

SECTION 88

ENGINEERING FABRICS

Engineering fabrics shall conform to Section 88 of the Caltrans Standard Specifications.

SECTION 89

LIGHTWEIGHT PORTLAND CEMENT CONCRETE

Lightweight Portland cement concrete shall conform to Section 89 of the Caltrans Standard Specifications.

SECTION 90

PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to Section 90 of the Caltrans Standard Specifications, and these City Standard Specifications.

90-1 GENERAL

90-1.01 Description. - Delete paragraphs 3 through 11 and 13 through 15 of Section 90-1.01 of the Caltrans Standard Specifications.

Portland cement concrete is designated by class based on 28-day compressive strengths (when tested in accordance with ASTM C 39) as specified herein:

- Class A Concrete shall contain approximately 564 pounds of portland cement per cubic yard and have a 28-day compressive strength of not less than 3000 psi.
- Class B Concrete shall contain approximately 470 pounds of portland cement per cubic yard and have a 28-day compressive strength of not less than 2500 psi.
- Class C Concrete shall contain approximately 376 pounds of portland cement per cubic yard and have a 28-day compressive strength of not less than 2000 psi.
- Class D Concrete shall contain not less than 658 pounds of portland cement per cubic yard and have a 28-day compressive strength of not less than 3500 psi.

<u>Class</u>	<u>Intended Use</u>
A	General Construction - structures, curbs, gutters, sidewalks, cast-in-place pipe, minor structures, thrust and anchor blocks.
B	Pavements, pavement base, slope pavement.
C	Nonreinforced concrete as gravity walls, backfills, jackets, cradles.
D	Emergency pavement, underwater placement, seals.

If the class of concrete is not specified on the plans or in these specifications, or otherwise directed by the Engineer, it shall be Class A.

The Contractor shall determine the mix proportions and consistency (slump) and shall furnish concrete which conforms to the strengths designated by class or as shown on the plans or specified in the special provisions. All mix designs shall be submitted for the Engineer's approval.

The Contractor shall be limited to one approved mix for each specific use.

90-2 MATERIALS

90-2.01 Portland Cement. - Unless otherwise specified, cement shall be Type II modified as described in Section 90 of Caltrans. Portland cement shall be specified, on the plans or in the special provisions, by the type (I, IA, IP (MS) Modified, II, IIA, II Modified, II Prestress, III, IIIA, IV, or V) and shall conform to the applicable provisions of ASTM Designation: C595 for type IP and ASTM Designation: C150 for other types.

Type II Prestress is for the same use as Type II Modified and where low contraction in air is required. Portland cement designated Type II Prestress shall conform to the requirements of Type II Modified, except that the mortar, when tested in accordance with California Test 527, shall not contract in air more than 0.053 percent.

Portland cement used for precast, prestressed concrete pilings and precast, prestressed concrete members shall be Type II Prestress.

Portland cement used for sanitary sewer facilities as specified in these specifications shall be Type V.

Either Type II Prestress or Type II Modified cement may be used in steam-cured concrete products.

90-6 MIXING AND TRANSPORTING

90-6.06 Amount of Water and Penetration. - Delete paragraph one of Section 90-6.06 of the Caltrans Standard Specifications, along with accompanying table.

The amount of water used in concrete mixes shall not exceed the amount necessary to produce suitable concrete, and shall be regulated so that the consistency of the concrete as determined by ASTM Designation: C 143 is within the nominal slump range for the mix design. When the nominal slump is exceeded, the moisture shall be adjusted as directed by the Engineer to reduce the slump to a value within the nominal range. The nominal slump of the mix design shall be stated on all delivery tags. Loads containing concrete that exceeds the maximum slump allowable based on the mix design and ASTM C94 shall be rejected.

90-10 MINOR CONCRETE

90-10.02 Materials. - Minor concrete shall be Class A, 3000 psi concrete and shall contain not less than 564 pounds of cement per cubic yard unless otherwise specified on the plans or in the special provisions. The cement per cubic yard requirement may be waived by the Engineer in writing, provided the mix as designed consistently produces concrete whose compressive strength is in excess of 3000 psi and has a moving average of 3500 psi or more.

The compressive strength of the concrete will be determined according to the procedures and provisions of Section 90-9, "Compressive Strength" of Caltrans Standard Specifications, except that sampling and testing will be done according to ASTM C172 and C39.

Concrete samples for compressive strength requirements as a basis for acceptance of minor concrete will be molded, cured and tested as provided for in Section 90-9 of the Caltrans Standard Specifications, except that sampling and testing will be done according to ASTM C172, ASTM C31, and ASTM C39. The

evaluation of compressive strength tests for minor concrete will be as provided for in Section 90-9 of the Caltrans Standard Specifications and as specified herein.

Acceptance of concrete will be based on the individual test and operating range test results representing accepted concrete. In the event of variations from these criteria, enforcement of these specifications shall be according to the nature of variation, as follows:

- (1) Individual test result above 3000 psi, moving average above 3500 psi: Concrete is acceptable. No effect on mix design. Moving average is continued.
- (2) Individual test result between 2850 psi and 3000 psi, moving average above 3500 psi: Concrete is deemed acceptable. No effect on mix design. Moving average is continued.
- (3) Individual test result between 2550 psi and 2850 psi, moving average above 3500 psi: Non conformance of this concrete may be waived by the Engineer. Mix design may be reviewed for possible changes. Moving average is continued.
- (4) Individual test below 2550 psi, moving average above 3000 psi and below 3500 psi: Concrete will be deemed not acceptable unless certified to be above 3000 psi at 28 days by an approved private laboratory according to Section 90-9.01 above. Mix design shall be reviewed for possible changes or improvements. No test results representing this concrete will be used in moving average calculations.
- (5) Individual test result above 3000 psi moving average below 3000 psi: Concrete is acceptable. Mix design is rejected. A redesigned mix will be required per #6 below. Moving average is continued.
- (6) Individual test result between 2850 and 3000 psi, moving average below 3000 psi: Concrete may be deemed acceptable. Supplier will be notified that moving average is below 3000 psi. Supplier will be required to redesign mix. Moving average will be continued until test results of new redesigned mix are available, at which time a new moving average will be started. The first individual test and from then on the moving average of the new redesigned mix up to 5 tests must be above 3000 psi. If either the first individual test or the moving average up to 5 tests is below 3000 psi, the supplier will not be allowed to supply concrete for the specific use of the mix until it is again redesigned and 28-day specimen shows it is above 3000 psi.
- (7) Individual test result between 2550 psi and 2850 psi, moving average below 3000 psi: Concrete is deemed not acceptable unless certified to be above 3000 psi at 28 days by an approved private laboratory according to Section 90-9.01 above. Supplier will be notified that

operating range is below 3000 psi. Supplier will be required to redesign mix. Moving average will be continued until test results of new redesigned mix are available, at which time a new moving average will be started. The first individual test and, from then on, the moving average of this new redesigned mix up to 5 tests must be above 3000 psi. If either the first individual test or the moving average up to 5 tests is below 3000 psi, the supplier will not be allowed to supply concrete for the specific use of the mix until it is again redesigned and 28-day specimens show that it is above 3000 psi.

- (8) Individual test result below 2550 psi, moving average below 3000 psi: Concrete is not acceptable.

Within 15 calendar days from date of receipt of test results, the Contractor or supplier shall have the option of either removing that portion of concrete represented by the test result below the designed compressive strength or, at their expense, have the concrete tested by a certified private testing laboratory who shall attest to the fact that the concrete does in fact conform to the compressive strength requirements of these specifications.

Each load of ready-mixed concrete shall be accompanied by a ticket, which shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise ordered by the Engineer. The ticket shall be clearly marked by stamping or imprinting 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. The delivery ticket shall also indicate the mix design designation and the nominal slump thereof.

A certificate of compliance in accordance with 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 certified by the City or used on City work, stating that minor concrete to be furnished meets all contract requirements, including minimum cement content specified.

90-10.02A Portland Cement. - Portland cement shall be Type II Modified, conforming to Section 90-2.01 of the Caltrans Standard Specifications and these City Standard Specifications.

SECTION 91

PAINT

Paint shall conform to Section 91 of the Caltrans Standard Specifications and these City Standard Specifications.

91-1.03 Manufacturing and Packaging. - Paint containers shall be of steel, non-tapered, and of metal not thinner than 24 gage. Containers shall have lug type crimp lids with ring seals, and be equipped with ears, as well as bails.

91-1.05 Certificate of Compliance. - A certificate of compliance for each type of paint used on the project shall be furnished to the Engineer in accordance with the provisions of Section 6-1.07, "Certificates of Compliance."

SECTION 92

ASPHALTS

Asphalts shall conform to Section 92 of the Caltrans Standard Specifications and these City Standard Specifications.

92-1.02 Grades. - At no time shall the temperature of asphalt in storage be higher than 10°F below the actual flash point of the asphalt.

92-1.03 Test Report. - At the time of delivery of each shipment of paving asphalt by tank car or truck load or fraction thereof, the vendor shall furnish the purchaser with certificate of compliance. The certificate of compliance shall indicate the name of the vendor, type and grade of asphalt delivered, date and point of delivery, contract number or purchase order number, quantity, and the results of specified tests. The certificate of compliance, signed by an authorized representative of the vendor, shall certify that the product delivered conforms to these specifications for the type and grade indicated. The purchaser shall provide the City the certified test reports, when requested by the Engineer, in accordance with the provisions of Section 6-1.07 "Certificates of Compliance."

92-1.04 Applying Asphalt. - Unless otherwise specified, paving asphalts shall be applied at temperatures within the limits given in the following table.

Grade of Asphalt	Pugmill Mixing Temperature °F		Distributor Application Temperature °F	
	Min.	Max.	Min.	Max.
AR-1000	225	275	270	350
AR-2000	275	325	285	350
AR-4000	275	325	290	350
AR-8000	275	325	295	350
AR-16000	300	350	300	350

SECTION 93

LIQUID ASPHALTS

Liquid asphalts shall conform to Section 93 of the Caltrans Standard Specifications and these City Standard Specifications.

93-1.03 Mixing and Applying. - Liquid asphalt shall not be heated during manufacture, storage, or construction to a degree to cause the formation of carbonized particles, and in no case shall the temperature be higher than 10 degrees fahrenheit below the actual flash point.

Unless otherwise authorized by the Engineer, no liquid asphalt, except tack coats, shall be applied when the air temperature is lower than 50 degrees fahrenheit.

SECTION 94

ASPHALTIC EMULSIONS

Asphaltic emulsions shall conform to Section 94 of the Caltrans Standard Specifications and these City Standard Specifications.

94-1.01 Description. - In addition to the bituminous emulsions specified in Section 94 of the Caltrans Standard Specifications, this Section includes a cationic maltenes emulsion material composed of a petroleum resin oil base uniformly emulsified with water.

Emulsified asphalts are classified according to penetration, high viscosity or mixing type, either as anionic or cationic as described herein.

- RS1 - Rapid setting penetration type anionic emulsion.
- RS2 - Rapid setting penetration high viscosity type anionic emulsion.
- SS1 - Slow setting mixing type anionic emulsion.
- SS1h - Slow setting mixing type anionic emulsion hard.
- CRS1 - Rapid setting penetration type cationic emulsion.
- CRS2 - Rapid setting penetration high viscosity type cationic emulsion.
- CMS2S - Medium setting sand mixing type cationic emulsion.
- CMS2 - Medium setting coarse aggregate mixing type cationic emulsion.
- CMS2h - Medium setting coarse aggregate mixing type cationic emulsion hard.
- CQS1h - Quick setting asphaltic emulsion for slurry seal.
- CSS1 - Slow setting coarse aggregate mixing type cationic emulsion.
- CSS1h - Slow setting coarse aggregate mixing type cationic emulsion hard.
- LMCRS2 - Rapid setting latex modified cationic emulsion.
- LMCRS1-1/2h - Rapid setting latex modified cationic emulsion hard.
- LMCRS2h - Rapid setting latex modified cationic emulsion hard.
- Maltenes cationic emulsion.

94-1.02 Requirements. - The asphaltic emulsion shall conform to the requirements prescribed in Tables 1 and 2 of Section 94 of the Caltrans Standard Specifications and in Tables 3, 4, and 5 of these specifications.

94-1.04 Method of Test. - The properties of the asphaltic emulsions given in Tables 3 and 4 shall be in accordance with AASHTO Designation: T59, "Testing Emulsified Asphalt" except as otherwise noted.

TABLE 3

Requirements for Latex Modified Cationic Emulsion

	<u>LMCRS2</u>	<u>LMCRS2h</u>	<u>LMCRS1-1/2h</u>
Tests on Emulsions:			
Viscosity SSF @ 122° F sec	75-300	75-300	40-100
Sieve, percent	--	0.3	0.3
Settlement, 5 days, percent	5	5	5
Demulsibility, percent	0.3 max.	40 min.	40 min.
Storage Stability Test, 1 day, %	--	1	1
Particle Charge	Positive	Positive	Positive
Ash Content (ASTM D3723), %	0.2 max.	0.2 max.	0.2 max.
Tests on Residue by Drying:			
Residue, percent (Calif. Test 331)	65 min.	65 min.	65 min.
Penetration @ 77° F	100-200	40-90	40-90
Ductility @ 77° F 5 cm/min, cm	40 min.	40 min.	40 min.
Torsional Recovery % (Calif. Test 332)	18 min.	18 min.	18 min.

TABLE 4

Requirements for Cationic Maltenes Emulsion

<u>Specification Designation</u>	<u>Test Method</u>	<u>Requirements</u>
Viscosity, S.F. at 77° F, seconds	AASHTO T 59	15-40
Residue - % Min	California Test 351	60
Miscibility Test (b)	AASHTO T 59	No coagulation
Sieve Test (a)		
(Distilled Water) % Max.	AASHTO T 59	0.10
Particle Charge Test	California Test 343	Positive
Tests on Residue from California Test 351		
Viscosity, CS 140° F	ASTM D 445	100-200
Asphaltenes, % Max.	California Test 352	0.75

- (a) Test procedure identical with AASTHTO T 59 except that distilled water shall be used in place of 2 percent sodium oleate solution.
- (b) Test procedure identical with AASHTO T 59 except that .02 normal calcium chloride solution shall be used in place of distilled water.

TABLE 5
Requirements for CQS1h Asphaltic Emulsion

<u>Test on Emulsion</u>		
<u>Test</u>	<u>Test Method</u>	<u>Requirement</u>
Viscosity, SSF @ 122°F.	AASHTO T 59	15-90 seconds
Sieve	ASTM D 244	
ASTM D 244	AASHTO T 59	0.30 percent
Storage	maximum	
Stability, 1 day	AASHTO T 59	1 maximum
Residue by	ASTM D 244	
Distillation	AASHTO T 59	57 percent
	ASTM D 244	minimum

Test on Residue from Distillation Test

Penetration @ 77°F.	AASHTO T 49	40 - 90
	ASTM D 5	
Ductility @ 77°F., 5 cm per minute	AASHTO T 51	40 cm.
	ASTM D 113	minimum
Solubility in Trichloroethylene	AASHTO T 44	97 percent minimum

In addition, quick setting Type CQS1h asphaltic emulsion shall test Positive for Particle Charge when tested in accordance with ASTM E 70. If the Particle Charge Test result is inconclusive the asphaltic emulsion shall meet a pH requirement of 6.7 maximum.

94-1.06 Applying. - Setting Grade 1-1/2 asphaltic emulsions shall be applied between 80° F and 140° F, unless otherwise directed by the Engineer.

Distributing equipment shall be the same as specified in Section 93, "Liquid Asphalts," except that hand spraying by means of hose or bar through a gear pump or air tank will be acceptable for applications to 0.10 gallon per square yard for flat work or tacking of vertical edges.

SECTION 95

EPOXY

Epoxy shall conform to Section 95 of the Caltrans Standard Specifications.