CONSTRUCTION STANDARDS

CS 10

STORM DRAIN

CS 1O-O1 **GENERAL**: Storm Drain System improvements shall be constructed in conformance with the City Standard Specifications and the Standard Drawings.

Nothing in the City Standard Specifications shall relieve the Contractor from conforming to the manufacturer's recommendations. If a conflict between the City Standard Specifications and the manufacturer's recommendations arises, the more stringent requirement shall apply.

All testing requirements of the ASTM standards and other provisions of these City Standard Specifications for the materials and equipment furnished shall be conducted by the manufacturer or its representative unless otherwise stated. A certificate of compliance conforming to these specifications must be furnished and submitted to the Inspector by the manufacturer through the Contractor. The certification must be approved by the Director of Public Works prior to installation of the materials or equipment. Such certification shall reference and specifically identify the materials and equipment delivered to the job site. All other testing requirements required by these City Standard Specifications shall be performed by the Contractor at its own expense unless otherwise noted.

CS 10-02 **ALLOWABLE PIPE MATERIALS:** The pipe material shall be furnished as specified on the Project Plans and/or Special Provisions. The pipe material, construction, and installation shall conform to the following:

A. REINFORCED CONCRETE PIPE (RCP):

1. **General: -** The minimum size RCP allowed is 15-inch diameter.
2. **Specifications: -** RCP construction shall conform to Section 65, Reinforced Concrete Pipe, of the CALTRANS Standard Specifications except as modified herein. Reinforced concrete pipe shall conform to the specifications of ASTM Designation C76 and shall be a minimum of Class III. The Contractor shall submit to the Inspector the manufacturer's "Certificate of Compliance that the pipe delivered to the project is in full compliance with the requirements of ASTM C76.
3. **Pipe Joints**: - Joints shall be tongue and groove, bell and spigot, or other approved type. Each joint shall be sealed to prevent leakage. Sealing materials shall consist of either, cement mortar, rubber gasket joints, or resilient materials conforming to Section 65-.1.06, Joints, of the CALTRANS Standard Specifications except that rubber gasket joints are required where the pipeline is installed below the ground water level. Joints sealed with cement mortar or resilient materials shall be sealed both inside and outside.

If cement mortar is used in sealing the joint, the sealed joint shall be constructed, protected and cured in a manner approved by the City Engineer/Director of Public Works.

B. CAST-IN-PLACE CONCRETE PIPE (CIPCP):

1. **General:** - Construction for CIPCP shall conform to the most current revisions to ACI 346-01, Specification of Cast in Place Concrete Pipe except as modified herein. Construction of cast-in-place concrete pipe will only be permitted when and where designated on the Project Plans or Special Provisions. The pipe shall be constructed with casting equipment specifically designed for constructing CIPCP. The casting equipment shall be equipped with internal vibrators and tampers. The contractor shall furnish evidence of successful operation of the proposed equipment on other projects. The contractor shall submit evidence to the Inspector that the proposed equipment is capable of conforming to these specifications.

   CIPCP is allowed for minimum of 36-inch diameter pipe and larger.

2. **Concrete: -** The Contractor shall submit for approval, a concrete mix design based upon the concrete consisting of a minimum of 564 pounds of Portland cement per cubic yard and attaining a minimum strength of 3000 psi at 28 days. Concrete used for CIPCP shall be subject to continuous testing at the direction of the Director of Public Works.

   The following tests shall be performed in accordance with the CALTRANS testing procedures and be conducted by certified personnel:

   a. Slump tests shall be conducted at a minimum of every 5^{th} truck load before the concrete will be permitted to be placed in the pipe casting machine. At the discretion of the Inspector, slump tests shall be conducted at every truck load. Any concrete having a slump that is not within the limits specified in **Table CS 10- 1**, Slump Requirements, shall be rejected.

TABLE CS 10-1

SLUMP REQUIREMENTS

Pipe Diameter	Slump
Less than 42 inches	2 ½ ± 1 ½ inches
42 to 72 inches	2 ½ ± 1 inch
Greater than 72 inches	2 ± ½ inch

b. A minimum of 4 standard 6-inch diameter by 12-inch long compressive strength test cylinders shall be cast from representative portions of each load of concrete required to be sampled. Each cylinder shall be labeled with the station location of the pipe, date and batch number.

c. One of the four cylinders shall be tested for compressive strength at the end of seven days, two cylinders shall be tested at the end of 28 days and the fourth shall be a spare and shall be subject to testing at the discretion of the Director of Public Works.

d. If the cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken from the same section of concrete represented by the faulty test under supervision of the Inspector. If core tests indicate concrete strength more than fifteen percent (15%) below the minimum specified strength, that portion of pipe shall be removed and replaced with precast RCP at the sole expense of the contractor.

3. **Trench Excavation, Foundation, Bedding, and Backfill-** Trench excavation**,** foundation, bedding and backfill shall conform to Section CS 2, Trench Excavation and Section CS 3, Trench Foundation, Bedding, and Backfill of the City Standard Specifications except as modified herein.

a. The trench shall be excavated using electronically guided equipment in strict conformance to the lines and grades as shown on the Project Plans. The trench shall be of the proper width and the bottom of the trench shall be shaped to the external diameter of the pipe to be constructed. The trench shall be prepared to provide full, firm, and continuous support by undisturbed earth or compacted fill for the area of the trench form which is defined as at least the bottom 210 degrees of the pipe. The trench form shall be stable and free of protrusions, mud, debris, and standing or running water.

b. All unstable material below the invert of the pipe shall be over excavated and backfilled with crushed rock compacted to provide a smooth and firm foundation for the pipe.

c. The trench width at the top of the pipe shall not exceed the outside diameter of the pipe at the spring line plus one inch.

d. The requirements for the maximum length of allowable open trench included in Section CS 2, Trench Excavation shall be modified for CIPCP construction such that the maximum length of open trench shall be subject to the approval of the Director of Public Works on a case by case basis.

e. The requirements for bedding included in Section CS 3, Trench Foundation, Bedding, and Backfill of the City Standard Specifications shall be modified as follows for construction of CIPCP. The bottom

limit of backfill starts at the top portion of the pipe in contact with the trench wall.

f. Backfill shall not commence until the concrete attains a compressive strength of 2500 psi.

g. The first lift of backfill shall consist of crushed rock conforming to the grading requirements of Section CS 3-03, Bedding, of the City Standard Specifications except where other material is specified on the Project Plans for parallel CIPCP installations. The crushed rock shall extend one foot above the top of the pipe. The first and second lift shall be separated by Geotextile Filter Fabric in accordance with Section CS 7, Geotextile Fabric of the City Standard Specifications. All backfill material shall be carefully placed so as to not disturb or damage the pipe.

Deleted: 3-04, Geotextile Filter

h. The remaining trench backfill shall conform to Section CS 03 Trench Foundation, Bedding, and Backfill of the City Standard Specifications.

4. **Placing Concrete: -** Concrete placement shall conform to the following requirements:

a. All surfaces against which concrete is to be placed shall be free of standing water, mud, rocks, sloughed material, and debris, and shall be firm enough to prevent contamination of the concrete by earth or other foreign material.

b. Absorptive surfaces against which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete.

c. The Contractor, at its sole expense, shall either probe or core small holes or submit and use a method or device approved by the Director of Public Works to ensure that the thickness of concrete is always maintained at not less than the minimum wall thickness specified in **Table CS 10-2**. The probe or core of the wall thickness shall be made at the top and bottom of the pipe at 100 foot intervals of pipe installed during the casting process. Approval of this device or method must occur prior to commencement of trench excavation. The holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe after measurements are made.

TABLE CS 10-2

CIPCP MINIMUM WALL THICKNESS

.			
Inside Diameter	Minimum Thickness	Inside Diameter	Minimum Thickness
36	3 ½	90	8 ½
42	4	96	9
48	5	108	10 ½
54	5 ½	120	12
60	6	132	14
66	6 ½	144	15
72	7		
78	7 ½		
84	8		

Dimensions shown in table are in inches

d. Variations in the internal diameter shall not be more than 2% of the specified pipe diameter.

e. The CIPCP shall be constructed in one placement around the complete pipe circumference.

f. The temperature of the concrete when being placed shall be not more than 90° F. If the concrete is placed when the weather is such that the temperature of the concrete could exceed 90°F, the Contractor shall employ effective means such as precooling of aggregates and mixing water and placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90°F.

Whenever the mean daily temperature in the vicinity of the work falls below 40°F, the concrete shall be maintained at a temperature not lower than 50°F for at least seventy-two (72) hours after it has been placed. Where artificial heat is employed, special care shall be taken by the Contractor to prevent drying.

g. Under no circumstance shall the Contractor continue the pipe installation if the vibrators of the cast-in-place machine are inoperable. Portable vibrators or stingers shall only be used to supplement vibrators on the machine and not as the sole source to consolidate and distribute the concrete mix.

5. Cold Joints: - If construction of the pipe stops short of a manhole, or for a period of time exceeding 20 minutes, the pipe end shall be left in a rough condition at a slope of approximately 45° with 24-inch long No.4

reinforcing dowels embedded 12 inches into the pipe around the pipe circumference.

a. The dowels shall be placed at 12-inch intervals around the pipe circumference for pipe sizes up to 72 inches in diameter and at 18-inch intervals for larger pipe sizes.

b. Prior to resumption of pipe casting pipe end surfaces shall be thoroughly cleaned of foreign materials, coatings, and loose or defective concrete and thoroughly wetted.

c. A tie-in cap shall be cast over the joint across the top of the pipe from trench wall to trench wall. The tie-in cap shall be a minimum of 24 inches long centered over the joint. The thickness of the tie- in cap shall be 1.5 times the minimum wall thickness shown in **Table CS 10-2.**

6. Finish: - The finish of the concrete shall conform to the following requirements:

a. The transverse and longitudinal difference in pipe thickness resulting from the metal form used in the casting process shall be hereafter referenced as an Offset at form lap. Offsets at form laps shall not exceed the limits specified in **Table CS 10-3**.

TABLE CS 10-3

Maximum Offset at Form Lap

Diameter of Pipe	Maximum Offset
36	½
42 through 72	¾
greater than 72	1

Dimensions shown in table are in inches

b. The finish surface of the concrete pipe shall be substantially free of fractures, cracks and interior surface roughness.

c. The contractor shall hand trowel the bottom ninety degrees (90°) of the inside of the pipe unless other alternative provisions are made to provide a smooth interior surface. The remaining interior surface of the pipe not covered by forms shall be equivalent to a steel screeded finish. All extraneous concrete shall be removed from the interior surface as soon as possible after placing. Any additional finish work or repair work should be completed within five (5) days after pipe placement.

d. Pipe may be rejected at the sole discretion of the Inspector if there is evidence of segregation or honeycombing or inadequate wall thickness.

7. **Forms: -** Forms shall be strong enough to permit the placement and vibrating of the concrete without causing distortion at any point. Form support systems shall be constructed so that previously placed concrete will not be damaged. The surfaces of the forms shall be cleaned of all dirt, mortar, and foreign material prior to use.

8. **Curing: -** The Contractor shall commence curing of exposed concrete surfaces immediately after finishing the surface in accordance with the following requirements;

   a. **Exterior Curing:** The Contractor shall use one of the methods described below for exterior curing.

      i. Polyethylene film complying with ASTM C 171 and with minimum nominal thickness of 0.0015 inch shall be placed over the exposed top surface immediately after the pipe is cast. The film shall be anchored in place to ensure continuous, adequate curing.

      ii. Pigmented membrane-curing compound conforming to ASTM C309 shall be applied to exposed top surface immediately after the pipe is cast. The compound shall be applied at not less than 1 gallon per 150 square feet of exposed concrete.

   b. **Interior Curing:**

      The contractor shall create and maintain a humid atmosphere within the pipe as evidenced by condensation on the pipe interior surface. The humid atmosphere shall be maintained continuously for a period of at least seven (7) days following placement of the concrete, except for a maximum period of forty eight (48) hours which is allowed for removing forms and making repairs. Measures shall be taken to prevent air drafts from drying the pipe. Pipe end openings shall be covered to prevent loss of the humid atmosphere.

9. **Crack Repair: -** Crack repair shall not be made until after completion of the entire limits backfill and compaction is in compliance with the specifications.

   a. Crack width shall be determined by penetration to more than 0.25 inch of a standard machinist-gauge defined in ASTM C 497-98.

   b. Circumferential cracks greater than 0.01 and less than 0.05 inch in width shall be cleaned and filled with cement mortar or with sealant approved by the Director of Public Works.

   c. Circumferential cracks of 0.05 inch and greater in width shall be cleaned and filled to a minimum depth of 0.4 inch with a sealant approved by the Director of Public Works.

   d. Longitudinal cracks of more than 0.01 inch in width and less than 0.0005 times the outside pipe diameter shall be cleaned and filled to a

depth of 0.40 inch with mortar or sealant approved by the Director of Public Works.

e. Pipe material with longitudinal cracks having displacement greater than 0.08 inch or width greater than 0.08 inch shall be rejected.

CS 10-03 **TRANSITION JOINTS (Concrete Collar):** Transition joints between RCP and CIPCP shall be made with a concrete collar unless the Project Plans show another method. The end of the CIPCP shall be squared off and an excavation of the trench shall be made along the sides and bottom of the CIPCP to permit casting of a concrete collar. The collar shall be 24 inches minimum in length and centered on the transition joint. The thickness of the collar shall be 1.5 times the minimum pipe wall thickness shown in **Table CS 10-2.**

CS 10-04 **PIPE INSTALLATION**: Installation for all pipe materials shall conform to the following requirements.

A. **GENERAL:** Storm Drain Pipe shall be installed in strict conformance with the line and grade shown on the Project Plans. The flow line elevation of the finish pipe shall not vary more than 0.08 foot from the grade line shown on the Project Plans for all diameters of storm drain pipe where measured between consecutive manholes, curb inlets and/or field inlets.

B. PIPE LAYING:

1. Pipe laying shall proceed from "downstream" to upstream", with the bell ends of bell and spigot pipe placed upstream in such a manner as to form a watertight, concentric joint with the adjoining pipe.

2. Pipe shall not be installed when the condition of the trench or the weather is unsuitable in the opinion of the Inspector.

3. The Contractor shall be responsible for dewatering the trench where groundwater is present. Dewatering shall continue until backfilling has progressed to a sufficient height to prevent flotation or damage to the pipe. Water shall be disposed of in such a manner that no property damage or hazard to the public health occurs. The location of the disposal of the groundwater is subject to the approval of the Inspector.

4. All pipe, fittings, and accessories shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable equipment in such a manner prevent damage to the materials. Under no circumstances shall these materials be dropped or dumped into the trench. The pipe shall be inspected for visible defects prior to lowering into the trench. Any visible defect or unsound material shall be replaced and removed from the project site.

5. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses.

6. All joint surfaces shall be cleaned before the pipes are connected.

7. For safety purposes, all open ends of pipe or structures shall be adequately and securely closed whenever the work is discontinued at the end of each day.

8. Trench excavation and backfill shall conform to Section CS 2 and Section CS-3 of the City Standard Specifications except as noted for CIPCP elsewhere in these standards.

CS 10-05 **FINAL CLEANING:** Final cleaning shall be performed by the Contractor upon completion of installation of the storm drain facilities including backfill and prior to paving with asphalt concrete and performing any television inspection.

A. The Contractor shall clean the entire new pipeline of all dirt and debris.

B. Pipes up to and including 24 inches in diameter shall be cleaned by the controlled balling method, or by vacuum truck, or other means as approved by the Director of Public Works.

C. Pipes over 24 inches in diameter shall be cleaned as approved by the Director of Public Works.

D. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt and debris from entering the existing storm drain facilities or natural channels. Installation and removal of temporary plugs shall be conducted under the supervision of the Inspector.

E. Only clean water from the cleaning operations shall be discharged into any downstream facility.

CS 10-06 **TELEVISION INSPECTION**: All new storm drain pipe installations shall be inspected by closed circuit television subject to the following conditions and requirements:

A. The entire storm drain system as shown on the Project Plans is ready for television inspection when the following work has been completed:

1. All structures are in place and pipelines are accessible from structures.

2. All other underground facilities, utility piping and conduits are installed.

3. Pipelines to be inspected have been cleaned and flushed.

4. Backfill is in place and compacted to the street subgrade elevation.

B. Television Inspection shall be performed prior to commencement of paving with asphalt concrete or placement of Portland Cement Concrete.

C. The Contractor shall inform the Inspector 48 hours in advance of performing the television inspection. The Inspector shall have the right to witness the TV inspection as it occurs. The television inspection shall be videotaped in color with DVD format. A video DVD disk of the television inspection shall be produced and delivered to the Inspector together with a typed log of the inspection. However, at the discretion of the City, the Director of Public Works may perform its own Television Inspection in lieu, of or in addition to the Contractor's Television Inspection.

D. The following observations from television inspection will be considered defects in the construction of storm drain pipelines and will require correction subject to the approval of the Director of Public Works prior to paving:

1. Low spots:

a. 0.12 foot or greater for 48-inch diameter and larger rubber gasket RCP.

b. 0.08 foot or greater for all other sizes and ends of RCP and for all sizes of CIPCP

2. Joint separation:

a. 0.12 foot or greater opening between pipe sections for 48-inch and larger rubber gasket RCP.

b. 0.06 foot or greater opening for all other conditions between pipe sections).

3. Cocked joints present in straight runs, or on the wrong side of pipe curves.

4. Chips in pipe ends of ½ inch and greater.

5. Cracked or damaged pipe or evidence of the presence of an external object bearing upon the pipe (rocks, roots, etc.).

6. Dropped or offset joints.

7. Infiltration.

8. Debris or other foreign objects.

9. Other obvious deficiencies including but not limited to those identified in Section CS_10-02B, CAST-IN-PLACE CONCRETE PIPE, of these Construction Standards..

E. The Inspector shall notify the Contractor of any deficiencies revealed by the television inspection that will require repair. If the Contractor wishes to view the video, the Contractor shall contact the Inspector to set a time for the viewing the video in the presence of the Inspector.

F. All corrective work shall be completed by the Contractor. The Contractor shall television inspect all repair work from manhole to manhole.

G. Television inspection of new work and correction of observed defects will not relieve the Contractor of his responsibility for the one-year guarantee period.

The Director of Public Works may inspect and/or test portions of any new storm drain installation during said guarantee period.

CS 10-07 MANHOLES:

A. GENERAL: Manholes shall be constructed of precast Portland Cement Concrete components unless an engineered design conforming to paragraph C, "Manhole Base", cast in place option, of this section of the City Standard Specifications is included on the Project Plans or has been submitted by the Contractor and approved by the Director of Public Works. Manholes shall be constructed in accordance with the Standard Drawings and shall conform to the following requirements specified in this section of the City Standard Specifications.

B. SPECIFICATIONS: Precast manhole barrels, risers, cones, flat tops and grade rings shall conform to ASTM Designation C478, with the additional requirement that the cement used shall be Type II or Type V. Manhole sections shall be manufactured without provisions for steps.

C. MANHOLE BASE: Manhole bases may be precast or cast-in-place. The manhole excavation shall be dewatered before installing or pouring the base. Stubs or couplings provided in precast bases shall be of the same material as the pipe to which they connect unless otherwise approved by the City Engineer/Director of Public Works.

The Contractor may, at its option, cast in place the base (lower portion) of the manhole subject to the following conditions:

1. The cast-in-place portion shall be a minimum of 6 inches above the outside tops of the main incoming and outgoing pipes.

2. Steel reinforcement shall be furnished and placed in the cast portion of the manhole in accordance with Section 52, Reinforcement, of the CALTRANS Standard Specifications and shall be subject to inspection by the Inspector.

3. The base slab and initial riser section shall be connected with integrally poured concrete to create a watertight joint.

4. Inside diameters of cast-in-place portions shall equal the diameter of the manhole specified. Standard precast manhole riser sections and/or cones shall be placed above the cast-in-place section to bring the manhole rim up to grade.

5. The Contractor shall furnish the Inspector a submittal for review and approval by the Director of Public Works that satisfies all the requirements of these City Standard Specifications and the Standard Drawings. This submittal must be approved by the Director of Public Works prior to the Contractor commencing trenching for pipe or excavation for the manhole.

D. CONES: Standard eccentric cones conforming to ASTM Designation C478 shall be used on all manholes unless otherwise specified. Where depth is insufficient for cones, flat slab tops shall be used.

E. JOINTS: All joints in the precast manhole sections shall be made with preformed self-bonding, self-sealing plastic gasket such as "Ram-Nek", or approved equal. The gasket shall be installed in full compliance with the manufacturer's current recommendations. All joint surfaces shall be thoroughly cleaned prior to placing the sealing compound. The exterior joints shall be mortared prior to backfilling.

F. FRAMES AND COVERS: Manhole frames and covers shall conform to the Standard Drawings unless otherwise specified on the Project Plans, in the Special Provisions, or in the following requirements.

1. Castings for manhole frames and covers, cleanout frames and covers, and other purposes, shall be gray iron, free from cracks and other defects.

2. The seating faces of manhole covers and frames shall be machined as shown on the drawings to assure a tight fit and prevent rocking.

3. The Contractor shall provide the Inspector if requested, the frame and cover manufacturer's test results stating that the material has been sampled, tested and inspected in accordance with the provisions of the latest issue of ASTM A-48, Gray Iron Castings.

4. Manhole frames and covers shall conform to the Standard Drawings, unless otherwise specified on the Project Plans or in the Special Provisions.

5. Manhole covers of 36 inches in diameter and larger shall be provided at large diameter storm drains, and other locations where required by the Director of Public Works. Covers shall be 2-piece and have a cast iron frame and cast iron outer cover with a concentric 24-inch cast iron inner cover, suitable for H-20 highway loading.

6. Bolt down covers shall be provided on all manholes located outside the paved area of the public street right of way.

CS 10-08 ADJUSTMENT OF MANHOLES TO GRADE:

A. The method for adjusting existing manholes shall conform to Section 15-2.05A, Frames, Covers, Grates, and Manholes, of the CALTRANS Standard Specifications except as modified herein.

B. The adjustment of manholes shall conform to adjacent surface elevations and may be made by utilization of precast grade rings or, in new manhole construction only, by a cast-in-place ring.

C. Adjusting manholes to grade within marked traffic lanes shall be completed, including placing concrete around and to the level of the ring and cover, by the end of the same day on which work is started.

CS 10-09 CONNECTIONS TO MANHOLES:

A. Pipe connections to manholes shall be made so that the pipe is flush with the inside face of the manhole.

B. Mortar shall be used to seal and smooth the joints in accordance with Section 65-1.06, Joints, of the CALTRANS Standard Specifications.

CS 10-10 CURB INLETS, FIELD INLETS, & JUNCTION BOXES:

Curb inlets, shall constructed in accordance with the provisions of this section of the Standard Specifications and the Standard Drawings.

Field inlets and junction boxes shall be constructed in accordance with the project plans and Section 51, Concrete Structures, of the CALTRANS Standard Specifications except as modified herein.

Concrete for curb inlets, field inlets and junction boxes shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete. No provision for steps shall be made in the structure.

CS 10-11 INLET & OUTLET STRUCURES:

This work includes construction of head, wing, end and cutoff walls at storm drain inlet and outlets. The scope of this work shall be in accordance with the project plans and Section 51, Concrete Structures, of the CALTRANS Standard Specifications except as modified herein. The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.

CS 10-12 ROCK SLOPE PROTECTION:

Rock slope protection shall conform to Section 72, Slope Protection, of the CALTRANS Standard Specifications except as amended herein. Rock slope protection shall be placed in accordance with Method A of the CALTRANS Standard Specifications except when noted otherwise on the Project Plans.

CS 10-13 CHANNEL, DITCH, AND DETENTION BASIN EARTHWORK:

A. Earthwork for channel, ditch, detention basins, and related access roads shall conform to Section 19, Earthwork, of the CALTRANS Standard Specifications except as modified herein.

B. The grading shall be performed in strict conformance with the line and grade indicated on the Project Plans.

C. The elevation of the finish grade shall not vary more than 0.10 foot from the horizontal alignment and vertical design grade shown on the project plans.

CS 10-14 DITCH CONCRETE LINING:

Concrete Lining for ditches shall conform to Section 72-4, "Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining", of the CALTRANS Standard Specifications and the City Standard Drawings except as amended herein.

The concrete lining shall be installed in strict conformance with the line and grade indicated on the Project Plans. The flow line elevation of finish concrete ditches shall not vary more than 0.05 foot from the horizontal alignment and vertical design grade shown on the project plans.

CS 10-18 VALLEY GUTTERS: Valley Gutters shall be constructed in accordance with the Standard Drawings**.**

CS 10-19 EXCAVATION AND BACKFILL:

A. Excavation for all items of work described in Section CS 10, Storm Drain Construction Standards shall conform to Section CS 2, Trench Excavation of said standards except modified by the contents of Section CS 10 of these standards.

B. Foundation, bedding and backfill for all items of work described in Section CS 10, Storm Drain Construction Standards shall conform to Section CS 3, Trench Foundation, Bedding, and Backfill of said standards except as modified by the contents of Section CS 10 of these standards.

1. Backfill for all items of work shall conform to Standard Drawings 20A and 20B.