

MEMORANDUM OF UNDERSTANDING

RIVERSIDE COUNTY TRANSPORTATION DEPARTMENT

AND

RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

FOR

DESIGN, CONSTRUCTION, INSPECTION AND MAINTENANCE

OF

FLOOD CONTROL DRAINAGE FACILITIES

REVISED: JUNE 24, 2008

FORM APPROVED COUNTY COUNSEL
BY: Neal R. Kipnis 6/16/08
DATE



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MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into June 24, 2008, between the Riverside County Transportation Department ("Transportation") and the Riverside County Flood Control and Water Conservation District ("District") regarding flood control and drainage facilities within the unincorporated area of Riverside County. Transportation and District may be referred to individually as "Agency" and collectively as "Agencies".

RECITALS

A. This MOU sets forth each Agency's respective understanding and commitments regarding the various processes required for the operation and maintenance of drainage facilities within the District's jurisdictional boundaries. The purpose of this MOU is an attempt to streamline the review process by both Agencies and avoid potential conflicting requirements to the public and the Development community, which includes but is not limited to the design, plan check, construction, inspection, specifications, operation, and maintenance of drainage facilities.

B. This MOU replaces the previous MOU dated September 1984 in its entirety.

C. This MOU is intended by both Agencies hereto as a final expression of their understanding with respect to the subject matter hereof and as a complete and exclusive statement of their commitments and responsibilities thereof and supersedes any and all prior understandings, oral or written, in connection therewith.

D. This MOU may be changed, amended, or modified only upon the written consent of both Agencies. Each Agency's respective Board of Supervisors will execute this MOU. However, the District's General Manager-Chief Engineer and Transportation Director will execute any future changes or amendments to this MOU.

E. Transportation and District each pledge to cooperate in regard to the operation and maintenance of their respective facilities as set forth herein and to discharge their respective maintenance responsibilities in an expeditious fashion so as to avoid the creation of any nuisance condition or undue maintenance impact upon the other Agency's facilities.

SECTION I - DEFINITIONS

1.1 Definitions - The following Definitions shall apply:

- **"Bleeder Pipes"** – Small interim storm drains whose primary purpose is to provide a low flow outlet for fully sized drainage facilities.
- **"Catch Basins"** – Curb inlets and drop inlets located within public rights of way and constructed in accordance with Transportation Department standard drawings.
- **"Connector Pipes"** – Small underground pipes located within public rights of way or a Transportation accepted drainage easement that convey flows from a Catch Basin to a District Storm Drain or a Transportation Storm Drain.
- **"District Facilities"** – District Storm Drains, Detention Basins (identified in a Master Drainage Plan or designated by the District as a Regional Facility), Levees and Slope Revetments, Concrete and Greenbelt Channels and Dams that are located within public rights of way, District rights of way or a District accepted drainage easement.
- **"District Storm Drains"** – Underground stormwater drainage facilities that are (i) pipes larger than 36 inches in diameter (or equivalent cross-sectional area) and reinforced concrete boxes (not less than 4' (H) x 4' (W)), (ii) located within public rights of way or a District accepted drainage easement and (iii) conform with District design and engineering standards. Exceptions are to be mutually agreed upon by Transportation and District.
- **"Greenbelt Channels"** – Open channel facilities located within District rights of way that either do not require concrete slope protection or utilize alternative slope and bed stabilization methods and which may also incorporate riparian vegetation corridors or public trail elements into the facility design.
- **"Private Drainage Facilities"** – Facilities that collect, convey, detain or retain stormwater flows and which are located on private property and outside of any District or County accepted drainage easements.
- **"Road Culverts"** – Drainage facilities whose primary function is to convey stormwater flows across road right of way below the traveled way.
- **"Swales"** – Roadside ditches located outside the shoulder but within the public rights of way or an accepted drainage easement. Such ditches are of a trapezoidal or "V" section and typically 2 feet or less in depth with side slopes that are 2:1 or flatter.

- **"Transportation Facilities"** – Transportation Storm Drains, Road Culverts, Catch Basins, Down Drains and Swales that are located within public rights of way or a Transportation accepted drainage easement.
- **"Transportation Storm Drains"** – Underground stormwater drainage facilities that are (i) 36 inches or smaller in diameter (or equivalent cross-sectional area), (ii) located within public rights of way or a Transportation accepted drainage easement and (iii) conform with Transportation design and engineering standards. Exceptions are to be mutually agreed upon by Transportation and District.

**SECTION II –
RESPONSIBLE AGENCY FOR DRAINAGE FACILITIES ELEMENTS**

2.1 Category A – Storm Drains -

CATEGORY A – STORM DRAINS		
Facility	Element of Responsibility	Responsible Agency
Category A-1 District Storm Drains (Including associated headwalls and wingwalls)	Design Review, Inspection & Maintenance	District
Category A-2 Transportation Storm Drains (Including associated headwalls and wingwalls)	Design Review	District
	Inspection & Maintenance	Transportation
Category A-3 Road Culverts that <i>connect</i> to an existing or planned District Drainage Facility	Design Review & Inspection	District
	Structural Maintenance	Transportation
	Maintenance (Sediment and Debris Removal)	District (After the connection to the District Drainage Facility is established)
	Maintenance (Sediment and Debris Removal)	Transportation (Until connected to District facility)

CATEGORY A – STORM DRAINS (CONTINUED)		
Facility	Element of Responsibility	Responsible Agency
Category A-4 Road Culverts that <i>do not connect</i> to an existing or planned District Drainage Facility	Design Review	District (where hydraulic calculations are required by District's conditions of approval)
	Design Review	Transportation (where hydraulic calculations are not required by Transportation's conditions of approval)
	Inspection & Maintenance	Transportation
Category A-5 Private Drainage Facilities (also see Category E-7)	Design Review	District
	Inspection	Building & Safety
	Maintenance	Private Property Owner or a County-approved maintenance mechanism (Homeowners Association, Valley Wide Park & Recreation District, etc.)
Category A-6 Bleeder Pipes Note: Transportation Dept. policy generally prohibits construction of Bleeder Pipes within Road R/W	Design Review	District
	Inspection & Maintenance	Agency accepting maintenance of upstream facility
Category A-7 Catch Basins (including connector pipes) which serve District Facilities or Transportation Facilities	Design Review	District
	Inspection & Maintenance	Transportation

2.2 Category B – Detention Basins -

CATEGORY B – DETENTION BASINS		
Facility	Element of Responsibility	Responsible Agency
Category B-1		
Detention Basins (MDP Facilities)	Design Review, Inspection & Maintenance	District
Category B-2		
Regional Basins (Non-MDP Facilities)	Design Review, Inspection & Maintenance	District
Category B-3		
Detention Basins (Increased Runoff / Non-MDP Facilities)	Design Review	District
	Inspection	Building & Safety
	Maintenance	Private Property Owner or a County approved maintenance mechanism (Homeowners Association, Valley Wide Park & Recreation District, etc.)
Category B-4		
Basin Inlet & Outlet Works (Increased Runoff Detention Basins)	Design Review	District
	Inspection	District (District Facilities)
	Inspection	Building & Safety (non-District Facilities)
	Maintenance	Private Property Owner via a County approved maintenance mechanism (Homeowners Association, Valley Wide Park & Recreation District, etc.)

2.3 Category C – Bridges -

CATEGORY C - BRIDGES		
Facility	Element of Responsibility	Responsible Agency
Category C-1 Bridges (crossing over District channels)	Design Review	District (where hydraulic calculations are required by District's conditions of approval)
	Design Review (including structural check) & Inspection	Transportation
	Maintenance (structural)	Transportation
	Maintenance (debris & sediment removal)	District (once the connection to a District Drainage Facility is established)

2.4 Category D – Channels -

CATEGORY D - CHANNELS		
Facility	Element of Responsibility	Responsible Agency
<p>Category D-1</p> <p>Concrete Channels (including MDP facilities or extensions thereof located within Road R/W)</p> <p>Note: Transportation Dept. policy generally prohibits construction of Concrete Channels within Road R/W</p>	Design Review, Inspection & Maintenance	District
<p>Category D-2</p> <p>Concrete Channels (including non-MDP facilities located within Road R/W)</p> <p>Note: Transportation Dept. policy generally prohibits construction of Concrete Channels within Road R/W</p>	Design Review	District
	Inspection & Maintenance	Transportation
<p>Category D-3</p> <p>Interim Earthen Channel Outlets (within existing Road R/W)</p> <p>Note: Transportation Dept. policy generally prohibits construction of Interim Earthen Channel Outlets within Road R/W</p>	Design Review	District
	Inspection	Agency inspecting upstream facility
	Maintenance	Transportation (once road improvements are accepted into County maintained system; otherwise, Private Property Owner through County-approved maintenance mechanism) (Homeowners Association, Valley Wide Park & Recreation District, etc.)

CATEGORY D – CHANNELS (CONTINUED)		
Facility	Element of Responsibility	Responsible Agency
Category D-4 Interim Earthen Channel Outlets (outside of existing Road R/W)	Design Review	District
	Inspection	Agency inspecting upstream facility
	Maintenance	Private Property Owner (no official acceptance of public maintenance)
Category D-5 Greenbelt Channels	Design Review & Inspection	District
	Maintenance (structural, lines & grades)	District
	Maintenance (landscaping, trail or recreation elements)	District-approved maintenance mechanism (Valley Wide Park & Recreation District, CSD, etc.)

2.5 Category E – Miscellaneous -

CATEGORY E - MISCELLANEOUS		
Facility	Element of Responsibility	Responsible Agency
Category E-1 Fences and Guardrails (across RCB headwalls and Bridges or any other drainage facility fencing)	Design Review	District (within District accepted easement or right of way) Transportation (within Transportation accepted easement or right of way)
	Inspection	Agency inspecting related facility
	Maintenance	Transportation (within Transportation accepted easement or right of way)
	Maintenance	District (within District accepted easement or right of way)
Category E-2 Retaining Walls (supporting District channel access roads inside or outside of Road R/W)	Design Review (including structural check), Inspection & Maintenance	District
Category E-3 Emergency Escape Ditches (100 year overflow ditch over District Storm Drains)	Design Review	District
	Inspection	District
	Surface Maintenance	Private Property Owner (no official acceptance of public maintenance)

CATEGORY E – MISCELLANEOUS (CONTINUED)		
Facility	Element of Responsibility	Responsible Agency
Category E-4 Emergency Escape Ditches (100 year overflow ditch over Transportation Storm Drains)	Design Review	District
	Inspection	Transportation
	Surface Maintenance	Private Property Owner (no official acceptance of public maintenance)
Category E-5 Drainage Easement (offered for dedication but not accepted by County or District)	Design Review	District
	Maintenance	Private Property Owner (no official acceptance of public maintenance)
Category E-6 Drainage Easement (offered for dedication and accepted by County or District)	Design Review	District
	Maintenance	District (within District accepted easement) Transportation (within Transportation accepted easement)
Category E-7 Brow Ditches, Terrace Ditches and Down Drains (located within Drainage Easement offered for dedication to County whether accepted or not; (typically not accepted))	Design Review	Building & Safety District (only where required by District on Tentative Map)
	Inspection	Building & Safety
	Maintenance	Private Property Owner (no official acceptance of public maintenance)

CATEGORY E – MISCELLANEOUS (CONTINUED)		
Facility	Element of Responsibility	Responsible Agency
Category E-8 Levees and Slope Revetments (located within District right of way)	Design Review, Inspection & Maintenance	District
Category E-9 Swales	Design Review	District
	Inspection & Maintenance	Transportation

2.6 Category F – Water Quality Management Facilities -

CATEGORY F – WATER QUALITY MANAGEMENT FACILITIES		
Facility	Element of Responsibility	Responsible Agency
Category F-1 Construction Activities BMPs	Design Review, Inspection & Maintenance	Private Property Owner responsible for construction activity
Category F-2 Post-Construction BMPs (catch basin filters, swales, etc., located within Road R/W)	Design Review	District
	Inspection & Maintenance	Transportation
Category F-3 Post-Construction BMPs (Retention / Detention Basins, swales, pipes and conveyance facilities located outside Road R/W)	Design Review	District
	Inspection	Building and Safety
	Maintenance	Private Property Owner or a County-Approved maintenance mechanism (Homeowners Association, Valley Wide Recreation & Park District, etc.)

SECTION III – DRAFTING STANDARDS FOR DRAINAGE FACILITIES

3.1 Drafting Manual – The District developed a Drafting Manual and it is now available on the District's website at <http://www.rcflood.org>. Select Technical Resources and then Publications and Records. A copy of the Drafting Manual is available to download from the District's website and/or it can be purchased directly from the District office. The District updates the manual as needed and all users are encouraged to use the latest version when working on projects requiring the District's review and approval.

**SECTION IV -
PLAN CHECK AND INSPECTION PROCEDURES
FOR DRAINAGE FACILITIES**

4.1 Plan Check Procedures – The District provides plan checking and design review services for the different Drainage Facilities categories in accordance with Section I of this MOU as follow:

1. The District and Transportation requires Developers to submit improvement plans for Drainage Facilities along with the Plan Check Deposit Based Fee Worksheet available on the District's website at <http://rcflood.org>. Search for Technical Resources and then select Publications and Records. A copy of the Plan Check Deposit Based Fee Worksheet is available to download. The District updates this worksheet as needed and all applicants working on projects requiring the District's review and approval must use the latest worksheet for their submittals.
2. Based on the information contained in the applicant's submittal, the District will prepare and submit a bonding estimate letter to Transportation detailing the estimated cost of the Drainage Facilities, which shall be the basis upon which Transportation will collect field inspection fees according to the provisions of Section 17.1 Security for Improvements of Riverside County Ordinance No. 460.
3. Transportation will review the bonding estimate letter and the improvement plans to confirm the District findings with respect to construction inspection responsibility and the estimated cost. Any discrepancies will be submitted to the attention of District staff who prepared the bonding estimate to clarify any issues before recordation and/or bonding for the proposed drainage improvements. The District inspection responsibility will be limited to those items mutually agreed upon in Section I of this MOU.
4. District requires Developer to pay District, within thirty (30) days after receipt of periodic billings from District, any and all such amounts as are deemed reasonably necessary by District to cover District costs. These costs are associated with the plan check and design review of Drainage Improvement Plans, right of way and conveyance documents review and approval, and with the processing and administration of preparing any agreements related to the Drainage Facilities.
5. District will provide Transportation with a reproducible copy of "as-built" improvement plans upon District acceptance of Drainage Facilities in accordance with Section I of this MOU.

4.2 Inspection Procedures – The District provides inspection services for the different Drainage Facilities categories in accordance with Section I of this MOU as follows:

1. The District requires Developers to deposit inspection fees in an amount as determined and approved by the District at the time of providing written notice to District of the start of Drainage Facilities construction. Inspection fees are determined in accordance with County of Riverside Ordinance Nos. 671 and 749, including any amendments thereto, based upon the bonded value of the Drainage Facilities.

2. Construction of Drainage Facilities shall be on a five (5) day, forty (40) hour workweek with no work on Saturday, Sundays or days designated by the District and County as legal holidays, unless otherwise approved by the District and Transportation as appropriate. If the Developer feels it is necessary to work more than the normal forty (40) hour workweek or on holidays, the Developer shall make a written request for permission from the District and Transportation to work the additional hours. The request shall be submitted at least 72 hours prior to the request date for additional work hours and state the reasons for the overtime and the specific time frames required. The decision granting permission for overtime work will be made by the District and Transportation at their sole discretion and shall be final. If permission is granted, the Developer will be charged the cost incurred at the overtime rates for additional inspection time required in connection with the overtime work in accordance with County of Riverside Ordinance Nos. 671 and 749, including any amendments thereto.

**SECTION V –
CAST-IN-PLACE CONCRETE PIPE FOR DRAINAGE FACILITIES**

5.1 Standard Specification References - The following Construction Specifications for Cast-in-Place Concrete Pipe (CIPP) shall apply:

1. Standard Specifications of the State of California, Business, Transportation and Housing Agency, Department of Transportation, 1992 Edition (State Standard Specifications).
2. Standard Specifications for Public Works Construction Latest Edition (Standard Specifications).

5.2 Design Manual References - The following design references shall apply:

1. Los Angeles County Flood Control District Structural Design Manual.
2. Lynch Manual, Cast-in-Place Concrete Pipe Process - 1990 Edition.

5.3 Specific Requirements and Specifications - The following specific requirements and specifications shall apply and may be exceptions to those listed in the references. The term "Engineer" when used in these specifications shall mean the Director of Transportation when the project is being inspected by Transportation or the General Manager-Chief Engineer when the project is being inspected by the District, or their authorized representative.

1. CIPP shall only be used where shown on the drawings and approved by the agency responsible for the maintenance of the project.
2. A geotechnical investigation report shall be prepared and transmitted to the approving agency at the time the drawings are initially submitted for review. The report shall be prepared by a licensed civil or geotechnical engineer registered in the State of California, and shall address, but not necessarily be limited to the following issues:
 - a. **trench wall stability**
A trench stability analysis shall be prepared. Sloughing and overall trench stability as it pertains to the construction of CIPP shall be addressed.
 - b. **existence of groundwater**
If groundwater is present, the report shall specify appropriate mitigation measures.
 - c. **existence of expansive soils**
CIPP shall not be used if expansive soils are present.

d. corrosion potential

A chemical analysis of the soil samples shall be made to determine sulfate concentrations. A recommendation with respect to cement "Type" shall be made.

e. overall feasibility of constructing CIPP

3. For structural design purposes, the pipe shall be designed flowing no more than just full unless structural calculations are submitted showing that the pipe can safely sustain the proposed hydrostatic head.
4. Design flow velocities greater than 20 ft./sec. will not be allowed unless an exception is granted by the Engineer.
5. A minimum 6 sack per cubic yard design mix shall be used and the compressive strength of the concrete (f_c) at 28 days shall be at least 4000 psi; the modulus of rupture shall be at least 550 psi. For velocities greater than 10 ft./sec. but not greater than 20 ft./sec. the compressive strength shall be 5000 psi. Compressive strengths shall be noted on the drawings.
6. Pipe wall thickness for flows having velocities equal to or less than 10 ft./sec. shall comply with the requirements as set forth in the Standard Specifications. For velocities greater than 10 ft./sec. but not more than 20 ft./sec. a 140 degree segment of invert shall be thickened 2 inches in wall thickness as "sacrificial concrete". Increases in standard wall thickness shall be noted on the drawings.
7. The minimum finished cover over the pipe shall be 3 feet.
8. The minimum pipe slope shall be 0.005.
9. CIPP, which is to be maintained by the Transportation or District, shall not be placed except in the presence of the Engineer.
10. When CIPP is specified as an alternative to reinforced concrete pipe, a note shall be added to the construction drawings stating that Transition Structure No. 3 shall replace Junction Structure No. 2 when CIPP is used. No changes need be made for Junction Structure No. 4.

11. CIPP shall not have curve radii less than shown here.

<u>PIPE SIZE</u>	<u>RADIUS*</u>
24 in.	45 ft.
36 in.	45 ft.
42 in.	45 ft.
48 in.	60 ft.
54 in.	60 ft.
60 in.	60 ft.
66 in.	60 ft.
72 in.	60 ft.
78 in.	90 ft.
84 in.	120 ft.
96 in.	150 ft.
120 in.	160 ft.

* These values may be reduced by 25% for curves with included angles of less than 25 degrees.

**SECTION VI -
SPECIAL PROVISIONS AND DETAILED SPECIFICATIONS
FOR DRAINAGE FACILITIES**

SPECIAL PROVISIONS

SECTION 6.1 - GENERAL

6.1.1 References - References made in these Special Provisions or Detailed Specifications to the "Standard Specifications" refer to the "Greenbook" Standard Specifications for Public Works Construction, current edition, including supplements. Standard Specifications of the American Society for Testing and Materials shall be designated by ASTM and the appropriate number of the standard. Unless otherwise specified, wherever the words "State Standard Specifications" are used in these Special Provisions or Detailed Specifications they shall mean the Standard Specifications of the State of California, Department of Transportation, current edition. Whenever the words "Caltrans Standards" are used they shall mean the Standard Plans of the State of California, Department of Transportation, current edition.

In case of conflict between the drawings and the specifications, the drawings shall govern; in case of conflict between the referenced specifications and these specifications, the latter shall govern.

6.1.2 Engineer - Throughout these specifications, the term "Engineer" shall refer to the Director of Transportation in all cases where the Riverside County Flood Control and Water Conservation District (District) is not maintaining the facility, and shall refer to the General Manager-Chief Engineer of the District whenever the District is to maintain the facility. The term "Engineer" refers to the Director of Transportation or the General Manager-Chief Engineer of the District acting directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.

SECTION 6.2 THROUGH SECTION 6.4 - NOT USED

SECTION 6.5 - PROJECT SITE MAINTENANCE

Through all phases of construction, the Contractor shall comply with the provisions of Section 7-8 of the Standard Specifications. The Contractor shall also comply with South Coast Air Quality Management District Rule 403 "Fugitive Dust" and requirements set forth by the California Regional Water Quality Control Board. The Contractor shall provide the Engineer a copy of the Stormwater Pollution Prevention Plan prior to construction. Before final acceptance of the work, the Contractor shall clean the work and the site of the work of all falsework, temporary structures, other construction materials and equipment, excess materials and rubbish, and shall leave the work and the site in a neat and presentable condition.

SECTION 6.6 - SPECIAL REQUIREMENTS

6.6.1 As-Built Drawings - Upon the completion of the project as determined by the Engineer, but prior to acceptance, the Owner/Developer shall provide redlined as-builts of the project to the appropriate agency maintaining the facility. After the redline as-built drawings have been approved by the Engineer, a time will be scheduled for the Owner's/Developer's representative to transfer the redlined information onto original mylars. At that time, the Owner's/Developer's Engineer, duly registered in the State of California, shall review and sign the mylars as "as-built".

6.6.2 Construction Tolerances - Variation in alignment, grade and dimensions of the structures and structural components from the established alignment, grade and dimensions shown on the drawings shall be within the tolerances specified in the following:

Departure from established alignment		2 inches on tangents 4 inches on curves
Departure from established profile grade	Channel bottoms, channel sideslopes in cut and fill, levee and access road sideslopes in cut	Zero above and 3 inches below the specified grade
	Top surfaces of levees and access roads in both cut and fill, levee and access road sideslopes in fill	Zero below and 3 inches above the specified grade

Regardless of the construction tolerances specified, the excavation and grading shall be performed so that the finished surfaces are in uniform planes with no abrupt breaks in the surface.

Departure from established alignment		2 inches on tangents 4 inches on curves
Departure from established profile grade		1 inch
Variation in thickness of lining sideslopes and invert		5 percent of specified thickness provided average thickness is maintained
Variation from specified width of section at any height		0.0025 times specified width W plus 1 inch. 0.0025W + 1 inch
Variation from specified height of lining		0.005 times specified height H plus 1 inch. 0.005H + 1 inch
Variation in surfaces (gradual)	Invert Sideslopes	¼ inch in 10 feet ½ inch in 10 feet
Variation in surfaces (abrupt)		¼ inch

Gradual Variation tolerance as measured by placing a 10-foot straight edge anywhere on the finished concrete structure within 72 hours after concrete placement. The gap at any point between the straight edge and the concrete shall not exceed the specified amount.

Table C - Tolerances for Formed, Cast-in-Place Concrete Structures		
Departure from established alignment		1 inch on tangents 2 inches on curves
Departure from established profile grade		1 inch
Inside dimensions		0.005 times specified dimension
Variation from the plumb or the specified batter in the lines and surfaces of walls, piers and in arises	Exposed, in 10 feet	½ inch
	Backfilled, in 10 feet	1 inch
Variation in cross-sectional dimensions		Minus ¼ inch Plus ½ inch
Variation in surfaces (gradual)	Invert	¼ inch in 10 feet
	Soffits, Walls, Sideslopes	½ inch in 10 feet
Variation in surfaces (abrupt)		¼ inch

Table D - Tolerances for Reinforcing Steel Placement		
Variance from indicated position	Spacing between adjacent bars and the distance between layers of bars	one bar diameter nor more than one inch
Concrete cover measured perpendicular to steel in the direction of tolerance		¼ inch

6.6.3 Confined Space - The Contractor shall submit, to the Engineer, a confined space procedure specific to the project. The procedure shall comply with requirements contained in California Code of Regulations, Title 8 Section 5158, Other Confined Space Operations, Section 5157, Permit Required Confined Space and Riverside County Flood Control and Water Conservation District Confined Space Procedures, SOM-18. The procedure shall be reviewed and approved by the Engineer prior to the issuance of a Notice to Proceed.

The procedure shall provide for recording of data to develop a history of acceptable atmosphere within the confined space. That history will include:

1. Daily calibration of a direct reading confined space meter by trained personnel.
2. Daily monitoring and recording of the confined space atmosphere with a calibrated direct reading confined space meter.
3. Records of Items 1 and 2 shall be maintained onsite and copies given to the Engineer.
4. The records shall indicate if readings are of natural or mechanically enhanced ventilation.

The Contractor will be required to keep a direct reading confined space meter onsite for the duration of the contract. The meter shall be calibrated daily and shall be made available for the Engineer's use upon request.

SECTION 6.7 THROUGH SECTION 6.9 - NOT USED

DETAILED SPECIFICATIONS

SECTION 6.10 THROUGH SECTION 6.13 - NOT USED

SECTION 6.14 - EARTHWORK

6.14.1 General Excavation Requirements - Pipe excavation shall be in conformance with Section 306 of the Standard Specifications. Channel excavation shall be in conformance with Section 300-7, and the structure excavation shall be in conformance with Section 300-3 of the Standard Specifications. Access to trenches shall be in conformance with Section 306-1.1.4 and the manner of bracing excavations shall be in conformance with Section 306-1.1.6 of the Standard Specifications.

Excavation shall be kept to the minimum widths required for efficient placing of the pipe or structure and the construction of the various other concrete structures. However, for pipe placement, the minimum width of trench shall be 24 inches greater than the outside diameter of the pipe. The maximum length of open trench shall be in conformance with Section 306-1.1.2 of the Standard Specifications.

In excavating for surfaces against which concrete is to be placed, care shall be exercised in removing the final lift. Upon completion of excavation for structures and pipe, surfaces against which concrete is to be placed shall be free of debris, mud or ponded water.

The foundation for all concrete structures including concrete channels and sideslopes will be inspected and tested after excavation. The subgrade shall be compacted to ninety (90) percent relative compaction prior to the placement of concrete.

Material which will not provide a suitable foundation shall be removed and replaced with compacted select material as directed by the Engineer.

Any overexcavation shall be filled with select material compacted to ninety (90) percent relative compaction and meeting the material requirements for backfill.

The Contractor shall remove slides and materials eroding into the work, and the slopes and grades refinished to original grades as specified.

The Contractor shall dispose of all surplus excavated material outside the limits of the construction easements and permanent rights of way.

6.14.2 General Fill and Backfill Requirements - Whenever fill is specified or required (except for pipe backfill) the work shall be performed as set forth in Sections 300-4.1 through 300-4.8 of the Standard Specifications. Backfill for pipe and box shall conform to Section 306-1.3 of the Standard Specifications except as modified herein.

No backfill materials shall be placed against the outside walls of cast-in-place concrete structures until the concrete has developed eighty (80) percent of its design strength.

No fill or traffic will be permitted on the top of any cast-in-place concrete structure, until the concrete in the structure has attained its design strength. Test cylinders taken by the Engineer will determine compressive strength.

Regardless of the method of densification, backfill material shall not be placed against any reinforced concrete structure until the structure has been inspected and approved for backfilling by the Engineer.

Densification of backfill will be accomplished by either mechanical methods or water densification methods as described in (1) and (2) below. All relative compaction tests will be made by the Engineer in conformance with Test Method No. California 216. Whenever relative compaction is specified to be determined by Test Method No. California 216, the in-place density may be determined by Test Method No. California 231. The wet weight or dry weight basis and English Units of measurement may be used at the option of the Engineer.

- (1) Mechanical Compaction - Backfill shall be mechanically compacted by means of tamping rollers, or other mechanical tampers. Impact-type pavement breakers (stompers), will not be permitted unless otherwise approved by the Engineer.

All backfill material for structures shall be placed in horizontal, uniform layers and shall be brought up uniformly on each side of the structure. The thickness of each layer of backfill shall not exceed 8 inches before compaction unless otherwise approved by the Engineer. For hand directed mechanical compactors, the thickness of each layer shall not exceed 4 inches before compaction.

- (2) Water Densification - Water Densification of bedding and backfill shall be by jetting and shall only be used when approved by the agency responsible for maintenance of the project. Jetting for bedding and backfill shall conform to Section 306-1.3.3 of the Standard Specifications except as modified as follows:
 1. Jetting may be allowed, when approved by the Engineer, in conditions where soils of the trench walls have a sand equivalent less than 15, provided the Contractor takes appropriate action to drain the water.
 2. Undensified lifts shall not exceed 4 feet.
 3. Suitable backfill material to be jetted shall have a sand equivalent of 30 or greater.
 4. If Cast-in-Place Concrete Pipe is used, jetting will not be permitted.
 5. Jetting of the top 4 feet of backfill measured from the subgrade plane will not be permitted in roadway areas.

Approval to use specific methods and compaction equipment shall not be construed as guaranteeing or implying that the use of such methods and equipment will not result in damage to adjacent ground, existing improvements, or improvements installed, nor shall it be construed as guaranteeing proper compaction. The Contractor shall make his own determination in this regard.

All backfill and bedding around structures and pipe shall be compacted to not less than ninety (90) percent relative compaction. Where such material is placed under existing or proposed paved roadways, the top 3 feet, measured from the subgrade plane, shall be compacted to ninety-five (95) percent and shall be compacted by Method (1).

Trench bottoms for structures and pipe shall be graded to provide firm and uniform bearing throughout the entire length of the structures and pipe.

Pipe and box bedding shall consist of well-graded granular material having a sand equivalent value of not less than 30 and be capable of being readily consolidated by jetting and vibrating. Jetting shall be as described by Method (2) Water Densification and the jet pipe shall be inserted at intervals of 3 feet maximum continuous along each side of the pipe. Gravel or crushed aggregate shall not be used for bedding material. Pipe and box bedding shall be placed to 1 foot above the top of the reinforced concrete pipe or box. The Contractor may use onsite material for this pipe and box bedding subject to the approval of the Engineer and provided it meets the requirements as set forth above. Should onsite material be unsatisfactory, the Contractor will be required to import suitable material.

Backfill material placed above the bedding shall consist of either select material from the excavation or imported material, as approved by the Engineer.

When Slurry Cement Backfill is required it shall conform to Section 19-3.062 of the State Standard Specifications.

6.14.3 Testing - Compaction tests shall be performed as described below which represents the minimum required. Additional testing may be ordered by the Engineer.

1. Mainline Trenches - A complete series of compaction tests shall be taken for each 4-foot thickness of backfill placed. Each series shall consist of tests taken at approximate maximum intervals of 300 feet. Each series shall begin at the top of the bedding zone.
2. Connector Pipe Trenches - Compaction tests shall be taken on 50% of the laterals, one test for each 4 feet of depth.
3. Any failed test shall result in a retest.

When water densification is requested, sand equivalent tests representing foundation soils and proposed backfill material shall be obtained at approximate maximum intervals of 1,000 feet. Additional tests may be necessary to define limits of suitable backfill material.

When testing is provided by the Owner's/Developer's consultant, a complete testing report shall be given to the Engineer prior to placement of the street structural section or acceptance of the project, whichever occurs first.

6.14.4 Filter Material - This section covers all filter material to be placed below the reinforced concrete pipe, box and various other structures but exclusive of connector pipes and catch basins.

The placing of filter material will be determined from field conditions as directed by the Engineer.

The materials for filter material shall conform to Sections 90-2.02 and 90-3.01 of the State Standard Specifications. Grading shall meet the requirements for 1" x No. 4 coarse aggregate as per Section 90-3.02 of the State Standard Specifications. The filter material shall be consolidated and the surface trimmed to final grade as directed by the Engineer.

6.14.5 Slurry Cement Backfill - Whenever slurry cement backfill is specified, methods and materials shall conform to Section 19-3.062 of the State Standard Specifications.

SECTION 6.15 - TRENCH SAFETY SYSTEM

6.15.1 General Requirements - The Contractor shall furnish and implement a safety system as required by Section 306-1.1.6 of the Standard Specifications. Excavation for any trench 5 feet or more in depth shall not begin until the Contractor has received a permit from the Division of Industrial Safety of the State of California. A copy of the permit shall be kept onsite at all times.

SECTION 6.16 - CONCRETE CONSTRUCTION

6.16.1 General Requirements - Concrete for all purposes shall be composed of Portland Cement, aggregates, and water of the quantities and qualities herein specified and in the required proportions. The ingredients are to be well mixed and brought to the proper consistency and have a compressive strength at the age of 28 days of not less than the amount shown in the following tabulation for each type of work listed:

<u>CONCRETE CLASS</u>	<u>TYPE OF WORK</u>	<u>POUNDS PER SQUARE INCH</u>
A	Bridges, Retaining Walls, Boxes, Transition Structure Nos. 1, 2 & 4, and Cast-in-Place Concrete Pipe.**	4000*
A	Trapezoidal Channels, Catch Basins, Drop Inlets, Junction Structure Nos. 1, 2, 3, 4 & 6, Manholes, Transition Structure No. 3, Bulkheads and Headwalls.	3250*
B	Local Depressions, Cutoff Walls, Collars, Encasements, Curb and Gutter, Driveways, Sidewalk and Miscellaneous Concrete not otherwise specified.	3000*

*Note: Concrete for use in structures constructed from State of California, Department of Transportation Standard Plans shall have compressive strengths as called for on those plans.

**Note: See the appropriate section for specifications on Cast-in-Place Concrete Pipe.

6.16.2 Material and Methods - All concrete materials, methods, forms and proportioning shall conform to Sections 51 and 90, and additionally, curb construction shall conform to Section 73 of the State Standard Specifications. Concrete test specimens shall be made in accordance with ASTM Designations C-31 and C-172. Tests for concrete compressive strengths shall be performed in accordance with the requirements of ASTM Designation C-39. Combined aggregate grading for all concrete shall be in conformance with Section 90-3.04 of the State Standard Specifications and the following tabulation for each type of work listed:

<u>TYPE OF WORK</u>	<u>COMBINED AGGREGATE GRADING</u>
Bridge Footings and Inverts of Trapezoidal Channels, Spillways, Reinforced Concrete Boxes, Rectangular Channels, Junction Structures, Transition Structures, Manholes, and Cast-in-Place Concrete Pipe with diameters of 48" or greater.	1-1/2" Maximum
Bridges, Retaining Walls, Trapezoidal Channel Slope Paving, Box Deck and Walls, Rectangular Channel Walls, Headwalls, Catch Basins, Drop Inlets, Local Depressions, Curb and Gutter, Driveways, Sidewalk, Cutoff Walls, Bulkheads, Collars, Encasements and Cast-in-Place Concrete Pipe, with diameters of less than 48" and other Miscellaneous Concrete not otherwise specified.	1" Maximum

Portland Cement Concrete shall conform to the requirements of Section 90 of the Standard Specifications except as follows:

1. Requirements on the construction plans for Portland Cement Concrete are modified to the PCC Class designations, as described in Section 90-1.01, "Description", of the Standard Specifications as follows:

Class "A" shall mean Class "2" and contain not less than 590 pounds of cementitious material per cubic yard.

Class "B" shall mean Class "3" except that the concrete shall contain not less than 550 pounds of cementitious material per cubic yard.

Class "C" shall mean Class "4" and contain not less than 420 pounds of cementitious material per cubic yard.

Class "D" shall mean Class "1" and contain not less than 675 pounds of cementitious material per cubic yard.

Minor Concrete shall mean Class "B" as defined above.

Whenever 28 day compressive strengths are specified no additional days will be allowed to obtain the specified strength.

2. Section 90-4.08, "Required Use of Mineral Admixtures", is replaced in its entirety as follows:

When the use of mineral admixtures in concrete is specified or is ordered by the Engineer, the minimum amounts of mineral admixture and Portland Cement and the type of cement shall be as specified or ordered. If the use of mineral admixture and cement and the cement type have not been specified or ordered, the concrete shall conform to one of the following:

- A. The concrete shall contain "Type IP (MS) Modified" cement conforming to the provisions in Section 90-2.01, "Portland Cement", in an amount sufficient to satisfy the specified minimum cement content.
- B. The concrete shall contain "Type II Modified" cement conforming to the provisions in Section 90-2.01, "Portland Cement", in an amount not less than 85 percent of the amount required to satisfy the specified minimum cement content. The concrete shall also contain a mineral admixture in an amount not less than 15 percent by weight of the amount of cement required to satisfy the specified minimum cement content. Where Section 90-1.01, "Description", specifies maximum cement content in pounds per cubic yard the total weight of Portland Cement and mineral admixture per cubic yard shall not exceed the specified maximum cement content.

3. Section 90-4.09, is replaced in its entirety and titled "Optional Use of Mineral Admixtures" as follows:

The Contractor will be permitted to replace up to 15 percent of the required Portland Cement, other than Type IP (MS) Modified or Type III cements, with a mineral admixture in all concrete except where high early strength has been specified or where the use of mineral admixtures is otherwise specified or prohibited. The weight of mineral admixture used shall be equal to or greater than the weight of Portland Cement replaced.

In the event that discrepancies are encountered, the option that provides the method, item or material with the greatest strength or utility shall be chosen, as directed by the Engineer.

Fly Ash may be substituted for cement, up to a maximum of 15 percent by weight for all concrete. Fly Ash shall meet the standards of ASTM Designation: C-618. When Fly Ash is used, water reducing agents meeting ASTM Designation: C-494 will be permitted in amounts recommended by the supplier and approved by the Engineer.

No other admixture shall be used in any class of concrete without written permission from the Engineer.

Supplementing Section 90-1.01 of the State Standard Specifications, prior to placement of any concrete the Contractor shall submit mix designs for all types of concrete to be placed, to the Engineer for approval. Supplementing Section 90-6.03 of the State Standard Specifications, concrete delivered to the job site shall be accompanied by a ticket containing the weight of each of the individual ingredients in the mix.

6.16.3 General Reinforcing Steel Requirements - Reinforcing steel for reinforced concrete boxes, bridges, retaining walls, rectangular channels, spillways and transition structures shall be Grade 60 Billet-Steel. For other reinforced concrete structures the reinforcement shall be Grade 40 Billet-Steel or greater as approved by the Engineer. In either case, the reinforcing steel for use in structures constructed from State of California, Department of Transportation Standard Plans shall be of Grade as called for on those plans. Cleaning, bending, placing and spacing of reinforcement shall conform to the applicable provisions of Section 52 of the State Standard Specifications and to the drawings. The Contractor shall furnish a "Certificate of Compliance" with the Specification of ASTM Designation: A-615. All splices shall conform to the requirements of the latest edition of A.C.I. Manual, Standard 318. Splices requested by the Contractor for his convenience shall be subject to approval by the Engineer.

6.16.4 Consistency - The consistency of the concrete shall be such as to allow it to be worked into place without segregation. Unless otherwise approved, the slump shall be 3 inches plus or minus 1 inch for all concrete, except the concrete for the Cast-in-Place Concrete Pipe shall have a slump of 2 inches plus or minus 1 inch.

The slump test shall be performed in accordance with the requirements of ASTM Designation: C-143. Slumps greater than those specified may be cause for rejection of the concrete by the Engineer.

6.16.5 Placing - Supplementing Section 51-1.09 of the State Standard Specifications, concrete shall not be placed except in the presence of the Engineer. The Contractor shall give reasonable notice to the Engineer each time he intends to place concrete. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

Formed concrete shall be placed in horizontal layers in lifts of not more than 20 inches. Hoppers and chutes, pipes and "elephant trunks" shall be used as necessary to prevent segregation of the concrete.

6.16.6 Form Removal and Finish - Forms shall be removed only when the Engineer has given his approval. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take stresses due to its own weight uniformly.

Forms shall not be removed sooner than the following minimum time or strength after the concrete is placed. These times represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is

above 50 degrees Fahrenheit. If the temperature falls below 50 degrees Fahrenheit at any time after the concrete is placed in the forms, the Engineer will advise the Contractor of additional time required before forms can be removed.

<u>Element</u>	<u>Strength or Time</u>
Bridge deck slabs, loaded bridge abutments or retaining walls - supporting forms and shoring, and Reinforced Concrete Boxes with spans equal to or greater than 14 feet	3000 psi & 7 days
Reinforced Concrete Boxes at pavement grade	3000 psi & 7 days
Reinforced Concrete Boxes with spans less than 14 feet and not at pavement grade, Transition Structure Nos. 1, 2 & 4	1600 psi
Cast-in-Place Concrete Pipe	6 hours
All other structures	16 hours

The finish on all exposed formed surfaces shall conform to Section 51-1.18B Class 1 Surface Finish of the State Standard Specifications. A tight wood float finish will be required on the surface of trapezoidal channels and bridge decks, and excessive surface working will not be permitted. The exposed concrete surfaces shall be broomed in a transverse direction with a fine textured hair push broom to produce a uniform surface and eliminate float marks. Brooming shall be done when the surface is sufficiently set to prevent deep scarring. If directed by the Engineer, a fine spray of water shall be applied to the surface immediately in advance of brooming.

Exposed corners of all concrete structures shall be finished with a 3/4" chamfer.

Concrete flatwork shall match adjacent surfaces. The concrete shall be struck off and tamped or vibrated until a layer of mortar has been brought to the surface. The top surface and face of curbs, gutters, catch basins and sidewalks shall be finished to match adjacent surfaces.

6.16.7 Curing - All concrete shall be prevented from drying for a curing period of at least seven (7) days after it is placed. Surfaces exposed to air during the curing process shall be kept continuously moist for the entire period or until curing compound is applied.

Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged. Water for curing shall be clean and free from any substances that will cause discoloration of the concrete.

Concrete may be coated with curing compound in lieu of the continued application of moisture. The curing compound shall comply with the requirements of Section 90-7.01B of the State Standard Specifications. The curing compound shall be No. 5 White Pigmented Curing

Compound conforming to the requirements of ASTM Designation: C-309, Type 2, Class B for all concrete surfaces other than for flatwork which shall be coated with a clear or translucent curing compound containing a red fugitive dye.

The curing compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. The curing compound shall be thoroughly mixed immediately before applying, and shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface.

6.16.8 Joints - Joints shall be made at the locations shown on the drawings, or as approved by the Engineer.

Transverse weakened plane joints shall be required in the trapezoidal channel at 10-foot spacing or as directed by the Engineer. The joints may be formed by placing a continuous strip of plastic or other material that will not react adversely with the chemical constituents of the concrete or bond with the concrete. The strip shall have a minimum thickness of 0.013 foot; a width of not less than 0.08 foot nor more than 0.09 foot for the four-inch thick concrete sideslopes; and a width of not less than 0.12 foot nor more than 0.13 foot for the six-inch thick channel invert. After placement, the vertical axis of the joint material shall be within 10 degrees of a plane normal to the surface of the concrete. The tops of the strip shall not be above nor more than 0.02 foot below the finished concrete. Final alignment of the strip for the transverse weakened plane joints shall not vary more than 0.04 foot from the edge of a 12-foot straight edge. After installation of a joint material the concrete shall be free of segregation, rock pockets or voids, and the finished concrete surface on each side of the joint shall be in the same plane.

The Contractor may elect to form the weakened plane joints in the channel surface by cutting a groove in the surface with a power driven saw. The grooves shall be cut to a minimum depth of 0.17 foot and the width shall be the minimum width possible with the type of saw being used, but in no case shall the width exceed 0.02 foot. The weakened plane joints shall be sawed within 12 hours after the concrete has been placed.

Construction joints, when required, shall be located between the transverse joints and, unless otherwise specified on the plans, shall utilize 1/2-inch diameter deformed bars 30 inches long, spaced at 24-inch centers as tie bars. The construction joints shall be straight and finished in a workmanlike manner.

Surfaces of construction joints shall be cleaned as set forth in Section 51-1.13 of the State Standard Specifications.

6.16.9 Weepholes - Weepholes shall be constructed in accordance with the drawings and at locations directed by the Engineer. All weepholes shall be 2-1/2 inches in diameter unless noted otherwise on the drawings.

Weepholes may be formed by removable round wooden dowels, Schedule 40 PVC Pipe or greater, or other methods acceptable to the Engineer.

All weepholes shall have a rodent screen consisting of 1/4-inch mesh, 16-gage galvanized hardware cloth securely and permanently attached over the drain opening in a manner approved by the Engineer.

Filter material for the weepholes shall be one inch (1") nominal size crushed rock conforming to the gradation of Section 200-1.2 of the Standard Specifications. Filter material shall also meet the quality requirements of Sections 200-1.1 and 200-1.2 of the Standard Specifications.

Filter material shall be wrapped in a single layer of Filter Fabric as shown on the drawings or approved by the Engineer. Filter Fabric shall conform to that specified for underdrains per Section 88-1.03 of the State Standard Specifications.

Filter Fabric shall be furnished in protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. The fabric shall also be ultraviolet stabilized.

The fabric shall be placed in the manner and at the locations shown on the drawings. The surface to receive the fabric shall be prepared to a smooth condition free of obstructions and debris.

The fabric shall be covered within 72 hours of its placement. Should the fabric be damaged during construction, the torn or punctured section shall be repaired or replaced as directed by the Engineer.

6.16.10 Use of the Channel Invert - Dump trucks, concrete trucks and earth-moving equipment (whether full or empty) will not be allowed to operate on the invert of the concrete channel.

A small crane with capacity not to exceed 10 tons will be permitted to operate on the concrete channel invert for the purpose of setting and moving forms, and erecting the steel reinforcement for the walls. Wheel loading types and amounts will be subject to the approval of the Engineer. Vehicles of 3/4-ton capacity (or less) will also be permitted access to the invert. The speed of any vehicle using the invert will be limited to 10 M.P.H. maximum to avoid impact loading.

No other category of equipment, except that specifically approved by the Engineer in writing, will be permitted to use the invert of the channel for access to the work area.

In any event, vehicular access to the invert will not be permitted until the concrete has achieved its design strength. Approval for access to use the invert shall not relieve the Contractor of the responsibility to avoid damage to the concrete. Cracking, displacement or other damage, which occurs to the invert, will be cause to restrict some or all of the categories of equipment allowed access to the channel. Repair or replacement of damaged concrete will be required.

6.16.11 Reinforced Concrete Box - This section covers the construction of reinforced concrete boxes.

Reinforced concrete box walls shall be constructed by placing the concrete directly against timber or steel sheeting used as the outside form and shoring. Sheeting shall be closely fitted and extend a minimum of 12 inches above the ground surface. Unless otherwise directed, all sheeting shall be removed and the void created shall be immediately backfilled with thoroughly jetted well-graded sand to the relative densities specified in backfill.

The Contractor has an option of forming both sides of the reinforced concrete box walls, however, due to additional loads on the box structure resulting from this trench condition the Contractor will be required to submit an alternate box design prepared by a civil engineer registered in the State of California.

If the box is constructed from State of California, Department of Transportation Standard Plans, either method of forming noted in the above paragraphs may be used without an alternate box design being submitted.

6.16.12 Manholes - The manhole rings are required and shall conform to ASTM Designation: C-478, and the drawings. The rings shall be laid up, using Type II Modified cement with a 1:2 mix mortar and with 1/2-inch minimum thickness pointed joints. On completion, vertical wall section shall not be out of plumb by more than 1/2-inch in 10 feet of vertical height. The manhole rings shall also be accurately aligned. The cast iron manhole frame and cover shall be installed, with frame accurately set to finished grade of pavement, in mortar well tamped around the perimeter of frame to ensure full bearing.

6.16.13 Use of Bridge or Box Deck Slabs - Loading and vehicular use of bridge and box deck slabs shall comply with the requirements of Section 51-1.11 of the State Standards.

SECTION 6.17 - CONCRETE PIPE

6.17.1 Description - This section covers Reinforced Concrete Pipe; Pipe on Curves; and Cast-in-Place Concrete Pipe of the various sizes, as required for the work; and Video Inspection.

6.17.2 Reinforced Concrete Pipe - Pipe materials, manufacture and quality, shall conform to ASTM Designation: C-76. The Engineer shall be furnished a "Certificate of Compliance" signed by the manufacturer of the pipe certifying that the pipe conforms to the ASTM requirements. All pipe and pipe material supplied by the Contractor shall be new.

The District will also require the D-load bearing strength test for new pipe, in conformance with Sections 207-2.9.1(1) and 207-2.9.2 of the Standard Specifications as a basis for acceptance of the pipe. The test shall be performed in the presence of the Engineer.

Pipe shall be laid in a trench free of ponded water in conformance with Section 306-1.2.2 with joints in conformance with Section 306-1.2.4 of the Standard Specifications.

Pipe ends shall be cleaned and moistened prior to making up joint.

The concrete cover on the inside of all reinforced concrete pipe must be increased to provide a minimum of 1-1/2" over the reinforcing when the design velocities exceed 20 feet per second. The concrete design strength in these reaches shall be $f_c = 5,000$ psi for velocities exceeding 20 feet per second and $f_c = 6,000$ psi for velocities exceeding 30 feet per second.

6.17.3 Pipe on Curves - Unsymmetrical closure of pipe joints shall not exceed 1 inch pull on the outside of the curve when pull is measured at the springline on the inside of the pipe. Mortar joints on curves shall conform in strength, texture of mortar finish, and tightness to the joints for straight ended pipe.

When beveled pipe is used the maximum deflection angle shall not exceed 6 degrees unless shown by the plans or approved by the Engineer.

6.17.4 Cast-in-Place Concrete Pipe - Cast-in-Place Concrete Pipe shall only be used where shown on the drawings and approved by the agency responsible for the maintenance of the project. The pipe shall only be placed in the presence of the appropriate agency inspector.

Cast-in-Place Concrete Pipe shall conform to Section 306.4 of the Standard Specifications except as modified as follows:

1. In lieu of the requirements of Section 306-4.2 the Contractor shall comply with Section 6.16 of these specifications. Compressive strengths shown on the drawings shall supersede that of Section 6.16.1 of these specifications.
2. Pipe wall thickness shown on the drawings shall supersede those of Section 306-4.6.3.
3. Holes drilled to verify wall thickness as specified in Section 306-4.7.2 shall be at 200-foot intervals. Load bearing tests per Section 306-4.7.4 shall only be required as directed by the Engineer.
4. In lieu of the requirements of Section 306-4.5 the Contractor shall comply with Section 6.14.2 of these specifications. No backfill shall be permitted until the concrete has developed the full strength specified. If the compressive strength has been increased due to abrasive flow as noted on the drawings, backfill may be placed when the concrete has developed eighty (80) percent of its design strength. Test cylinders taken by the Engineer will determine compressive strength.
5. Criteria for circumferential crack repair defined in Section 306-4.4.8 shall be amended as follows: Circumferential cracks 0.01 inch or less in width shall be left as is. Cracks greater than 0.01 inch and less than 0.05 inch shall be cleaned and filled with cement paste. Cracks 0.05 inch and greater shall have concrete

removed to a depth of 0.75 inch and width of 0.50 inch after which they shall be cleaned and filled with an elastomeric sealant.

6. Criteria for longitudinal crack repair defined in Section 306-4.4.8 shall be amended as follows: Longitudinal cracks with a width of more than 0.01 inch and less than 0.0005 multiplied by the outside diameter shall be cleaned and filled with cement paste. Cracks having differential displacement greater than 0.08 inch or width greater than 0.0005 multiplied by the outside diameter shall be repaired by full epoxy pressure grouting.
7. Criteria for rejection based on longitudinal cracking per Section 306-4.4.9 shall be replaced as follows: If longitudinal cracks exceeding 0.0015 multiplied by the outside diameter occur intermittently in 25 percent or more of a reach of pipe, the pipe shall not be repaired and shall be removed and replaced.
8. Crack width shall be determined by penetration to more than 0.25 inch of a standard machinist leaf gauge as defined in AASHTO D 280.

The placement of soil on Cast-in-Place Concrete Pipe for the purpose of shading will not be permitted.

6.17.5 Video Inspection - All concrete pipe (cast-in-place and reinforced) with inside diameters of 30-inch or less shall be televised prior to final inspection. Copies of the videotapes shall be given to the appropriate agency. For pipe placed within roadway areas, video inspection shall be performed and the results approved by the Engineer prior to paving.

SECTION 6.18 - AIR-PLACED CONCRETE

6.18.1 Air-Placed Concrete - Air-placed concrete may be used for construction of channel transition walls only when specifically allowed elsewhere in these Special Provisions or on the drawings.

Air-placed concrete shall be installed only by subcontractors with a minimum of 5 years experience specializing in construction of reinforced concrete structures by air-placed methods. Only personnel skilled in the techniques of air placement of concrete shall be utilized for air-placed concrete construction, and nozzle operators shall have a minimum of 3 years experience in air placement of concrete in reinforced concrete structures.

Air-placed concrete shall be applied only by Method B (shotcrete) in conformance with Section 303-2.1.3 of the Standard Specifications.

Equipment used for air placement of concrete shall be in conformance with Section 303-2.2 of the Standard Specifications for "Method B", except that only "positive displacement piston" type pumps shall be allowed to convey the premixed concrete. So-called "rotating roller squeeze" pumps or "ball valve" pumps will not be allowed. In addition, air compressors shall have a minimum capacity of 250 cubic feet per minute for each operating nozzle.

Concrete for air-placed concrete shall conform to the material, proportioning and mixing requirements of these Special Provisions, except that materials shall conform to specifications applicable to the "wet-mix process" in Section 53-1.02 of the State Standard Specifications. The use of 3/8" pea gravel described therein will be required. The use of admixtures will be subject to the approval of the Engineer.

Strength of air-placed concrete shall be determined from cores taken from test panels in accordance with Section 303-2.4 of the Standard Specifications. The test panels shall have the same thickness as the maximum wall thickness of the transition section being constructed. A minimum of three cores shall be taken for each 250 cubic yards or fraction thereof of air-placed concrete deposited each day. One core test specimen shall be obtained and tested at 14 days, and the remaining two obtained and tested at 28 days. The tests shall be conducted in the presence of the Engineer and by a qualified laboratory acceptable to the Engineer. All coring and testing required shall be at the Contractor's expense. The minimum compressive strength of air-placed concrete shall be in accordance with the requirements of these Special Provisions. A final report documenting all testing shall be given to the Engineer prior to acceptance of the project.

Preparation of surfaces to receive air-placed concrete shall be in accordance with Section 303-2.5 of the Standard Specifications.

Forms and ground wires shall be in conformance with Section 303-2.7 of the Standard Specifications.

Placement of air-placed concrete shall be in accordance with Section 303-2.6 of the Standard Specifications and these Detailed Specifications. Prior to placing any concrete, sufficient scaffolding or other means of access shall be provided to allow adequate access to the work area for proper placement and finishing of the air-placed concrete. Scaffolding shall not be supported by the reinforcing steel or forms. After placement of concrete has started, workmen shall not walk on reinforcing steel or graded slopes. No concrete shall be placed until all scaffolding, forms, reinforcement, ground wires and joints have been inspected and approved by the Engineer. Air-placed concrete shall be applied only in the presence of the Engineer. Whenever possible, except when enclosing reinforcing steel, the nozzle shall be held at right angles to the air-placed concrete surface at a distance of 2-1/2 to 3-1/2 feet. When enclosing steel, the nozzle shall be held at an angle so as to direct the material around the bars. A nozzleman's helper equipped with an air jet shall attend the nozzleman and blow out all rebound, sand, etc., which may have lodged on the forms, steel or air-placed concrete. Concrete material shall emerge from the nozzle in a steady, uninterrupted flow. When flow becomes intermittent for any cause, the nozzle shall be diverted from the work until the flow again becomes constant. In shooting walls or slopes, application shall begin at the bottom and shall completely embed the reinforcement for the full thickness of the structural section less an allowance of one inch for the finish coat. The limit of lift height (when the in-place material begins to sag) shall not be exceeded. Immediately after the lift has been allowed to take its initial set, all surfaces shall be cleaned of rebound and other loose material by rodding or brooming.

Construction joints shall be in conformance with Section 303-2.8 of the Standard Specifications and these Detailed Specifications. Before applying air-placed concrete,

construction joints and adjacent steel and forms shall be cleaned by sand, air and water blast of all laitance, overspray and rebound materials, and the surface of the joint thoroughly wetted.

Finishing shall be in accordance with Section 303-2.9 of the Standard Specifications and these Detailed Specifications. The finished surface on exposed portions of transition walls with sideslopes steeper than 1:1 (run to rise) shall have a Class 1 surface finish in conformance with Section 51-1.18B of the State Standard Specifications. Remaining portions of the transition shall have a broomed finish to match the adjacent trapezoidal channel surface. Prior to placing the finish coat, all laitance shall be removed from the existing surface, and the surface thoroughly cleaned and wetted by air and water blast. The finished coat shall be applied no more than eight (8) hours after the placement of the structural section, and the surface of the structural section shall be kept continuously moist until the finished coat is placed.

Curing of air-placed concrete shall be in accordance with the requirements of these Detailed Specifications.

SECTION 6.19 - NOT USED

SECTION 6.20 - FENCES AND GATES

6.20.1 Chain Link Fence - All materials shall be new except that specified for removal and relocation and shall conform to Section 206-6 of the Standard Specifications and the drawings, with installation in conformance with Section 304-3.2. Materials salvaged shall be subject to the Engineer's approval prior to reinstallation. All posts shall be set in commercial plant quality, 4 sack per cubic yard concrete.

6.20.2 Double Drive Gates - Gates shall be installed complete with all gateposts set in concrete and in conformance with Section 304-3.3 of the Standard Specifications.

6.20.3 Fencing on Boxes and Bridges - Fencing on boxes and bridges adjacent to pedestrian walkways shall conform to Standard B11-7 of the State of California Standard Plans for the Construction of Local Streets and Roads, latest edition.

SECTION 6.21 - MISCELLANEOUS

6.21.1 Description - This section covers the contract items Miscellaneous Iron and Steel; Corrugated Metal Pipe; Subdrain; and Filter Blanket.

6.21.2 Miscellaneous Iron and Steel - This section covers all ferrous metal used in the various hydraulic structures. Materials, parts and fittings shall conform to the following:

- (a) Manhole Frames and Covers - Per ASTM Designation: A-48, Class 30. Manhole frames and covers shall be minimum weight as shown on the plans, and the weight of each frame and cover shall be indicated thereon in white paint. The Engineer shall approve style and markings. The castings shall be free from cracks, blowholes or other imperfections, straight, true to pattern and

have a uniform finish. The castings for manholes in streets shall be thoroughly cleaned and coated with asphaltum paint of approved composition; all other castings for frames and covers shall be cleaned and galvanized. The cover shall fit firmly into the frame without rocking, with the frame accurately placed so that cover is flush with finish paving.

- (b) All other Miscellaneous Metal - Per ASTM Designation: A-36.
- (c) Except for manhole frames and covers described above, all exposed ferrous metal shall be galvanized per Section 210.3 of the Standard Specifications.

6.21.3 Corrugated Metal Pipe - Pipe materials and dimensions shall conform to AASHTO Designation: M-36. The Engineer shall be furnished a "Certificate of Compliance" signed by the manufacturer stating that pipe conforms to the designated specifications.

Separate sections of corrugated metal pipe shall be laid in the trench with outside laps of circumferential joints facing up grade. Pipe shall have full bearing, and variation from slope between the sections after assembly shall not exceed 1/2 inch.

Steel thicknesses noted on the plans are after galvanizing. Galvanizing shall conform to Section 75-1.05 of the State Standard Specifications.

6.21.4 Subdrain - Subdrain covers trenching and the furnishing of the subdrain pipe, all fittings, galvanized screen, filter material and Filter Fabric.

The filter material shall be wrapped in Filter Fabric as shown on the drawings. Filter material and Filter Fabric shall conform to the material specifications as stated in Section 6.16.9, Weepholes, of these Detailed Specifications.

Filter Fabric shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. The fabric shall also be ultraviolet stabilized.

The fabric shall be placed in the manner and at the locations shown on the drawings. The surface to receive the fabric shall be prepared to a smooth condition free of obstructions and debris.

The fabric shall be covered within 72 hours of its placement. Should the fabric be damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is large enough to cover the damaged area and to meet the overlap requirement. Adjacent borders of the fabric shall be overlapped a minimum of twelve (12) inches or sewn. Upstream sections of fabric shall overlap downstream sections.

Perforated subdrain pipe shall be vitrified clay pipe, concrete pipe, ABS Pipe, or PVC pipe, at the option of the Contractor. Vitrified Clay pipe shall meet the requirements of ASTM Designation: C-700, for extra strength pipe. Concrete Pipe shall meet the requirements of

ASTM Designation: C-14 Class 3 and C-444 Type I. ABS pipe shall meet the requirements of ASTM Designation: D-2751, SDR 23.5, and the perforations shall be that as described in ASTM Designation: C-700. PVC pipe shall meet the requirements of ASTM Designation: D2665 and perforations shall be that as described in ASTM Designation: C-700.

SECTION 6.22 THROUGH SECTION 6.25 - NOT USED

SECTION 6.26 - STONEMWORK

6.26.1 Description - This section covers Rock Slope Protection of various classes; Concreted Rock; and Rock Protection Fabric.

6.26.2 General - All rock materials shall meet the quality requirements of Section 72-2.02 of the State Standard Specifications.

Rock materials shall be blocky and predominantly angular in shape. Not more than 25% of the rock shall have a length more than 2.5 times the breadth or thickness. No rock shall have a length exceeding 3.0 times its breadth or thickness. All over-size rocks, as determined by the Engineer, shall be removed.

Rock materials shall be placed on a firm dry foundation in conformance with Method B of Section 72-2.03 of the State Standard Specifications, however, additional placement effort shall be required to meet the lines and grades as shown on the drawings and to fill and chink oversize voids with selected rock to establish a stable interlock. Chinking of voids will not be required for rock specified to be concreted.

Concrete for concreted (grouted) rock shall be Class "B", and shall have a slump sufficient to allow gravity flow into the interstices of the rock with rodding and vibration. Concrete for concreted rock shall be placed in accordance with Section 72-5.04 of the State Standard Specifications except that total penetration of the rock blanket by the concrete will be required, and the outer rocks of the finished rock surface shall project approximately 9 to 12 inches from the concrete surface.

6.26.3 Rock Protection Fabric - Rock Protection Fabric placed beneath rock shall conform to Type "B" per Section 88-1.04 of the State Standard Specifications with the exception that the weight in ounces per square yard shall be a minimum of 10. A six-inch minimum layer of backing material shall be placed over the fabric prior to placing rock unless otherwise shown on the plans.

SECTION 6.27 THROUGH SECTION 6.29 - NOT USED

**SECTION VII –
MAINTENANCE ACCEPTANCE FOR DRAINAGE FACILITIES**

The following procedures shall apply to all drainage facilities constructed and inspected under the provisions of Ordinance No. 460 and shall also apply in those situations where, under special circumstances, the District has entered into a construction inspection agreement.

7.1 Notification of Maintenance Acceptance - District shall notify Transportation in writing as to the satisfactory completion of the flood control facilities to which the District has agreed to provide construction inspection and maintenance.

7.2 Release of Bonds -

1. Transportation shall not release any portion of the performance or material and labor bonds on any flood control facility to which the District has agreed to provide construction inspection and maintenance without prior approval of District in the form of completion notice.
2. Transportation shall immediately notify District in writing when bonds are released on all facilities where the District is to assume maintenance responsibility; whereupon the District shall assume said responsibility.
3. Transportation shall notify District 30 days prior to the expiration of the one-year guarantee and warranty period. Transportation shall release the final 10% of the performance bond at the end of the one-year period unless otherwise instructed in writing by District.

7.3 As-Built Drawings - Transportation and District will each be responsible for preparation and filing of their respective As-Built Drawings. Upon completion and signature of "As-Built" by District, if catch basins, connector pipes or inlets are shown thereon which have been inspected by Transportation, the originals shall be delivered to Transportation for preparation and signature of "As-Built" with respect to these items, and returned to the District for filing.