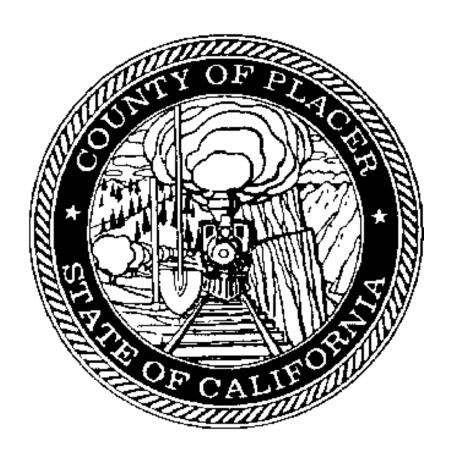
General Specifications

August 2005



Department of Public Works

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COUNTY OF PLACER

GENERAL SPECIFICATIONS

GENERAL PROVISIONS

SECTION 1: DEFINITIONS AND TERMS

1-1.00 STANDARD SPECIFICATIONS

That edition of the State of California, Department of Transportation Standard Specifications currently adopted by the Board of Supervisors of Placer County.

All section numbers and titles herein are identical or added consecutively to the Standard Specifications.

When the statement, "The Standard Specifications are incorporated herein by this reference", is used, it means the section(s) is adopted from the Standard Specifications without change. When the statement, "The Standard Specifications are incorporated herein by this reference, except as noted", is used, it means that the section(s) is adopted from the Standard Specifications except for changes exceptions incorporated. When a change to a section(s) of the Standard Specifications has been made, the section(s) has been reprinted in its entirety incorporating the change, and section(s) of the Standard Specifications not applicable has been eliminated. When the statement, "not adopted" is used, it means that the section(s) from the Standard Specifications has not adopted.

The Standard Specifications are incorporated herein by the following references, except as noted:

1-1.03 ACCEPTANCE

The formal written acceptance by the Department of an entire contract which has been completed in all respects in accordance with the plans and specifications and any modifications thereof previously approved.

1-1.07 BIDDER (not adopted)

1-1.09 CONTRACT

The documents issued or approved by the department covering the construction of the work. The contract shall include the project conditions of approval, permits, plans, specifications, and any other approvals given by the department for the work

contemplated and which may be required to complete the work in a substantial and acceptable manner.

1-1.10 CONTRACTOR

The person or persons, firm, partnership, corporation, or combination thereof, private or municipal, who have been authorized or approved by the department to construct work on behalf of a Subdivider, Developer, or Property Owner. Where applicable in the context of these Specifications and as necessary for proper implementation of the contract, the term Contractor shall be interpreted to mean the Subdivider, Developer, or Property Owner of the project.

1-1.13 DEPARTMENT

The Board of Supervisors, Department of Facility Services, or the Department of Public Works of the County of Placer.

1-1.145 DEVELOPER

The person or persons, firm, partnership, corporation, or combination thereof, private or municipal, who have been authorized or approved by the department to construct work.

1-1.15 DIRECTOR

The Director of the Placer County Department of Public Works or the Director of the Department of Facility Services.

1-1.18 ENGINEER

The Director of the Placer County Public Works Department, the Director of the Placer County Department of Facility Services, or an authorized agent appointed by the Director. The duties of the Engineer shall not include any functions that may concern the private contractual relationship between the Subdivider, Developer, or Property Owner and the Contractor, such as questions relating to compensation. Where applicable in the context of these Specifications and as necessary for the proper implementation of the contract, the term Engineer shall be interpreted to mean Private Engineer as defined by section 1-1.50.

1-1.19 ENGINEER'S ESTIMATE

The list of estimated quantities and construction cost of work to be performed, as prepared by the Private Engineer.

1-1.21 FIXED COSTS (not adopted)

LABORATORY

The established laboratory(ies) of the Department of Public Works of Placer County, or other laboratories authorized by the Department to test materials and work involved in the contract.

1-1.26 LIQUIDATED DAMAGES (not adopted)

1-1.305 PROPERTY OWNER

The person or persons, firm, partnership, corporation, or combination thereof, private or municipal, shown as the legal owner of the property on the latest equalized assessment roll in the Office of the County Assessor.

- 1-1.31 PROPOSAL (not adopted)
- 1-1.32 PROPOSAL FORM (not adopted)
- 1-1.33 PROPOSAL GUARANTEE (not adopted)

1-1.39 STATE

Reference to the State or State of California shall mean the County of Placer unless the reference is to a law or regulation of the State and reference to Sacramento shall mean Placer County offices in Auburn unless otherwise noted.

1-1.40 STATE CONTRACT ACT (not adopted)

1-1.48 WORK

All the work specified, indicated, shown or contemplated in the contract to construct the improvement, including all alterations, amendments or extensions thereto, as authorized and approved by the department.

1-1.50 PRIVATE ENGINEER

A registered Civil Engineer who has been employed by a Property Owner, Subdivider or Developer to prepare the documents, maps and plans required by County Ordinances.

1-1.51 UTILITY DISTRICT

Any public or private entity which is authorized under a law to provide a utility service to the public.

1-1.52 SUBDIVIDER

As defined by Business and Professions Code, Section 11508.

SECTION 2: PROPOSAL REQUIREMENTS AND CONDITIONS (not adopted)

SECTION 3: AWARD AND EXECUTION OF CONTRACT (not adopted)

SECTION 4: SCOPE OF WORK

The Standard Specifications are incorporated herein by the following references, except as noted:

4-1.03 CHANGES

The Department reserves the right to require alterations, deviations, additions to or deletions from the plans and specifications, as may be deemed by the Engineer to be necessary or advisable for the proper completion or construction of the whole work contemplated.

4-1.03A	Procedure & Protest (not adopted)
4-1.03B	<pre>Increased & Decreased Quantities (not adopted)</pre>
4-1.03B(1)	Increases of More than 25% (not adopted)
4-1.03B(2)	Decreases of More than 25% (not adopted)
4-1.03B(3)	Eliminated Items (not adopted)
4-1.03C	Changes in Character of Work (not adopted)
4-1.03D	Extra Work (not adopted)

SECTION 5: CONTROL OF WORK

The Standard Specifications are incorporated herein by the following references, except as noted:

5-1.01 AUTHORITY OF ENGINEER

The Engineer shall decide all questions which may arise as to the quality or acceptability of materials furnished and work performed and all questions which may arise as to the interpretation of the plans and specifications. The Engineer's decision shall be final, and the Engineer shall have authority to enforce and make effective those decisions and orders which the Contractor fails to carry out promptly.

5-1.04 COORDINATION AND INTERPRETATION OF PLANS, STANDARD SPECIFICATIONS, AND SPECIAL PROVISIONS

These County General Specifications, Standard Specifications, Land Development Manual Drawings, Standard Plans of the State of California, project plans, Special Provisions, and all supplementary documents are essential parts of the contract, and a

requirement occurring in one is as binding as though occurring in all. They are intended to be complementary, and to describe and provide for a complete work.

Contract documents shall govern in the following order:

- 1. Project Conditions of Approval
- 2. Special Provisions(if approved by Department)
- 3. Project Plans/Permits
- 4. County General Specifications
- 5. Standard Specifications
- 6. Land Development Manual Drawings
- 7. Standard Plans of the State of California

Should it appear that the work to be done or any of the matters relative thereto are not sufficiently detailed or explained in the Contract Documents, the Contractor, Subdivider, Developer or Project Owner shall apply to the Engineer for such further explanations as may be necessary and shall conform to them as part of the contract.

5-1.05 ORDER OF WORK

When required by the plans, permits or conditions, the Contractor shall follow the sequence of operations as set forth therein.

5-1.06 SUPERINTENDENCE

The Subdivider, Developer, or Project Owner shall designate in writing before starting work, an authorized representative who shall have the authority to represent and act for the Contractor. The authorized representative shall be present at the site of the work at all times while work is actually in progress. When work is not in progress during periods when work is suspended, arrangements acceptable to the Engineer shall be made for any emergency work that may be required. Whenever the Contractor or the authorized representative is not present on any particular part of the work where it may be desired to give direction, orders will be given by the Engineer, shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which the orders are given. Any order given by the Engineer, not otherwise required by the specifications to be in writing, will on request of the Contractor, be given or confirmed by the Engineer in writing.

5-1.07 LINES AND GRADES

5-1.07A Staking

following lines and grades will normally be furnished by the Private Engineer for the construction:

5-1.07A(1) Clearing Stakes

One set of stakes at 50 foot intervals, or as required.

5-1.07A(2) Slope Stakes

One set of offset stakes at 50 foot intervals, or as required. (Plate C-1)

5-1.07A(3) Subgrade, Subbase and Base Stakes

One set of bank plugs shall be placed by the Private Engineer at 50-foot intervals, or as required by the Engineer. The Contractor may place blue tops from the bank plugs for subgrade, subbase and base grade as directed by the Engineer. (Plates C-2,C-3)

The Contractor shall furnish two persons to assist the Engineer in checking grade.

5-1.07A(4) Utility Stakes

Grade stakes shall be used for utility line control, unless not required by the Engineer. Separate staking shall be provided at street intersections. Vertical curves on all sewer lines shall be staked 25 feet on-center.

5-1.07B Responsiblity

Contractor is responsible for all line, location and elevation stakes for pipes, drainage structures, curb and gutter, and other miscellaneous facilities.

When errors in staking are found by the Contractor, he shall notify the Engineer. The Private Engineer shall immediately correct the erroneous stakes.

5-1.116 DIFFERING SITE CONDITIONS (not adopted)

5-1.14 COST REDUCTION INCENTIVE (not adopted)

SECTION 6: CONTROL OF MATERIALS

6-1 GENERAL

The Standard Specifications are incorporated herein by the following references, except as noted:

6-1.02 STATE-FURNISHED MATERIALS (not adopted)

6-1.04 DEFECTIVE MATERIALS

All materials which the Engineer has determined do not conform the requirement of the plans and specification will be rejected whether in place or They shall be removed immediately from the site of work, unless otherwise permitted by the Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used in the work, unless approval in writing has been given by the Engineer. Materials in place, and samples of the material tested by an independent laboratory and determined not to comply with the specifications shall constitute a means of rejection of those No rejected material, the defects have materials. been subsequently corrected, shall be used in the work, unless approval in writing has been given by the Engineer.

6-2 LOCAL MATERIALS

The Standard Specifications are incorporated herein by the following references except as noted:

6-2.02 POSSIBLE LOCAL MATERIAL SOURCES (not adopted) 6-2.03 MANDATORY LOCAL MATERIAL SOURCES (not adopted)

6-3 TESTING

The Standard Specifications are incorporated herein by the following references, except as noted:

6-3.01A TESTING OF WORK

Various acceptance tests may be performed by the Engineer as outlined in the following sections. Testing of any areas shall be at random locations as selected by the Engineer.

All testing shall be conducted by the Engineer or his representative. Any tests performed by others will not be acknowledged or recognized for acceptance of materials or work performed, unless authorized by the Engineer.

6-3.02 TESTING BY CONTRACTOR (not adopted)

SECTION 7: LEGAL RELATIONS AND RESPONSIBILITY

The Standard Specifications are incorporated herein by the following references, except as noted:

7-1.01A	Labor Code Requirements (not adopted)
7-1.01A(1)	Hours of Labor (not adopted)
7-1.01A(2)	Prevailing Wage (not adopted)
7-1.01A(2)(a)	Travel & Subsistence Payments (not adopted)
7-1.01A(3)	Payroll Records (not adopted)
7-1.01A(4)	Labor Nondiscrimination (not adopted)
7-1.01A(5)	Apprentices (not adopted)
7-1.01A(6)	Worker's Compensation (not adopted)
7-1.01A(7)	Suits to Recover Penalties & Forfeitures(not adopted)
7-1.01B	Fair Labor Standards Act (not adopted)
7-1.01J	Assignment of Antitrust Actions (not adopted)
7-1.03	PAYMENT OF TAXES (not adopted)

7-1.11 PRESERVATION OF PROPERTY

Attention is directed to Section 7-1.12, "Indemnification and Insurance", and to Section 8-1.10, "Utility and Non-Highway Facilities". Due care shall be exercised to avoid injury to existing highway improvements or facilities, utility facilities, adjacent property, and roadside trees, shrubs, and other plants that are not to be removed.

Roadside trees, shrubs, and other plants that are not to be removed, and pole lines, fences, signs, markers and monuments, buildings and structures, conduits, pipe lines under or above ground, sewer and water lines, all highway facilities, and any other improvements or facilities within or adjacent to the highway shall be protected from injury or damage, and if ordered by the Engineer, the Contractor shall provide and install suitable safeguards, approved by the Engineer, to protect such objects from injury or damage. If such objects are injured or damaged by reason of the Contractor's operations, they shall be replaced or at the Contractor's expense. facilities shall be replaced or restored to a condition as good as when the Contractor entered upon the work, or as good as required by the specifications accompanying the contract, if any such objects are part of the work being performed under the contract. The Engineer may make or cause to be made such temporary repairs as are necessary to restore to service any damaged highway facility. The cost of such repairs shall be borne by the Contractor and may be deducted from any monies due or to become due to the Contractor under the contract.

The location of existing utilities such as gas mains, water and sewer mains, drainage lines, underground electric and telephone installations where indicated on the plans are in accordance with such information as may be available to the County. However, the exact positions of such facilities must be ascertained by the Contractor by means of potholing. Likewise it shall be the duty of the Contractor to ascertain if additional facilities other than those shown on the plans may exist. The information concerning utilities as shown on the plans is offered for such use as the Contractor may wish to make of it but the County does not guarantee its correctness or completeness.

The limits of work shall be flagged in the field by the Private Engineer. The contractor shall confine all construction activities to these limits. Upon completion of the work, denuded areas within the limits shall be cleaned up and seeded or planted as specified in Section 20.

The Standard Specifications are incorporated herein by the following references, except as noted:

7-1.12B	Insurance (not adopted)
7-1.12B(1)	Casualty Insurance (not adopted)
7-1.12B(1)(a)	Workers' Compensation and Employer's Liability
	Insurance (not adopted)
7-1.12B(1)(b)	Liability Insurance (not adopted)
7-1.12B(1)(c)	Liability Limits/Additional Insureds (not adopted)
7-1.12B(2)	Automobile Liability Insurance (not adopted)
7-1.12B(3)	Policy Forms, Endorsements and Certificates (not
	adopted)
7-1.12B(4)	Enforcement (not adopted)
7-1.12B(5)	Self-Insurance (not adopted)
7-1.12B(6)	Miscellaneous (not adopted)
7-1.125	Legal Actions Against the Department (not adopted)

7-1.125A

Unusual conditions may arise on the work which will require that immediate and unusual provisions be made to protect the public from danger or loss or damage to life or property, due directly or indirectly to the prosecution of the work, and it is part of the service required of the Contractor to make such provisions and to furnish such protection.

Whenever, in the opinion of the Department, an emergency exists, against which the Contractor has not taken sufficient precaution for the safety of the public or the protection of utilities or of adjacent structures or property which may be injured by process of construction on account of such neglect; and whenever, in the opinion of the

Department, immediate action shall be considered necessary in order to protect public or private property interest, or prevent likely loss of human life or damage on account of the operations under the contract, then, and in that event the Department may provide suitable protection to said interests by causing such work to be done and material to be furnished as, in the opinion of the Department may seem reasonable and necessary.

The cost and expense of said labor and material, together with the cost and expense of such repairs as may be deemed necessary, shall be borne by the Contractor. Failure of the Department, however, to take such precautionary measures, shall not relieve the Contractor of his full responsibility for public safety.

7-1.165 DAMAGE BY STORM, FLOOD, TSUNAMI OR EARTHQUAKE (not adopted)

7-1.17 ACCEPTANCE OF PROJECT

When the Engineer has made the final inspection as provided in Section 5-1.13 "Final Inspection", the developer shall furnish Engineer with letters of acceptance from all agencies having utilities or facilities within the project, Project Final Acceptance form signed by the appropriate County Departments, one set of reproducible "Record Drawings" plans - ink on mylar originals, photo positive mylar copies, or diazo positive mylar copies, payment of all fees, a copy of a sewer "Bill of Sale" if required, and a copy the recorded "Notice of Completion," required. If at this time the Engineer determines that the contract has been complete in all respects in accordance with the plans and specifications, the Engineer will recommend that the Department formally accept the project.

7-1.21 REPAIR OF EQUIPMENT (not adopted) 7-1.22 MATERIAL PLANTS (not adopted)

SECTION 8: PROSECUTION AND PROGRESS (not adopted)

SECTION 9: MEASUREMENT AND PAYMENT (not adopted)

MISCELLANEOUS

SECTION 10: DUST CONTROL

The Standard Specifications are incorporated herein by this reference, except as noted:

10-1.04 PAYMENT (not adopted)

SECTION 11: MOBILIZATION

The Standard Specifications are incorporated herein by this reference, except as noted:

11-1.02 PAYMENT (not adopted)

SECTION 12: CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

The Standard Specifications are incorporated herein by this reference, except as noted:

12-4 MEASUREMENT AND PAYMENT (not adopted)

SECTION 13:(BLANK)

SECTION 14: (BLANK)

SECTION 15: EXISTING HIGHWAY FACILITIES

The Standard Specifications are incorporated herein by this reference, except as noted:

15-2 MISCELLANEOUS HIGHWAY FACILITIES

15-2.07	PAYMENT (not adopted)	
	15-3 REMOVING CONCRETE	
15-3.03 15-3.04	MEASUREMENT (not adopted) PAYMENT (not adopted)	
	15-4 BRIDGE REMOVAL	
15-4.03	PAYMENT (not adopted)	

MEXCIDEMENT (not adopted)

15-2 06

GRADING

SECTION 16: CLEARING AND GRUBBING

The Standard Specifications are incorporated herein by this reference, except as noted:

16-1.05	MEASUREMENT (not adopted)
16-1.06	PAYMENT (not adopted)

16-1.07 ADJUSTMENT OF LUMP SUM ITEM (not adopted)

SECTION 17: WATERING

The Standard Specifications are incorporated herein by this reference, except as noted:

17-1.04 PAYMENT (not adopted)

SECTION 18: DUST PALLIATIVE

The Standard Specifications are incorporated herein by this reference, except as noted:

18-1.04	MEASUREMENT	(not adopted)
18-1.05	PAYMENT (not	adopted)

SECTION 19: EARTHWORK

19-1 GENERAL

The Standard Specifications are incorporated herein by the following references, except as noted:

19-1.01A Additional Description(s)

Earthwork shall consist of all excavation, including roadways, unless separately designated.

19-1.03 GRADE TOLERANCE

Immediately prior to placing subsequent layers thereon, the grading plane of the sub-grade at any point shall not vary more than 0.00 foot above or 0.10 foot below the grade established by the Private Engineer. Immediately prior to placing subsequent layers thereon, the grading plane of the aggregate base grade at any point shall not vary more than 0.00 foot above or 0.05 foot below the grade established by the Private Engineer.

19-2 ROADWAY EXCAVATION

The Standard Specifications are incorporated herein by the following references, except as noted:

19-2.02A Regulatory Approvals

Excavation or utilization of hazardous materials and/or asbestos containing materials shall not be permitted without a work plan and site safety plan approved by the appropriate regulatory agency.

19-2.08 MEASUREMENT (not adopted)

19-2.09 PAYMENT (not adopted)

19-3 STRUCTURE EXCAVATION & BACKFILL

The Standard Specifications are incorporated herein by the following reference, except as noted:

19-3.01A Trench Excavation

Unless boring is required, trench excavation shall be in accordance with Plates U-26.1, U-26.2, U-27, U-28, and U-29 of these General Specifications. When the trench is in an existing paved area, the pavement shall be sawed or scored and broken, or ground, ahead of the trenching operations. The proper tools and equipment shall be used in marking and breaking so that the pavement will be cut accurately on neat lines, parallel and perpendicular to wheel path.

When water is encountered, the trench shall be kept

dry in a manner approved by the Engineer until the placing of the bedding material, laying and jointing of the pipe, and placing of the shading material has been completed and approved. Ground water pumped from the trench shall be disposed of in such manner as will not cause injury to public or private property or constitute nuisance or menace to the public. The manner employed to dispose of water pumped from an excavation shall be subject to the approval of the Engineer and shall conform to Section 7-1.01G, "Water Pollution".

Whenever the bottom of the trench is soft, yielding, or in the opinion of the Engineer otherwise unsuitable as a foundation for the pipe, the unsuitable material shall be removed to a depth such that when replaced with suitable material as specified in Section 19-3.06A(1) of these General Specifications, it will provide a stable and satisfactory foundation. Compaction of the imported material shall be 90 percent relative compaction or as shown on the plans or detailed in the project specifications.

In new construction, when sewer pipes and manholes are to be placed in new fill material, the fill material (down to original ground) under the sewer pipes and manholes shall be compacted to a relative compaction of 95% so as to prevent differential settlement.

Trenches shall not be left open farther than 300 feet in advance of pipe laying operations or 200 feet to the rear thereof, unless otherwise permitted by the Engineer. When left unattended by the contractor, no more than 100 feet of trench shall be left open.

When contractor is working in public right-of-way or easement, prior to departure from the work site, all unattended open trenches shall be protected by approved steel plate, or 6' high chain link fence, or as directed by the Engineer.

Attention is directed to Section 5-1.02A, "Trench Excavation Safety Plans" of the Standard Specifications. The contractor shall comply with the California Division of Occupational Safety and Health (OSHA) and all other applicable safety regulations.

19-3.06A(1) Trench Bedding and Initial Backfill

Bedding and initial backfill shall consist of material placed from the bottom of the trench to 1 foot above the top of pipe or as required by the utility owner. This material shall have a minimum sand equivalent of 25 and shall pass the ¾ inch

aggregate grading requirements shown below. All exceptions shall be approved by the Engineer. (See Section 71 for special conditions for sewer pipe.)

AGGREGATE GRADING REQUIREMENTS Percentage Passing For ¾" Maximum Aggregate

Sieve Size	% Passing
1" ¾" No. 4 No. 30 No. 200	100 90-100 35-60 10-30 2-5

Compactable concrete may also be approved as pipe bedding material. The compactable concrete shall be prepared and placed as specified in Section 19-3.062.

When determined by the Engineer that the foundation material is wet or rocky, bedding material shall be placed to a depth of at least 6.0 inches below the pipe or one-fourth the outside diameter of the pipe barrel, whichever is greater. This material shall be washed rock 100% passing the ¾ inch screen, and wrapped in filter fabric as appropriate to prevent migration of fines into rock voids.

In excessively wet areas a special foundation design shall be required by the Engineer.

In fill areas and sag points in the profile, cross trenches for services and additional cross drain trenches may be required by the Engineer. The trenches shall be day lighted to the fill slope at a minimum slope of 0.5 percent and the lower 1.0 foot backfilled with bedding and initial backfill material.

19-3.06A(2) Trench Intermediate Backfill

Intermediate backfill shall consist of material placed from 1.0 foot above the pipe to subgrade. All intermediate backfill shall be free of debris and organic matter, and shall be free of any rocks over 3.0 inches in diameter

Utilities and culverts placed with less than 1.0 foot of intermediate backfill, shall be encased in concrete or provided with a concrete cover, cement slurry or other method approved by the Engineer.

19-3.06A(3) Trench Compaction

The required compaction for utility trenches within the roadway shall be a minimum of:

Bedding and Initial Backfill

95% relative compaction, unless otherwise specified by the utility owner.

Intermediate Backfill

92% relative compaction to subgrade, or as shown on the plans or in the project specifications.

The required compaction for utility trenches <u>outside</u> the <u>roadway</u> shall be a minimum of 90 percent from the bottom of the trench to finished grade, or as shown on the plans or in the project specifications.

Compaction shall be obtained by mechanical means in layers not to exceed 8 inches in thickness. Trench jetting will not be allowed within the roadway prism.

19-3.06A(3)(a) Restoration and Resurfacing

Trench restoration and final resurfacing shall be performed in conjunction with the other operations of the contractor so that no more than 1000 lineal feet (in aggregate) of trench has not been resurfaced and accepted by the County at any time. This limit may be reduced to 500 feet or increased to 2000 feet by written direction of the Engineer, if warranted in the Engineer's sole judgment.

19-3.061 COMPACTABLE 3/8" CONCRETE MIX DESIGN

PER CUBIC YARD:

77% OF 3/8" AGGREGATE (Crushed rock)

23% OF SAND

188# OF CEMENT (2 SACK)

12 GALLONS OF WATER

Compact in 1-foot lifts using a vibraplate or whacker.

3/8" Aggregate per following specification:

SIEVE SIZE	% PASSING
1"	100%
3/4 "	0-100%
3/8 "	0-20%
No. 100	2-3%

Sand as per Standard Specifications Section 90-3.03

19-3.07 MEASUREMENT (not adopted)

19-3.08 PAYMENT (not adopted)

19-4 DITCH EXCAVATION

The Standard Specifications are incorporated herein by the following references, except as noted:

19-4.02 MEASUREMENT (not adopted) 19-4.03 PAYMENT (not adopted)

19-5 COMPACTION

The Standard Specifications are incorporated herein by the following references, except as noted:

19-5.03 RELATIVE COMPACTION (95 PERCENT)

Relative compaction of not less than 95 percent shall be obtained for a minimum depth of 1.00 foot below the grading plane for the width between the outer edges of shoulders, whether in excavation or embankment. In addition, relative compaction of not less than 95% shall be obtained for a minimum depth of 2.5 feet below finished grade under a roadway, and for a distance of three feet each side thereof, whether in excavation or embankment.

Except for the outer 5.0 feet measured horizontally from the embankment side slopes, the full width of embankment within 150 feet of bridge abutments shall be compacted to a relative compaction of not less than 95 percent. The 150 feet limit of 95 percent compaction will be measured horizontally from the bridge abutment and either parallel or concentric with the roadway centerline. In addition, a relative compaction of not less than 95 percent shall be obtained for embankment under retaining wall footings pile foundations within the established by inclined planes sloping 1:1.5 down and out from lines 1.0 foot outside the bottom edges of the footing.

All materials used shall be compacted to a relative compaction of 95% minimum.

19-5.06 PAYMENT (not adopted)

19-6 EMBANKMENT CONSTRUCTION

The Standard Specifications are incorporated herein by the following references, except as noted:

19-6.03 PAYMENT (not adopted)

19-7 BORROW EXCAVATION

The Standard Specifications are incorporated herein by the following references, except as noted:

19-7.04 19-7.05 MEASUREMENT (not adopted)
PAYMENT (not adopted)

SECTION 20: EROSION CONTROL AND HIGHWAY PLANTING

currently adopted edition of the Caltrans "Standard Specifications and the "Erosion & Sediment Control Guidelines for Developing Areas of the Sierra Foothills and Mountains" (prepared by the High Sierra RC&D Council, October, 1991) are incorporated herein by this reference, with the exception of Standard Specifications sections relating to measurement and payment. In case of conflict, the "Erosion & Sediment Control Guidelines for Developing Areas of the Sierra Foothills and Mountains", shall govern over the Standard Specifications. In the Lake Tahoe Basin, authoritative site-specific erosion control manuals may be used in lieu of the High Sierra RC&D Manual or the Caltrans Standard Specifications when allowed by the Engineer.

SECTION 21: (BLANK)

SECTION 22: FINISHING ROADWAY

The Standard Specifications are incorporated herein by this reference, except as noted:

22-1.02 MEASUREMENT (not adopted)
22-1.03 PAYMENT (not adopted)

SECTION 23: (BLANK)

SUBBASES AND BASES

SECTION 24: LIME STABILIZATION

The Standard Specifications are incorporated herein by this reference, except as noted:

24-1.08 FINISH ROLLING AND GRADING

The finished surface of the lime stabilized material shall be the grading plane and at any point shall not vary more than 0.00-foot above or 0.08-foot below the grade established by the Engineer.

If the compacted material is above the grade tolerances specified in this section, the excess material shall be trimmed, removed, and disposed of. No loose material shall be left on the finished plane. Trimming of excess material shall not be conducted unless finish rolling can be completed within 2 hours after trimming.

Trimmed surfaces shall receive finish rolling consisting of at least one complete coverage with steel drum or pneumatic-tired rollers. Vibratory rollers will not be allowed. Minor indentations may remain in the surface of the finished material after final trimming and rolling. Under no circumstances will it be permissible to add new or trimmed lime stabilized material to fill low areas or to raise the grade of compacted lime stabilized material.

24-1.10 MEASUREMENT (not adopted)

24-1.11 PAYMENT (not adopted)

SECTION 25: AGGREGATE SUBBASES

The Standard Specifications are incorporated herein by this reference, except as noted:

25-1.06 MEASUREMENT (not adopted)
25-1.07 PAYMENT (not adopted)

SECTION 26: AGGREGATE BASES

The Standard Specifications are incorporated herein by the following reference, except as noted:

26-1.05 COMPACTING

Aggregate bases, after compaction, shall be watered in conformance with the provisions in Section 17, "Watering."

The relative compaction of each layer of compacted base material shall be not less than 95 percent. The surface of the finished aggregate base at any point shall not vary more than 0.00-foot above or 0.05-foot below the grade established by the Engineer.

Base which does not conform to the above requirements shall be reshaped or reworked, watered and thoroughly recompacted to conform to the specified requirements.

26-1.06 MEASUREMENT (not adopted) 26-1.07 PAYMENT (not adopted)

SECTION 27: CEMENT TREATED BASES

The Standard Specifications are incorporated herein by the following reference, except as noted:

27-1.07 COMPACTING

Compacting equipment shall produce the required compaction within the operation time limit specified in Section 27-1.08, "Operation Time Requirement."

Compaction shall follow immediately after the spreading operation, and shall consist of at least one complete coverage of the treated material.

When the finished surface after initial compaction is outside the tolerance specified hereinafter, high spots shall be trimmed off to within the specified tolerance. Filling of low areas by drifting or hauling of trimmed material is prohibited. Following trimming, trimmed areas shall receive one complete coverage and have such additional compaction performed that the entire layer of cement treated base conforms to the compaction requirements hereinafter specified. Final compaction shall be accomplished in such a manner that no loose material remains on the surface and tear marks are eliminated.

When cement treated base is spread and compacted in more than one layer, each lower layer shall be compacted to the required degree of compaction before placing the next layer. Only such trimming will be required as is necessary to meet the requirements for layer thickness contained in Section 27-1.06, "Spreading Treated Mixture."

The relative compaction of cement treated base shall be not less than 95 percent. The compaction shall be determined by California Test 312 or 231 for Class A cement treated base. Each layer of cement treated base may be tested for compaction, or all layers may be tested together, at the option of the Engineer. When all layers are tested together, the Contractor will not be relieved of the responsibility to achieve the required compaction in each layer placed.

The finished surface of cement treated base shall be uniform and shall not deviate at any point more than 0.03-foot from the bottom of an 11.8 feet \pm 0.2-foot straightedge laid in any direction.

The surface of the finished cement treated base at any point shall not vary more than 0.00-foot above or 0.05-foot below the grade established by the Engineer, except that when portland cement concrete pavement is to be placed on cement treated base, the surface of the cement treated base at any point shall not extend above the grade established by the Engineer.

Areas of the finished cement treated base which are lower than 0.05-foot below the grade established by the Engineer shall be removed and replaced with cement treated base which complies with requirements of these specifications, or if permitted by the Engineer, shall be filled as hereinafter specified.

When surfacing material is asphalt concrete, the low areas shall be filled with asphalt concrete conforming to the requirements for the lowest layer of asphalt concrete to be placed as surfacing. This filling shall be done as a separate operation prior to placing the lowest layer of surfacing.

When surfacing material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation that the surfacing is placed.

The surface shall be kept moist at all times until the curing seal is applied.

Excess material may be placed as aggregate for shoulder construction subject to the following conditions:

- A. The shoulder subgrade shall be prepared as specified.
- B. Hardened chunks of trimmed material shall be removed or reduced to the maximum size specified for shoulder aggregate prior to spreading additional shoulder aggregate.
- C. The amount of trimmed material incorporated in the shoulder shall not exceed 25 percent of the planned volume of shoulder aggregate per linear meter {linear foot} of shoulder. When trimmings

- exceed this limit, the excess shall be removed and may be placed in other shoulder areas, in conformance with the 25 percent limit.
- D. The excess material shall be uniformly distributed in the shoulder area prior to spreading additional shoulder aggregate.

The excess material may also be used at other locations in the work provided the excess material complies with applicable specification requirements, or shall be otherwise disposed of as permitted by the Engineer.

27-1.11 MEASUREMENT (not adopted)
27-1.12 PAYMENT (not adopted)

SECTION 28: LEAN CONCRETE BASE

The Standard Specifications are incorporated herein by the following reference, except as noted:

28-1.06 SPREADING, COMPACTING AND SHAPING

Lean concrete base shall be spread, compacted and shaped in conformance with the provisions for spreading, compacting and shaping concrete pavement in the first and fourth paragraphs of Section 40-1.07, "Spreading, Compacting and Shaping."

In advance of curing operations, lean concrete base to be surfaced with asphalt concrete shall be textured with a drag strip of burlap, a broom or a spring steel time device which will produce scoring in the finished surface. The scoring shall be parallel with the centerline or transverse thereto. The operation shall be performed at a time and in a manner to produce the coarsest texture practical for the method used.

Lean concrete base to be surfaced with portland cement concrete pavement shall not be textured and shall be finished to a smooth surface, free of mortar ridges and other projections, before curing compound is applied.

The finished surface of lean concrete base shall be free from porous areas. It shall not vary at any point more than 0.00-foot above or 0.05-foot below the grade established by the Engineer.

28-1.08 SURFACES NOT WITHIN TOLERANCE

Hardened lean concrete base with a surface lower than 0.05-foot below the grade established by the Engineer shall be removed and replaced with lean concrete base which complies with these specifications, or if permitted by the Engineer, the low areas shall be filled with pavement material as follows:

When pavement material is asphalt concrete, the low areas shall be filled with asphalt concrete conforming to the requirements for the lowest layer of asphalt concrete to be placed as pavement. This shall be done as a separate operation prior to placing the lowest layer of pavement.

When pavement material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation that the pavement is placed.

28-1.09 MEASUREMENT (not adopted) 28-1.10 PAYMENT (not adopted)

SECTION 29: TREATED PERMEABLE BASES

The Standard Specifications are incorporated herein by this reference, except as noted:

29-1.05 SPREADING AND COMPACTING ASPHALT TREATED PERMEABLE BASE

Asphalt treated permeable base shall be spread and compacted in the same manner as provided for asphalt concrete in Sections 39-5, "Spreading and Compacting Equipment," and 39-6, "Spreading and Compacting," and these specifications.

Asphalt treated permeable base shall be spread only when the atmospheric temperature is above 40° F.

Asphalt treated permeable base shall be spread and compacted in one layer. Asphalt treated permeable base shall be compacted in accordance with one of the following methods:

- A. One complete coverage with a steel-tired, 2-axle tandem roller which has an operating mass of not more than 110 pounds per linear inch of steel tire width. Compaction shall begin when the temperature of the base mixture is less than 250° F and shall be completed before the base mixture is less than 200° F. Asphalt treated permeable base shall not be cooled with water.
- B. One complete coverage with a steel-tired, 2-axle tandem roller with a mass of not less than 8 tons nor more than 12 tons. Compaction shall begin when the temperature of the base mixture is less than 150°F and shall be completed before the base mixture is less than 100°F. Asphalt treated permeable base shall not be cooled with water.

Vibratory rollers meeting the above requirements may be used provided the vibratory unit is turned off.

The finished surface of asphalt treated permeable base shall be uniform and shall not vary at any point more than 0.00-foot above or 0.05-foot below the grade established by the Engineer.

Care shall be exercised to prevent contamination of asphalt treated permeable base. Asphalt treated permeable base which, in the opinion of the Engineer, has been contaminated shall be removed and replaced by the Contractor at the Contractor's expense.

Asphalt treated permeable material for edge drains shall be placed and compacted in conformance with the provisions in Section 68-3.03, "Installation."

Filter fabric shall be placed on the edge and top of the high side (the side opposite the edge drain side) of the asphalt treated permeable base, and at intermediate cross drain interceptors as shown on the plans. The filter fabric shall conform to the provisions for filter fabric for edge drains in Section 88, "Engineering Fabrics," and shall be placed in conformance with the provisions for placing filter fabric for edge drains in Section 68-3.03, "Installation."

Damage to the asphalt treated permeable base shall be repaired promptly by the Contractor, at the Contractor's expense, as directed by the Engineer.

29-1.06 PLACING, SPREADING, COMPACTING AND SHAPING CEMENT TREATED PERMEABLE BASE

Placing of cement treated permeable base shall conform to the provisions for placing concrete pavement in Section 40-1.06, "Placing," except that the third paragraph in Section 40-1.06 shall not apply.

Cement treated permeable base shall be spread, compacted and shaped in conformance with the provisions for spreading, compacting and shaping concrete pavement in the first and fourth paragraphs of Section 40-1.07, "Spreading, Compacting and Shaping," except that vibrators shall not be used.

Compaction shall be performed with a 2-axle teel-tired roller with a mass of not less than 6 tons nor more than 10 tons. Compaction shall follow within one-half hour after the spreading operation and shall consist of 2 complete coverages of the cement treated permeable base.

Cement treated permeable base shall be spread only when the atmospheric temperature is above 40° F.

The completed cement treated permeable base shall be cured by sprinkling the surface with a fine spray of water every 2 hours for a period of 8 hours. Curing shall start the morning after the base has been placed.

The finished surface of cement treated permeable base shall be uniform and shall not vary at any point more than 0.00-foot above or 0.05-foot below the grade established by the Engineer.

Care shall be exercised to prevent contamination of cement treated permeable base. Cement treated

permeable base which, in the opinion of the Engineer, has been contaminated shall be removed and replaced by the Contractor at the Contractor's expense.

Cement treated permeable material for edge drains shall be placed and compacted in conformance with the provisions in Section 68-3.03, "Installation."

Filter fabric shall be placed on the edge and top of the high side (the side opposite the edge drain side) of the cement treated permeable base, and at intermediate cross drain interceptors as shown on the plans. The filter fabric shall conform to the provisions for filter fabric for edge drains in Section 88, "Engineering Fabrics," and shall be placed in conformance with the provisions for placing filter fabric for edge drains in Section 68-3.03, "Installation."

Damage to the cement treated permeable base shall be repaired promptly by the Contractor at the Contractor's expense, as directed by the Engineer.

29-1.07 SURFACES NOT WITHIN TOLERANCE

Hardened treated permeable base with a surface lower than 0.05-foot below the grade established by the Engineer shall be removed and replaced with treated permeable base which complies with these specifications, or if permitted by the Engineer, the low areas shall be filled with pavement material as follows:

When pavement material is asphalt concrete, the low areas shall be filled with asphalt concrete conforming to the requirements for the lowest layer of asphalt concrete to be placed as pavement. This shall be done as a separate operation prior to placing the lowest layer of pavement.

When pavement material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation in which the pavement is placed.

29-1.08 MEASUREMENT (not adopted) 29-1.09 PAYMENT (not adopted)

SECTION 30 - 36: (BLANK)

SURFACINGS AND PAVEMENTS

SECTION 37: BITUMINOUS SEALS

The Standard Specifications are incorporated herein by this reference, except as noted:

37-1.02 MATERIALS

Asphalt emulsion shall conform to the provisions in section 94, Table 3, "Asphaltic Emulsions", and shall be of the grade specified in the special provisions.

Liquid asphalt for prime coat, if required, shall be of the grade specified in the special provisions, and shall conform to the provisions in Section 93, "Liquid Asphalts."

Asphalt emulsion shall be anionic or cationic type polymer modified asphaltic emulsion grade PMRS-2h or PMCRS-2h. Bituminous binder shall be determined by use of California test Method 302, Film Stripping, 10% Maximum, for Compatibility to Anionic or Cationic Emulsions.

Due to field conditions or performance of the finished product, modifications to the asphaltic emulsion may be necessary. Modifications will be as requested by the Engineer and will be within the ranges specified in these Provisions.

Cationic type asphaltic emulsion grade PMCRS-2h shall conform to the following requirements when tested in accordance with the specified test methods:

TEST	TEST METHOD	REQUIREMENT
Test on Emulsions:		
Viscosity SSF, @ 122°F., sec.	AASHTO T 59	100-300
Cottlement E derre %	AACHEO E EO	5 Maximum
Settlement, 5 days, %	AASHTO T 59	5 Maxillulli
Storage Stability, 1 day, %	AASHTO T 59	1 Maximum
Sieve Test, %	AASHTO T 59	0.30 Maximum
Demulsibility, 35 ml 0.8% Sodium dioctylslfosuccinage, %	AASHTO T 59	60-95
Particle Charge	AASHTO T 59	3 Maximum

TEST	TEST METHOD	REQUIREMENT		
Test on Residue from Evaporation Using California Test Method 331:				
Ring & Ball softening Point, Deg. F.	AASHTO T 53	120°		
Residue, %	AASHTO T 59	65 Minimum		
Penetration, @ 77°F., With 100 grams for 5 seconds.	AASHTO T 59	45-65 dmm		
Solubility in trichloroethylene, %	ASTM D 2042	97.5 Minimum		
Ductility, 77°F., 5cm/min., cm RTFO Aged Residue	AASHTO T 51	60 Minimum		

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Torsional Recovery, %

Anionic type asphaltic emulsion Grade PMRS-2h shall conform to the following requirements when tested in accordance with the specified test methods:

18 Minimum

TEST	TEST METHOD	REQUIREMENT
Test on Emulsions:		
Viscosity SSF, @ 122°F., sec.	AASHTO T 59	100-250
Settlement, 5 days, %	AASHTO T 59	5 Maximum
Storage Stability, 1 day, %	ASHTO T 59	1 Maximum
Sieve Test, %	AASHTO T 59	0.30 Maximum
Demulsibility, 35 ml 0.02 N CaCl ₂ , %	AASHTO T 59	60-95
Oil distillate by volume of emulsion, %	AASHTO T 59	3 Maximum

TEST METHOD	REQUIREMENT
AASHTO T 53	120°
AASHTO T 59	65 Minimum
AASHTO T 59	45-65 dmm
ASTM D 2042	97.5 Minimum
AASHTO T 51	60 Minimum
	AASHTO T 53 AASHTO T 59 AASHTO T 59 ASTM D 2042

The Contractor shall submit samples from all suppliers furnishing the following materials:

18 Minimum

1) One quart of the asphaltic emulsion.

Torsional Recovery, %

2) 50 pounds of the medium fine screening.

Cal. test 332

The above sample (No. 1) shall be submitted to the Engineer in a one quart plastic container, and both samples (No. 1 and 2) shall be submitted in a minimum of 10 days prior to the beginning of the seal coat work.

Additionally, half-gallon samples of the asphaltic emulsion delivered to the project will be taken from the spray bar of the distributor truck at mid-load.

The size of screenings for the various types of seal coats shall conform to the following:

Seal Coat Types	Size of Screenings
Fine	1/4" x No.10
Medium fine	5/16" x No.8
Medium	3/8" x No.6
Coarse	1/2" x No.4
Double	
1st application	1/2" x No.4
2nd application	1/4" x No.10

Screenings shall conform to the following requirements prior to depositing on the roadbed.

Screenings shall consist of broken stone, crushed gravel or both. At least 90 percent by mass of the screenings shall consist of crushed particles as determined by California Test 205.

Screenings shall be clean and free from dirt and other deleterious substances.

The percentage composition by mass of screenings shall conform to one of the following gradings:

Percentage Passing

	Medium	Medium Fine
Sieve Size	3/8 x No. 6	$5/16 \times No. 8$
1/2"	100	
3/8"	90-100	100
No. 4	5-30	30-60
No. 8	0-10	0-15
No. 16	0-5	0-5
No. 30		0-3
No. 200	0-2	0-2

Screenings shall contain no more than 10% by weight of quartz rock.

Screenings shall contain no more than 10% by weight of Lime Stone.

Screenings shall also conform to the following quality requirements:

	California Test	Requirements
Cleanness value	227	85
Minimum		
Los Angeles	211	25%
Rattler Loss at		
500 Rev.(max)		

If the results of the aggregate grading for screenings does not meet the gradation specified, the seal coat represented by the test shall be removed.

Samples for the aggregate grading and Cleanness Value tests will be taken from the conveyor belt of the spreader prior to application.

37-1.05 APPLYING ASPHALTIC EMULSION

Asphaltic emulsion shall be applied in accordance with the provisions in Section 94, "Asphaltic Emulsions," and the provisions specified in this Section 37-1.05.

The application rate of fog seal coat (asphaltic emulsion and added water) shall be such that the original emulsion will be spread at a rate of 0.05- to 0.10-gallon per square yard. The exact rate of application will be determined by the Engineer.

The application rates of asphaltic emulsion for the other types of seal coats shall be within the following ranges in gallons per square yard. The exact rates will be determined by the Engineer.

Seal Coat Type	Ranges (Gal/Sq. Yd)
Medium	0.26 to 0.42
Medium / Fine	0.25 to 0.35

Asphaltic emulsion at the time of application shall be between 130° F and 180° F.

Asphaltic emulsion shall not be applied when weather conditions are unsuitable. Seal coats requiring screenings shall not be applied until sufficient screenings are on hand to immediately cover the asphaltic emulsion, or when the atmospheric temperature is below 65° F or above 110° F, or when the pavement temperature is below 80° F. Fog seal coat shall not be applied when the atmospheric temperature is below 40° F.

The Engineer will notify the Contractor, no later than 4:00 p.m., if it is anticipated that the next working day will not be suitable for the application of seal coat. This notice may be given on the day preceding the date the Contractor intends to begin work, any working day after the Contractor has begun work, and any day previously named by the Engineer as a day unsuitable for applying seal coat. When the Engineer has declared a day to be unsuitable by reason of expected low temperature or unsuitable weather conditions, the Contractor shall not apply any new seal coat. If maintenance of previously applied seal coat can be performed, the Contractor shall continue to perform the maintenance.

If the Contractor has not been notified by the Engineer of an anticipated unsuitable day and at the beginning of the work day the weather is unsuitable for the application of seal coats, but maintenance of previously applied seal coat can be performed,

the Contractor shall not apply any seal coat. Binder and screenings brought to the project shall be returned, stored or disposed of as directed by the Engineer. The Contractor shall continue maintenance of previously applied seal coat.

After the application of a fog seal coat, asphaltic emulsion that becomes tacky shall be sprinkled with water in the amount ordered and as directed by the Engineer.

When more than one type of seal coat is to be applied, the fog seal coat shall be applied at least 4 days in advance of the application of an adjoining seal coat requiring screenings. The seal coats shall be applied in such a manner that the joint between 2 types will present a neat and uniform appearance true to the line shown on the typical cross section and established by the Engineer.

Applying asphaltic emulsion shall be discontinued sufficiently early in the day to permit the termination of traffic control prior to darkness. Asphaltic emulsion shall be applied to only one designated traffic lane at a time, and the entire width of the lane shall be covered in one operation. Asphaltic emulsion shall not be applied a greater distance than can be immediately covered by screenings, unless otherwise permitted by the Engineer.

The cut off of asphaltic emulsion shall be made on building paper or similar material spread over the surface. Paper shall also be placed over the treated surface for a sufficient length at the beginning of a spread to avoid spraying existing pavement or previously placed screenings and so that the nozzles are spreading properly when the uncovered surface is reached. The building paper shall then be removed and disposed of in a manner satisfactory to the Engineer.

The distribution of asphaltic emulsion shall not vary more than 15 percent transversely from the average as determined by tests, nor more than 10 percent longitudinally from the specified rate of application as determined by California Test 339.

37-1.07 FINISHING

After the screenings have been spread upon the polymer modified asphaltic emulsion, any piles, ridges or uneven distribution shall be carefully removed prior to initial rolling, to insure against permanent ridges, bumps or depressions in the completed surface. Prior to initial rolling, additional screenings shall be spread in whatever

quantities required to prevent picking up of the polymer modified asphaltic emulsion by the rollers or traffic, and to provide a uniform surface and appearance to the roadway.

Rollers shall be pneumatic-tired type. A minimum of three pneumatic-tired rollers conforming to Section 39-5.02, "Compacting Equipment", shall be furnished and operating at all times. Rollers shall not exceed speeds of 10 MPH during initial and secondary rolling.

Initial rolling shall consist of one complete coverage and shall begin immediately behind the chip spreader. Polymer modified asphaltic emulsion and screenings shall not be spread more than 2,500 feet ahead of completion of initial rolling operations. Secondary rolling shall consist of a minimum of two complete coverages, and shall begin immediately after completion of the initial rolling. The amount of secondary rolling shall be sufficient to adequately seat the screenings, and in no case shall be less than two complete coverages.

Upon completion of secondary rolling, traffic will be permitted to travel over the seal coat (fine). Initial sweeping of screenings will be performed by the Contractor. Application of new screenings shall not begin until the Contractor has begun sweeping the previous day's screenings, unless otherwise directed by the Engineer.

On roads requiring pilot-car assisted traffic control, initial sweeping of loose screenings will be done by the Contractor on the same day on which the screenings are placed. The Contractor may begin initial sweeping after the screenings have been in place for a period of approximately 3 1/2 to 4 hours, and after the Engineer has determined the seal coat (fine) is ready for sweeping.

On roads not requiring pilot car assisted traffic control, initial sweeping of loose screenings will be done by the Contractor on the calendar day following the placement of the screenings, except that initial sweeping will not be performed on Sundays, holidays, or July 3, 1995 by the Contractor.

The Contractor will be required to provide operated brooms for sweeping operations (removal of loose screenings) only when so directed in writing by the Engineer. Brooms shall be self-propelled and have a hopper capacity of three cubic yards minimum. The Contractor shall provide adequate and suitable sweeping equipment to meet the above requirements,

and when ordered by the Engineer shall remove unsuitable equipment from the work.

The completed seal coat (fine) surface shall present a uniform appearance and shall be free from ruts, humps, depressions or any other irregularity regardless of cause. All irregularities to the seal coat (fine) shall be repaired prior to fog sealing. The Contractor shall maintain the seal coat (fine) from the time of application to application of seal coat (fog). Maintenance of seal coat (fine) shall include providing traffic control, pre-sweeping, distribution and sweeping of screenings to absorb any free bituminous material, to cover any area deficient in seal coat material, and to prevent formation of corrugations. Clean sand may be used in lieu of screenings to cover any excess polymer modified asphaltic emulsion which comes to the surface. The use of roadside material for this purpose will not be permitted.

37-1.07A Sand Application

Sand shall be placed on the seal coat (fog) if it is necessary to open the roadway to traffic before the seal coat (fog) has completely cured. Sand shall be placed on the seal coat (fog) at a uniform rate of one to three pounds per square yard, the exact rate of sand application will be determined by the Engineer.

A mechanical spreader capable of spreading sand uniformly shall be used to spread the sand cover. The spreader shall be equipped with a mechanism for adjusting the spread rate.

Sand shall be free from clay and organic material, and shall be of such size that from 90 percent to 100 percent will pass a No. 4 sieve, and not more than five percent will pass a No. 200 sieve.

The sanded surface shall be maintained in a smooth and satisfactory condition. Placement of excess sand shall be removed and disposed of, at the Contractor's expense, as directed by the Engineer.

37-1.08 MEASUREMENT (not adopted) 37-1.09 PAYMENT (not adopted)

SECTION 38: (BLANK)

SECTION 39: ASPHALT CONCRETE

The Standard Specifications are incorporated herein by this reference, except as noted:

39-8 MEASUREMENT AND PAYMENT (not adopted)

SECTION 40: PORTLAND CEMENT CONCRETE PAVEMENT

The Standard Specifications are incorporated here by this reference, except as noted:

40-1.14 PAYMENT (not adopted)

SECTION 41: PAVEMENT SUBSEALING AND JACKING

The Standard Specifications are incorporated herein by this reference, except as noted:

41-1 PAVEMENT SUBSEALING

41-1.04 41-1.05	MEASUREMENT (not adopted) PAYMENT (not adopted)
	41-2 PAVEMENT JACKING
41-2.04 41-2.05	MEASUREMENT (not adopted) PAYMENT (not adopted)

SECTION 42: GROOVE AND GRIND PAVEMENT

The Standard Specifications are incorporated herein by this reference, except as noted:

42-1 GROOVING

42-1.03 42-1.04	MEASUREMENT (not adopted) PAYMENT (not adopted)
	42-2 GRINDING
42-2.04 42-2.05	MEASUREMENT (not adopted) PAYMENT (not adopted)

SECTION 43 - 48: (BLANK)

STRUCTURES

SECTION 49: PILING

The Standard Specifications are incorporated herein by this reference, except as noted:

49-6 MEASUREMENT AND PAYMENT (not adopted)

SECTION 50: PRESTRESSING CONCRETE

The Standard Specifications are incorporated herein by this reference, except as noted:

50-1.11 PAYMENT (not adopted)

SECTION 51: CONCRETE STRUCTURES

The Standard Specifications are incorporated herein by this reference, except as noted:

51-1.23 PAYMENT (not adopted)

SECTION 52: REINFORCEMENT

The Standard Specifications are incorporated herein by this reference, except as noted:

52-1.10 MEASUREMENT (not adopted) 52-1.11 PAYMENT (not adopted)

SECTION 53: SHOTCRETE

The Standard Specifications are incorporated herein by this reference, except as noted:

53-1.07 MEASUREMENT (not adopted) 53-1.08 PAYMENT (not adopted)

SECTION 54: WATERPROOFING

The Standard Specifications are incorporated herein by this reference, except as noted:

54-1.04 MEASUREMENT (not adopted) 54-1.05 PAYMENT (not adopted)

SECTION 55: STEEL STRUCTURES

The Standard Specifications are incorporated herein by this reference, except as noted:

55-4 MEASUREMENT AND PAYMENT (not adopted)

SECTION 56: SIGNS

The Standard Specifications are incorporated herein by this reference, except as noted:

56-1 OVERHEAD SIGN STRUCTURES

56-1.09 56-1.10	MEASUREMENT (not adopted) PAYMENT (not adopted)	
	56-2 ROADSIDE SIGNS	

56-2.05	MEASUREMENT (not adopted)
56-2.06	PAYMENT (not adopted)

SECTION 57: TIMBER STRUCTURES

The Standard Specifications are incorporated herein by this reference, except as noted:

57-4 MEASUREMENT AND PAYMENT

SECTION 58: PRESERVATIVE TREATMENT OF LUMBER, TIMBER AND PILING

The Standard Specifications are incorporated herein by this reference, except as noted:

58-1.05 PAYMENT (not adopted)

SECTION 59: PAINTING

The Standard Specifications are incorporated herein by this reference, except as noted:

59-2 PAINTING STRUCTURAL STEEL

59-2.16	PAYMENT (not adopted)
	59-3 PAINTING GALVANIZED SURFACES
59-3.04	PAYMENT (not adopted)
	59-4 PAINTING TIMBER
59-4.04	PAYMENT (not adopted)
	59-5 PAINTING SIGN STRUCTURES

59-5.03 PAYMENT (not adopted)

59-6 PAINTING CONCRETE

59-6.06	MEASUREMENT (not adopted)
59-6.07	PAYMENT (not adopted)

SECTION 60: (BLANK)

DRAINAGE FACILITIES

SECTION 61: CULVERT AND DRAINAGE PIPE JOINTS

The Standard Specifications are incorporated herein by this reference.

SECTION 62: ALTERNATIVE CULVERTS

The Standard Specifications are incorporated herein by this reference, except as noted:

62-1.03 MEASUREMENT (not adopted) 62-1.04 PAYMENT (not adopted)

SECTION 63: CAST-IN-PLACE CONCRETE PIPE

The Standard Specifications are incorporated herein by this reference, except as noted:

63-1.08 MEASUREMENT (not adopted) 63-1.09 PAYMENT (not adopted)

SECTION 64: PLASTIC PIPE

The Standard Specifications are incorporated herein by the following references, except as noted:

64-1.01 DESCRIPTION

This work shall consist of furnishing and installing corrugated or ribbed plastic pipe for culverts, with all necessary fittings and coupling systems, as shown on the plans or as determined by the Engineer in accordance with the provisions in these specifications and the special provisions.

64-1.02 MATERIALS

Plastic pipe shall be either: 1) Type S corrugated polyethylene pipe, 2) ribbed profile wall polyethylene pipe, or 3) ribbed polyvinyl chloride drain pipe.

All polyethylene drainage pipe shall be dual wall smooth interior.

Where designated on the plans as smooth interior wall type, plastic pipe shall be, at the option of the Contractor, either Type S corrugated polyethylene pipe, ribbed profile wall polyethylene pipe, or ribbed polyvinyl chloride drainpipe.

Where the type of plastic pipe is not designated on the plans, plastic pipe shall be, at the option of the Contractor, either corrugated or smooth interior wall.

64-1.08 MEASUREMENT (not adopted)

64-1.09 PAYMENT (not adopted)

SECTION 65: REINFORCED CONCRETE PIPE

The Standard Specifications are incorporated herein by this reference, except as noted:

65-1.09	MEASUREMENT (not adopted)
65-1.10	PAYMENT (not adopted)

SECTION 66: CORRUGATED METAL PIPE

The Standard Specifications are incorporated herein by this reference, except as noted:

66-4 MEASUREMENT AND PAYMENT (not adopted)

SECTION 67: STRUCTURAL METAL PLATE PIPE

The Standard Specifications are incorporated herein by this reference, except as noted:

67-1.07	MEASUREMENT (not adopted)
67-1.08	PAYMENT (not adopted)

SECTION 68: SUBSURFACE DRAINS

The Standard Specifications are incorporated herein by this reference, except as noted:

68-1 UNDERDRAINS

68-1.04 68-1.05	MEASUREMENT (not adopted) PAYMENT (not adopted)	
	68-2 HORIZONTAL DRAINS	
68-2.04 68-2.05	MEASUREMENT (not adopted) PAYMENT (not adopted)	
	68-3 EDGE DRAINS	
60 2 04	MENGINEMENT (not odontod)	

68-3.04 MEASUREMENT (not adopted) 68-3.05 PAYMENT (not adopted)

SECTION 69: OVERSIDE DRAINS

The Standard Specifications are incorporated herein by this reference, except as noted:

69-1.05 MEASUREMENT (not adopted)

69-1.06 PAYMENT (not adopted)

SECTION 70: MISCELLANEOUS FACILITIES

The Standard Specifications are incorporated herein by this reference, except as noted:

70-1.04 MEASUREMENT (not adopted)

70-1.05 PAYMENT (not adopted)

SECTION 71: SEWERS

71-1.00 DEFINITION OF SEWER

Any conduit intended for the reception and transfer of sewage and fluid industrial waste.

71-1.01 DESCRIPTION

This work shall consist of laying sewer pipe and constructing sewer structures as shown on the plans, in accordance with these specifications, the special provisions and as directed by the Engineer. The specifications set forth in this section shall be adhered to in the construction of all sewer systems except where a local sewer district or a controlling agency has a higher standard, in which case their requirements shall take precedence. In the case of conflict with the specifications in this section and those of other sections of these General Specifications, the most restrictive specification shall apply.

The type of sewer pipe and sewer structures will be designated in the contract items.

71-1.02 MATERIALS

IDENTIFICATION MARKS

All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer, the location of plant, and strength.

Portland cement used in the production of concrete products set forth in this Section 71-1.02 shall conform to the provisions in Section 90, "Portland Cement Concrete."

71-1.02A Clay Sewer Pipe

Clay sewer pipe shall conform to the specifications for extra strength vitrified clay pipe of ASTM Designation C700 except that plain end pipe otherwise complying in all respects with the said specification may be used. See Plate U-30 for strength and cover requirements.

The requirements in the specification for scoring of the ends of the pipe; for the shape of the socket; and for the minimum dimensions for the inside diameter of the socket may be waived with the approval of the Engineer when such waiver is conducive to the proper application of the joint to be used.

The ends of the pipe shall be so formed that, when the pipes are laid together and jointed, the pipe will form a continuous line with a smooth interior surface.

At the option of the Contractor, clay sewer pipe shall conform either to the absorption requirements of ASTM C700 or to the permeability requirements as specified and as determined by California Test 672.

Joints For Vitrified Clay Pipe

Joints for vitrified clay pipe and fittings shall be factory applied, mechanical, flexible-compression type and shall conform to ASTM C425.

Fittings

Fittings shall be made to such dimensions as will accommodate the joint system specified. Wyebranch fittings shall be furnished with spurs securely fastened by the manufacturer to the barrel of the pipe. There shall be no projection on the inner surface of the barrel.

Loading Tests

The loading tests shall be documented in accordance with ASTM C301 for 3 edge bearing. VCP pipe shall withstand the minimum following loads:

MINIMUM TEST LOADS

Nominal Size inches	<u>Load</u> lb./linear ft.	Nominal Size inches	<u>Load</u> lb./linear ft.
4	2000	24	4800
6	2000	27	5200
8	2200	30	5500
10	2400	33	5800
12	2600	36	6300
15	3100	39	6600
18	3600	42	7000
21	4200		

71-1.02B Ductile Iron Sewer Pipe

Ductile iron pipe shall be class 50 and comply with ANSI A 21.51 (AWWA C151). Pipe joints shall comply with the following:

Type of Joint

Rubber Gasket Push-on Joint Mechanical Joint Flanged Joint

Flanged Joint (Threaded Flanges)

Specifications

ANSI A21.11(AWWA C111) ANSI A21.11(AWWA C111) ANSI B16.1,B.16.2,and A21.10 (AWWA C 110) ANSI B2.1.

(1) Fittings

All rubber gasket, push-on, mechanical and flanged joint fittings for cast iron or ductile iron sewer pipe shall be manufactured in accordance with ANSI A21.10 (AWWA C110).

(2) Lining and Coating

When specified, the internal surfaces of ductile iron pipe and fittings shall be lined with a uniform thickness of cement mortar then sealed with a bituminous coating in accordance with ANSI A21.4 (AWWA C104). The outside surfaces of ductile iron pipe and fittings for general use shall be coated with a bituminous coating 1 mil thick in accordance with ANSI A21.6 or ANSI A21.51.

(3) Inspection and Certification

The manufacturer shall furnish a certified statement that the pipe has been manufactured and tested in accordance with these specifications.

(4) Polyethylene Encasement For External Corrosion

Protection

When loose polyethylene encasement for the protection of ductile pipes, fittings, valves, and appurtenances is specified in the Plans or in the Specifications, it shall be furnished and installed in accordance with the requirements of ANSI A21.5 (AWWA C105).

(5) Cast Iron Soil Pipe and Fittings

Cast iron soil pipe and fittings shall comply with ASTM A74.

71-1.02C Polyvinyl Chloride Sewer Pipe (PVC)

Polyvinyl Chloride Sewer Pipe shall conform to the requirements of ASTM D 3034, SDR 26 pipe (SOLID WALL).

All services and cleanout bends shall be long sweep.

71-1.02D Force Mains

Force mains shall be constructed of Polyvinyl Chloride (PVC) Pressure Pipe.

(1) Small Diameter PVC

Polyvinyl Chloride (PVC) Pressure Pipe, 4" - 12", shall conform to current AWWA C900 and have Underwriters' Laboratories, Factory Mutual and NSF approval. All parts of C900 not in conflict with these specifications shall apply in full force. PVC pipe shall be dimension ratio (DR) 18, class 150 for internal working pressures up to 130 psi and use DR 14, class 200 for internal working pressures between 130 and 180 psi. For internal working pressures greater than 180 psi, the pipe DR and class shall be determined by the Engineer.

(2) Large Diameter PVC

PVC pipe in sizes 14" through 36", shall be manufactured to AWWA C905 standards. Use dimension ratio (DR) 25, pressure rating (PR) 165 for internal working pressures up to 130 psi and use DR 21, PR 200 for internal working pressures between 130 psi and 180 psi. For internal working pressures greater than 180 psi, the pipe DR & PR shall be determined by the Engineer.

(3) Joints

Lengths of PVC shall be joined by a locked-in flexible elastomeric gasket coupling with bell and spigot configuration. Lubricants intended for use with PVC pipe shall be compatible with the plastic material and not adversely affect the quality of the sewage being transported. Joints between PVC pipe and

fittings shall be slip-on type or mechanical type as shown on the plans. Slip-on type joints shall be sealed by means of rubber rings designated for use with the type of pipe being installed.

Joints between PVC pipe and other types of pipe shall be made by means of the proper sized compression type adaptor.

(4) Fittings

Fittings shall be cast or ductile iron fittings, or fusion epoxy lined and coated fabricated steel fittings.

71-1.02E Cement Mortar

Cement mortar shall conform to the provisions in Section 65-1.06, "Joints".

71-1.02F Resilient Joint Material

Flexible compression joints in clay pipe and resilient **joint** materials to be used therein shall conform to the requirements of ASTM Designation: C 425.

71-1.02G Miscellaneous Iron and Steel

Miscellaneous iron and steel items shall conform to the provisions in Section 75, "Miscellaneous Metal."

71-1.02H Reinforcement

Reinforcement shall conform to the provisions in Section 52, "Reinforcement".

71-1.02I Concrete

Concrete shall conform to the provisions in Section 51, "Concrete Structures," and Section 90, "Portland Cement Concrete."

71-1.02J Material Submittals and Certificates Of Compliance

Material submittals and certificates of compliance shall be submitted by the contractor to the Engineer for all materials incorporated into the work.

71-1.03 Excavation and Backfill

Excavation and backfill for all sewers shall conform to the provisions of Section 19-3.01, "DESCRIPTION", 19-3.01A, "Trench Excavation", Section 19-3.06A(1), "Trench Bedding and Initial Backfill", and 19-3.06A(2), "Trench Intermediate Backfill", of the General Specifications.

If the trench is constructed in unsuitable material, as determined by the Engineer, the minimum trench width for PVC pipe shall be the outside diameter of the pipe plus 2.5 pipe diameters on either side of the pipe.

The pipe shall be laid in a trench excavated to the lines and grades designated by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel.

Suitable excavation shall be made to receive the bell of the pipe and the joint shall not bear upon the bottom of the trench. All adjustment to line and grade shall be made by scraping away or filling in with approved initial backfill material under the body of the pipe, and not by wedging or blocking. Shovel slicing is the preferred method of insuring that adequate initial backfill will support the bottom of the pipe.

Pipe may be laid in open trenches or in sections of open trenches connected by tunnels, as permitted by the Engineer.

The excavation shall be supported so that it will be safe, and that the ground alongside the excavation will not slide or settle, and all existing improvements, either on public or private property, will be fully protected from damage.

All supports shall be removed after construction is completed, unless otherwise directed by the Engineer, and shall be withdrawn in a manner that will prevent the caving of the sides of the excavation. All openings caused by the removal of supports shall be filled with suitable material properly compacted.

Trench bedding and initial backfill for P.V.C. gravity sewer pipes shall consist of crushed rock, conforming to the following grading: (See Section 19-3.06A(1)

SIEVE SIZE	PERCENT PASSING
3/4"	100%
(No.4)	0-5%

The crushed rock shall have a fractured face. Trench bedding and initial backfill for sewer forcemains shall be select material of sand or decomposed granite with 90% passing the ¾" sieve, and 100% passing the 1" sieve and having a sand equivalent of 20. It shall be free of clay or organic material and

shall be placed at 90% compaction. Backfill shall be placed to about the same elevation on both sides of the pipe to prevent unequal loading and displacement of the pipe and then tamped on both sides to obtain compaction.

71-1.04 EXISTING MANHOLES & FACILITIES

Existing manholes shall be adjusted to grade, remodeled or abandoned as shown on the plans and in accordance with the provisions in Section 15, "Existing Highway Facilities."

When designated on the plans, or directed by the Engineer, existing manhole frames and covers shall be reset on new structures.

71-1.04A Remodeling Existing Sewer Facilities

Where the Plans indicate construction involving existing sewer facilities, the Contractor shall provide temporary seals, enclosures, forced ventilation or other devices as may be necessary to prevent odor nuisance during construction. Sewers shall be open to the atmosphere only for a reasonable time necessary for construction.

Where a manhole bottom is to be remodeled on an existing sewer, the portion to be remodeled shall be removed to a minimum depth of 3 inches to permit construction of new channels and shelves. Sewage in new and remodeled manholes shall be controlled across the manhole in such a manner that sewage does not flow over concrete channels until they have cured for 24 hours. The controls shall prevent backup of sewage upstream from the manhole unless otherwise approved by the Engineer.

Where required by the Plans or Specifications, the Contractor shall submit shop drawings for control operations in accordance with section 5-1.02, "PLANS AND WORKING DRAWINGS", of the STANDARD SPECIFICATIONS.

71-1.04B Existing Facilities Containing Asbestos

Care shall be given in handling, working with, removing, disposing, or abandoning existing pipe and facilities containing asbestos such as asbestos cement pipe (transite pipe). Current federal and State laws and regulations govern how such pipe can handled and disposed of during construction procedures. The contractor shall follow applicable federal, state and Cal OSHA regulations while handling the pipe, and it will be his sole responsibility to adhere to these regulations. Only appropriately licensed hazardous waste contractors and subcontractors may do said asbestos work if the asbestos material is friable. The contractor will notify the county prior to doing this work and provide documentation that the material has been properly disposed of.

If any asbestos material is to be removed from the ground for disposal, it shall be considered a hazardous waste, and it shall be properly disposed of in accordance with all current federal, state, and local regulations.

71-1.05 PIPE LAYING

Pipe shall be protected during handling against impact shocks and free fall.

When the new facilities interfere with the existing flow of sewage, the Contractor shall provide satisfactory bypass facilities at his expense.

The pipe shall be laid without break upgrade from structure to structure, with bell end upgrade for bell and spigot pipe, unless otherwise permitted by the Engineer.

Whenever the sewer line horizontal radius is less than 400 feet, the Contractor shall use pipe lengths of 12 linear feet or less in order to have sufficient joints to make up the curve.

The Contractor (including all corporate officers) and employees shall not enter existing Placer County facilities requiring confined space entry unless all such entries comply with applicable U.S. and California OSHA confined spacer requirements. All entries into active sanitary sewer manholes are considered confined space entries. The Contractor is responsible to ensure that their personnel engaged in confined space entries are adequately trained for this procedure. The Entry Supervisor shall complete a Confined Space Entry Permit prior to confined space entry, and shall provide a copy of each completed Confined Space entry Permit to the ENGINEER upon

demand. Information regarding training for this procedure, certification of entry Supervisor, and the Confined Space Entry Permit can be obtained by calling the Sacramento District Office of CalOSHA at (916) 263-0704 or visiting their web site at www.dir.ca.gov.

All joints shall be cleaned and then sealed with the type of materials specified or required by the local municipality, utility, or owner. In the absence of such requirements the pipe shall be jointed with materials recommended by the pipe manufacturer for the purposes intended, and approved by the Engineer, in order to obtain a watertight joint against leakage and infiltration under all conditions of expansion, contraction, and settlement.

Whenever the work ceases for any reason, the end of the pipe shall be securely closed with a tight fitting plug or cover so as to prevent infiltration of water.

Whenever existing pipes are to be cut or abandoned, the open end of said pipes shall be securely closed by a permanent tight fitting plug and held in place by a wall of concrete plug not less than 1.0-foot thick.

Stoppers for pipes and branches left unconnected shall be made of the same material as the pipe or of resilient joint material conforming to Section 71-1.02G, "Resilient Joint Material", of the General Specifications. After placing the stopper, it shall be covered with a layer of sealant. The sealant shall be sufficiently fluid to insure free flow around the stopper.

The pipe shall be laid in conformity to the prescribed line and grade, with grade stakes set and each pipe length checked to grade lines. Three consecutive points shown on the same rate of slope shall be used in common, in order to detect any variation from a straight grade. In case any such discrepancy exists, the work shall be stopped and immediately corrected by the Contractor to the satisfaction of the Engineer. In addition, a string line, laser or other method approved by the Engineer shall be used to insure a straight alignment of pipe between manholes.

(1) <u>Horizontal Alignment</u> & Grade Tolerance

The horizontal alignment of the pipe shall be laid such that any point shall not vary more than 0.10 foot from the design alignment established by the Engineer. Note that no section of pipe may vary more than 0.50 degree (30 minutes) of arc in any

direction from the engineered design alignment. Immediately prior to back filling the trench the pipe flowline at any point shall not vary more than 0.05 foot above or 0.05 foot below the grade established by the Engineer.

Pipe shall be laid continuously upgrade with the bell of the pipe forward. Each length of pipe shall be laid on a firm bed and shall have a true bearing for the entire length between bell holes. No wedging or blocking up of the pipe will be permitted. Both bell and spigot and inside of pipe shall be clean before the joint is made and care shall be taken that nothing but the joint-making material enters the joints. Each section of pipe shall be laid true to line and grade in such a manner as to form a watertight, concentric joint with the adjoining pipe.

When, for any reason, pipe laying is discontinued for an hour or more, the open end of all lines shall be closed with a close fitting stopper.

All pipe jointing shall be of an approved type and shall be in accordance with accepted best practice and/or recommendations of the manufacturer and as approved by the Engineer. Chipped or cracked pipes shall be rejected.

(2) Locator Tape and Wire

Locator tape, as approved by the Engineer, will be placed above the pipe once the pipe and trench bedding and initial backfill have been placed. An American Public Works Association (APWA) detectable locator tape or "Alarm Tape" (2 inches minimum width) shall be positioned continuously at a minimum of 1 foot above the top of all types of gravity and pressure sewer pipe, including service sewers. For force mains or low pressure sewer pipe, both a locating wire and the locator tape are required. The locator wire, No. 10, direct burial, insulated copper cable, shall be taped continuously to the top of the pipe and accessible at all manholes and valve boxes. A continuity test shall be performed before project acceptance.

71-1.05A Connections To Existing Systems

No new sewer line shall be connected to an existing sewer system until the new sewer lines are balled, flushed and satisfactorily tested in accordance with Section 71-1.08, "Testing Sewers," of the General Specifications, unless, due to construction problems, it is necessary that such connection be made during construction. Should a construction connection be necessary a plug shall be placed at the connection to prevent water or debris from entering the existing sewer system. The plug

shall remain in place until construction is completed, and the Engineer has authorized its removal.

All debris and testing water shall be removed from the system prior to its entrance into the existing system. Should this not be possible, removal shall be at the nearest clean-out facility of the existing system.

71-1.05B Boring and Jacking

Where specified or permitted the sewer pipe shall be placed in a conductor pipe, which shall have been previously placed under a roadway, railroad, or other obstruction by boring and jacking. The equipment and method of operation shall be approved by the Engineer before proceeding with the work.

Excavation for the boring operation shall be the minimum necessary to satisfactorily complete the work. Bracing and shoring shall be adequate to protect workers and any adjacent structures or roadbed.

(1) Installation Of Conductor

The conductor shall closely follow the boring operation. The bored hole shall not be more than 0.1 foot larger in diameter than the outside diameter of the conductor. Guide rails shall be accurately set to line and grade to insure installation of the conductor within allowable limits. The conductor diameter shall be sufficient to allow adjustment of line and grade of the sanitary sewer pipe to meet allowable tolerances and to allow sand to be placed between the conductor and sewer pipe. Tunnel liner ribs shall have a minimum of 3 inches clearance from the sanitary pipe.

(2) Placing Sewer Pipe In Conductor

If necessary to establish correct line and grade, cement mortar shall be placed on the invert of the conductor. Sewer pipe, of which any part of the joint is larger in diameter than the barrel of the pipe, shall be strapped to 2 redwood or plastic skids with steel straps every five feet. The skids shall adequately support the center of each pipe section and shall be large enough to prevent any part of the joint from bearing on the conductor.

Sewer pipe with joints not larger than the pipe barrel shall be laid into place on 2 skids which have been securely fastened to the invert of the conductor or strapped to the barrel of the pipe. In lieu of skids, pipe with joints smaller than the pipe barrel shall be placed on a cement mortar bed which has been shaped to hold the pipe on correct line and grade.

Pipe section shall be joined outside the conductor and then slid into place.

The space between the sewer pipe and conductor shall be completely filled with clean dry sand blown into place, or sand which has been sluiced into place. The method of placing sand shall be subject to the Engineer's approval. The ends of the conductor pipe shall then be sealed, to prevent loss of the sand, by a method approved by the engineer.

(3) Filling Of Voids

Whenever in the opinion of the Engineer, the nature of the soil indicates the likelihood of ground loss which would result in a greater space between the outer surface of the conductor than herein allowed, as determined by the Engineer, the Contractor shall take immediate steps to prevent such occurrences by installing a jacking head extending at least 18 inches from the leading edge of the conduit and project not more than 1/2 inch beyond the conduit's out surface. Excavation shall not be made in advance of this jacking head.

Voids greater than allowable, as determined by the Engineer, shall be filled with sand, soil cement, or grout as directed by the Engineer. Where voids are suspected, the Engineer may direct the Contractor to drill the conduit, to pressure inject grout to refusal and then to repair the drilled hole. Grouting pressure shall not exceed 50 PSI at the nozzle.

When tunnel liner is used as the conductor, the space between the outer earth and the tunnel liner shall be pressure grouted to fill all voids. Grout shall consist of 1 part Portland Cement to 3 parts clean sand, by volume, and sufficient water to make it workable, all injected at a pressure as approved by the Engineer.

(4) Tolerances

Extreme care shall be exercised by the Contractor to maintain line and grade during jacking operations. Maximum deviation from stated line and grade of tunnel liner or conductor pipe shall be such that the sanitary sewer pipe can be adjusted a sufficient amount within the conductor pipe or tunnel liner to achieve the line and grade shown on the plans. This adjustment shall be made to all pipe deviating from line and grade and not merely to the sections of pipe nearest the end of the conductor or tunnel liner.

Directly jacked conductors will be allowed a maximum deviation of 0.25% (0.25 feet per 100 feet) from

intended line and grade unless more stringent tolerances are shown on the plans or indicated by the Engineer.

71-1.05C Service Sewers

Commercial and residential service sewers shall be constructed as shown on Plate U-17 of the Placer County Land Development Manual, and at the locations shown on the plans. Unless otherwise specified, they shall be 4 inches in diameter and constructed to the property line or 24 inches behind the utility trench adjoining and furthest from the right-of-way or easements, or the right-of-way or easement lines which provide the greatest length of sewer service. A regular manufactured wye fitting shall be used in the lateral sewer for each service sewer and shall be inclined upwards at a minimum angle of 30 degrees from the horizontal. The ends of all service sewers shall be securely sealed by stoppers in such a manner that the stoppers can be removed for extending the line without damage to the pipe. Service sewers shall be flushed and televised.

The depth of cover of the service sewer at the easement or property line shall be as noted on the plans.

An elevation given on the plans with a service sewer represents the invert elevation at the easement or property line. The elevation given shall be the maximum allowable elevation, and the minimum slope of the service shall be 2% (1/4 inch per foot). If the service is to be bored, the tolerance of the operation shall be within these limits.

Service sewers entering a manhole shall be set to an invert to crown match with the outgoing pipe or higher in the manhole with an inside drop connection. New service sewers shall not connect into existing sewers greater than 10 inches. They shall be connected to an existing or new manhole, or a new parallel sewer line will be constructed and the sewer service connected to the parallel line.

71-1.05D Curb Mark & Service Marker

Where concrete curb and/or gutter exists, or is to be constructed concurrently with the sewer facilities, the location of each service sewer shall be permanently indicated by inscribing the letter "S" in the face of the curb directly above the line when the service is perpendicular to the street centerline. Otherwise, the "S" mark for a skewed or angling service shall be placed at a right angle to the end of the service. When service sewers are installed in an existing street, the curb mark shall be placed at the time the service is installed to

assure proper location. In new subdivisions when the service sewers are installed before the curb is constructed, it shall be the Contractor's responsibility to establish the exact location of each service sewer and the curb and gutter Contractor's responsibility to place the "S" in the curb after it is poured. Rebar shall be placed at the end of the service as shown on Plate U-17 of the Placer County Land Development Manual.

71-1.06 CONCRETE PIPE ENCASEMENT, PIPE REINFORCEMENT & BACKFILL

Where shown on the plans or directed by the Engineer, sewer pipe shall be encased in concrete, reinforced concrete, or backfilled with concrete in accordance with the details shown on the plans.

Concrete for pipe encasement, pipe reinforcement, and backfill shall conform to provisions in Section 90-10, "Minor Concrete," of the Standard Specifications, except that the minor concrete shall contain not less than 470 pounds of cement per cubic yard.

71-1.06A Bracing and Shoring

As required by the "Trench Construction Safety Orders" of the California Construction Safety Orders of the Division of Occupational Safety and Health, bracing and shoring shall be installed in trenches of five feet or greater depth to insure the safety of workers and to protect and facilitate the work.

Bracing and shoring shall comply with Sections, 5-1.02A, "Trench Excavation Safety Plans", AND 7-1.01E, "Trench Safety", of the Standard Specifications.

The excavation shall be supported so that it will be safe and that the ground alongside the excavation will not slide or settle, and all existing improvements, either on public or private property, will be fully protected from damage.

All support shall be removed after construction is completed, unless otherwise directed by the Engineer, and shall be withdrawn in a manner that will prevent the caving of the side of the excavation. All openings caused by the removal of supports shall be filled with suitable material properly compacted.

71-1.07 SEWER STRUCTURES

New manholes and flushing branches for sewers shall be constructed in accordance with the details shown on the plans, as specified in this Section 71-1.07 and as directed by the Engineer.

Precast concrete pipe manholes shall conform to the provisions in Section 70, "Miscellaneous Facilities," except for measurement and payment.

Concrete for sewer structures shall be Six sack mix unless otherwise shown on the plans.

When the manhole is located in the pavement area, it shall not be constructed to final grade until the pavement has been completed.

The inside bottoms of existing manholes, where new connections are made, and of new manholes shall be shaped to provide channels conforming to the size and shape of the lower portion of the inlets and outlets of the manholes. The channels shall vary uniformly in size and shape from inlet to outlet.

No pipe shall project more than 50 mm (0.17-foot) into a manhole and in no case shall the bell of a pipe be built into the wall of a manhole or structure.

All concrete shall be cured for a period of not less than ten days after being placed and shall be protected from damage.

71-1.07A Manholes

Manholes shall be water-tiqht structures constructed by placing precast concrete sections on a poured concrete base or a precast manhole base. Precast manhole bases shall only be allowed where precast direction geometry matches all incoming and outgoing lines by +/- 4 degrees. When coating of the inside of manholes is specified by the project plans and specifications, the coating material chosen from a pre-approved list, shall be applied according to manufacture's specifications. When manhole coatings are used, the coating manufacturer may require grouting under the coating be an epoxy sand grout. Regular non-shrink grout may compatible.

71-1.07B The poured concrete base shall be made of Six sack mix with 1-1/2 inch maximum size aggregate.

All manholes shall be constructed on a non-yielding firm bed. The base of a manhole constructed in an engineered fill section shall either extend to one

foot below original ground, or a minimum of 95% relative compaction shall be obtained beneath the manhole. Cast-in-place manhole bases shall have an outside form and the concrete shall be vibrated. All precast manhole bases shall be constructed on a minimum of 8 inches of class 2 AB compacted to 95%. When water is encountered, or in the opinion of the Engineer, existing conditions are such that the excavated ground at the base of any manhole is not firm, additional baserock will be required prior to manhole base construction. The first manhole barrel shall be placed before the poured concrete base has set. Backfill around the outside of manholes shall be considered structural backfill and compacted to 95%.

71-1.07C

All precast manhole barrels and cones shall conform to ASTM Specification C-478.

All precast sections shall be joined together with pre-formed plastic gaskets.

Pre-formed plastic gaskets shall be equal to "Ram-Nek" and shall comply with the requirements of Federal Specification SS-S--210 "Sealing Compound, Pre-formed plastic for Pipe Joints", Type I, Rope Form.

71-1.07D

Where sewer lines pass through cast in place manholes, the pipe shall be laid continuously as a whole pipe. After the manhole base and precast sections have been placed and sufficient time has elapsed to allow all concrete and grout to set, the top half of the pipe within the manhole shall be carefully cut off and the sides mortared, as shown on Plate U-12 of the Placer County Land Development Manual. All channels so formed shall be checked with a template and shall form a smooth flowing channel at all flow depths.

In sewers of uniform size passing through cast in place manholes without a major change in direction or slope, the pipe shall be carried through the manhole on a uniform slope.

To provide flexibility for pipes entering and leaving a manhole, standard couplings shall be placed within the walls of the concrete base. The couplings are to be inspected and approved prior to backfilling. Flexible pipe to manhole connectors may be allowed when the connector is approved by the Engineer.

Lift holes shall be packed and sealed with Ram-Nek or Kent-Seal gasket material or equal. Before backfilling, all joints and lift holes must be grouted with non-shrink grout on the inside and outside of the manhole three inches on either side of

the joint. In addition, the manhole interior face shall be grouted with mortar such that all joints and edges are smooth. The exterior manhole face shall have a minimum thickness of 1/2 inch of mortar at the joint, and the grout shall be tapered to the face of the manhole three inches above and below the joint.

Cast in Place manhole bases shall cure a minimum of 14 days prior to any loading being placed on them unless provisions are made to shorten the cure time with add mixtures. The manufacturer of pre-cast manhole bases shall provide certification that the bases have cured longer than 28 days prior to their installation.

71-1.07E

Temporary covers of 3/8 inch steel plate of sufficient size to adequately cover the opening shall be placed on the cone until the pavement is completed. Suitable locating ribs shall be welded to the underside of the cover to hold it in place during the grading and paving operations. The top of the temporary cover shall have a skid proof surface as determined by the Engineer.

71-1.07F

The throat of the manhole (i.e. the top of the manhole cone to the manhole casting) shall be made of precast concrete rings of the proper inside diameter. For new construction the maximum depth of throat permitted shall be 12 inches excluding the frame.

71-1.07G

Manhole frame and covers shall conform to Plates U-10.1, U-13, and U-14 of the Standard Drawings of the Placer County Land Development Manual. When adjusting the manhole frame and covers to grade, the frame shall be wired to a straight edge of sufficient length to span the excavation, and the throat completed to the proper level. Whenever the space between the bottom of the frame and top of a ring is less than 3 inches, the void may be filled with concrete, poured against a suitable form on the inside of the structure.

In snow areas the grade of the manhole cover shall be 1/2 to 1 inch below pavement grade.

When the manhole is in the shoulder area or a paved taper, the pavement shall be extended 25 feet to each side of the manhole to meet the existing pavement and the manhole shall be 1/2 inch below finished grade.

Manholes, located in off-road easements shall be a minimum of twelve inches above the natural ground surface, and above anticipated high water levels.

71-1.07H

When adjusting an existing manhole to grade and the total depth of the throat from the top of the frame

to the bottom of the throat exceeds 24 inches, the upper portion of the manhole shall be removed to the first full size manhole section. The upper portion shall then be reconstructed to grade as outlined above in Sections 71-1.07F and 71-1.07G.

71-1.07I

Before any work is started on adjusting or repairing a manhole, the channels in the base shall be covered with strips of wood and the entire base covered with a heavy piece of canvas. This cover shall be kept in place during all work. Upon completion of the work the wood strips and the canvas shall be removed from the manhole allowing no debris to fall or remain in the manhole.

71-1.07J

Any new structure to be placed or existing structure to be adjusted shall be temporarily covered with a heavy steel plate below the grading plane before subsequent layers are placed thereon. After completion of paving the structure shall be raised to grade.

71-1.08 TESTING SEWERS

All sewers and sewer services shall be tested by the Contractor and observed by the Engineer for obstructions and leakage as provided for in the General Specifications. Forty-eight (48) hours notice shall be given to the Engineer prior to all sewer and manhole testing. The amount of leakage shall not exceed the rate allowed by the General Specifications. Where the leakage of the sewer exceeds the above amount, it shall be corrected immediately and the amount of leakage reduced to a quantity within the specified amount. In any case, the Contractor shall stop any individual leaks that may be observed.

Testing of the sewer lines for obstructions and leakage shall take place as required in Section 71-1.08A, "Tests for Obstructions" and 71-1.08B, "Tests for Leakage", of the General Specifications.

Testing of manholes shall take place after the manholes have been set to grade and are complete in place. Additional testing may be required by the Engineer.

In addition to testing as required in Section 71-1.08, "Testing Sewers", of the General Specifications the following will be required for Polyvinyl Chloride (PVC) sewer pipe only:

After balling and flushing and prior to acceptance of the project by the County, the Contractor shall pull a deflection gage or mandrel through each section of pipe. The gage shall be designed to resist movement through the pipe when a deflection of 3 percent of the base inside diameter of the pipe is reached as shown in the following table:

Pipe Sizes	Mandrel Diameter
Inches	Inches
6	5.60
8	7.50
10	9.37
12	11.15
15	13.65
Pipe Sizes	Mandrel Diameter-Inches
_	SDR 26
6	SDR 26 5.444
- 6 8	
	5.444
8	5.444 7.263

71-1.08A Tests For Obstructions

After construction to subgrade and after manholes are raised to grade all sewer lines shall be cleaned by balling and flushing. The ball shall be controlled by a tag line or rope, or sewer rods, and permitted to move slowly through the sewer. The ball shall be of the inflatable grooved type and inflated to have a snug fit in the pipe.

A swivel will be placed between the rope and the ball in order to allow the ball to rotate and cause the proper flushing action.

In lieu of balling and flushing, the contractor can use a high pressure sewer cleaning machine to clean the new sewer lines provided the cleaning head is approved for PVC pipe and the hose is retracted no faster than one foot per second.

Any obstructions or irregularities shall be removed or repaired by the Contractor. All testing, cleaning, and repairing shall be done to satisfaction of the Engineer. The Contractor shall provide all necessary labor, materials, and equipment for the test and shall dispose of all waste, including water.

71-1.08B Tests For Leakage

After laying, backfilling, and compaction to subgrade in accordance with General Specifications and Special Provisions, all sewers shall be tested for leakage. Testing will be done as determined by the Engineer and in accordance with the provisions of these General Specifications. The Contractor shall furnish all labor, tools, and equipment necessary to make the tests and to perform any work incidental thereto. The Contractor shall take all necessary precautions to prevent any joints from drawing while the pipelines or their appurtenances are being He shall correct any excess leakage and tested. repair any damage to the pipe and its appurtenances or to any structures indicated by or resulting from one of the following tests:

(1) Air Test For Leakage

The Contractor shall test all sewers by means of the air test specified herein unless otherwise directed by the Engineer. The length of line tested at one time shall be limited to the length between adjacent manholes or flushing The pressure gauge used shall be branches. supplied by the Contractor, shall have a minimum division of 0.25 PSI, and shall have an accuracy of 0.10 PSI. Accuracy and calibration of the gauge shall be certified by a reliable testing firm at six month intervals or when requested by the Engineer. In addition, the Engineer may compare the Contractor's gauge with County owned gauge at any time.

Air test procedures shall be as follows:

Pressurize the test section to 3.5 PSI and hold above 3.0 PSI for not less than five minutes. Add air if necessary to keep the pressure above 3.0 PSI. At the end of this five minute saturation period, note the pressure (must be 3.0 PSI min.) and begin the time period. During this period the airline between the air supply and the gasket shall be bled off or disconnected from the air supply.

If the pressure drops 0.5 PSI in less than the time given in the following table the section of pipe shall not have passed the test.

LATERAL SIZE	MINIMUM TIME
INCHES	IN SECONDS
4	122
6	184
8	245
10	306
12	367
15	460

For larger diameter pipe, use the following formula: Minimum time in seconds = 370 x pipe diameter in feet.

When the prevailing ground water is above the sewer being tested, air pressure shall be increased 0.43 PSI for each foot the water table is above the outlet flowline of the downstream sewer manhole. The elevation of the water table will be taken as the highest water table elevation along the section of pipe being tested. If the time for the pressure to drop 0.5 PSI is 125 percent or less of the time given in the table, the line shall immediately be repressurized to 3.0 PSI and the test repeated.

For 8 inch and smaller pipe only, if, during the 5 minute saturation period, pressure drops less than 0.5 PSI after the initial pressurization and air is not added, the section undergoing the test shall have passed.

If the test is not passed, all leaks shall be found and repaired to the satisfaction of the Engineer.

Sewer Services shall be considered part of the lateral to which they are connected and no adjustment of the test shall be allowed to compensate for the smaller diameter.

(2) Hydrostatic Test

For gravity sewers, the hydrostatic test may be used in lieu of the air test only when authorized by the Engineer.

All sections of sewer shall be tested by inserting stoppers in the lower end of the sewer, the inlet sewer of the upper manhole, and any side sewers at intervening manholes, and filling the pipe and manholes with water to a point in the upper manhole not less than 5 feet above the invert of the pipe or prevailing ground water elevation, whichever is higher. The maximum length of section tested shall be 1,000 feet.

The line shall be filled approximately 4 hours

prior to testing. It shall be tested for at least 2 hours, maintaining the head specified above by measured additions of water. The sum of these additions shall be the leakage for the test period.

Maximum allowable head of water above any portion of sewer being tested shall be 15 feet. Where the difference in elevation between successive manholes exceeds 15 feet, a test tee shall be installed between manholes, and testing shall be carried on between the tee and the manhole.

The allowable leakage shall not exceed 240 milliliters per minute, per 0.066 gallon per minute, per inch diameter, per 1,000 feet of main line sewer being tested. This is equivalent to 500 gallons per day, per inch diameter, per mile.

Where the actual leakage in a section tested exceeds the allowable, the Contractor shall remedy it before the sewer is accepted. If the leakage is less than allowable and leaks are observed, such leaks shall be repaired.

When underground overflow tanks are constructed as part of a sewage lift station, the tanks shall be tested in accordance with the hydrostatic test procedures noted above. Leakage shall not exceed

71-1.08C Force Mains and Low Pressure Sewers

Each section of pipe to be tested shall be slowly filled with water and all air expelled from the pipe. After the pipe has been filled, it shall be allowed to set for a period of not less than 24 hours.

The pipe shall then be refilled to the original water level and subjected to a pressure of not less than 100 pounds per square inch or the service pressure plus 50 pounds per square inch, whichever is greater, for a period of two hours.

All exposed joints, bends, angles, and fittings shall be closely examined during the test. Any part of the line which proves to be defective shall be replaced and the line retested.

The maximum allowable leakage shall not exceed 30 gallons per 24 hours per mile of pipe per inch of nominal diameter.

71-1.08D Manholes

Manholes shall be tested for leakage by the following vacuum procedure:

- (1) The test shall be done after assembly of the manhole, but before backfill.
- (2) All lift holes shall be filled with non-shrink grout.
- (3) All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.
- (4) The test head shall be placed inside the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations. The pressure gage shall be located can be easily read by the inspector without entering the excavation.
- (5) A vacuum of 10" of mercury (approx. 5 PSI) shall be drawn and the vacuum pump shut off with the valves closed. The time shall be measured for the vacuum to drop to 9". The manhole shall pass if the time is greater than 60 sec. for a 48" manhole, 75 sec. for a 60" and 90 sec. for a 72".
- (6) If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
- (7) The contractor is to perform the test and supply all test equipment.
- (8) After passing tests, the manhole joints shall then be mortared inside and out.

71-1.08E TV Inspection

All sewer pipes, service sewers (from the property line cleanout to the wye) and all manholes shall be inspected, after backfill, by means of an inline sewer TV camera. The TV camera used shall have VHS color with a 270 degree articulating lens. All sewer services shall be inspected from the public sewer line to the property line cleanout for detecting defects such as offset joints, sags, etc. Care shall be taken to make sure that the channel of all manholes are televised as well as the first few feet of the sewer pipe leaving the manhole.

The costs of providing this inspection shall be the responsibility of the Contractor and the work shall

be done by private forces, <u>not</u> Placer County. All records and video tapes are to be turned in to and become the property of the Department of Facility Services. The tapes must be compatible with the Department's viewing equipment. Any irregularities in construction or grade shall be corrected prior to acceptance of the project. In addition all sewer lines are subject to viewing with a TV camera by Department of Facility Services personnel.

Prior to televising sewer pipes, service sewers and manholes, sufficient clean water will be placed into the pipes to fill all sags and dips. A water stream shall be placed into the pipe until it enters the next downstream manhole. During the televising of the pipes a weighted target, of known size, shall be fixed in front of the TV camera to allow the measurement of the depth of any standing water.

Any deviations from the plans or specifications noted by such viewing shall be corrected by the Contractor at his expense.

In no event will sags or dips in the pipe or manholes creating standing water deeper than 0.05 ft. be considered an acceptable deviation. Offset joints due to rubber "band" couplings which are greater than one half the pipe wall thickness will also be considered an unacceptable deviation.

71-1.09 TRENCH RESURFACING

Trenches shall be resurfaced in accordance with Plates U-26.1, U-26.2 and U-27 through U-29 of the Placer County Land Development Manual.

71-1.09A Clean Up

During the progress of the work, the Contractor shall keep the entire job site in a clean and orderly condition. Excess or unsuitable backfill material, broken pipe, or other waste material shall be removed from the job site. Spillage resulting from hauling operations along or across existing streets or roads shall be removed immediately by the Contractor. All gutters and roadside ditches shall be kept clean and free from obstructions. Any deviation from this practice shall have prior approval from the Engineer.

SECTION 72: SLOPE PROTECTION

The Standard Specifications are incorporated herein by this reference, except as noted:

72-2 ROCK SLOPE PROTECTION

72-2.04	MEASUREMENT (not adopted)
72-2.05	PAYMENT (not adopted)

72-4 CONCRETE SLOPE PROTECTION, GUTTER LINING, DITCH LINING, AND CHANNEL LINING

72-4.05	MEASUREMENT (not adopted)
72-4.06	PAYMENT (not adopted)

72-5 CONCRETED-ROCK SLOPE PROTECTION

72-5.05	MEASUREMENT	(not adopted)
72-5.06	PAYMENT (not	adopted)

72-6 SLOPE PAVING

72-6.05	MEASUREMENT (not adopted)
72-6.06	PAYMENT (not adopted)

SECTION 73: CONCRETE CURBS AND SIDEWALKS

The Standard Specifications are incorporated herein by this reference, except as noted:

73-1.05 EXPANSION AND WEAKENED PLANE JOINTS

Expansion Joints

Expansion Joints shall be constructed as shown on the approved plans or as specified herein. Transverse expansion joints of an approved type 0.5-inch wide shall be installed to the full depth of the placed concrete sidewalk, curb or gutter. These joints shall be placed at a maximum of 24-foot intervals or at the location where every 4th weakened plane joint would be required by the criteria set forth in the Weakened Plane Joint section. Additionally, expansion joints shall be located at all curb returns and other transition points.

Joint filler shall be installed to the full depth of the expansion joint and shall completely fill the entire constructed joint. In areas where existing sidewalks are being replaced and where obstacles such as utility poles extend through the walkway, the Engineer may require joint filler to be placed at the contact point between the new walkway and the obstacle.

Weakened Plane Joints

Weakened Plane Joints shall be constructed as shown on the approved plans or as specified herein. Weakened plane joints shall be constructed with a concrete tool 1-1/2 inches deep in all concrete sidewalks, curbs and gutters prior to finishing work and marked. At final finishing, the finished joints shall be completed using an appropriate concrete tool to create a rounded mark not to exceed ½-inch in depth at the location of the marked joint.

These joints shall be placed at intervals no greater than 6-feet apart. In areas where the sidewalk is less than 6-feet wide, the joints shall be located a distance apart equal to the width of the sidewalk or as approved by the Engineer.

73-1.07 MEASUREMENT (not adopted)
73-1.08 PAYMENT (not adopted)

SECTION 74: PUMPING PLANT EQUIPMENT

The Standard Specifications are incorporated herein by this reference, except as noted:

74-1 GENERAL

74-1.08 PAYMENT (not adopted)

74-2 DRAINAGE PUMPING EQUIPMENT

74-2.08 PAYMENT (not adopted)

74-3 PUMPING PLANT ELECTRICAL EQUIPMENT

74-3.12 PAYMENT (not adopted)

SECTION 75: MISCELLANEOUS METAL

The Standard Specifications are incorporated herein by this reference, except as noted:

75-1.06	MEASUREMENT	(not adopted)
75-1.07	PAYMENT (not	adopted)

SECTION 76: WATER

76-1.01 DESCRIPTION

This work shall consist of laying water pipe and constructing water structures and appurtenances as shown on the plans, in accordance with these General Specifications, the Special Provisions and as directed by the Engineer.

These specifications apply only in those areas in which a water system is subject to inspection, operations and maintenance, and jurisdiction by Placer County, a County Service Area, or a County Assessment District. In all other cases the specifications of the applicable water purveyor will govern.

The current edition of the Placer County Water Agency Specifications is incorporated herein except as per these General Specifications.

The type of water pipe and water structures will be designated in the contract items.

76-1.02 MATERIALS

Materials shall be as shown on the plans and specified in the Special Provisions conforming to the requirements of the General Specifications.

76-1.03 EXCAVATION AND BACKFILL

Excavation and backfill shall conform to the provisions of Section 19-3.01A, "Trench Excavation", Section 19-3.06A(1), "Trench Bedding and Initial Backfill", Section 19-3.06A(2), "Trench Intermediate Backfill", and Sec. 19-3.06A(3), "Trench Compaction" of the General Specifications.

76-1.04 PIPE LAYING

Pipe shall be laid in conformity to the lines and grades approved by the Engineer.

Water lines shall be installed at a depth which will provide a minimum cover of 30 inches over the top of the pipe as measured from the finished grade.

76-1.05 WATER STRUCTURE

Any new structure to be placed or existing structure to be adjusted shall be temporarily covered below the grading plane before subsequent layers are placed thereon. After completion of paving the structure shall be raised to grade.

Locating tape shall be placed above the pipe once the pipe and the trench bedding and initial backfill have been placed. An American Public Works Association

(APWA) detectable locator tape or "Alarm Tape" (2 width) shall be positioned inches minimum continuously at a minimum of 1 foot above the top of all types of pipe. A locator wire, No. 10, direct burial, insulated copper cable, shall be taped continuously to the top of the pipe and accessible at all structures and valve boxes. Care shall be given in handling, working with, removing, disposing, or abandoning existing pipe or appurtenances containing asbestos such as asbestos cement pipe (transite pipe). Current federal and state laws regulations govern how such pipe can be handled and disposed of during construction procedures. contractor shall follow all applicable federal, state, and Cal OSHA regulations while handling the pipe and it will be his sole responsibility to adhere to these regulations. Only appropriately licensed hazardous waste contractors and subcontractors may do said asbestos work. The contractor will notify the county prior to doing this work and provide documentation that the material has been properly disposed of.

All such asbestos pipe shall remain in the ground unless otherwise specified in the special provisions. If any of it is to be removed from below the ground for disposal, it shall be considered a hazardous waste, and it shall be properly disposed of in accordance with all current federal, state, and local regulations.

Unless otherwise specified in the special provisions, full compensation for the work involved in working with, removing, handling, disposing, payment of all applicable fees, obtaining all permits and licenses, and all labor, equipment, materials, and appurtenances required, shall be considered as included in the prices paid for the various items of work and no additional compensation will be allowed therefore.

SECTION 77 - 79: (BLANK)

RIGHT OF WAY AND TRAFFIC CONTROL FACILITIES

SECTION 80: FENCES

The Standard Specifications are incorporated herein by this reference, except as noted:

80-3 TYPES BW AND WM FENCE

80-3.03	MEASUREMENT (not adopted)
80-3.04	PAYMENT (not adopted)

80-4 CHAIN LINK FENCE

80-4.03	MEASUREMENT (not adopted)
80-4.04	PAYMENT (not adopted)

SECTION 81: MONUMENTS

The Standard Specifications are incorporated herein by this reference, except as noted:

81-1.05	MEASUREMENT (not adopted)
81-1.06	PAYMENT (not adopted)

SECTION 82: MARKERS & DELINEATORS

The Standard Specifications are incorporated herein by this reference, except as noted:

82-1.05	MEASUREMENT (not adopted)
82-1.06	PAYMENT (not adopted)

SECTION 83: RAILINGS AND BARRIERS

The Standard Specifications are incorporated herein by this reference, except as noted:

83-1 RAILINGS

83-1.03 83-1.04	MEASUREMENT (not adopted) PAYMENT (not adopted)
	83-2 BARRIERS
83-2.03 83-2.04	MEASUREMENT (not adopted) PAYMENT (not adopted)

SECTION 84: TRAFFIC STRIPES AND PAVEMENT MARKINGS

The Standard Specifications are incorporated herein by this reference, except as noted:

84-2 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

84-2.05 MEASUREMENT (not adopted) 84-2.06 PAYMENT (not adopted)

84-3 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

84-3.06 MEASUREMENT (not adopted) 84-3.07 PAYMENT (not adopted)

SECTION 85: PAVEMENT MARKERS

The Standard Specifications are incorporated herein by this reference, except as noted:

85-1.08 MEASUREMENT (not adopted) 85-1.09 PAYMENT (not adopted)

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

The Standard Specifications are incorporated herein by this reference, except as noted:

86-8 PAYMENT (not adopted)

SECTION 87: (BLANK)

MATERIALS

SECTION 88: ENGINEERING FABRICS

The Standard Specifications are incorporated herein by this reference, except as noted:

88-1.05 MEASUREMENT AND PAYMENT (not adopted)

SECTION 89: (BLANK)

SECTION 90: PORTLAND CEMENT CONCRETE

90-1 GENERAL

90-1.01 DESCRIPTION

Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.

The Contractor shall determine the mix proportions for concrete in conformance with these specifications. Unless otherwise specified, cementitious material shall be a combination of cement and mineral admixture. Cementitious material shall be either:

- 1. "Type IP (MS) Modified" cement; or
- 2. A combination of "Type II Modified" portland cement and mineral admixture; or
- 3. A combination of Type V portland cement and mineral admixture.

Type III portland cement shall be used only as allowed in the special provisions or with the approval of the Engineer.

Seven Sack mix concrete shall contain not less than 658 pounds of cementitious material per cubic yard.

Six sack mix concrete shall contain not less than 590 pounds of cementitious material per cubic yard.

Five sack mix concrete shall contain not less than 564 pounds of cementitious material per cubic yard.

Four sack mix concrete shall contain not less than 376 pounds of cementitious material per cubic yard.

Minor concrete shall contain not less than 548 pounds of cementitious material per cubic yard unless otherwise specified in these specifications or the special provisions.

Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic yard of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content pounds/CY	
Concrete designated by compressive strength: Deck slabs and slab spans of bridges Roof sections of exposed top box culverts Other portions of structures	674 min., 801 max 674 min., 801 max 590 min., 801 max	
Concrete not designated by compressive strength: Deck slabs and slab spans of bridges Roof sections of exposed top box culverts Prestressed members Seal courses Other portions of structures	674 min. 674 min. 674 min. 674 min. 590 min.	
Concrete for precast members	590 min., 927 max.	

Whenever the 28-day compressive strength shown on the plans is greater than 3,600 pounds per square shall the concrete be designated inch, If the plans show a 28-day compressive strength. compressive strength that is 4,000 pounds per square inch or greater, an additional 14 days will be allowed to obtain the specified strength. 28-day compressive strengths shown on the plans that are 3,600 pounds per square inch or less are shown information only and are design not requirement for acceptance of the concrete.

Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.

Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, mineral admixture shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

If any concrete has a cementitious material, portland cement, or mineral admixture content that

is less than the minimum required, the concrete shall be removed.

The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENT

Unless otherwise specified, cement shall be either "Type IP (MS) Modified" cement, "Type II Modified" portland cement or Type V portland cement.

"Type IP (MS) Modified" cement shall conform to the requirements for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate and uniform blend of Type II cement and not more than 35 percent by mass of mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

"Type II Modified" portland cement shall conform to the requirements for Type II portland cement in ASTM Designation: C 150.

In addition, "Type IP (MS) Modified" cement and "Type II Modified" portland cement shall conform to the following requirements:

- A. The cement shall not contain more than 0.60 percent by mass of alkalis, calculated as the percentage of Na₂O plus 0.658 times the percentage of K₂O, when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;
- B. The autoclave expansion shall not exceed 0.50 percent; and
- C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.

Type III and Type V portland cements shall conform to the requirements in ASTM Designation: C 150 and the additional requirements listed above for "Type II Modified" portland cement, except that when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075 percent.

Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.

Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.

Adequate facilities shall be provided to assure that cement meeting the provisions specified in this Section 90-2.01 shall be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper, in conformance with California Test 125.

If cement is used prior to sampling and testing as provided in Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

90-2.02 AGGREGATES

Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

Natural aggregates shall be thoroughly and uniformly washed before use.

The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.

Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."

Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, $D_{\rm f}$, of the fine aggregate is 60, or greater, when tested for durability in conformance with California Test 229.

If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."

If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed.

If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed.

The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply.

No single Cleanness Value, Sand Equivalent or aggregate grading test shall represent more than 325 cubic yards of concrete or one day's pour, whichever is smaller.

When the source of an aggregate is changed, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates.

90-2.02A Coarse Aggregate

Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, crushed air-cooled iron blast

furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.

Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value Operating Range	227	75 min.
Contract Compliance	227	71 min.

In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

- 1. coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested by California Test 227; and
- 2. prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.02B Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.

Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory ^a
Mortar Strengths Relative	515	95%, min.
to Ottawa Sand		
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

a Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

In lieu of the above Sand Equivalent requirements, a limit Equivalent "Operating Range" minimum and a Sand Equivalent "Contract Compliance" limit of 68 minimum will be used to determine the acceptability of the fine aggregate Contractor furnishes a Certificate of Compliance, as 6-1.07, "Certificates provided in Section Compliance, certifying that:

- 1. fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
- 2. prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.03 WATER

In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO_4 , when tested in conformance with California In restressed concrete work, the water Test 417. for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO₄, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when

tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as SO_4 , when tested in conformance with California Test 417.

In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ($Na_2O + 0.658 \ K_2O$) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ± 0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

Admixture materials shall conform to the requirements in the following ASTM Designations:

- A. Chemical Admixtures—ASTM Designation: C 494.
- B. Air-entraining Admixtures—ASTM Designation: C 260.
- C. Calcium Chloride-ASTM Designation: D 98.
- D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C 618; silica fume conforming to the requirements in ASTM Designation: C 1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

Unless otherwise specified in the special provisions, mineral admixtures shall be used in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a

primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
1 1/2" x 3/4"	1"	19 - 41
1" x No. 4	3/4"	52 - 85
1" x No. 4	3/8"	15 - 38
1/2" x No. 4	3/8"	40 - 78
3/8" x No. 8	3/8"	50 - 85
Fine Aggregate	No. 16	55 - 75
Fine Aggregate	No. 30	34 - 46
Fine Aggregate	No. 50	16 - 29

Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

90-3.02 COARSE AGGREGATE GRADING

The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

	Percentage Passing Primary Aggregate Nominal Sizes							
	1 1/2" x 3/4"		1" x No. 4		1/2" x No. 4		3/8" x No. 8	
	Operat	Contract	Operat	Contract	Operat	Contract	Operat	Contract
Sieve	ing		ing		ing		ing	
Sizes	Range	Compliance	Range	Compliance	Range	Compliance	Range	Compliance
2"	100	100	_	_	_	_	_	_
1 1/2	88-100	85-100	100	100	_	_	_	_
II .								
1"	x ± 18	X ± 25	88-100	86-100	_	_	_	_
3/4"	0-17	0-20	X ± 15	X ± 22	100	100	_	_
1/2"	1	_	_	_	82-100	80-100	100	100
3/8"	0-7	0-9	X ± 15	X ± 22	X ± 15	X ± 22	X ± 15	X ± 20
No. 4	1	_	0-16	0-18	0-15	0-18	0-25	0-28
No. 8	1	_	0-6	0-7	0-6	0-7	0-6	0-7

In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

Coarse aggregate for the 1 1/2 inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

When the one inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 1 inch x No. 4 primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

Fine aggregate shall be graded within the following limits:

	Percentage Passing			
Sieve Sizes	Operating	Contract		
	Range	Compliance		
3/8"	100	100		
No. 4	95-100	93-100		
No. 8	65-95	61-99		
No. 16	X ± 10	X ± 13		
No. 30	X ± 9	X ± 12		
No. 50	X ± 6	X ± 9		
No. 100	2-12	1-15		
No. 200	0-8	0-10		

In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the No. 16 sieve and the total percentage passing the No. 30 sieve shall be between 10 and 40, and the difference between the percentage passing the No. 30 and No. 50 sieves shall be between 10 and 40.

Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."

The combined aggregate grading, except when specified otherwise in these specifications or the special provisions, shall be either the 1 1/2 inch, maximum grading, or the one inch, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

	Percentage Passing				
Sieve	1 1/2 inch	1 inch	1/2 inch	3/8 inch	
Sizes	Max.	Max.	Max.	Max.	
2"	100	_	_	_	
1 1/2"	90-100	100	_	_	
1"	50-86	90-100	_	_	
3/4"	45-75	55-100	100	_	
1/2"	_	_	90-100	100	
3/8"	38-55	45-75	55-86	50 - 100	
No. 4	30-45	35-60	45-63	45 - 63	
No. 8	23-38	27-45	35-49	35 - 49	
No. 16	17-33	20-35	25-37	25 - 37	
No. 30	10-22	12-25	15-25	15 - 25	
No. 50	4-10	5-15	5-15	5 - 15	
No. 100	1-6	1-8	1-8	1 - 8	
No. 200	0-3	0-4	0-4	0 - 4	

Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

90-4 ADMIXTURES

90-4.01 GENERAL

Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined by California Test 415, shall not be used in prestressed or reinforced concrete.

Calcium chloride shall not be used in concrete except when otherwise specified.

Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be from the same source and of the same percentage.

Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

90-4.02 MATERIALS

Admixture materials shall conform to the provisions in Section 90-2.04, "Admixture Materials."

90-4.03 ADMIXTURE APPROVAL

No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.

Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.

When the Contractor proposes to use an admixture of a type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.

If a mineral admixture is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the manufacturer or supplier of the mineral admixture. If the mineral admixture is used in ready-mix concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE

When the use of a chemical admixture or calcium chloride is specified, the admixture shall be used at the dosage specified, except that if no dosage is specified, the admixture shall be used at the dosage

normally recommended by the manufacturer of the admixture.

Calcium chloride shall be dispensed in liquid, flake, or pellet form. Calcium chloride dispensed in liquid form shall conform to the provisions for dispensing liquid admixtures in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures."

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

The Contractor will be permitted to use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

- A. When a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by mass, except that the resultant cementitious material content shall be not less than 506 pounds per cubic yard, and
- B. When a reduction in cementitious material content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.

Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive

tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate as provided in Section 40-1.015, "Cement Content."

90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material.

The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 618.

The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:

- A. The minimum amount of cement shall not be less than 75 percent by mass of the specified minimum cementitious material content;
- B. The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:
 - 1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix;
 - When the calcium oxide content of a amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix;
 - 3. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix
- C. The total amount of mineral admixture shall not exceed 35 percent by mass of the total amount

of cementitious material to be used in the mix. Where Section 90-1.01, "Description," specifies a maximum cementitious content in pounds per cubic yard, the total mass of cement and mineral admixture per cubic yard shall not exceed the specified maximum cementitious material content.

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

admixtures Chemical and air-entraining admixtures shall be dispensed in liquid form. liquid admixtures Dispensers for shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ±5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at proportioning operations are controlled to permit a visual check of batching accuracy prior to Each measuring unit shall be clearly discharge. marked for the type and quantity of admixture.

Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix.

When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit

are not emptied from the dispenser into each batch of concrete.

Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

Liquid admixtures requiring dosages greater than one-half gallon per cubic yard shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

Special admixtures, such as "high range" water reducers that may contribute to a high rate of slump loss, shall be measured and dispensed as recommended by the admixture manufacturer and as approved by the Engineer.

90-4.11 STORAGE, PROPORTIONING, AND DISPENSING OF MINERAL ADMIXTURES

Mineral admixtures shall be protected from exposure to moisture until used. Sacked material shall be piled to permit access for tally, inspection and identification for each shipment.

Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures in order to prevent any but the specified mineral admixtures from entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper.

Mineral admixtures shall be incorporated into concrete using equipment conforming to the requirements for cement weigh hoppers, and charging and discharging mechanisms in ASTM Designation: C 94, in Section 90-5.03, "Proportioning," and in this Section 90-4.11.

When concrete is completely mixed in stationary paving mixers, the mineral admixture shall be weighed in a separate weigh hopper conforming to the provisions for cement weigh hoppers and charging and discharging mechanisms in Section 90-5.03A, "Proportioning for Pavement," and the mineral admixture and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the mineral admixture is not

weighed in a separate weigh hopper, the Contractor shall provide certification that the stationary mixer is capable of mixing the cement, admixture, aggregates and water uniformly prior to discharge. Certification shall contain the following:

- A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;"
- B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
- C. The mixer rotation speed and time of mixing prior to discharge that are required to produce a mix that meets the requirements above.

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and also that the various sizes shall not become intermixed before proportioning.

Aggregates shall be stored or stockpiled and handled in a manner that shall prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

- A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
- B. Contamination of aggregates by contact with the ground shall be positively prevented. The

Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. method of handling aggregates that results in breakage of particles excessive shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

90-5.02 PROPORTIONING DEVICES

Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and mineral admixture for one batch of concrete is a single operation of a switch or starter.

Proportioning devices shall be tested at the expense of the Contractor as frequently as the Engineer may deem necessary to ensure their accuracy.

Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the mass of each batch of material shall not vary from the mass designated by the Engineer by more than the tolerances specified herein.

Equipment for cumulative weighing of aggregate shall have a zero tolerance of ±0.5 percent of designated total batch mass of the aggregate. systems with individual weigh hoppers for various sizes of aggregate, the zero tolerance shall ±0.5 percent of the individual batch mass designated for each size of aggregate. Equipment for cumulative weighing of cement and mineral admixtures shall have a zero tolerance ±0.5 percent of the designated total batch mass of the cement and mineral admixture. Equipment for weighing cement or mineral admixture separately shall have a zero tolerance of ±0.5 percent of their designated individual batch masses. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated mass or volume.

The mass indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

- A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch mass of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch masses; and
- Cement shall be within 1.0 percent of its В. designated batch When mass. weighed individually, mineral admixture shall be within 1.0 percent of its designated batch mass. When mineral admixture and cement are permitted to weighed cumulatively, cement shall be weighed first to within 1.0 percent of its designated batch mass, and the total for cement mineral admixture shall be within 1.0 percent of the sum of their designated batch masses; and
- C. Water shall be within 1.5 percent of its designated mass or volume.

Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, mineral admixture, or cement plus mineral admixture and aggregates shall not exceed that of commercially available scales having single graduations indicating a mass not exceeding the maximum permissible mass variation above, except that no scale shall be required having a capacity of less than 1,000 pounds, with one pound graduations.

90-5.03 PROPORTIONING

Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement,

mineral admixture, and water as provided in these specifications. Aggregates shall be proportioned by mass.

At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.

Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

Bulk "Type IP (MS) Modified" cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

Bulk cement and mineral admixture may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and mineral admixture are weighed cumulatively, the cement shall be weighed first.

When cement and mineral admixtures are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the mineral admixture shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material weighing device. The cement and the mineral admixture shall be discharged into the mixer simultaneously with the aggregate.

The scales and weigh hoppers for bulk weighing cement, mineral admixture, or cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.

For batches with a volume of one cubic yard or more, the batching equipment shall conform to one of the following combinations:

- A. Separate boxes and separate scale and indicator or weighing each size of aggregate.
- B. Single box and scale indicator for all aggregates.
- C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

In order to check the accuracy of batch masses, the gross mass and tare mass of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed at the Contractor's expense on scales designated by the Engineer.

90-5.03A Proportioning for Pavement

Aggregates and bulk cement, mineral admixture, and cement plus mineral admixture for use in pavement shall be proportioned by mass by means of automatic proportioning devices of approved type conforming to these specifications.

The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by mass of the fine aggregate.

The batching of cement, mineral admixture, or cement plus mineral admixture and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and mineral admixture hoppers or the cement plus mineral admixture hopper are charged with masses that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."

When interlocks are required for cement and mineral admixture charging mechanisms and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."

The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture, or cement plus mineral admixture into the aggregate as directed by the Engineer.

When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.

Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.

When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.

The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

Equipment having components made of aluminum or alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement, mineral admixture, or cement plus mineral admixture.

Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 1/2 inch. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 169 pounds per cubic yard of concrete.

Average Slump	Maximum Permissible Difference			
Less than 4"	1"			
4" to 6"	1 1/2"			
Greater than 6" to 9"	2"			

The Contractor, at the Contractor's expense, shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

90-6.02 MACHINE MIXING

Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

The temperature of mixed concrete, immediately before placing, shall be not less than 50° F or more than 90° F. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 150° F. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time.

Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

The size of batch shall not exceed the manufacturer's guaranteed capacity.

When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

Concrete shall be mixed and delivered to the jobsite by means of one of the following combinations of operations:

- A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in non-agitating hauling equipment (central-mixed concrete).
- B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
- C. Mixed completely in a truck mixer (transit-mixed concrete).
- D. Mixed completely in a paving mixer.

Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."

Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

Bodies of non-agitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.

Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 75° F.

No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85° F or above, the time allowed may be less than 1.5 hours.

When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85° F or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (pounds) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.

Weighmaster certificates shall be provided printed form, or if approved by the Engineer, the may be submitted in electronic media. Electronic media shall be presented tab-delimited format on a 3 1/2-inch diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one for separate record" with allowances line, sufficient fields to satisfy the amount of data required by these specifications.

The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch masses or measurements for a load of concrete provided that both certificates are imprinted with the same non-repeating load number that is unique to the contract and delivered to the jobsite with the load.

Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

90-6.05 HAND-MIXING

Hand-mixed concrete shall be made in batches of not more than 1/3 cubic yard and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than one foot in total depth. On this mixture shall be spread the dry cement and mineral admixture and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

90-6.06 AMOUNT OF WATER AND PENETRATION

The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the "Nominal" values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent

batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. When Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 9 inches after the chemical admixtures are added.

Type of Work	Nomina	al	Maximum		
	Penetration inches	Slump inches	Penetration inches	Slump inches	
Concrete Pavement	0-1	_	1 1/2	_	
Non-reinforced concrete facilities	0-1 1/2	_	2		
Reinforced concrete structures					
Concrete placed under water	_	6-8	_	9	
Cast-in-place concrete piles	2 1/2-3 1/2	5-7	4	8	

The amount of free water used in concrete shall not exceed 308 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cementitious material in excess of 548 pounds per cubic yard.

The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

Where there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic yard of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard.

The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment

shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

90-7.01A Water Method

The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

When a curing medium consisting of cotton mats, rugs, carpets, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B Curing Compound Method

Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.

Curing compounds to be used shall be as follows:

- 1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
- 2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.

- 3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
- 4. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
- 5. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
- 6. Non-pigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.

The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.15 kilograms per square meter in 24 hours.

The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.

When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.

Curing compound shall be applied at a nominal rate of one gallon per 150 square feet, unless otherwise specified.

At any point, the application rate shall be within ±50 square feet per gallon of the nominal rate specified, and the average application rate shall be within ±25 square feet per gallon of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.

Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.

The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.

Agitation shall not introduce air or other foreign substance into the curing compound.

The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.

Curing compounds shall remain sprayable at temperatures above $40\,^{\circ}$ F and shall not be diluted or altered after manufacture.

The curing compound shall be packaged in clean 274-gallon totes, 55-gallon barrels or 5-gallon pails or shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 274-gallon totes and the 55-gallon barrels shall have removable lids and airtight fasteners. The 5-gallon pails shall be round and have standard full open head and Lids with bungholes shall not be permitted. Settling or separation of solids in containers, except tanks, must be completely redispersed with low speed mixing prior to use, in conformance with specifications the these and manufacturer's recommendations. Mixing shall be accomplished either manually by use of a paddle or by use of a mixing blade driven by a drill motor, at low speed. Mixing blades shall be the type used for mixing paint. On site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.

Each container shall be labeled with manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and application of curing compound shall be shown on the label of the curing compound containers conformance with the Construction Safety Orders and General Industry Safety Orders of the State of California.

Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State of California.

When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels. Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.

Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C Waterproof Membrane Method

The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.

The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 0.33-foot.

The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.

Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D Forms-In-Place Method

Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 days.

Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 CURING PAVEMENT

The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."

When the curing compound method is used, compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation οf the curing compound during the time application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 60° F, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of

10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

90-7.03 CURING STRUCTURES

Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only Ordinary Surface Finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required.

90-7.04 CURING PRECAST CONCRETE MEMBERS

Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming

period. If the ambient air temperature is below 50° F, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50° F and 90° F.

- B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
- C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
- Steam at the jets shall be at low pressure and D. in a saturated condition. Steam jets shall not directly on the impinge concrete, cylinders, or forms. During application of the the temperature rise within enclosure shall not exceed 40° F per hour. curing temperature throughout the enclosure shall not exceed 150° F and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
- E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 200 feet of continuous bed length will be required for checking temperature.
- F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 60° F until the stress is transferred to the concrete.
- G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

Newly placed concrete for precast prestressed

concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles with a class designation ending in C (corrosion resistant) shall be cured as follows:

- A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
- B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

90-7.06 CURING SLOPE PROTECTION

Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," or with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."

Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Shotcrete shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

Mortar and grout shall be cured by keeping the surface damp for 3 days.

After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket,

or by any of the methods provided in Section 90-7.01, "Methods of Curing."

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8.

Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

90-8.02 PROTECTING CONCRETE STRUCTURES

Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 45° F for 72 hours after placing and at not less than 40° F for an additional 4 days. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

90-8.03 PROTECTING CONCRETE PAVEMENT

Pavement concrete shall be maintained at a temperature of not less than 40°F for 72 hours. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.

When ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 550 pounds per square inch. The modulus of rupture will be determined by California Test 523.

No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 550 pounds per square inch. Concrete that fails to attain a modulus of rupture of 550 pounds per square inch within 10 days shall not be opened to traffic until directed by the Engineer.

Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."

When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 2.4 MPa has been attained, provided that:

- A. Unit pressure exerted on the pavement by the paver shall not exceed 20 pounds per square inch;
- B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
- C. No part of the track shall be closer than one foot from the edge of pavement.

In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.

Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor at the Contractor's expense.

The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.

compressive strength of concrete will determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. cylinders will be molded and initially field cured in conformance with California Test 540. cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.

When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall, at the Contractor's expense, make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State \$10 for each in-place cubic

yard of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State \$15 for each in-place cubic yard of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the Concrete maximum age specified or allowed. represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

If the test result indicates that the compressive strength at the maximum curing age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum curing age specified or allowed below 85 percent, the concrete represented by that test will rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.

No single compressive strength test shall represent more than 325 cubic yards.

When a precast concrete member is steam cured, the compressive strength of the concrete will determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. When the concrete is designated by strength rather 28-day compressive than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.

When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.

Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 600 pounds per square inch greater than specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

The certified test data and trial batch test reports shall include the following information:

- A. Date of mixing.
- B. Mixing equipment and procedures used.
- C. The size of batch in cubic yards and the mass, type, and source of all ingredients used.
- D. Penetration of the concrete.
- E. The air content of the concrete if an air-entraining admixture is used.
- F. The age at time of testing and strength of all concrete cylinders tested.

Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.

When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required.

After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.

The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.

When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.

The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and

methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

90-10.02 MATERIALS

Minor concrete shall conform to the following requirements:

90-10.02A Cementitious Material

Cementitious material shall conform to the provisions in Section 90-1.01, "Description."

90-10.02B Aggregate

Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.

The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.

The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1 1/2-inch or smaller than 3/4-inch.

The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C Water

Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

90-10.02D Admixtures

The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

90-10.03 PRODUCTION

Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and

that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.

The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."

The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.

Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 90° F will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.

The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.

The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.

Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor

concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

90-10.05 PROTECTING MINOR CONCRETE

Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 40° F for 72 hours after placing.

SECTION 91: PAINT

The Standard Specifications are incorporated herein by this reference.

SECTION 92: ASPHALTS

The Standard Specifications are incorporated herein by this reference, except as noted:

92-1.05 MEASUREMENT (not adopted)

SECTION 93: LIQUID ASPHALTS

The Standard Specifications are incorporated herein by this reference, except as noted:

93-1.03 MIXING AND APPLYING

Attention is directed to Sections 7-1.11 and 7-1.12, "Preservation of Property," and "Indemnification and Insurance," respectively. Liquid asphalt shall be prevented from spraying upon adjacent pavements, that portion of the traveled way being used by traffic, structures, railings and barriers, markers, trees and shrubbery that are not to be removed, adjacent property and improvements, and other highway improvements or facilities not mentioned herein.

Unless otherwise specified in these specifications or in the special provisions, the various grades of liquid asphalt shall be applied at temperatures within the limits specified in the table of application temperatures below. When liquid asphalt is to be mixed with aggregate, the temperature of the aggregate, at the time of adding the liquid

asphalt, shall not exceed that shown in the column of pugmill mixing temperatures.

At no time, after loading into a tank car or truck for transportation to the site of the work, shall the temperature of the liquid asphalt be raised above that given in the last column of the following table, unless authorized by the Engineer.

Application Temperatures of Liquid
Asphalts

	Pug Mill Mixing	Distributor	
Grade	Temperature	Application	
of	of Aggregate	Temperature	
Liquid	Max. ° F	Min.	Max.
Asphalt		° F	° F
SC-70	_	105	175
SC-250	200	140	230
SC-800	225	175	255
SC-3000	260	215	290
MC-70	_	105	175
MC-250	200	140	230
MC-800	225	175	255
MC-3000	260	212	290

Liquid asphalt shall be heated by a retort or by steam coils in such a manner that steam will not be introduced directly into the liquid asphalt during heating. The Contractor shall furnish and keep available at all times, an accurate thermometer suitable for determining the temperature of the liquid asphalt being applied.

Distributor trucks shall be of the pressure type with insulated tanks. The use of gravity distributors will not be permitted. Spray bars shall have a minimum length of 9 feet and shall be of the full circulating type. The spray bar shall be adjustable to permit positioning at various heights above the surface to be treated. The valves shall be operated by levers so that one or all valves may be quickly opened or closed in one operation.

Spreading by means of cab controlled valves will be permitted in the application of seals. The valves which control the flow from nozzles shall positively so as to provide a uniform unbroken spread of bituminous material on the surface. distributor shall be equipped with devices to provide for accurate and rapid charts determination and control of the amount bituminous material being applied and with a bitumeter of the auxiliary wheel type registering speed in feet per minute, and trip and total distance in meters {feet}. The spreading equipment

shall be designed so that uniform application of bituminous material, in controlled amounts, may be made ranging from 0.02- to one gallon per square yard of surface and with a range of pressure from 25 to 75 pounds per square inch. If a spray bar extension is used to cover a greater width, it shall be of the full circulating type. The distributor shall be equipped with a hose and nozzle to be used for spraying areas that are inaccessible to the distributor. The distributor shall also be equipped with pressure gages and an accurate thermometer for determination of temperatures of the bituminous material. Distributor and booster tanks shall be so maintained at all times as to prevent dripping of bituminous material from any part of the equipment. In order to secure uniform distribution at the junction of 2 applications, the distribution shall be promptly stopped when the uniform flow decreases, indicating the tank is about empty.

The Department reserves the right to order the use of any equipment discontinued which, in the opinion of the Engineer, fails to produce a satisfactory distribution of asphalt in accordance with the specifications.

Spreading liquid asphalt will not be permitted when the surface to be treated is appreciably damp, or when weather conditions are unsuitable, or when the atmospheric temperature is below the minimum temperature specified for the particular type of work.

Disposing of excess liquid asphalt within sight of the highway will not be permitted. Distributors shall stop spreading asphalt while traffic is passing, if directed by the Engineer.

Liquid asphalt delivered to the work shall not be used for any purpose other than that provided for in the specifications.

The Contractor shall provide a satisfactory method of accurately measuring the volume of liquid asphalt in the storage tanks and in each spreading unit at any time.

Each distributor truck shall be equipped, at all times, with its' proper measuring stick and calibration card. On-site calibration of the distributor trucks, for determining actual spread rate of asphaltic emulsion, shall be performed when directed by the Engineer.

93-1.04 MEASUREMENT (not adopted)

SECTION 94: ASPHALTIC EMULSIONS

The Standard Specifications are incorporated herein by this reference, except as noted:

94-1.06 APPLYING

Asphaltic emulsion shall be reheated, if necessary, but at no time after loading into a tank car or truck for transporting to the site of the work shall the temperature of the emulsion be raised above 160° F, unless permitted by the Engineer. During all reheating operations the asphaltic emulsion shall be agitated to prevent localized overheating. Asphaltic emulsion shall be applied in conformance with the provisions in Section 93, "Liquid Asphalts," and the following additional requirements.

Setting Grade 1 asphaltic emulsions, except when used for fog seal coats, shall be applied at a temperature between 75° F and 130° F, and Setting Grade 2 asphaltic emulsions shall be applied at a temperature between 110° F and 185° F, unless otherwise directed by the Engineer.

Asphaltic emulsions shall not be permitted to cool to a temperature of less than 40° F.

The cationic asphaltic emulsion shall be stored in heated circulation tanks at controlled temperatures, between 140° F. and 180° F., for a period not to exceed seven calendar days.

The temperature of the asphaltic emulsion shall be between 130° F. and 180° F. at the time of application.

94-1.07 MEASUREMENT (not adopted)

SECTION 95: EPOXY

The Standard Specifications are incorporated herein by this reference.