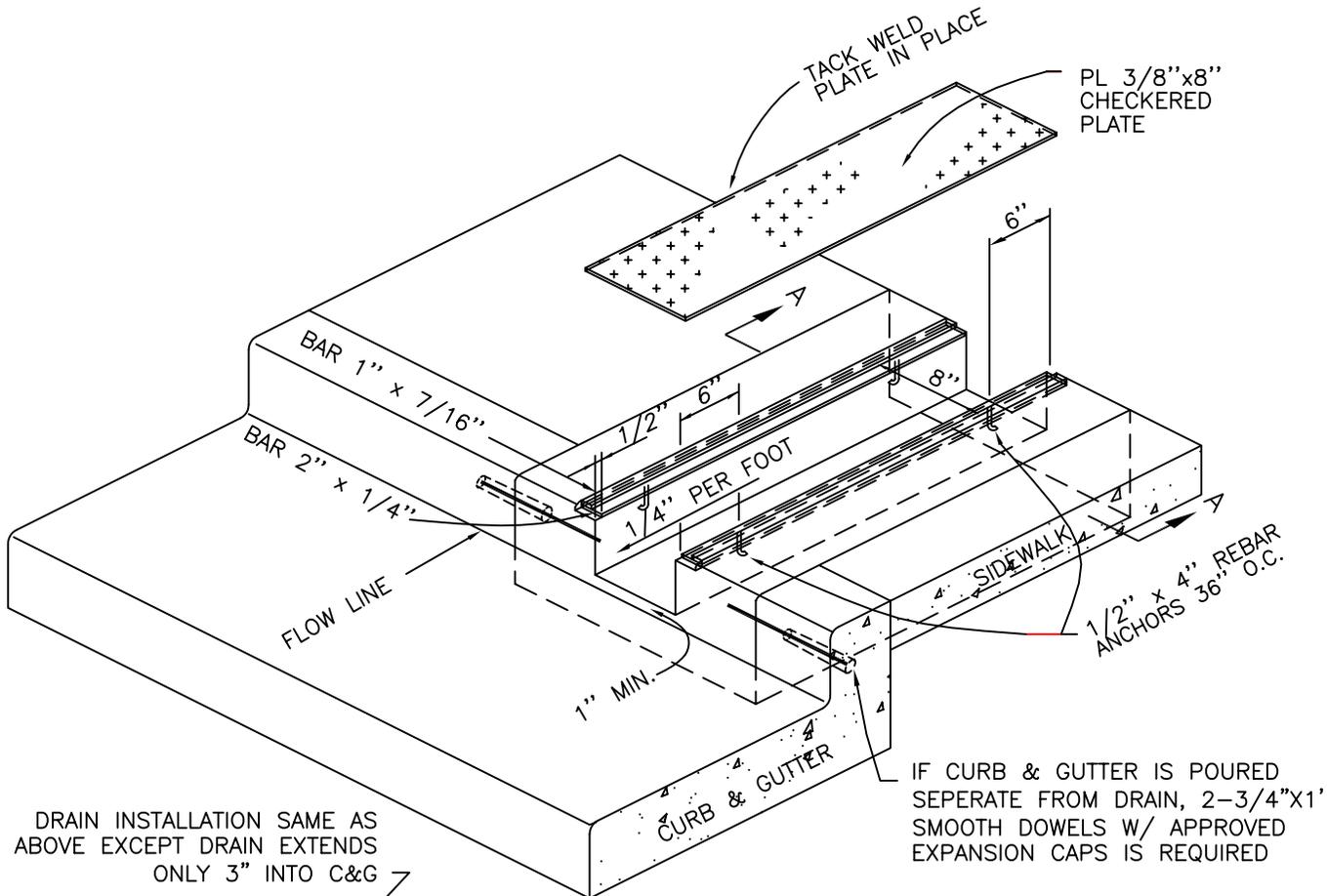
SHEET: SD7

Checked By: N.W.

Approved By: R.P.M.

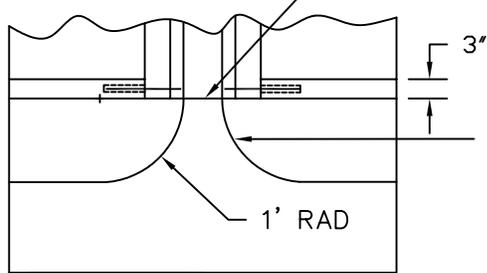
FILENAME: SD7

Rev: 9/26/00



DRAIN INSTALLATION SAME AS ABOVE EXCEPT DRAIN EXTENDS ONLY 3" INTO C&G

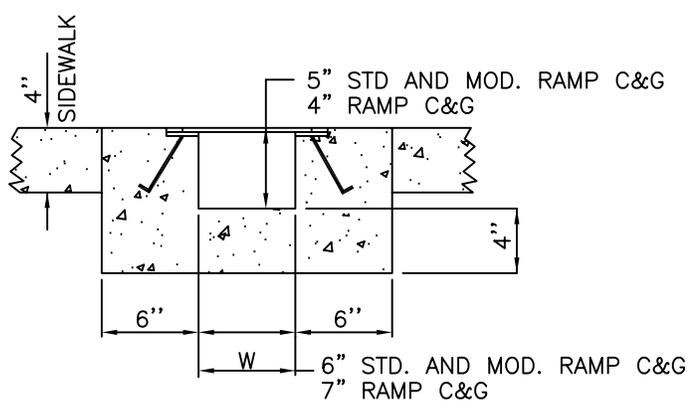
IF CURB & GUTTER IS POURED SEPERATE FROM DRAIN, 2-3/4" X 1" SMOOTH DOWELS W/ APPROVED EXPANSION CAPS IS REQUIRED



MODIFIED RAMP TRANSITION
NOT TO SCALE

SIDEWALK DRAIN
NO SCALE

NOTE:
ALL STEEL SHALL RECEIVE ONE COAT RED OXIDE METAL PRIMER AND ONE FIELD COAT BLACK ENAMEL.
FOR INSTALLATION OF A SIDEWALK DRAIN WHERE THERE IS EXISTING CURB AND GUTTER A FIVE (5) FOOT MINIMUM SECTION OF CURB AND GUTTER MUST BE REMOVED. REMOVAL OF JUST THE CURB HEAD FOR INSTALLATION OF SIDEWALK DRAIN WILL NOT BE ALLOWED



FOR "W" > 8", MUST BE APPROVED BY CITY ENGINEER
SECTION A-A

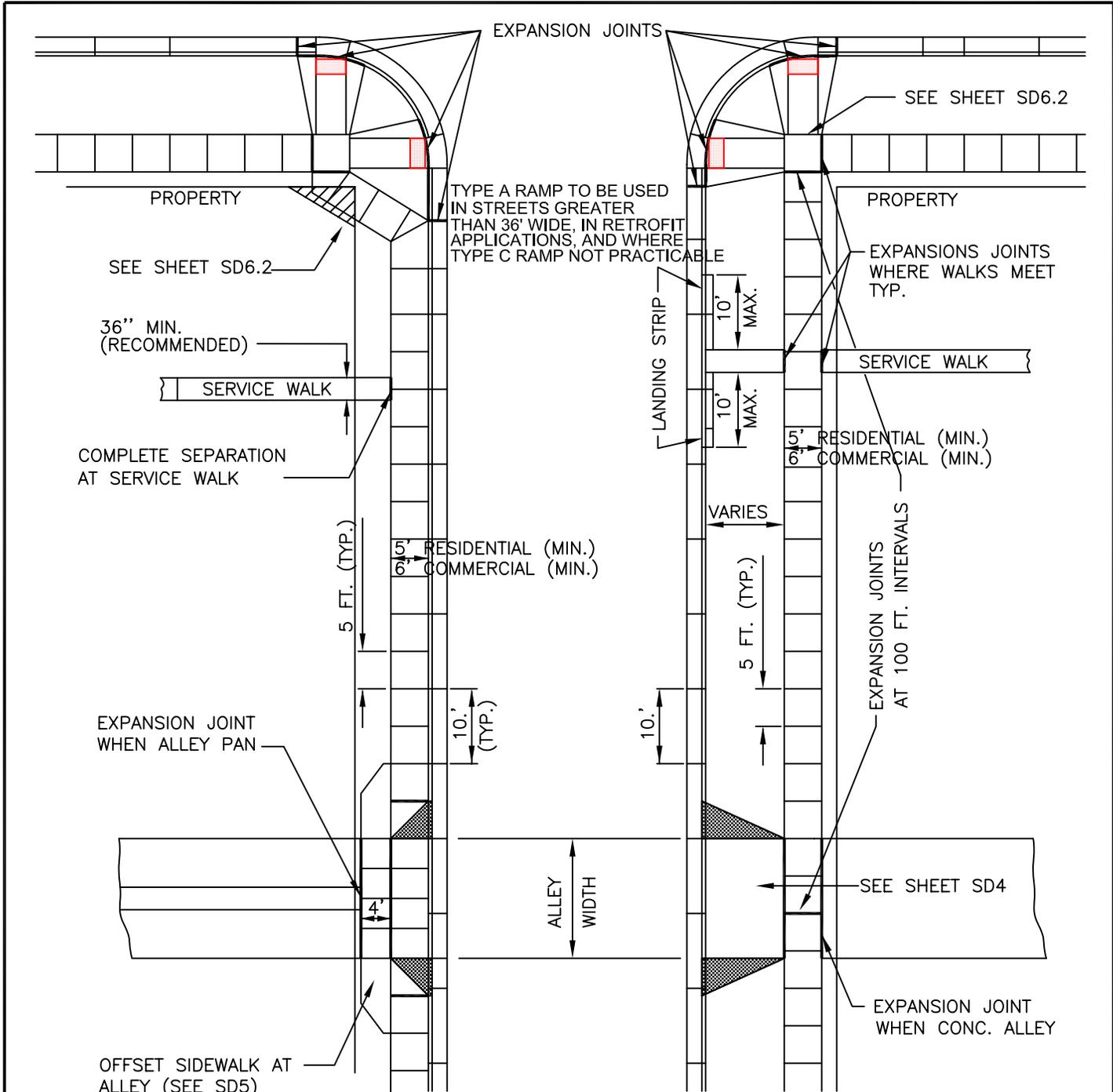
SCALE: 1"=1'-0"

FILENAME: SDB

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS
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SIDEWALK DRAIN
DETAIL

Rev: 3-28-05	Drawn By: A.C.M.	Date: NOV-1995	SHEET: SD8
Rev: 12/16/99	Checked By: N.W.	Approved By: R.P.M.	
Rev: 09/12/97			



SCALE: 1" = 20'-0"

NOTE:

PROVIDE 2 FOOT SQUARE EXPANSION JOINT AROUND ALL FIRE HYDRANTS AND POWER POLES IF UTILITY COMPANY UNABLE TO RELOCATE.
SEE APPLICABLE DETAILS FOR SPECIFIC REQUIREMENTS.

CITY OF



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JOINT PLACEMENT AND WIDTH STANDARDS FOR WALK, CURB AND GUTTER AND ALLEYS

Drawn By: A.C.M.

Date: 2/05/04

SHEET: SD9

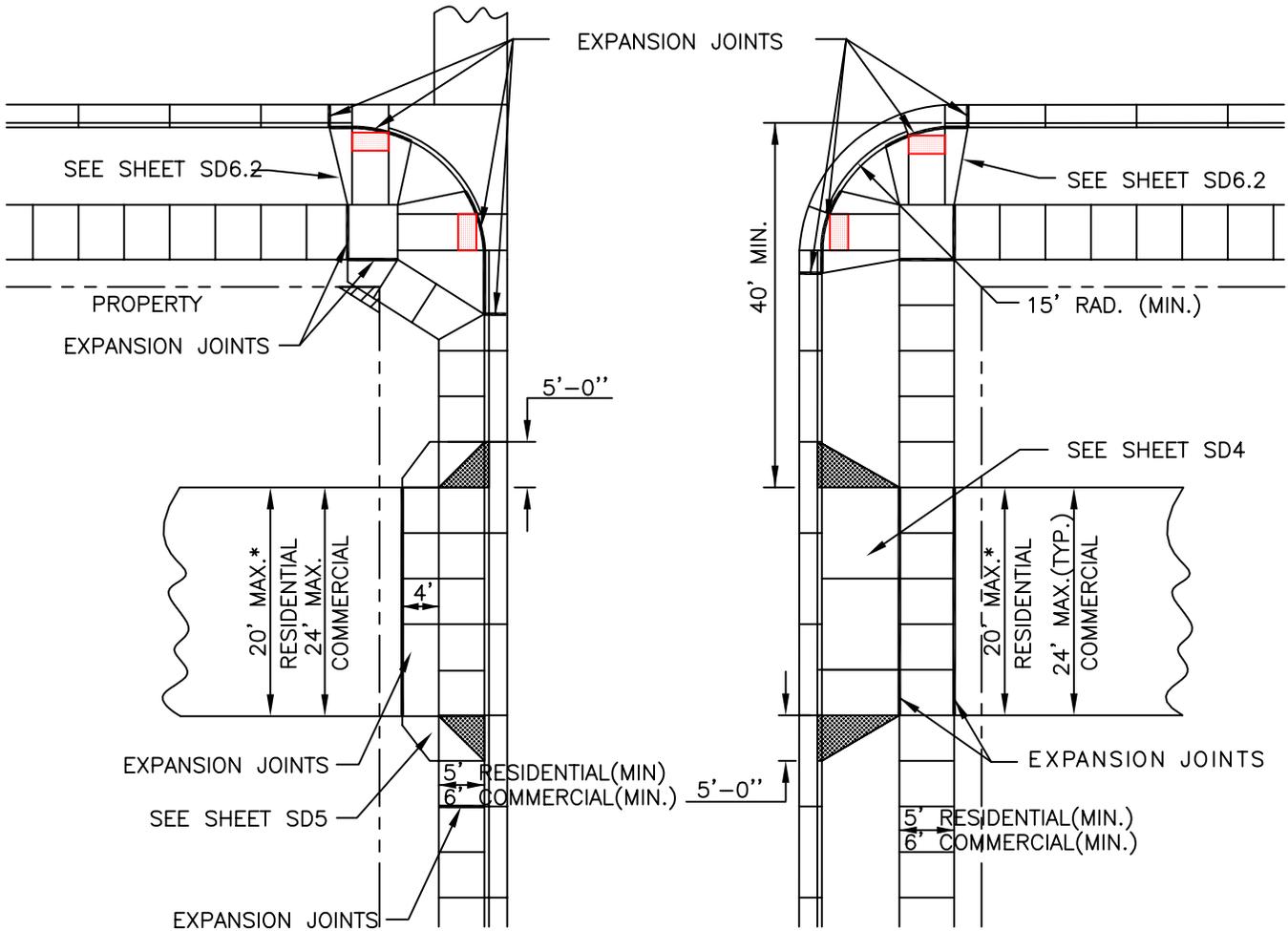
Checked By: MB

Approved By: MB

FILENAME: SD9

REV: 5-24-04

TYPE A RAMP TO BE USED
 IN STREETS GREATER
 THAN 36' WIDE, IN RETROFIT
 APPLICATIONS, AND WHERE
 TYPE C RAMP NOT PRACTICABLE



GENERAL REQUIREMENTS FOR
DRIVEWAYS

SCALE: 1" = 20'-0"

NOTES:

THAT PORTION OF ANY WALK AT DRIVEWAY CROSSING OR AT A PROBABLE FUTURE CROSSING MUST BE AT LEAST 6" THICK. THIS REGULATION APPLIES TO ALL NEW SIDEWALK CONSTRUCTION AND ALL SIDEWALK REPLACEMENT.

* RESIDENTIAL DRIVEWAYS SHALL BE 12' MIN. AND 20' MAX.
 ANY PROPOSED DRIVE CUTS GREATER THAN 20' IN IN WIDTH (24' COMMERCIAL) WILL REQUIRE PRIOR APPROVAL FROM THE TRAFFIC ENGINEER

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GENERAL REQUIREMENTS
 FOR DRIVEWAYS

Drawn By: A.C.M.

Date: 2/05/04

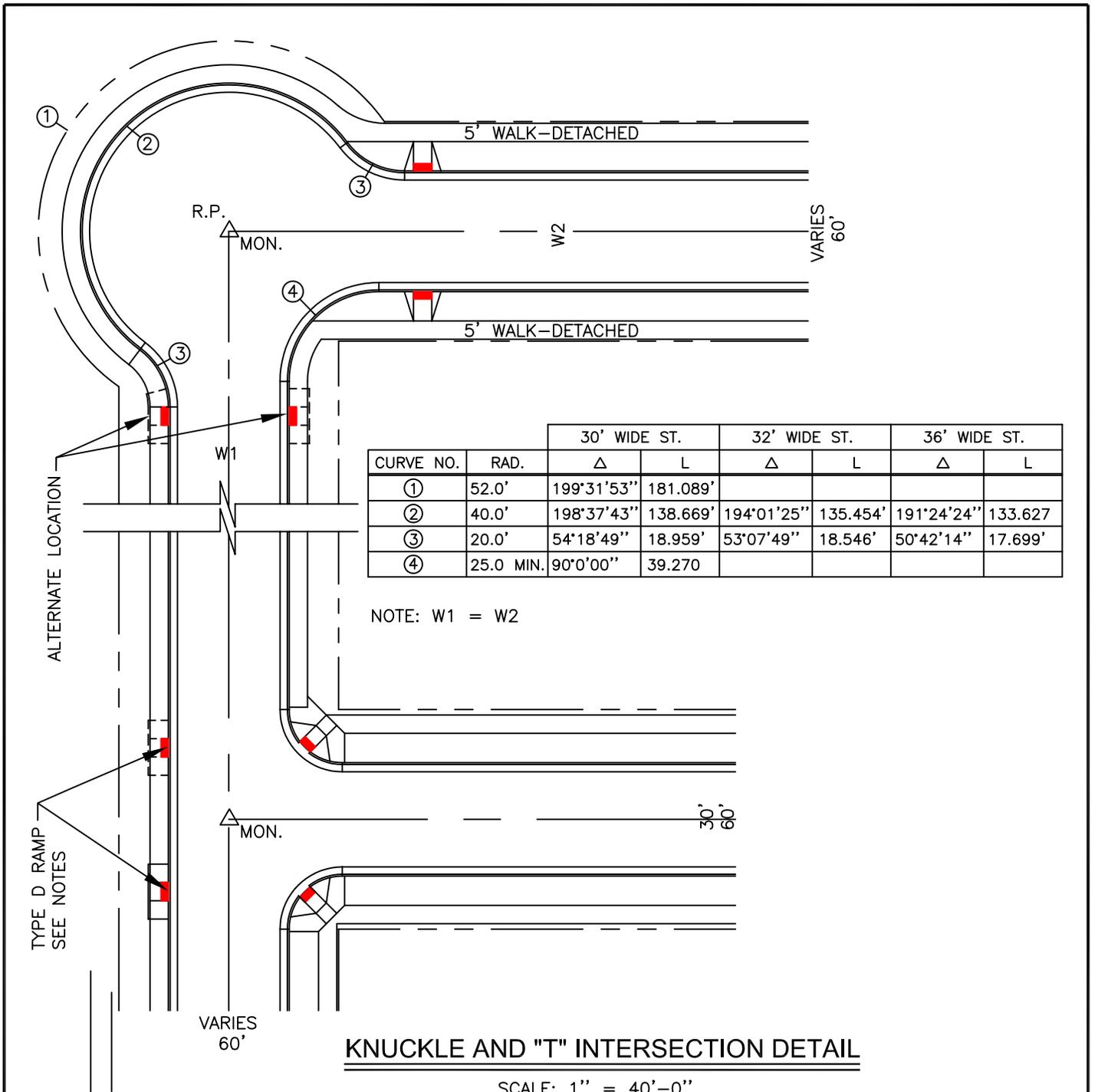
SHEET: SD10.1

Checked By: MB

Approved By: MB

FILENAME: SD10

Rev: 5-24-04



KNUCKLE AND "T" INTERSECTION DETAIL

SCALE: 1" = 40'-0"

NOTES:

SEE DETAILS SD6.1 THRU SD6.5 FOR CURB RAMP STANDARDS.

LOCATION OF "IN-LINE" CURB RAMPS TO BE COORDINATED WITH DRIVE-CUTS, INLETS, ETC. AND SHALL BE CENTERED ON PROPERTY LINES WHERE POSSIBLE.

AT "T" INTERSECTIONS WITH DETACHED SIDEWALKS, ONE OF THE IN-LINE RAMPS MAY BE ELIMINATED IF A SINGLE DIRECTIONAL RAMP IS INSTALLED AT THE CORNER AND MEASURES ARE EMPLOYED TO ELIMINATE THE CROSSWALK.

CITY OF **PUEBLO** COLORADO

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FAX (719) 553-2294

**KNUCKLE AND "T" INTERSECTION
DETAIL**

Rev: 3-28-05	Drawn By: A.C.M.	Date: 5/24/04	SHEET: SD10.2
Rev: 5-24-04	Checked By: MB	Approved By: MB	

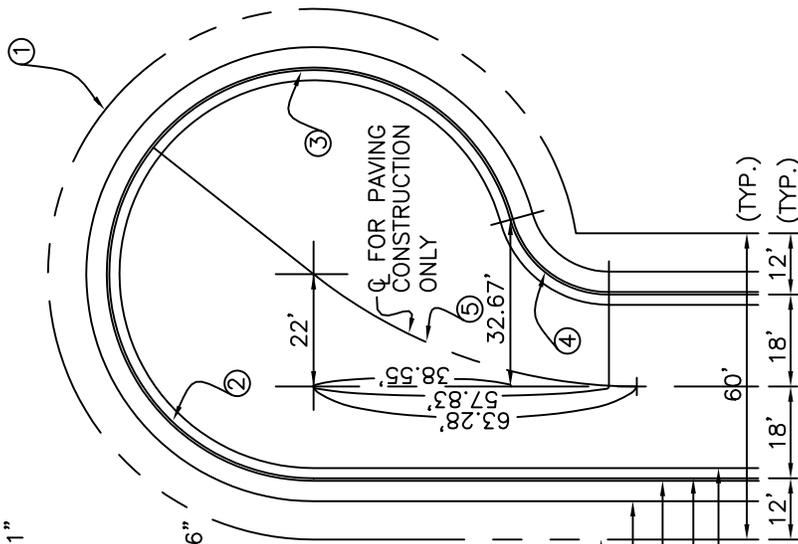
FILENAME: SD10b

CURVE DATA

- ① R = 52'
Δ = 261°09'00"
L = 237.01'
- ② R = 40'
Δ = 128°20'33"
L = 89.60'
LC = 72.01'
T = 82.64'
- ③ R = 40'
Δ = 126°11'38"
L = 88.10'
LC = 71.34'
T = 78.83'
- ④ R = 20'
Δ = 74°32'31"
L = 26.02'
LC = 24.22'
T = 15.22'
- ⑤ R = 102'
Δ = 38°20'36"
L = 68.26'
LC = 66.99'
T = 35.46'

CURVE DATA

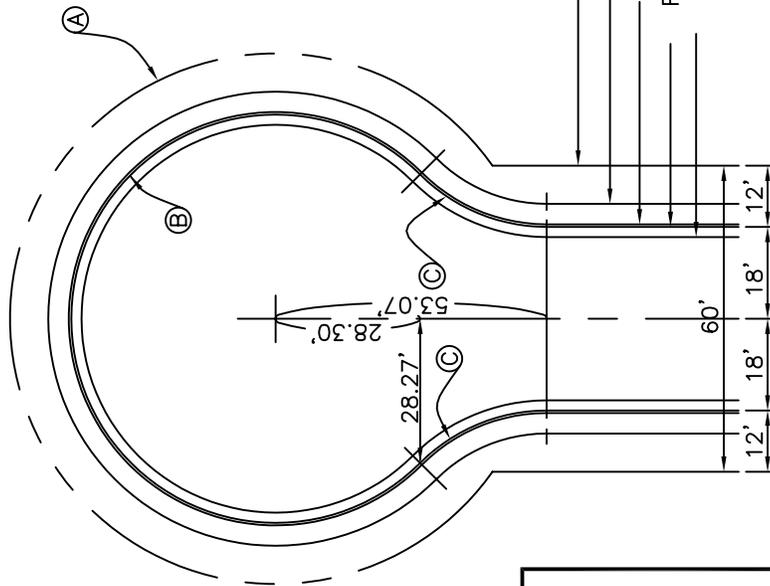
- Ⓐ R = 52'
Δ = 289°31'52"
L = 262.77'
- Ⓑ R = 40'
Δ = 270°04'16"
L = 188.55'
- Ⓒ R = 35'
Δ = 45°02'08"
L = 27.51'
LC = 26.81'
T = 14.51'



PROPERTY LINE
4' SIDEWALK
BACK OF CURB
FLOWLINE OF GUTTER
LIPLINE OF GUTTER

OFFSET CUL-DE-SAC - DETAIL

NO SCALE



CUL-DE-SAC-DETAIL

NO SCALE

CITY OF



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CUL-DE-SAC DETAILS

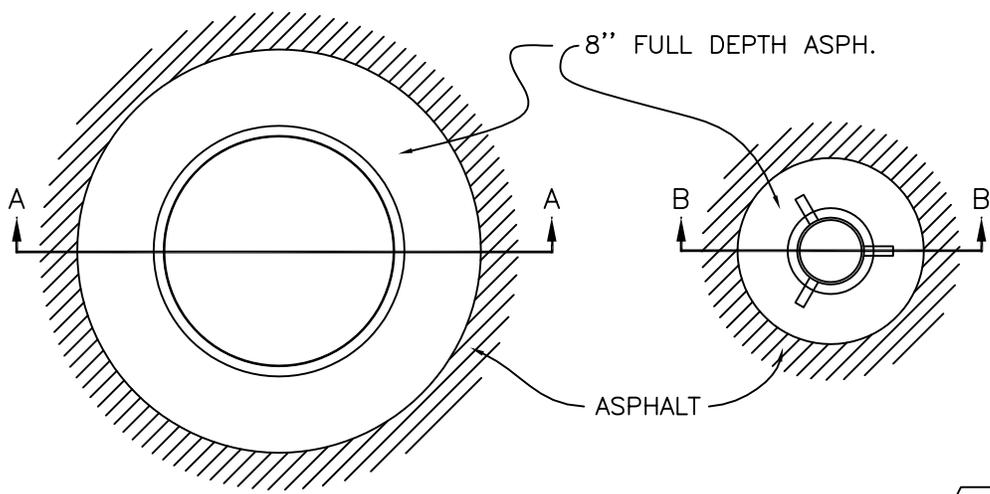
Drawn By: A.C.M.

Date: NOV-1995

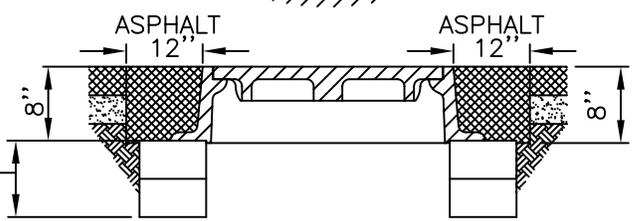
Checked By: N.W.

Approved By: R.P.M.

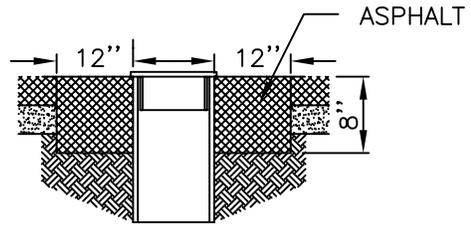
SHEET: SD11



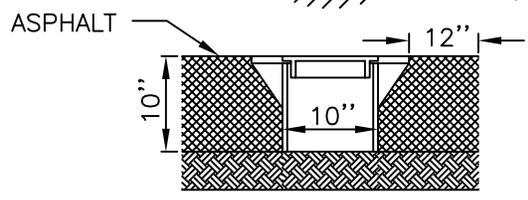
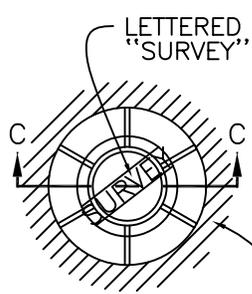
4" MIN.
12" MAX
GRADE
RINGS



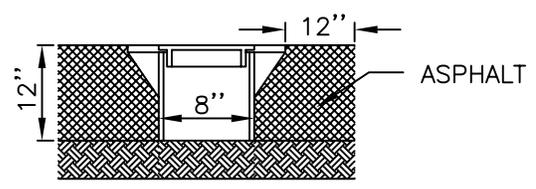
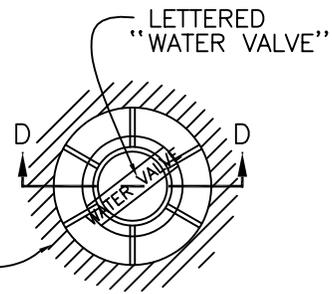
SECTION A-A
MANHOLE RING
N.T.S.



SECTION B-B
GAS VALVE BOX
N.T.S.



SECTION C-C
MONUMENT BOX
N.T.S.



SECTION D-D
WATER VALVE BOX
N.T.S.

ADJUSTMENT DETAILS
NO SCALE

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	ADJUSTMENT DETAILS

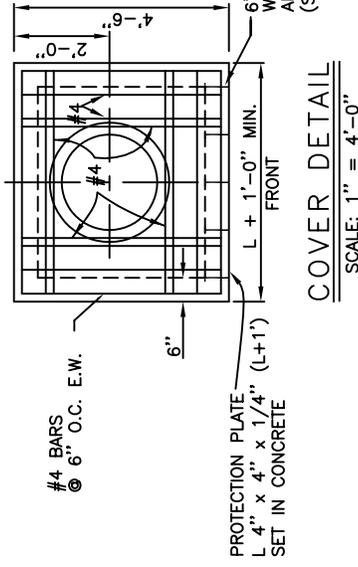
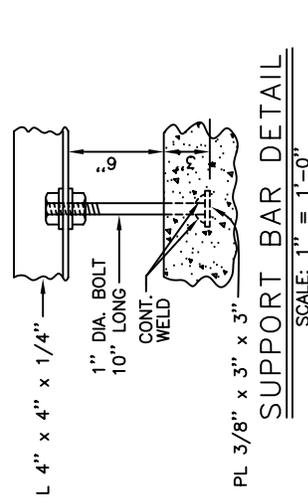
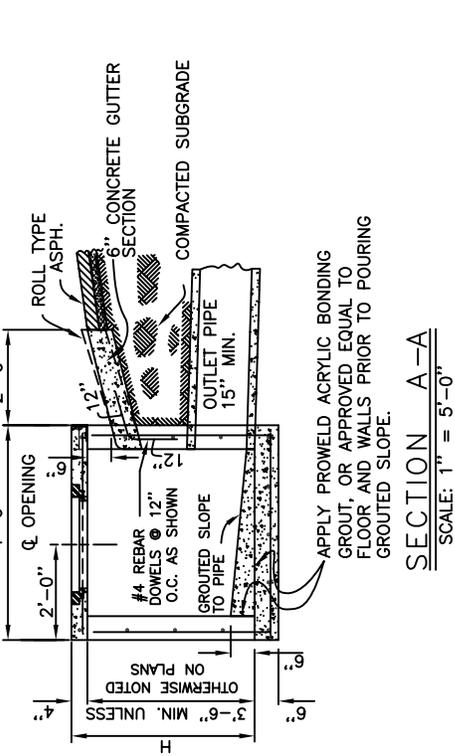
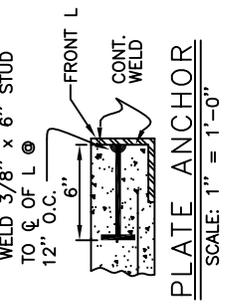
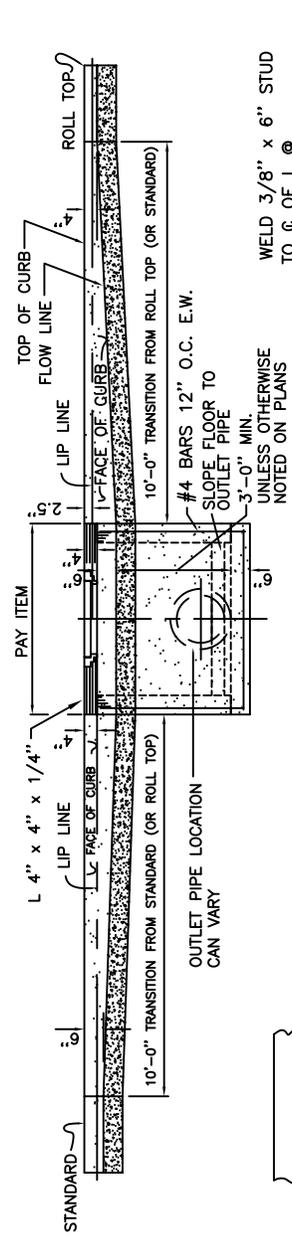
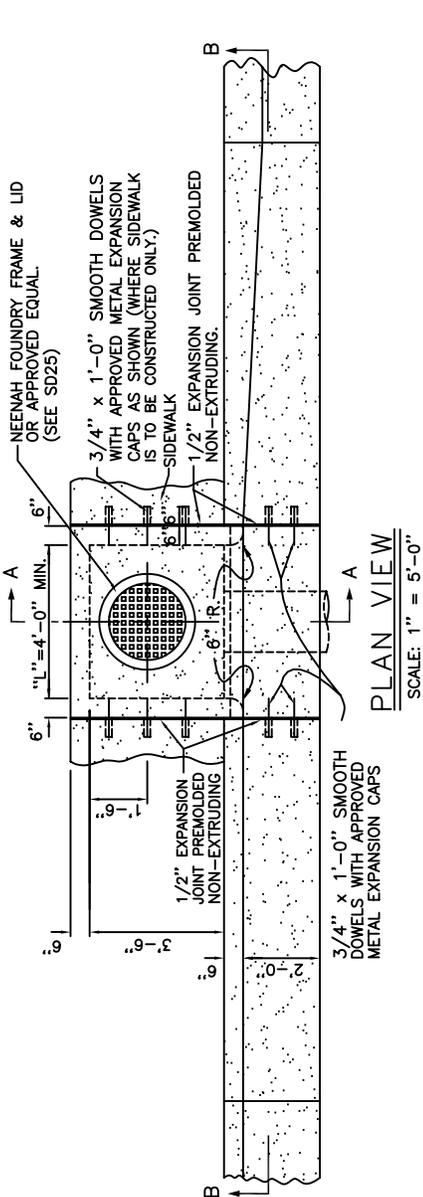
Rev: 12-27-99	Drawn By: A.C.M.	Date: NOV-1995	SHEET: SD12
Rev: 09-12-97	Checked By: N.W.	Approved By: R.P.M.	

FILENAME: SD12

NOTES:

1. INLET PIPE OR OUTLET PIPE MAY VARY TO LOCATION WITHIN INLET
2. DEPTH AND LENGTH OF INLET MAY VARY. LENGTH SHOULD VARY BY INCREMENTS OF 1'-0". "L" SHALL BE INDICATED ON PLAN.
3. INLET WALLS AND BASE WITH #4 BARS 12" EACH WAY SHALL BE REQUIRED W/BENT BARS OR CORNER BARS.
4. FLOOR SURFACE OF INLET SHALL BE FINISHED TO A SMOOTH SURFACE AND SHALL SLOPE TOWARDS OUTLET.
5. MANHOLE SHALL BE LOCATED AS SHOWN ALONG BACK WALL AND CENTERED ON OUTLET PIPE.
6. WALK WIDER THAN 4'-0" TO BE DOWELED INTO BACK OF INLET COVER.
7. ALL PIPES TO BE TRIMMED FLUSH WITH INSIDE WALL OF BOX.
8. CONCRETE SHALL BE OF 4000 P.S.I. AT 28 DAYS WITH TYPE II-V (6 SACK) OR TYPE II (7 SACK) CEMENT.
9. IF OPENING IS GREATER THAN 4'-0" SUPPORT BARS WILL BE REQUIRED AT INTERVALS NOT GREATER THAN 3' ON CENTER.
10. SURFACE OF ALL EXPOSED CONCRETE SHALL CONFORM IN SLOPE, GRADE, COLOR, FINISH, AND SCORING TO EXISTING OR PROPOSED SURFACES.
11. SUPPORT BAR MAY BE WELDED TO L 4" X 4" X 1/4" IN LIEU OF BOLT AND NUT CONNECTION.
12. THE EXPOSED PORTION OF THE L 4" X 4" X 1/4" AND SUPPORT BARS SHALL BE CLEANED AND PAINTED WITH AN ASPHALT BASE PAINT AFTER THE CONCRETE PORTION OF THE INLET HAS BEEN COMPLETED.
13. REINFORCING STEEL - ASTM A615 (60,000 PSI MIN. YIELD).
14. INLET STEPS REQUIRED FOR "H" GREATER THAN 3'-6". SEE STEP DETAIL ON SHEET #SD26.
15. INLETS SHALL BE LOCATED AT LEAST 10' FROM PCRS.

FILENAME: SD13



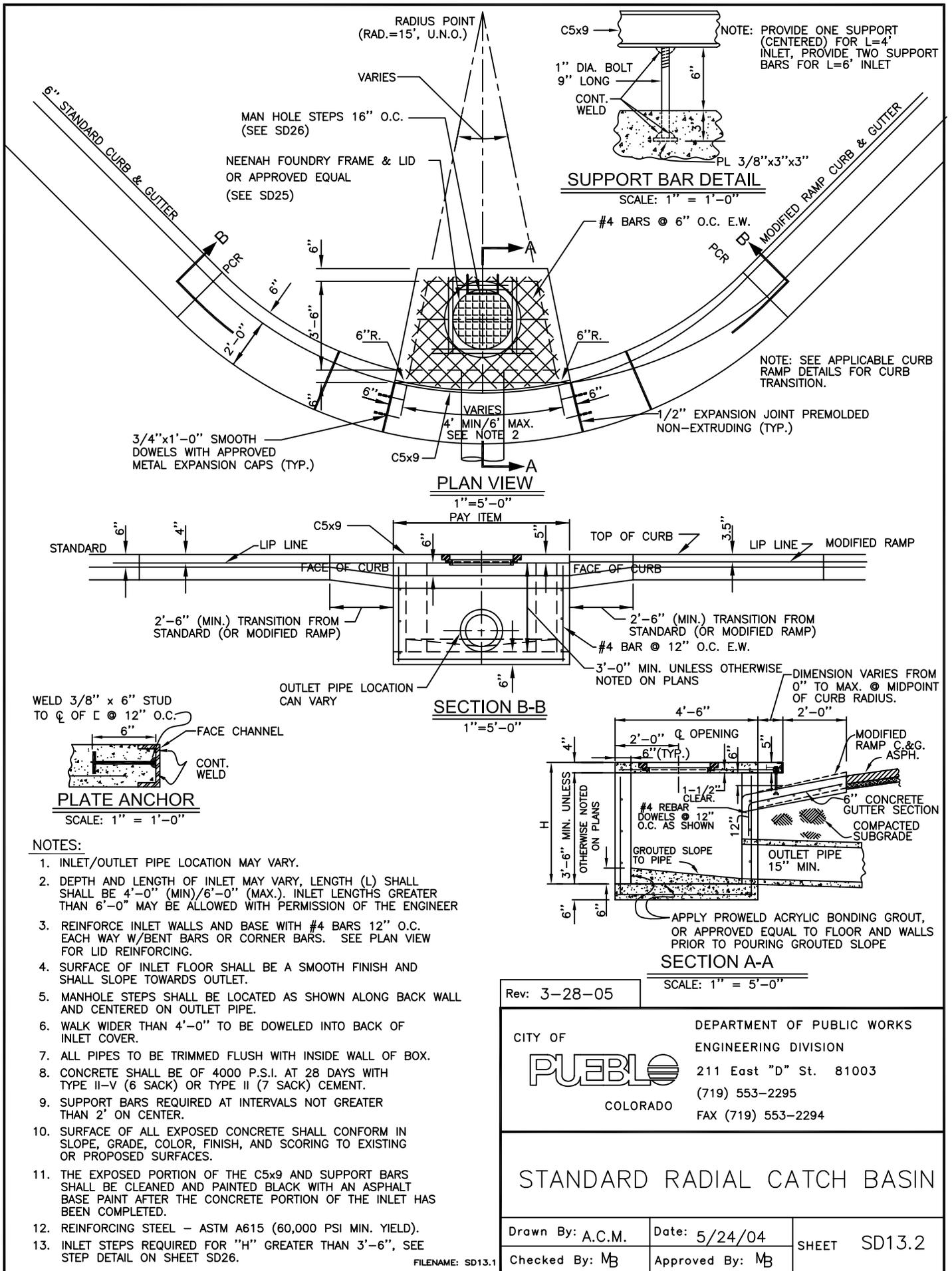
Rev: 3-28-05
Rev: 9-26-00

CITY OF **PUEBLO** COLORADO

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CAST-IN-PLACE TYPE "S" INLET

Drawn By: A.C.M.	Date: NOV-1995	SHEET SD13.1
Checked By: N.W.	Approved By: R.P.M.	



NOTE: PROVIDE ONE SUPPORT (CENTERED) FOR L=4' INLET, PROVIDE TWO SUPPORT BARS FOR L=6' INLET

NOTE: SEE APPLICABLE CURB RAMP DETAILS FOR CURB TRANSITION.

NOTES:

1. INLET/OUTLET PIPE LOCATION MAY VARY.
2. DEPTH AND LENGTH OF INLET MAY VARY, LENGTH (L) SHALL BE 4'-0" (MIN)/6'-0" (MAX.). INLET LENGTHS GREATER THAN 6'-0" MAY BE ALLOWED WITH PERMISSION OF THE ENGINEER
3. REINFORCE INLET WALLS AND BASE WITH #4 BARS 12" O.C. EACH WAY W/BENT BARS OR CORNER BARS. SEE PLAN VIEW FOR LID REINFORCING.
4. SURFACE OF INLET FLOOR SHALL BE A SMOOTH FINISH AND SHALL SLOPE TOWARDS OUTLET.
5. MANHOLE STEPS SHALL BE LOCATED AS SHOWN ALONG BACK WALL AND CENTERED ON OUTLET PIPE.
6. WALK WIDER THAN 4'-0" TO BE DOWELED INTO BACK OF INLET COVER.
7. ALL PIPES TO BE TRIMMED FLUSH WITH INSIDE WALL OF BOX.
8. CONCRETE SHALL BE OF 4000 P.S.I. AT 28 DAYS WITH TYPE II-V (6 SACK) OR TYPE II (7 SACK) CEMENT.
9. SUPPORT BARS REQUIRED AT INTERVALS NOT GREATER THAN 2' ON CENTER.
10. SURFACE OF ALL EXPOSED CONCRETE SHALL CONFORM IN SLOPE, GRADE, COLOR, FINISH, AND SCORING TO EXISTING OR PROPOSED SURFACES.
11. THE EXPOSED PORTION OF THE C5x9 AND SUPPORT BARS SHALL BE CLEANED AND PAINTED BLACK WITH AN ASPHALT BASE PAINT AFTER THE CONCRETE PORTION OF THE INLET HAS BEEN COMPLETED.
12. REINFORCING STEEL - ASTM A615 (60,000 PSI MIN. YIELD).
13. INLET STEPS REQUIRED FOR "H" GREATER THAN 3'-6", SEE STEP DETAIL ON SHEET SD26.

FILENAME: SD13.1

Rev: 3-28-05

CITY OF PUEBLO COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294
	STANDARD RADIAL CATCH BASIN

Drawn By: A.C.M.	Date: 5/24/04	SHEET SD13.2
Checked By: MB	Approved By: MB	

NOTES:

1. INLET PIPE OR OUTLET PIPE MAY VARY TO LOCATION WITHIN INLET.
2. DEPTH AND LENGTH OF INLET MAY VARY. LENGTH SHOULD VARY BY INCREMENTS OF 1'-0". "L" SHALL BE INDICATED ON PLAN.
3. INLET WALLS AND BASE WITH #4 BARS. 12" EACH WAY SHALL BE REQUIRED W/BENT BARS OR CORNER BARS.
4. FLOOR SURFACE OF INLET SHALL BE FINISHED TO A SMOOTH SURFACE AND SHALL SLOPE TOWARDS OUTLET.
5. MANHOLE SHALL BE LOCATED AS SHOWN ALONG BACK WALL AND CENTERED ON OUTLET PIPE.
6. WALK WIDER THAN 4'-0" TO BE DOWELED INTO BACK OF INLET COVER.
7. ALL PIPES TO BE TRIMMED FLUSH WITH INSIDE WALL OF BOX.
8. CONCRETE SHALL BE OF 4000 P.S.I. AT 28 DAYS WITH TYPE II-V (6 SACK) CEMENT.
9. IF OPENING IS GREATER THAN 4'-0" SUPPORT BARS WILL BE REQUIRED AT INTERVALS NOT GREATER THAN 3' ON CENTER.
10. SURFACE OF ALL EXPOSED CONCRETE SHALL CONFORM IN SLOPE, GRADE, COLOR, FINISH, AND SCORING TO EXISTING OR PROPOSED SURFACES.
11. SUPPORT BAR MAY BE WELDED TO L 4" X 4" X 1/4" IN LIEU OF BOLT AND NUT CONNECTION.
12. THE EXPOSED PORTION OF THE L 4" X 4" X 1/4" AND SUPPORT BARS SHALL BE CLEANED AND PAINTED WITH AN ASPHALT BASE PAINT AFTER THE CONCRETE PORTION OF THE INLET HAS BEEN COMPLETED.
13. REINFORCING STEEL - ASTM A615 (60,000 PSI MIN. YIELD).
14. INLET STEPS REQUIRED FOR "H" GREATER THAN 3'-6". SEE STEP DETAIL ON SHEET #SD26.
15. INLETS SHALL BE LOCATED AT LEAST 10' FROM PCR.S.
16. SUBMIT SHOP DRAWINGS FOR REVIEW

FILENAME: SD14

Rev: 3-28-05

Rev: 9-26-00

CITY OF



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PRE-CAST
TYPE "S" INLET

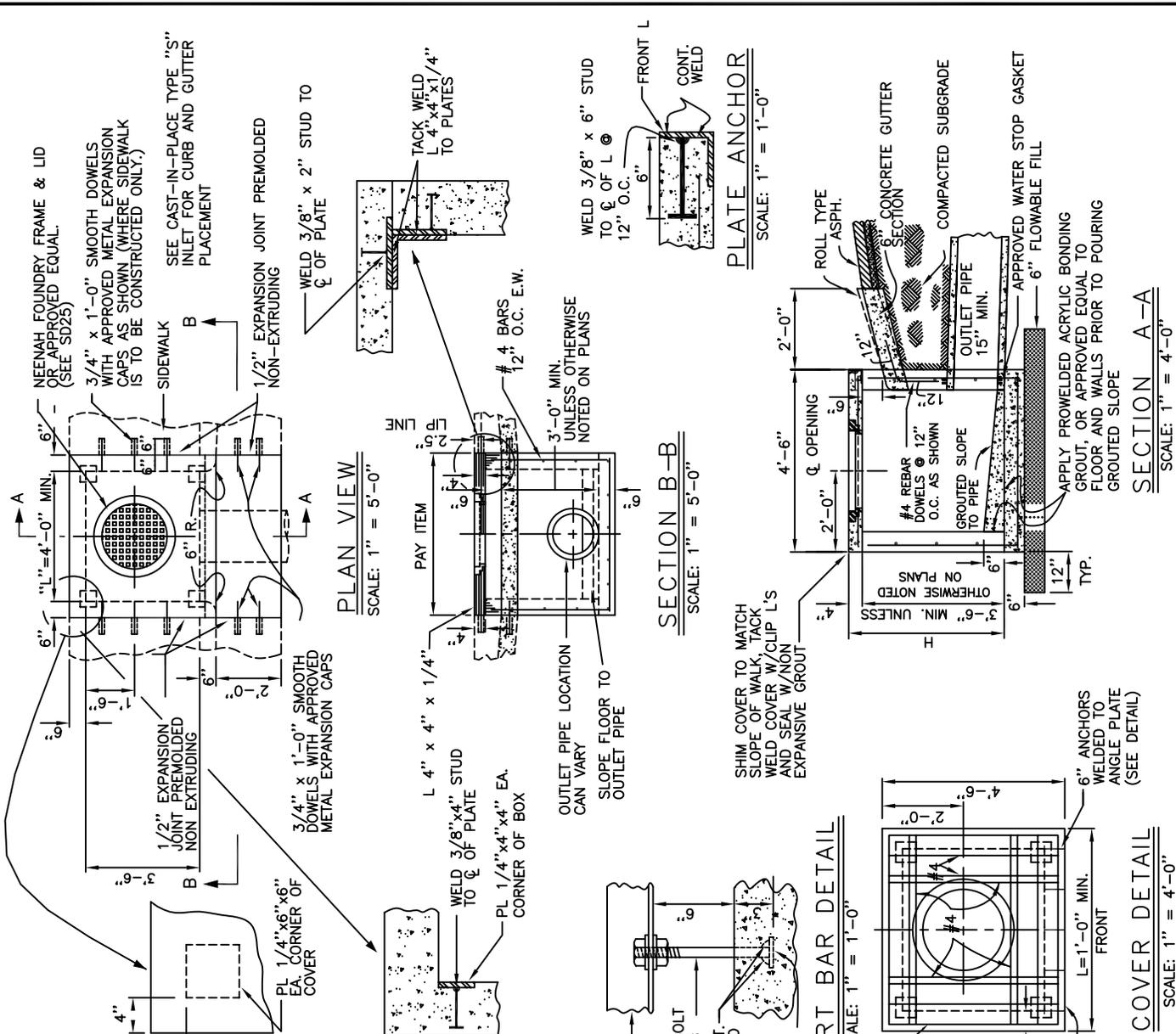
Drawn By: A.C.M.

Date: NOV-1995

SHEET: SD14

Checked By: N.W.

Approved By R.P.M.

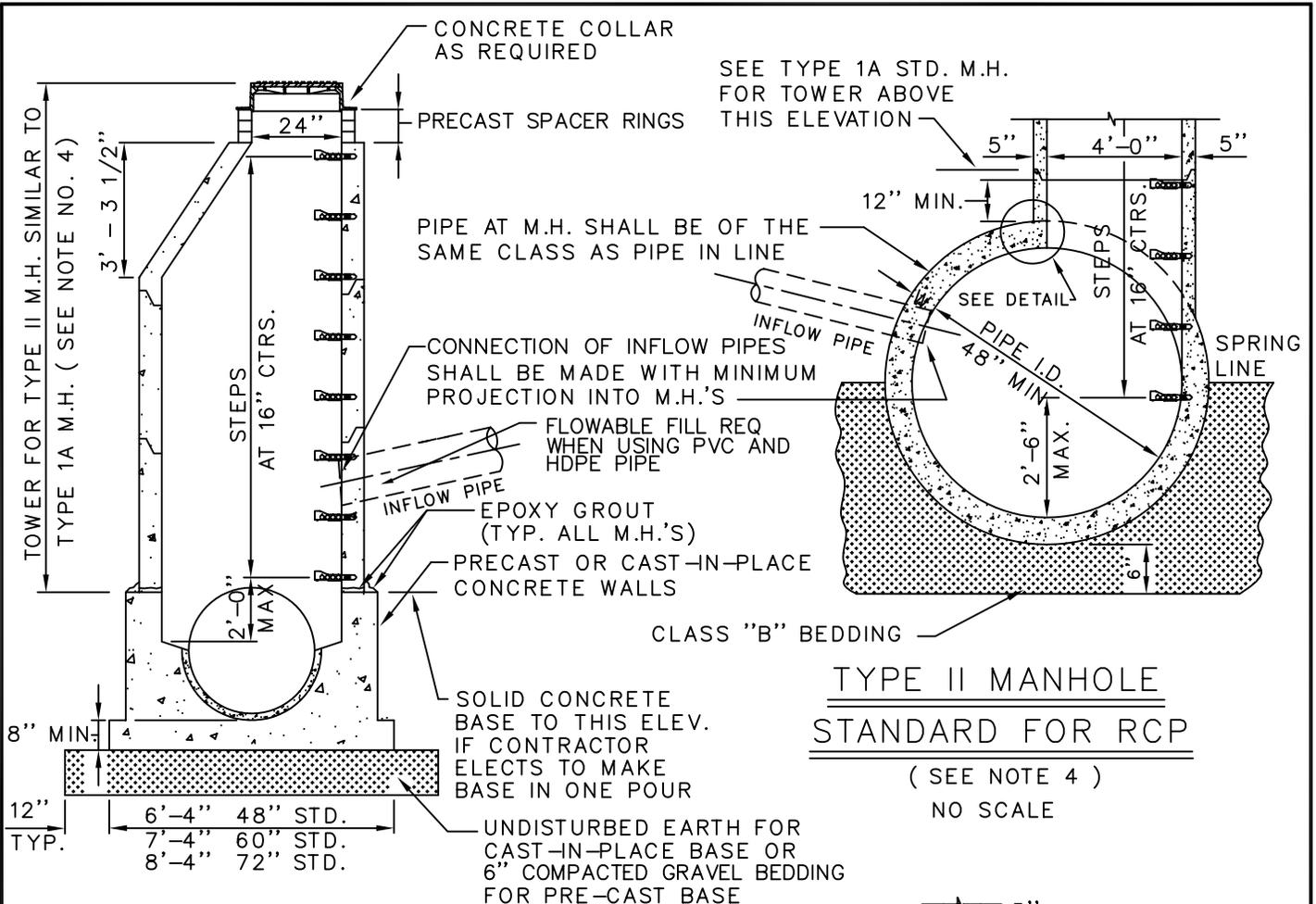


SECTION A-A
SCALE: 1" = 4'-0"

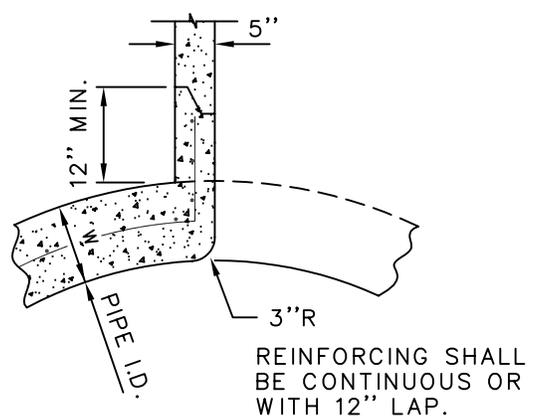
SECTION B-B
SCALE: 1" = 5'-0"

SUPPORT BAR DETAIL
SCALE: 1" = 1'-0"

COVER DETAIL
SCALE: 1" = 4'-0"



TYPE II MANHOLE
STANDARD FOR RCP
 (SEE NOTE 4)
 NO SCALE



RCP CONNECTION DETAIL
 SCALE: 1"=2'0"

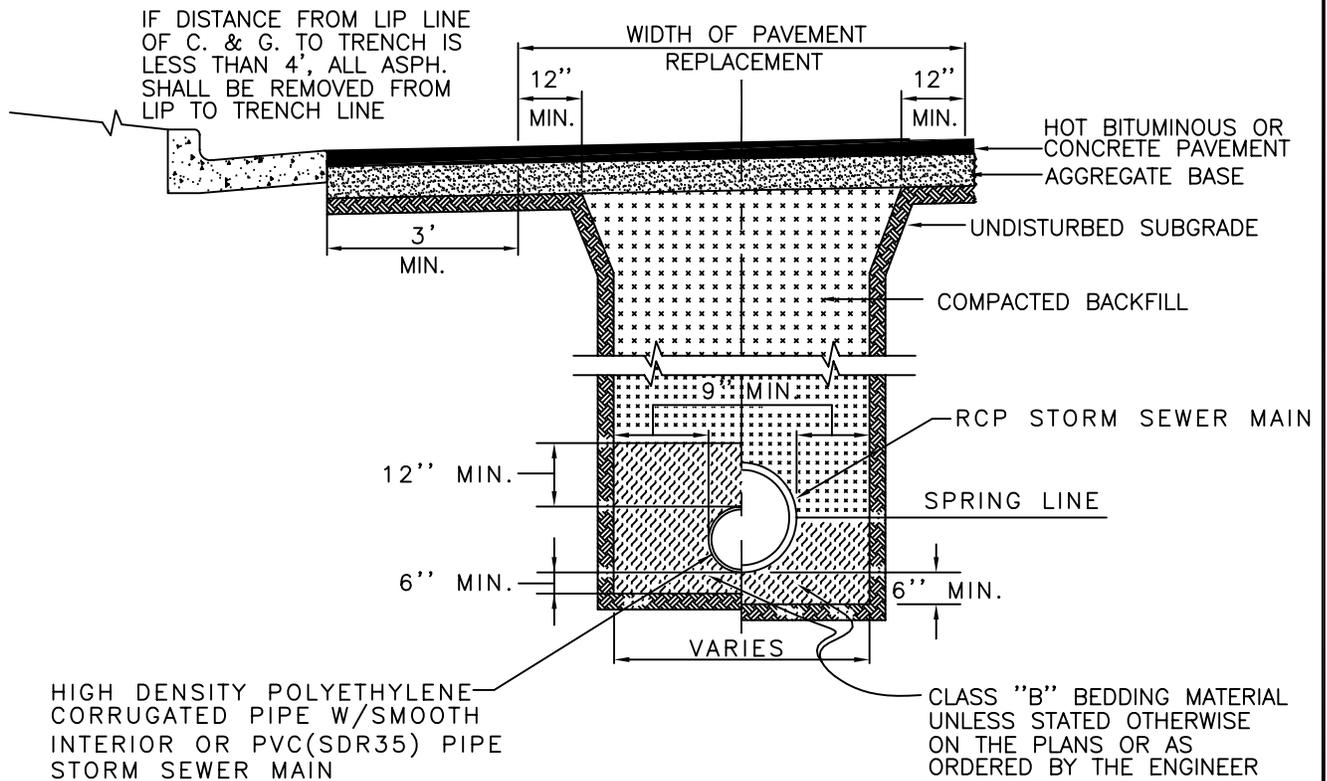
- TYPE 1A 48" STANDARD MANHOLE**
8" THRU 15"
- TYPE 1B 60" STANDARD MANHOLE**
18" THRU 36"
- TYPE 1C 72" STANDARD MANHOLE**
42" THRU 48"
NO SCALE

NOTES:

1. DESIGN CRITERIA:
CONCRETE -4,000 P.S.I. COMPRESSIVE STRENGTH AT 28 DAYS (TYPE II-V CEMENT).
2. FOR PIPE INVERT ELEV.'S SEE PLAN & PROFILE SHEETS.
3. LADDER RUNGS REQUIRED IN ALL M.H.'S
4. IF ALTERNATE CSP DESIGN IS USED, TYPE II M.H. SHALL BE MODIFIED & CONSTRUCTED FROM CORRUGATED PIPE.
5. IF PRE-CAST MANHOLE BASES ARE USED, THE CONCRETE BENCH/TROUGH SHALL BE CAST-IN-PLACE.

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<h2 style="margin: 0;">STORM MANHOLES</h2>		
Drawn By: A.C.M.	Date: NOV-1995	SHEET SD15
Checked By: N.W.	Approved By: R.P.M.	

Rev: 3-28-05	Rev: 9-25-00
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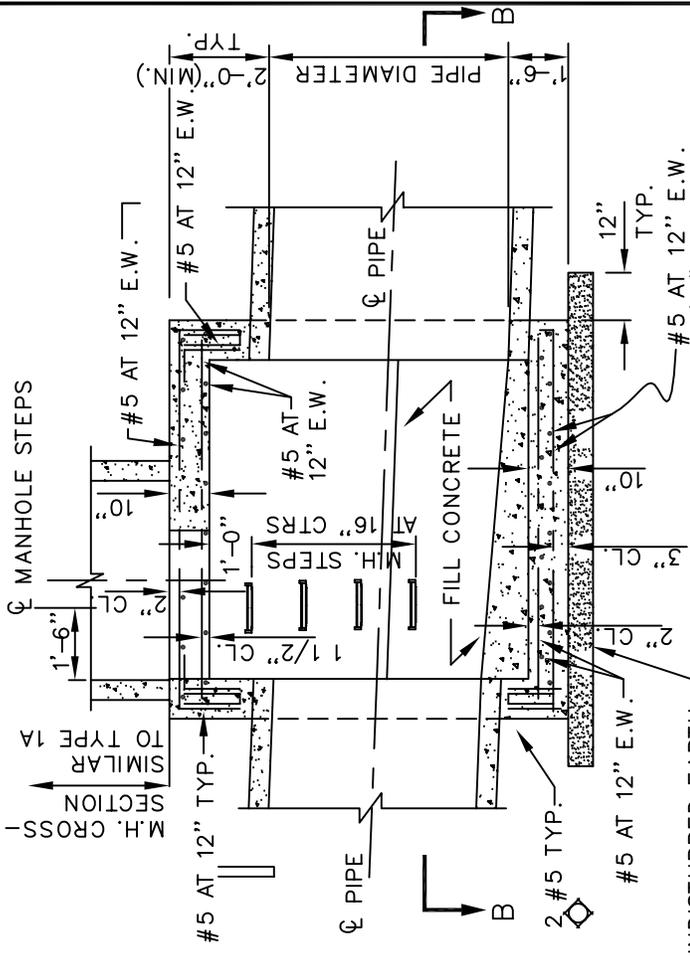
TRENCH DETAIL FOR STORM SEWER MAIN

SCALE: 1" = 3'-0"

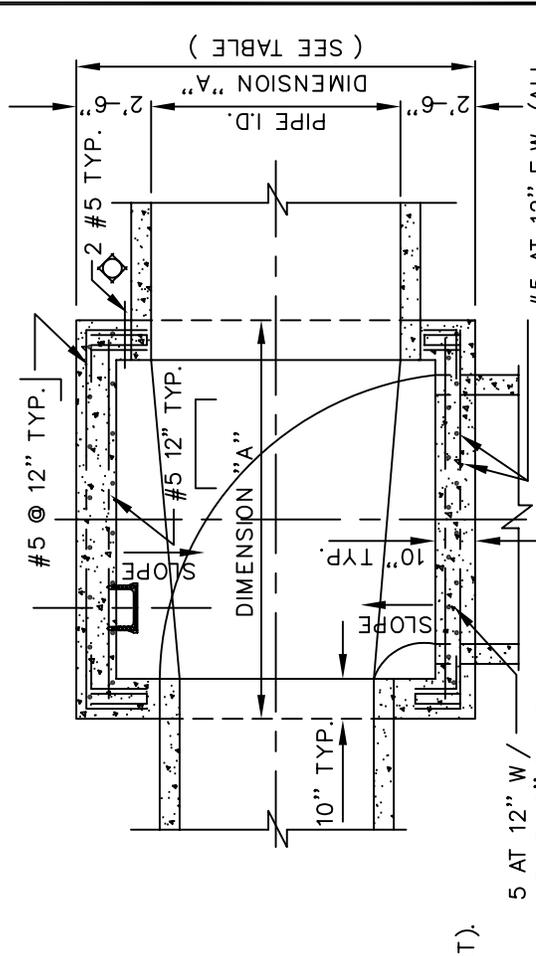
NOTE:

1. CONTRACTOR SHALL COMPLY WITH ALL LOCAL, STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS INCLUDING BUT NOT LIMITED TO DEPOSITION OF CUT, SLOPING AND/OR BRACING.
2. 1' ASPHALT CUT BACK IS NOT REQUIRED IN LIEU OF FLOWABLE BACKFILL

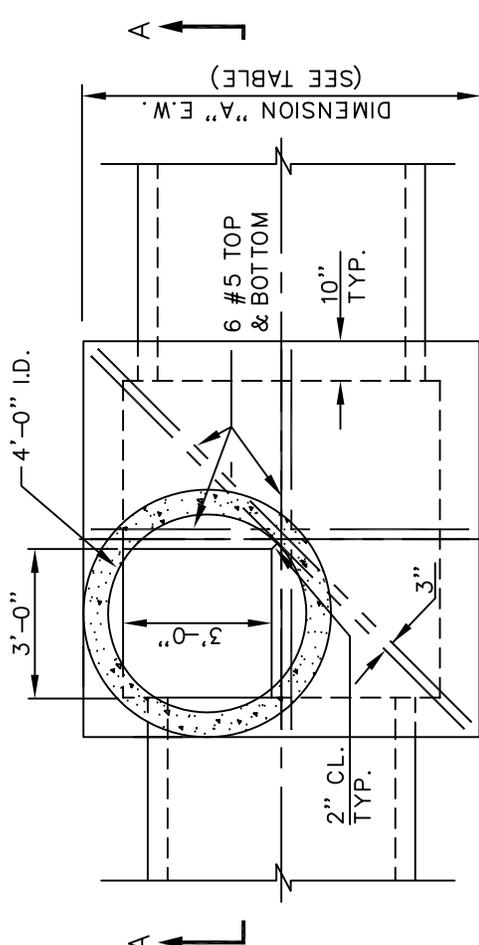
CITY OF  COLORADO	DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294	
<h3>STORM SEWER TRENCH DETAIL</h3>		
Drawn By: A.C.M.	Date: NOV-1995	SHEET SD16
Rev: 12-27-99	Checked By: N.W.	Approved By: R.P.M.



SECTION A-A
NO SCALE



SECTION B-B
NO SCALE



PLAN
SCALE: 1"=4'-0"

PIPE SIZE	DIMENSION "A"
54"	9'-6"
60"	10'-0"
66"	10'-6"
72"	11'-0"
78"	11'-6"
84"	12'-0"
90"	12'-6"
96"	13'-0"

NOTE: "A" DIMENSION OF BOX IS GOVERNED BY LARGEST PIPE DIA. AT EACH MANHOLE

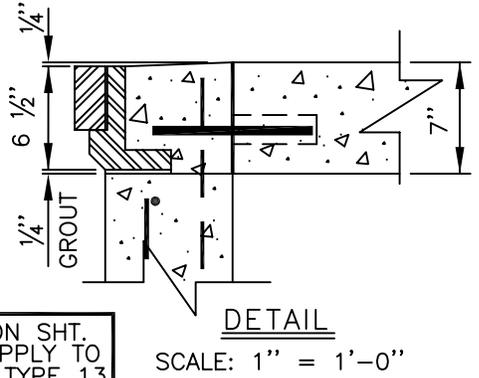
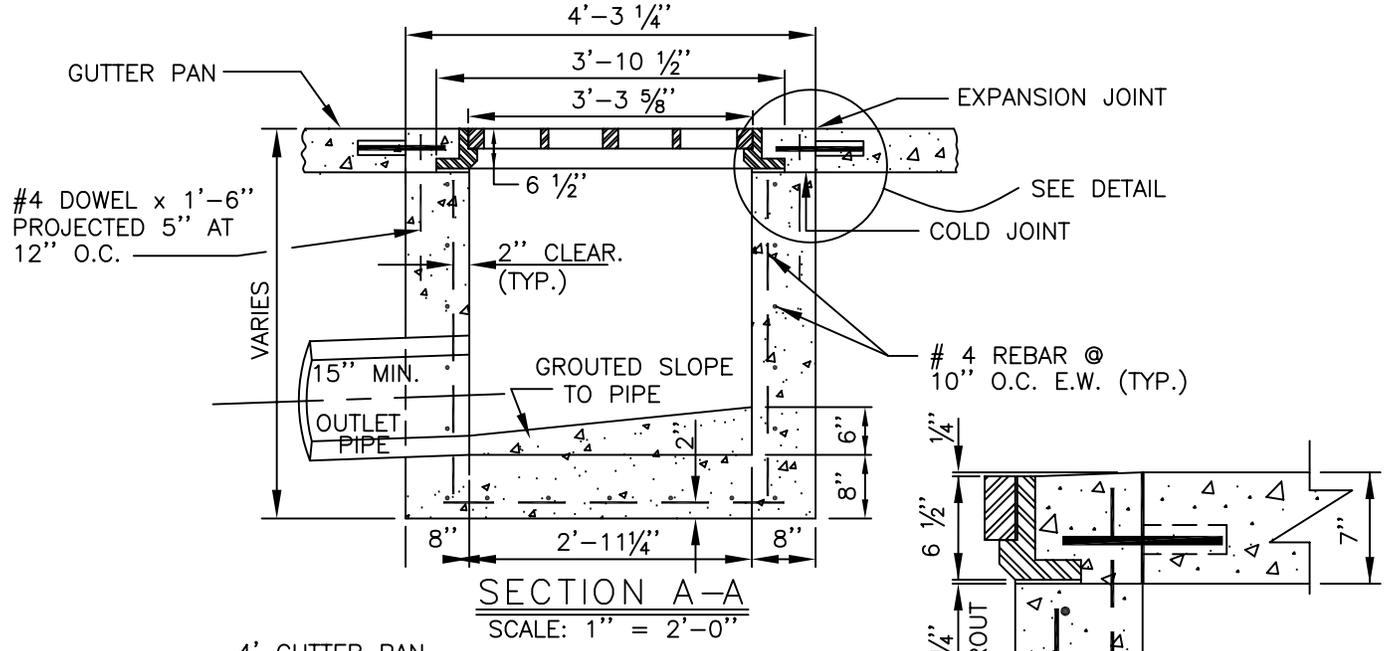
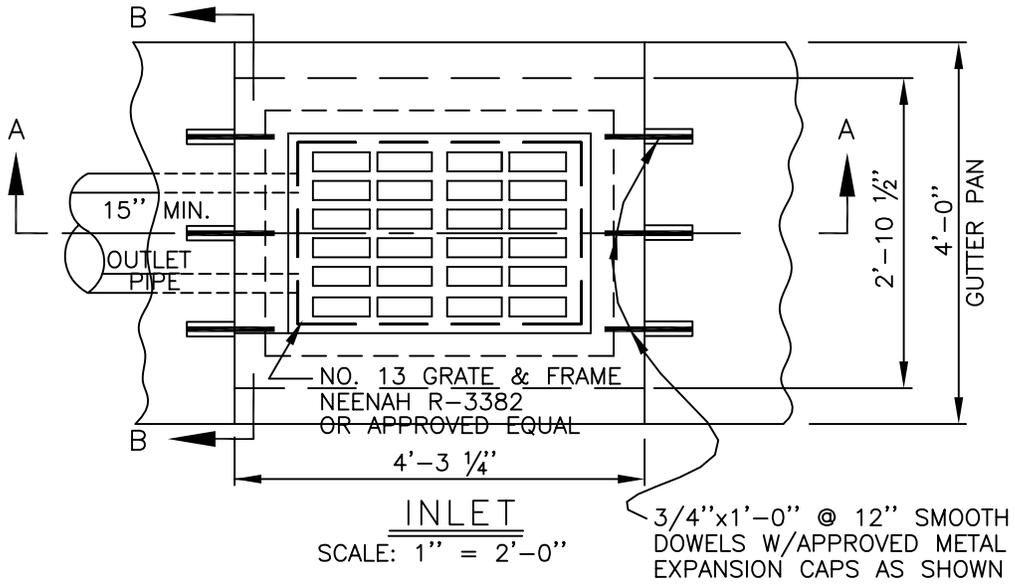
NOTES:

1. CHAMFER ALL EXPOSED EDGES OF CONCRETE 3/4" x 45° UNLESS OTHERWISE NOTED.
2. DESIGN CRITERIA
REINFORCING STEEL-ASTM A615 (60,000 P.S.I. MIN. YIELD)
CONCRETE-4,000 P.S.I. COMPRESSIVE STRENGTH AT 28 DAYS (TYPE II-V CEMENT).
3. ALL HORIZONTAL BARS SHALL BE CONTINUOUS AT CORNERS OR PROVIDE CORNER BARS.
4. FOR PIPE INVERT ELEV.'S SEE PLAN & PROFILE SHEETS.

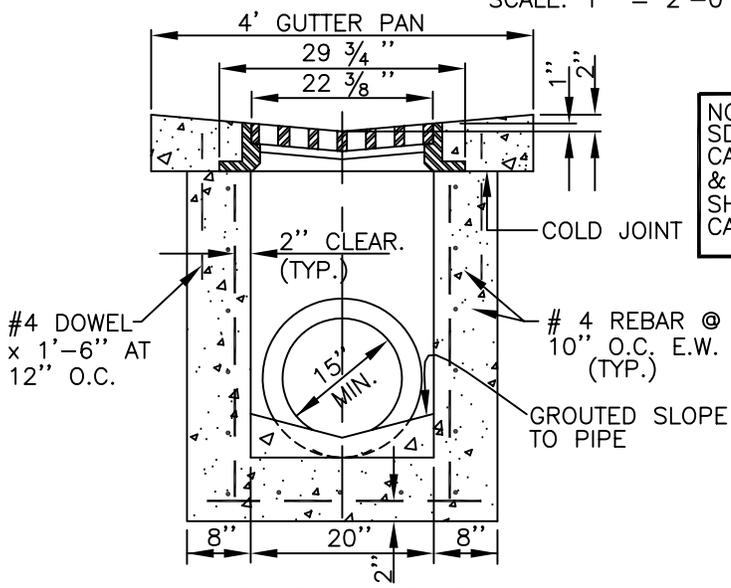
CITY OF **PUEBLO** COLORADO
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TYPE III STANDARD MANHOLE

Drawn By: A.C.M.	Date: NOV-1995	SHEET SD17
Checked By: N.W.	Approved By: R.P.M.	



NOTE: NOTES ON SHT. SD13.1 SHALL APPLY TO CAST-IN-PLACE TYPE 13 & NOTES ON SHT. SD14 SHALL APPLY TO PRE-CAST TYPE 13



CITY OF **PUEBLO** COLORADO

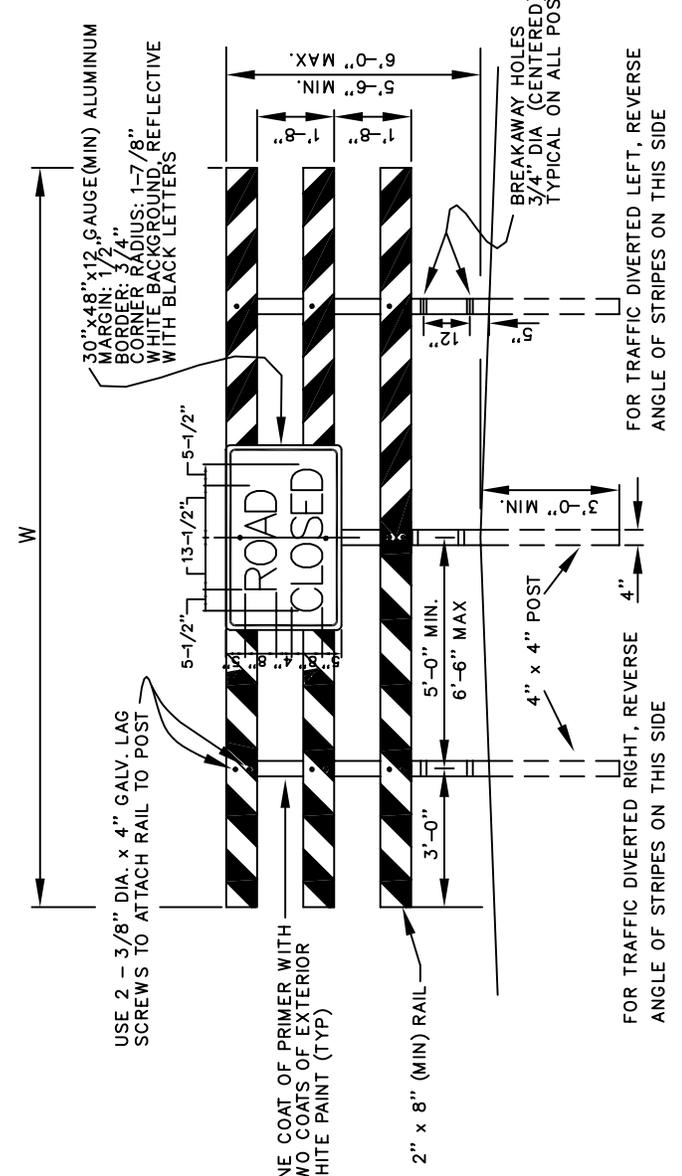
DEPARTMENT OF PUBLIC WORKS
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**GRATED INLET
TYPE 13 (SINGLE)**

Drawn By: A.C.M. Date: DEC-1996 SHEET SD19
Checked By: N.W. Approved By: R.P.M.

Rev: 9/26/00

FILENAME: SD19



GENERAL NOTES

1. FIELD LOCATION TO BE DETERMINED BY TRAFFIC ENGINEER.
2. ALL REFLECTIVE SURFACES SHALL BE SMOOTH SURFACE TYPE REFLECTIVE SHEETING OR APPROVED EQUAL.
3. ALL TIMBER SHALL BE GRADE NO. 2 OR BETTER, (DOUGLAS FIR, LARCH OR HEM-FIR.)
4. ALL POSTS SHALL BE PRESERVATIVE TREATED IN ACCORDANCE WITH AWPB-FDN STANDARDS.
5. ATTACH "ROAD CLOSED" SIGN TO POST WITH 2-3/8" DIA. x 4" GALV. LAG SCREWS. WHERE W = 24', PLACE SIGN ON POST LOCATED ON RIGHT SIDE OF BARRICADE CENTER.
6. PAINT FOR RAILS AND POSTS SHALL BE SHERWIN WILLIAMS A-100 ALKYD EXTERIOR WOOD PRIMER A-100 ALKYD EXTERIOR WOOD PRIMER WITH A-100 LATEX HOUSE AND TRIM PAINT (SERIES A8) OR APPROVED EQUAL.

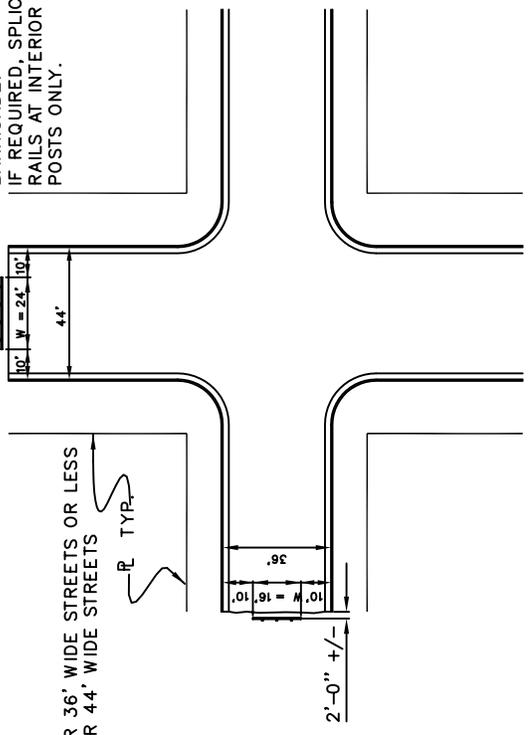
FILENAME: SD20

Rev: 12-27-99

CONSTRUCTION DETAIL

NO SCALE

PROVIDE 4 POSTS AS SHOWN FOR W=24' BARRICADE. IF REQUIRED, SPLICE RAILS AT INTERIOR POSTS ONLY.

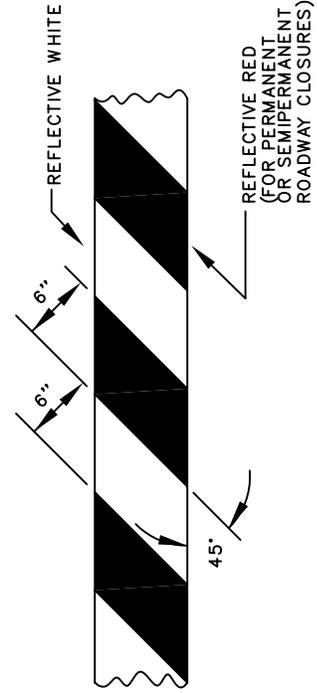


LOCATION DETAIL

NO SCALE

NOTE

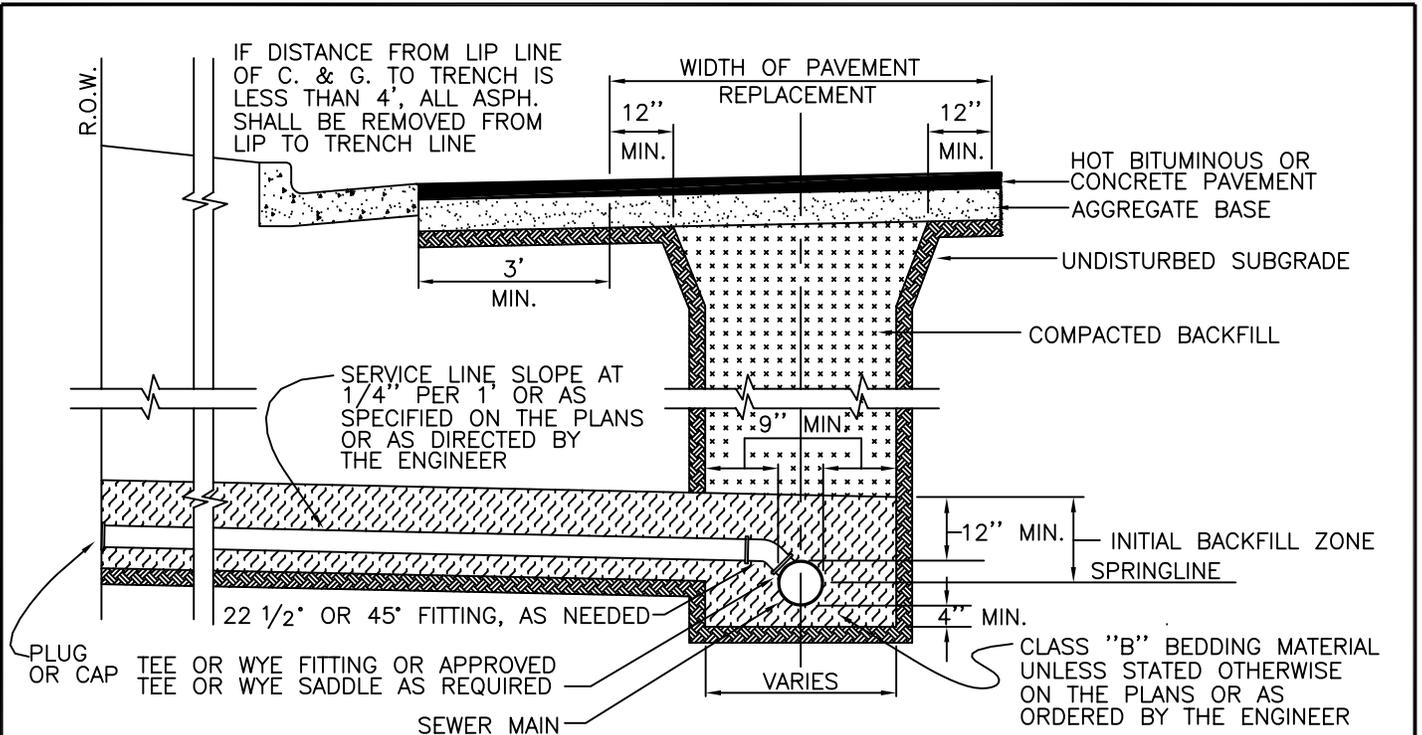
W = 16' FOR 36' WIDE STREETS OR LESS
W = 24' FOR 44' WIDE STREETS



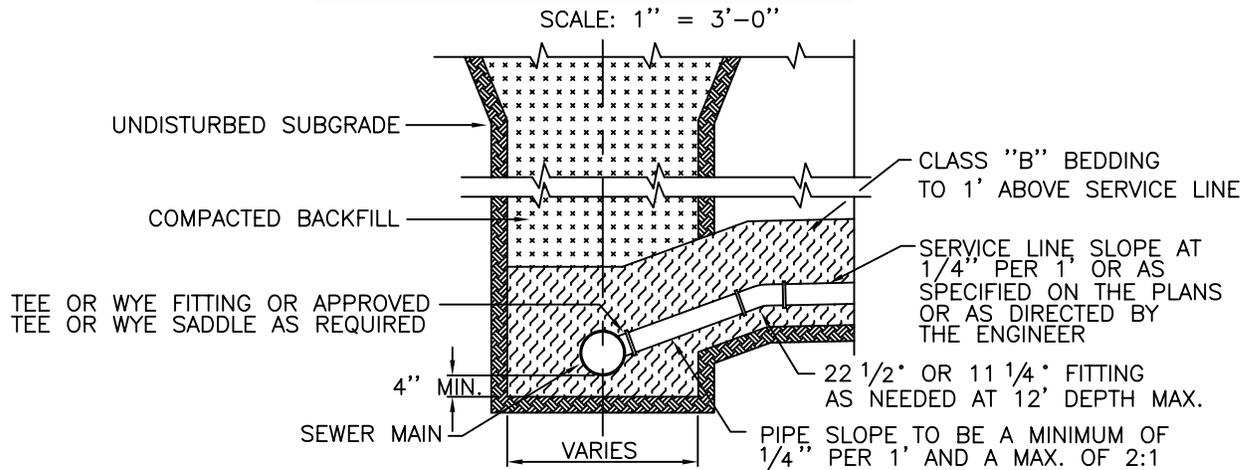
RAIL STRIPING DETAIL

NO SCALE

CITY OF  COLORADO		DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294	
STANDARD TYPE III BARRICADE			
Drawn By: A.C.M.	Date: NOV-1995	SHEET SD20	
Checked By: N.W.	Approved By: R.P.M.		



TRENCH DETAIL FOR SANITARY SEWER
MAIN AND SERVICE LINES



SANITARY SEWER SERVICE INSTALLATION FOR
MAINS GREATER THAN 12 FEET DEEP

NOTE:

1. CONTRACTOR SHALL COMPLY WITH ALL LOCAL, STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS INCLUDING BUT NOT LIMITED TO DEPOSITION OF CUT, SLOPING AND/OR BRACING.
2. SERVICE LINES SHALL BE CONNECTED TO THE SEWER MAIN SO THE FLOWLINE IS AT/OR ABOVE THE SPRINGLINE OF THE PIPE FOR 8" AND 10" SEWER MAINS AND IN THE TOP 1/4 OF THE PIPE FOR 12" AND LARGER SEWER MAINS.
3. THE ENDS OF ALL SERVICE LINES SHALL BE MARKED FOR LOCATION WITH A 2"x4" BOARD OR OTHER SUITABLE MARKER EXTENDING 2 FEET ABOVE AND 3 FEET BELOW GRADE IN ADDITION TO A 3 INCH WIDE GREEN PLASTIC TAPE TIED TO THE END OF THE SERVICE LINE AND EXTENDING 6 INCHES ABOVE THE GROUND SURFACE.

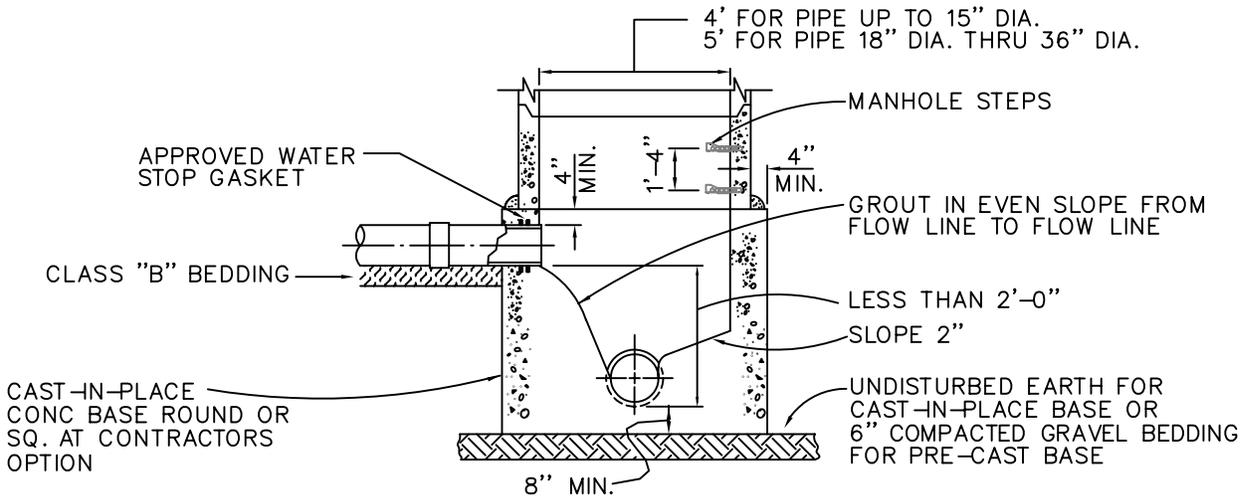
SCALE: 1" = 3'-0"

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	<p align="center">SANITARY SEWER TRENCH DETAIL</p>

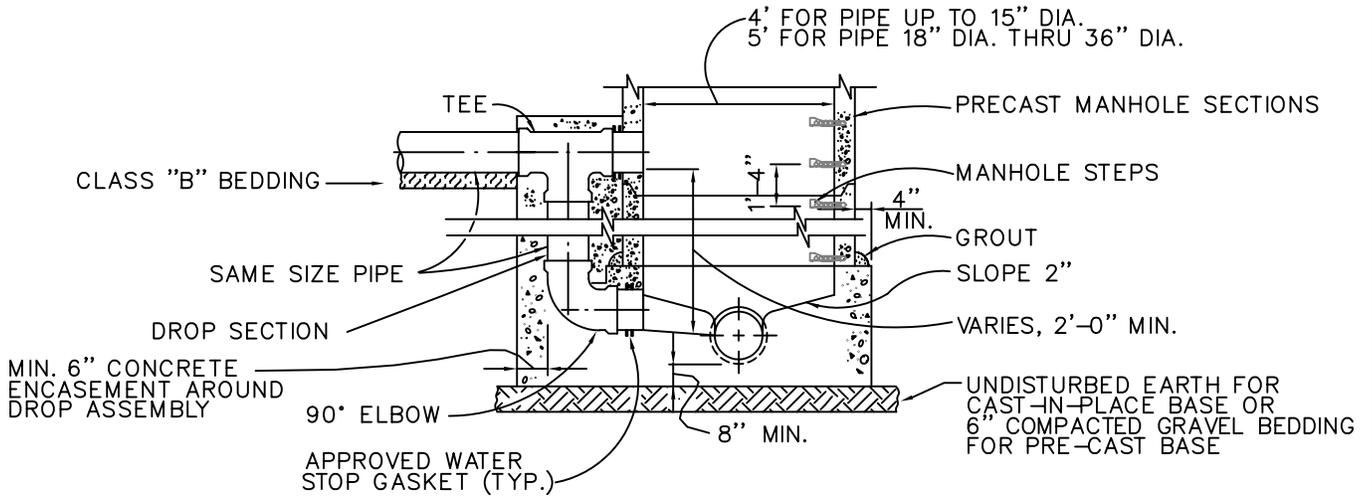
Drawn By: A.C.M.	Date: NOV-1995	SHEET SD21
Checked By: S.V.	Approved By: J.D.	

FILENAME: SD21

Rev: 12-27-99



MANHOLE BASE SECTION
FOR PIPE DROP LESS THAN 2'-0"
 NOT TO SCALE



MANHOLE BASE SECTION
WITH DROP ASSEMBLY
 NOT TO SCALE

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SANITARY SEWER
 MANHOLE DETAILS

Drawn By: A.C.M.	Date: NOV-1995	SHEET SD23
Checked By: S.V.	Approved By: J.D.	

PLACE CONC. COLLAR,
AS SHOWN IN ALL
UNPAVED AREAS

PRECAST CONC
GRADE RINGS
BRICK (EXISTING MH'S ONLY)

VARIES AS REQD
12" MAX, 4" MIN

PRECAST ECCENTRIC
CONE

MANHOLE STEPS

24" STANDARD MANHOLE
COVER WITH FRAME

FINISH GRADE

GROUT

AGGREGATE BASE

2'-0" ±

2'-6" MIN

DIA TO MATCH
BASE SECTION

PRECAST
MANHOLE
SECTION

NOTE:
TO BE USED FOR MANHOLES
GREATER THAN 6' DEEP.

MANHOLE TOP SECTION
WITH RING EXTENSION

SCALE: 1"=2'-0"

PLACE CONC. COLLAR,
AS SHOWN IN ALL
UNPAVED AREAS

BRICK (EXISTING MH'S ONLY)
PRECAST 2", 4" OR 6"
GRADE RINGS

VARIES AS REQD
12" MAX, 4" MIN

REINFORCED
STANDARD TOP
SLAB DESIGNED
FOR H2O LOADING

24" STANDARD MANHOLE
COVER WITH FRAME

FINISH GRADE

GROUT

AGGREGATE BASE

8"

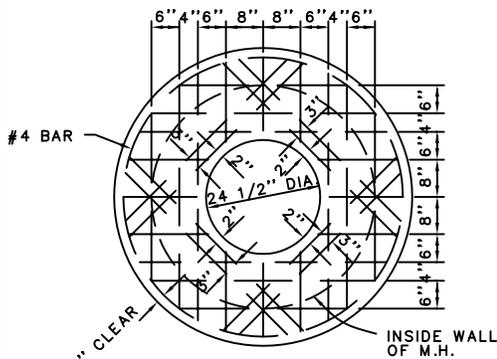
DIA TO MATCH
BASE SECTION

PRECAST
MANHOLE
SECTION

FLAT TOP MANHOLE

SCALE: 1"=2'-0"

NOTE:
TO BE USED FOR MANHOLES
6' DEEP OR LESS



1. DESIGNED FOR H2O LOADING
2. BARS TO BE TIED, NOT WELDED.
3. SLAB TO BE 8" THICK.
4. STEEL TO BE PLACED TOP & BOTTOM WITH 2" CLEAR BTWN. BARS & CONC. SURFACE.
5. ALL BARS TO BE #4.

TOP CONCRETE SLAB
FOR FLAT TOP M.H.
NO SCALE

Rev. 3-28-05

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MANHOLE DETAILS

Drawn By: A.C.M.

Date: NOV-1995

SHEET SD24

Checked By: S.V.

Approved By: J.D.

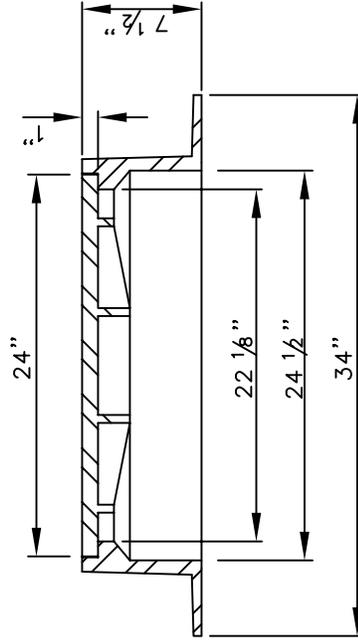
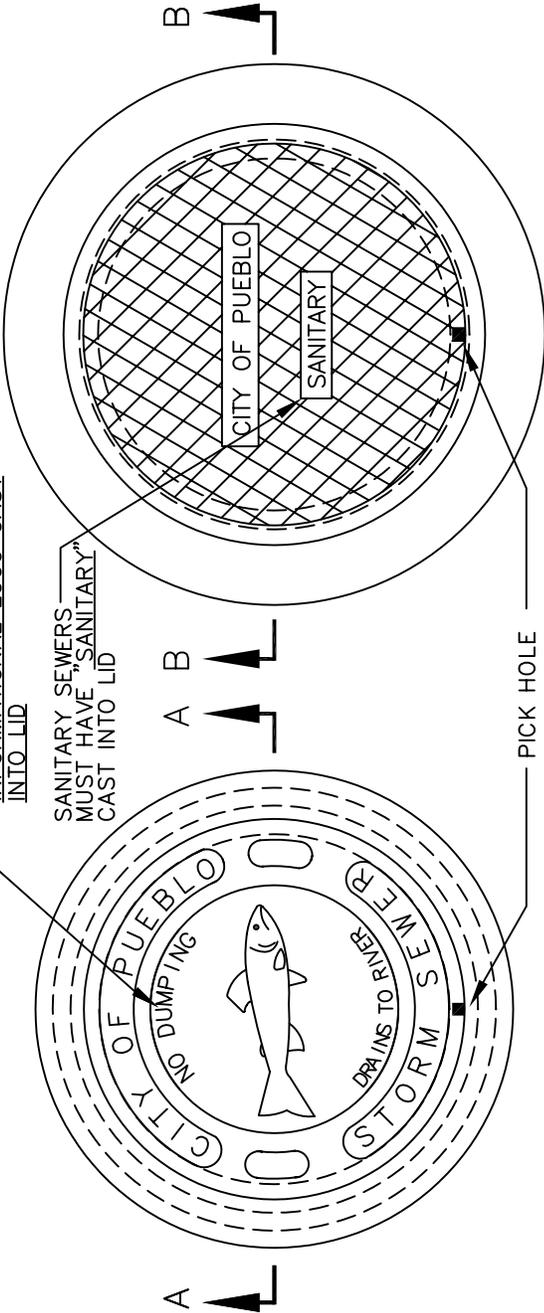
FILENAME: SD24

STORM SEWERS MUST HAVE
INFORMATIONAL LOGO CAST
INTO LID

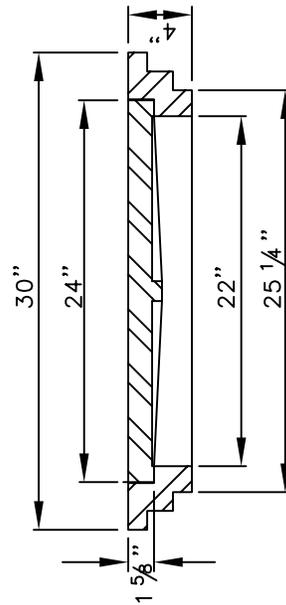
SANITARY SEWERS
MUST HAVE "SANITARY"
CAST INTO LID

PICK HOLE

MACHINE SEAT ON BOTH
FRAME AND COVER



SECTION B-B
STANDARD MANHOLE
RING AND COVER
NEENAH R-1706, DEETER 1258
EAST JORDAN IRONWORKS 2430
OR APPROVED EQUAL
SCALE 1" = 1'-0"



SECTION A-A
STANDARD MANHOLE
RING AND COVER FOR INLET
NEENAH R-6041, DEETER 1157
EAST JORDAN IRONWORKS 2855
OR APPROVED EQUAL
SCALE 1" = 1'-0"

MANHOLE NOTES

1. USE 24" STANDARD MANHOLE FRAME AND COVER UNLESS OTHERWISE NOTED ON PLANS.
2. PROVIDE 'BOLT DOWN' COVERS FOR MANHOLE IN REMOTE UNIMPROVED AREAS.

CITY OF



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ENGINEERING DIVISION

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(719) 543-2860

FAX 542-6244

MANHOLE & INLET RING
& COVER DETAILS

Rev: 3-28-05

Drawn By: A.C.M.

Date: NOV-1995

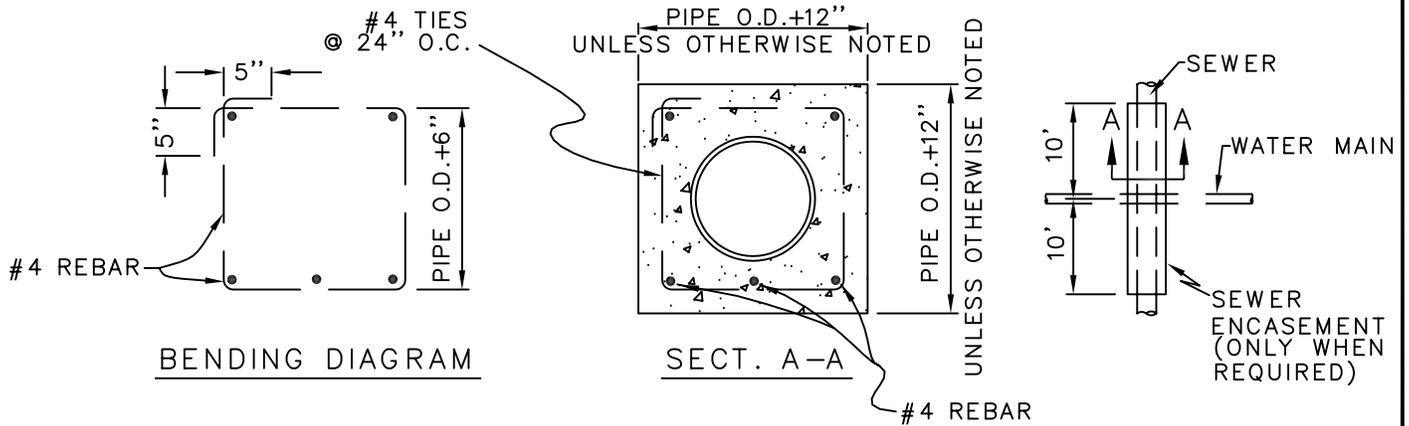
Rev: 12-28-99

Checked By: S.V.

Approved By: J.D.

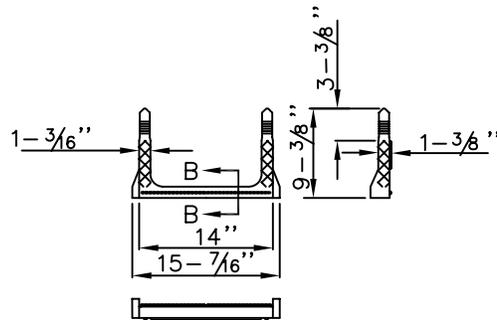
SHEET SD25

FILENAME: SD25



SEWER ENCASEMENT DETAILS FOR
WATER MAIN CROSSINGS

NO SCALE



COPOLYMER POLYPROPYLENE
PLASTIC

1/2" GRADE 60 STEEL REINF.

SECTION B-B



MANHOLE STEP

NO SCALE

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SEWER DETAILS

Drawn By: A.C.M.

Date: NOV-1995

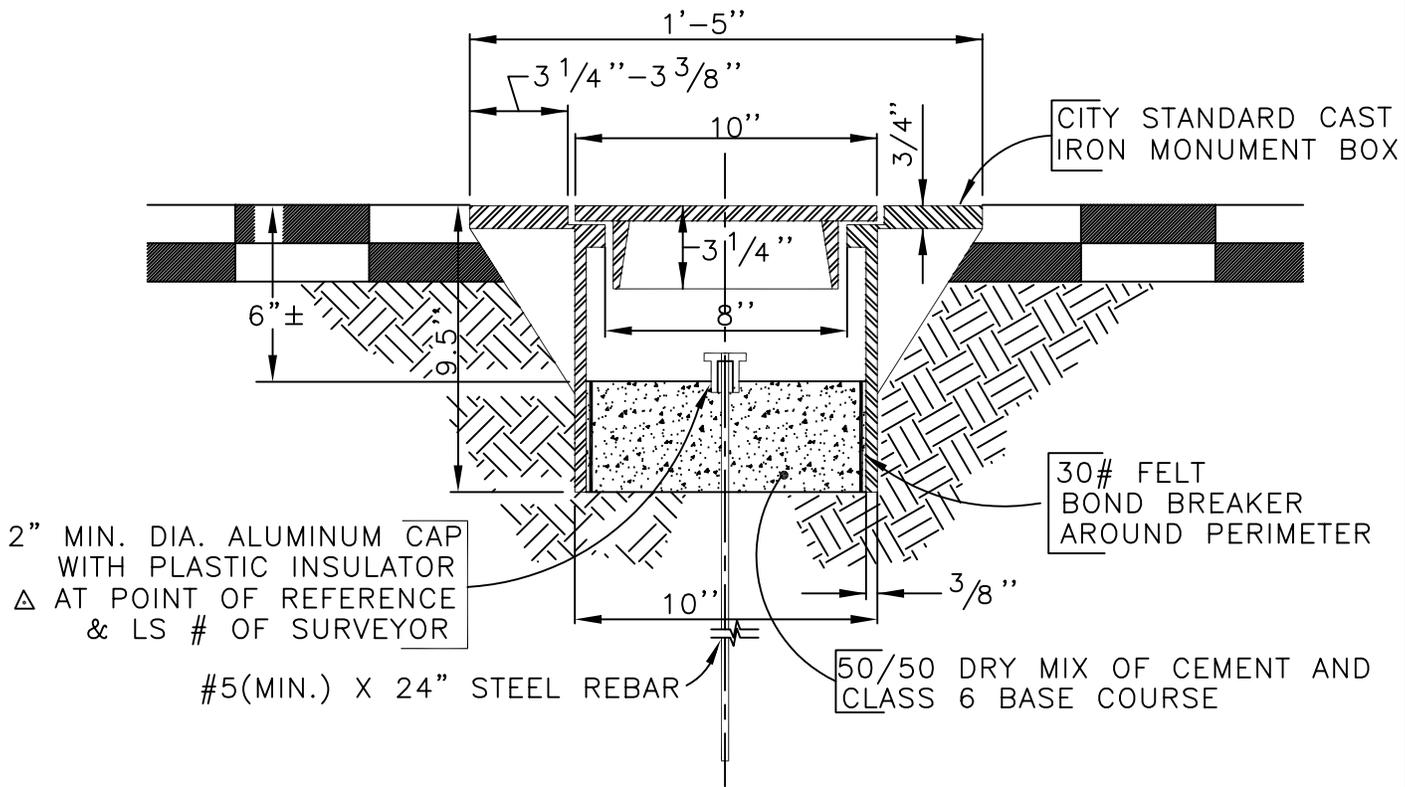
SHEET SD26

FILENAME: SD26

Rev: 12-27-99

Checked By: S.V.

Approved By: J.D.



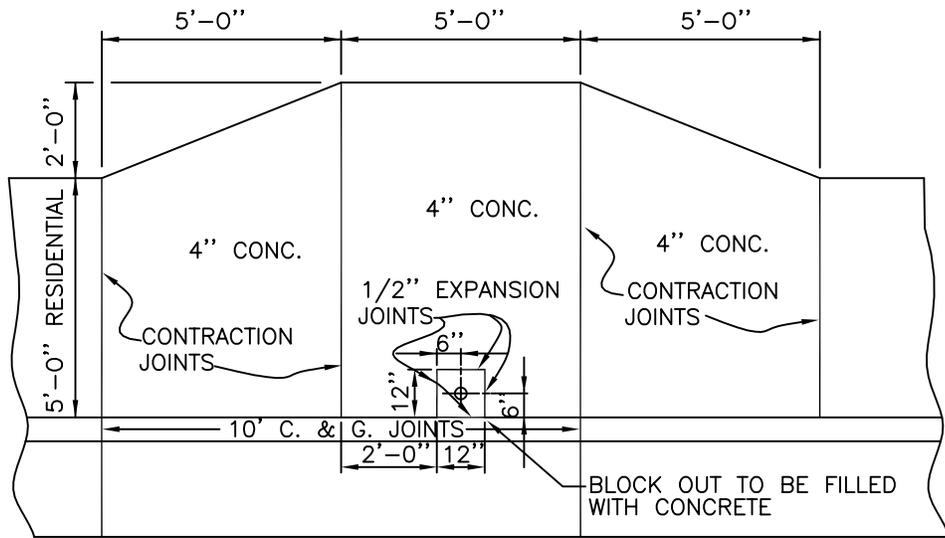
RIGHT OF WAY
MONUMENTATION STANDARD

NOT TO SCALE

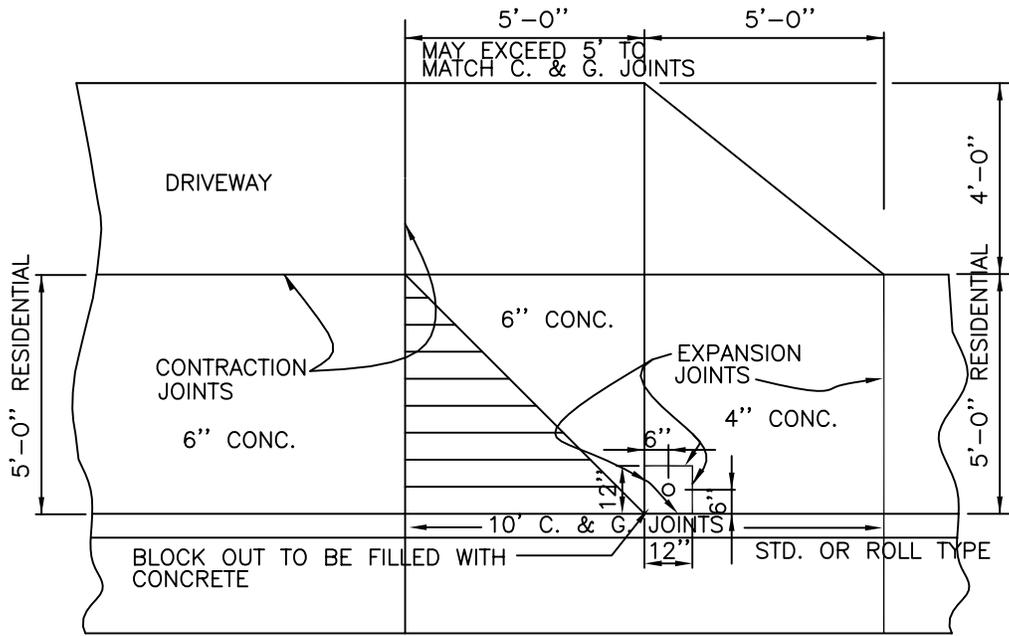
<p>CITY OF PUEBLO COLORADO</p>	<p>DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION 211 East "D" St. 81003 (719) 553-2295 FAX (719) 553-2294</p>
	<p>RIGHT OF WAY MONUMENTATION STANDARD</p>

RIGHT OF WAY
MONUMENTATION STANDARD

Drawn by: KR	Date: OCT. 1996	SHEET SD27
Checked by: MB	Approved by: RPM	



SCALE: 1" = 4'



SCALE: 1" = 4'

NOTE:
FOR MAIL BOXES LARGER THAN DIMENSIONS SHOWN,
DETAIL SHALL BE MODIFIED TO PROVIDE A MINIMUM
3'-6" CLEARANCE TO EDGE OF WALK

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CURB SIDE MAIL BOXES

Drawn By: A.C.M.

Date: 2-07-04

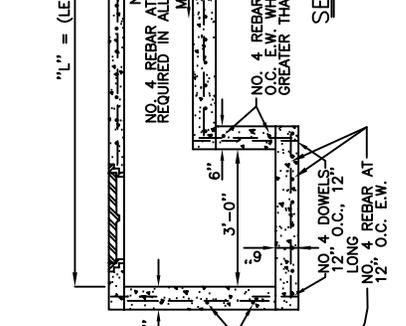
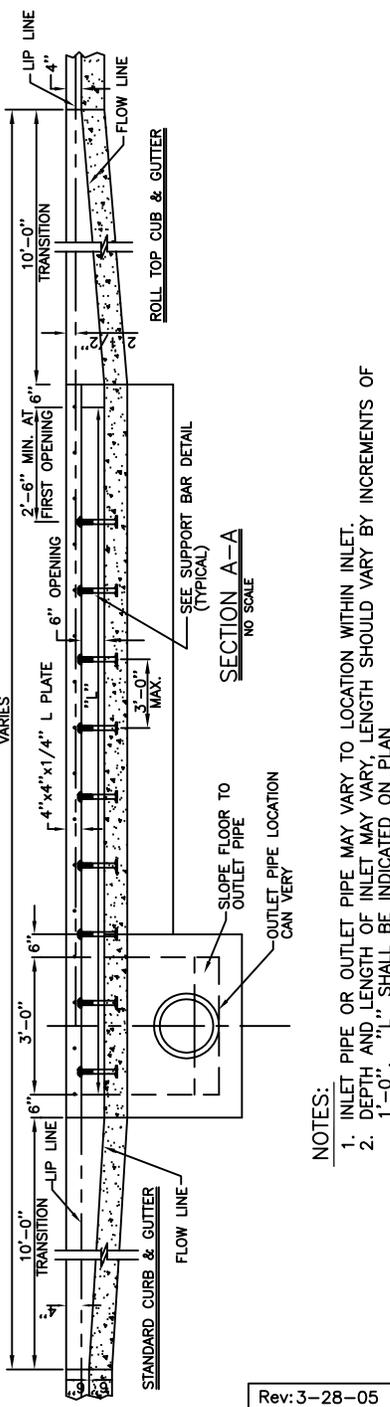
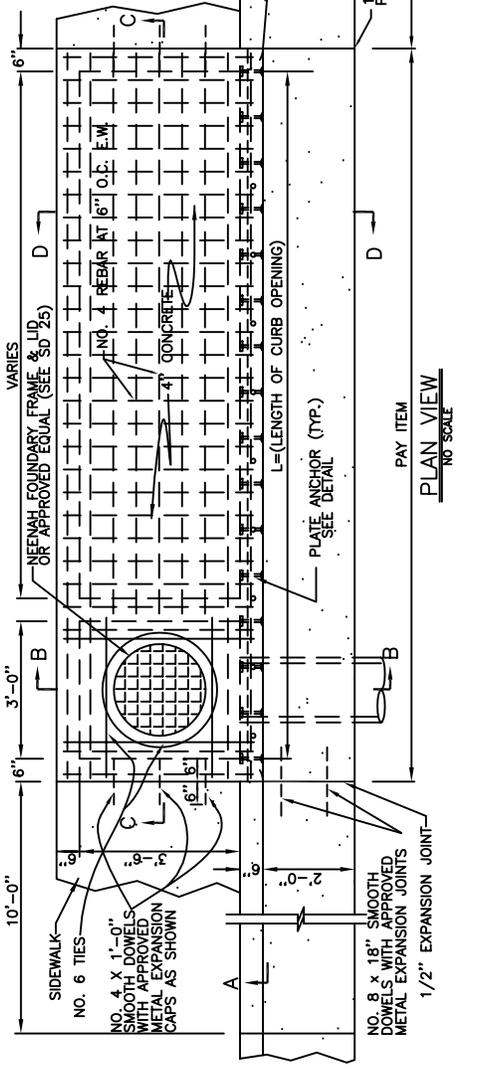
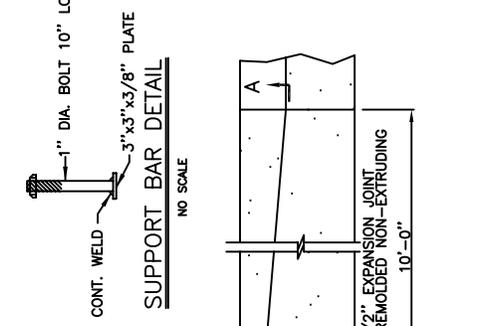
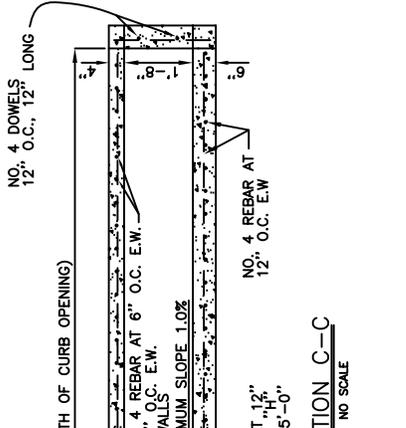
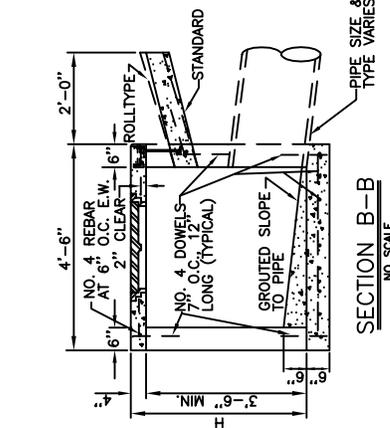
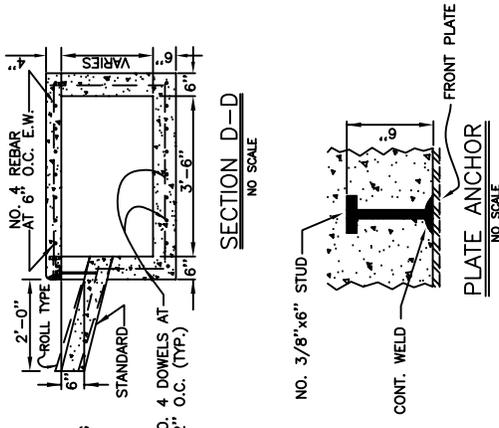
SHEET: SD28

FILENAME: SD28

Rev: 5-24-04

Checked By: M.B.

Approved By: M.B.

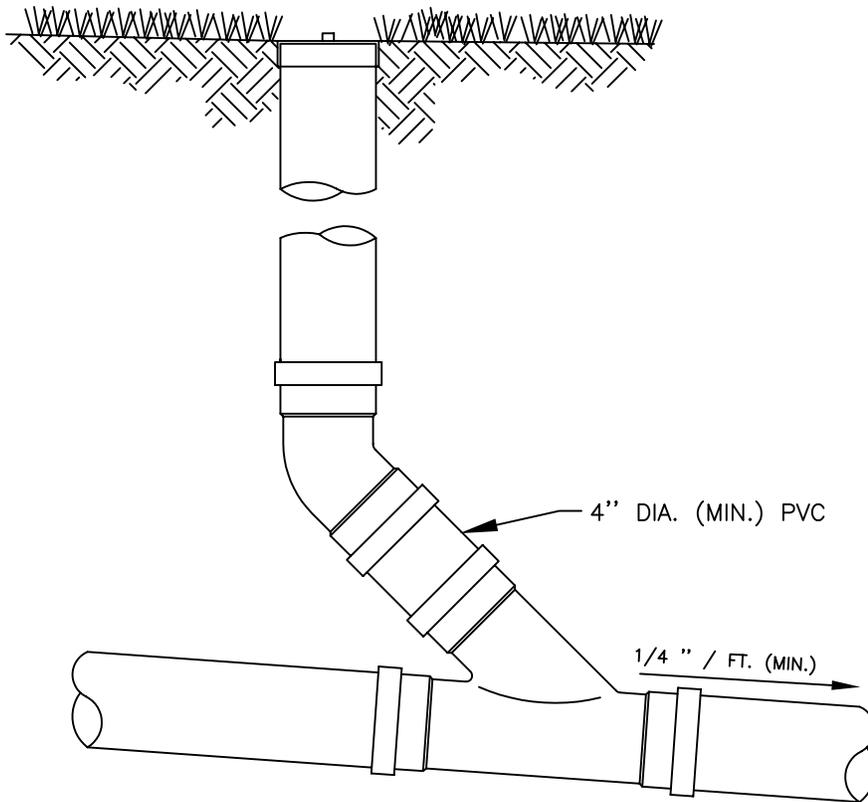


- NOTES:
1. INLET PIPE OR OUTLET PIPE MAY VARY TO LOCATION WITHIN INLET.
 2. DEPTH AND LENGTH OF INLET MAY VARY, LENGTH SHOULD VARY BY INCREMENTS OF 1'-0". "L" SHALL BE INDICATED ON PLAN.
 3. INLET WALLS AND BASE WITH #4 BARS 12" EACH WAY SHALL BE REQUIRED.
 4. FLOOR SURFACE OF INLET SHALL BE FINISHED TO A SMOOTH SURFACE AND SHALL SLOPE TOWARDS OUTLET.
 5. MANHOLE SHALL BE LOCATED AS SHOWN ALONG BACK WALL AND CENTERED ON OUTLET PIPE.
 6. WALK WIDER THAN 4'-0" TO BE DOWELED INTO BACK OF INLET COVER.
 7. ALL PIPES TO BE TRIMMED FLUSH WITH INSIDE WALL OF BOX.
 8. CONCRETE SHALL BE OF 4000 P.S.I. AT 28 DAYS WITH TYPE II-V (6 SACK) OR TYPE II (7 SACK) CEMENT.
 9. IF OPENING IS GREATER THAN 4'-0" SUPPORT BARS WILL BE REQUIRED AT INTERVALS NOT GREATER THAN 3' ON CENTER.
 10. SURFACE OF ALL EXPOSED CONCRETE SHALL CONFORM IN SLOPE, GRADE, COLOR, FINISH, AND SCORING TO EXISTING OR PROPOSED SURFACES.
 11. SUPPORT BAR MAY BE WELDED TO L4"x4"x1/4" IN LIEU OF BOLT AND NUT CONNECTION.
 12. THE EXPOSED PORTION OF THE L4"x4"x1/4" AND SUPPORT BARS SHALL BE CLEANED AND PAINTED WITH AN ASPHALT BASE PAINT AFTER THE CONCRETE PORTION OF THE INLET HAS BEEN COMPLETED.
 13. REINFORCING STEEL - ASTM A615 (60,000 PSI MIN. YIELD).
 14. INLET STEPS REQUIRED FOR "H" GREATER THAN 3'-6", SEE STEP DETAILS ON SHEET #SD26.
 15. INLETS SHALL BE LOCATED AT LEAST 10' FROM PCR.S.

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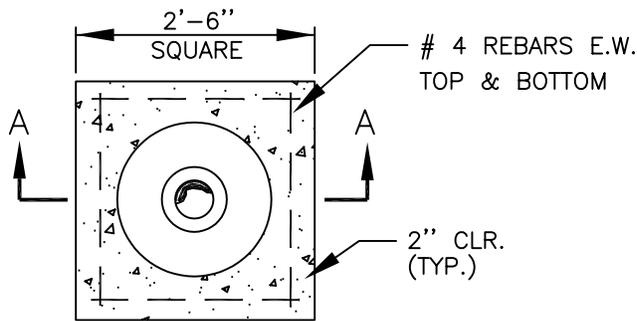
TYPE "W" INLET

Rev: 3-28-05	Drawn By: A.C.M.	Date: MAR-1996	SHEET: SD29
Rev: 9-28-00	Checked By:	Approved By:	



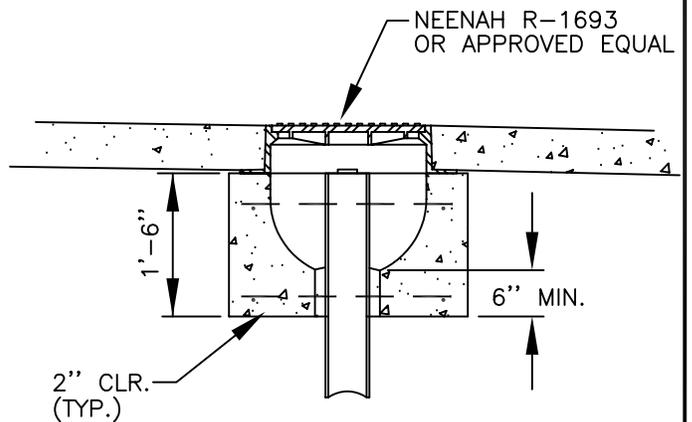
TYPICAL CLEANOUT DETAIL

N.T.S.



COVER DETAIL

SCALE: 1" = 2'-0"



X-SECTION A-A

SCALE: 1" = 2'-0"

NOTE:

WHEN CLEANOUT IS IN STREET,
PARKING OR ANY DRIVEWAY,
CONSTRUCT COVER AS SHOWN

FILENAME: SD30

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SANITARY SEWER MAIN
CLEANOUT

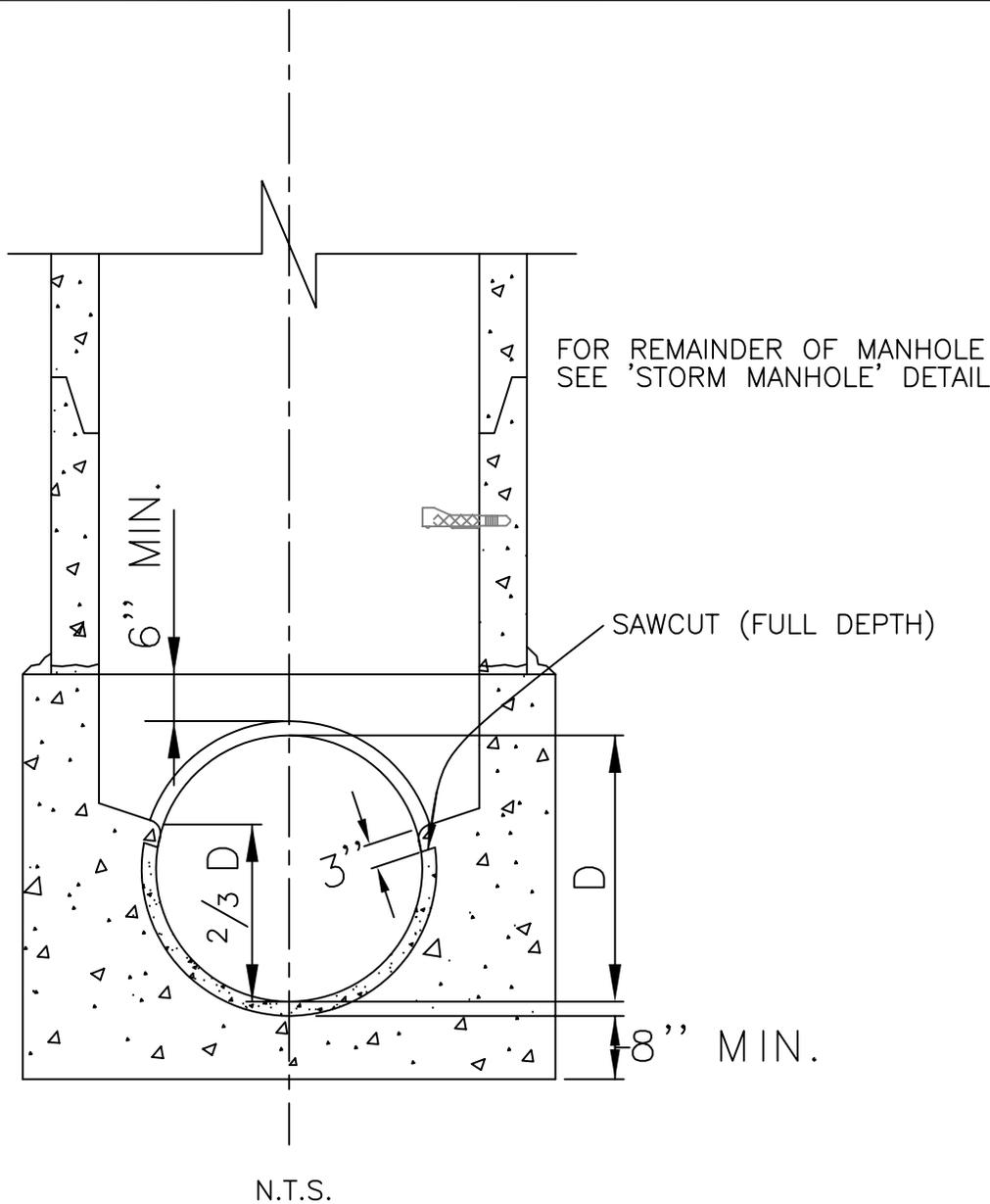
Drawn By: A.C.M.

Date: SEPT-1998

SHEET: SD30

Checked By: N.W.

Approved By: J.D.



NOTES

1. SEE NOTES FOR "STORM MANHOLES".
2. FOR USE WHERE ALIGNMENT AND GRADE DO NOT CHANGE THROUGH THE MANHOLE AND NO OTHER PIPES ENTER MANHOLE BELOW SPRINGLINE OF THE MAIN PIPE.

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ALTERNATIVE STORM MANHOLE FOR 18" THRU 48" PIPE

Drawn by: A.C.M.

Date: 1-18-2000

SHEET SD31

Checked by: MB

Approved by: RPM

FILENAME: SD31

Rev: