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**** WARNING ** WARNING ** WARNING ** WARNING ****
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April 20, 2007

07-LA-710-15.1/29.6
07-183114
ACNH-710-1(786)N

Addendum No. 2

Dear Contractor:

This addendum is being issued to the contract for construction on State highway in LOS ANGELES COUNTY IN LONG BEACH, CARSON, COMPTON, PARAMOUNT, LYNWOOD, AND SOUTH GATE FROM ROUTE 405/710 SEPARATION TO FIRESTONE BOULEVARD OVERCROSSING.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on May 10, 2007.

This addendum is being issued to revise the Project Plans, the Notice to Contractors and Special Provisions and the Proposal and Contract.

Project Plan Sheets 2, 5, 10, 30, 36, 39, 42, 43, 44, 45, 46, 93, 185, 199, 202, 204, 206, 252, 261, 262, 263, 412, 413, 484, 485, 487, 488, 705 and 752 are revised. Half-sized copies of the revised sheets are attached for substitution for the like-numbered sheets.

In the Special Provisions, Section 4, "BEGINNING OF WORK, TIME OF COMPLETION, AND LIQUIDATED DAMAGES" is revised as attached.

In the Special Provisions, Section 5-1.14, "COMPENSATION ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS," in the table of the first paragraph "(PBA-6A)(MODIFIED)" is revised to "(PG 64-28 PM)."

In the Special Provisions, Section 5-1.21 "RELATIONS WITH UNITED STATES ARMY CORPS OF ENGINEERS," in the third paragraph "Fish and Game Code Section 1601" is revised to "Army Corps of Engineers Nationwide Permit."

In the Special Provisions, Section 5-1.22 "RELATIONS WITH LOS ANGELES FLOOD CONTROL DISTRICT," in the third paragraph "Fish and Game Code Section 1601" is revised to "Los Angeles County Flood Control District Permit."

In the Special Provisions, Section 10-1.025 "MIGRATORY BIRD PROTECTION," is added as attached.

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In the Special Provisions, Section 10-1.14, "MAINTAINING TRAFFIC," in TABLE 3, "PERMISSIBLE HOURS OF FULL FREEWAY CLOSURE FOR EXTENDED WEEKEND CLOSURES (STAGES 3&4)" is revised to "PERMISSIBLE HOURS OF FULL FREEWAY CLOSURE FOR SET UP AND REMOVAL OF EXTENDED WEEKEND CLOSURES."

In the Special Provisions, Section 10-1.14, "MAINTAINING TRAFFIC," in TABLE 4, "PERMISSIBLE HOURS OF FULL FREEWAY CLOSURE FOR EXTENDED WEEKEND CLOSURES (STAGES 5&6)" is revised to "PERMISSIBLE HOURS OF FULL FREEWAY CLOSURE FOR SET UP AND REMOVAL OF EXTENDED WEEKEND CLOSURES."

In the Special Provisions, Section 10-1.39, "ASPHALT CONCRETE (PBA-6A AND PG 70-10)" is replaced with "ASPHALT CONCRETE, (PG 64-28 PM AND PG 70-10)" as attached.

In the Special Provisions, Section 10-1.46, "REPLACE CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE)" is revised as attached.

In the Special Provisions, Section 10-1.85, "CONCRETE BARRIER," subsection "Measurement and Payment," the following paragraph is added after the first paragraph:

"Concrete Barrier Transition will be measured and paid for as Concrete Barrier (Type 60G Modified)."

In the Special Provisions, Section 39, "ASPHALT CONCRETE," is revised as attached.

In the Special Provisions, Section 11-2, "ASPHALTS," is deleted.

In the Special Provisions, Section 92, "ASPAHLTS," is deleted.

In the Proposal and Contract, the Engineer's Estimate Items 28, 34, 50, 73, 77, 91, 92, 93, 94, 96, 111, 142, 150, 151, 153, 166, 169, and 176 are revised, Items 232, 233 and 234 are added and Item 231 is deleted as attached.

To Proposal and Contract book holders:

Replace the entire pages 4, 5, 6, 7, 8, 10, 11, and 14 of the Engineer's Estimate in the Proposal with the attached revised pages 4, 5, 6, 7, 8, 10, 11, and 14 of the Engineer's Estimate. The revised Engineer's Estimate is to be used in the bid.

Inquiries or questions in regard to this addendum must be communicated as a bidder inquiry and must be made as noted in the NOTICE TO CONTRACTORS section of the Notice to Contractors and Special Provisions.

Indicate receipt of this addendum by filling in the number of this addendum in the space provided on the signature page of the proposal.

Submit bids in the Proposal and Contract book you now possess. Holders who have already mailed their book will be contacted to arrange for the return of their book.

Inform subcontractors and suppliers as necessary.

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April 20, 2007

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This office is sending this addendum by DHL overnight mail to Proposal and Contract book holders to ensure that each receives it. A copy of this addendum and the modified wage rates are available for the contractor's use on the Internet Site:

http://www.dot.ca.gov/hq/esc/oe/weekly_ads/addendum_page.html

If you are not a Proposal and Contract book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,

ORIGINAL SIGNED BY

REBECCA D. HARNAGEL, Chief
Office of Plans, Specifications & Estimates
Division of Engineering Services - Office Engineer

Attachments

SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION, AND LIQUIDATED DAMAGES

The first working day is the fifty-fifth day after contract approval.

The Contractor shall not begin work at the job site, except for measuring controlling field dimensions and locating utilities, until the following submittals are received and approved by the Engineer:

1. Baseline Progress Schedule (Critical Path Method)
2. Storm Water Pollution Prevention Plan (SWPPP)
3. Notification of Dispute Review Board (DRB) nominee and disclosure statement
3. Notification of Dispute Resolution Advisor (DRA) nominee and disclosure statement

In addition to the above submittals, the Contractor shall not begin work at the job site, except for measuring controlling field dimensions and locating utilities, until the following submittals are received by the Engineer:

1. Notice of Materials To Be Used.
2. Contingency plan for reopening closures to public traffic.
3. Written statement from the vendor that the order for the sign panels has been received and accepted by the vendor. The statement shall show the dates that the materials will be shipped.
4. Written statement from the vendor that the order for electrical material has been received and accepted by the vendor. The statement shall show the dates that the materials will be shipped.

The Contractor may begin work at the job site before the fifty-fifth day after contract approval if:

1. The Contractor submits and obtains required approvals for the submittals before the fifty-fifth day
2. Authorized by the Engineer in writing

The Department will grant time extensions for delays only that are beyond the Contractor's control and that prevent the Contractor from starting work at the job site on the first working day.

The work (except plant establishment work) shall be diligently prosecuted to completion before the expiration of **1,220 WORKING DAYS**.

The Contractor shall pay to the State of California the sum of \$ **12,000** per day for each day's delay in finishing the work (except plant establishment work) in excess of the number of working days specified above.

The work (including plant establishment work) shall be diligently prosecuted to completion before the expiration of **1,340 WORKING DAYS**.

The Contractor shall pay to the State of California the sum of \$600 per day for each day's delay in completing the plant establishment work.

In no case will liquidated damages of more than \$ **12,000** per day be assessed.

INCENTIVES AND DISINCENTIVES

General

Attention is directed to the provisions in "Order of Work" and "Maintaining Traffic" of these special provisions. Incentives and disincentives are applicable to the designated portion of work and damages specified in "Closure Requirements and Conditions" of these special provisions and will be assessed for failure to open lanes of traffic as specified herein.

An "extended weekend closure" is defined as a lane closure of extended duration specifically for the purpose of completing the designated portion of work. An extended duration is a period of time greater than 14 hours and up to 55 hours beginning after 2200 Friday and ending before 0500 the following Monday.

Designated Portion of Work

The designated portion of work is defined as follows:

- A. Replacement of existing concrete pavement with structural section Type 3, including subgrade excavation, as shown on the plans within the following limits:
 - 1. Station 163+80 to 176+40 northbound and Stations 163+80 to 177+00 Southbound (UPRR Underpass to the vicinity of Del Amo Boulevard Undercrossing)
 - 2. Station 206+20 to 209+10 Northbound and Stations 206+20 to 211+30 Southbound (in the vicinity of Artesia Boulevard-Route 91)
 - 3. Station 218+10 to 220+90 (in the vicinity of Atlantic Avenue Northbound and Southbound)
 - 4. Station 222+90 to 226+80 Southbound (in the vicinity of Alondra Boulevard)
 - 5. Station 231+40 to 233+60 (in the vicinity of Compton Boulevard Northbound and Southbound)
 - 6. Station 241+40 to 242+44 Northbound and Station 241+40 to 242+37 Southbound
- B. Crack and seat and overlay existing pavement with structural section Type 1, as shown on the plans within the following limits:
 - 1. Station 153+00 to 163+80
 - 2. Station 176+40 to 206+20 Northbound and Stations 177+00 to 206+20 Southbound
 - 3. Station 209+10 to 218+10 Northbound and Stations 211+30 to 218+10 Southbound
 - 4. Station 220+90 to 231+40, Northbound and Sta 220+90 to 222+90 Southbound
 - 5. Station 226+80 to 231+40 Southbound
 - 6. Station 233+60 to 241+40
- C. Asphalt concrete overlay tapers, as shown on the plans from Stations 152+00 to 153+00.
- D. Replace Concrete Pavement (Rapid Strength Concrete) Station 242+37 to 259+70 Southbound, and Station 242+44 to 259+70 Northbound.
- E. Concrete Pavement (Weigh-in-Motion), Stations 184+90 to 185+84, Southbound and Stations 184+50 to 185+44, Northbound.
- F. Structure approach slabs (Type R) and (Type R) (Modified).

APPLICATION

Incentives and disincentives will apply to the designated portion of work in accordance with the following:

- A. Thirty four extended weekend closures will be the basis for determination if incentives and disincentives for completion of the designated portion of work. For each extended weekend closure in addition to 34, a disincentive deduction of \$250,000 per extended weekend closure needed to finish the designated portion of work will be deducted from any monies due to the Contractor under the contract. For each extended weekend closure less than 34, the Contractor will receive an incentive payment of \$250,000. The total incentive payments paid will not exceed \$2,000,000. No credit will be issued to offset damages specified in "Closure Requirements and Conditions" of these special provisions.
- B. The designated portion of work shall be diligently prosecuted to completion before the expiration of 34 extended weekend closures. Beginning at 0500 on the Monday of the 34th extended weekend closure, the Contractor shall pay to the State, or funds will be withheld from the next progress payment, a sum of \$250,000 for each extended weekend closure in excess of 34 extended weekend closures.
- C. Delays due to action required by the Engineer performing inspection, testing, and review shall be considered as included in the number of extended weekend closures for completion of the designated portion of work and no extensions of time will be allowed for such actions in determining payments to the State or for determining funds withheld from progress payments.

CONSTRUCTION MANAGEMENT PLAN FOR EXTENDED WEEKEND CLOSURES, PREPARATION, APPROVAL, AND UPDATES

The Contractor shall submit a written request to the Engineer at least 60 days prior to the start of an extended weekend closure.

A Construction Management Plan will be required for extended weekend closures as part of the request. The Construction Management Plan shall include a general time-scaled logic diagram displaying the major activities and sequence of planned operations that comply with the requirements of these special provisions and a contingency plan at each stage of operations to prevent late opening of extended weekend closures. "Early finish" and "late finish" milestones shall be clearly identified for every major activity. The contingency plan shall include detailed operations to be undertaken by the Contractor should a major activity pass the "late finish" milestone. If the Contractor fails to open all lanes to public traffic on time for an extended weekend closure, approvals for Construction Management Plans for remaining extended weekend closures will be considered invalid.

The Engineer will have 15 days to review Construction Management Plans. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit Construction Management Plans within 15 days of receipt of the Engineer's comments. The Engineer will have 7 days to review revisions. The Contractor shall not proceed with extended weekend closures unless written approval of final Construction Management Plans is issued by the Engineer 7 days before the planned extended weekend closure.

If the Contractor plans consecutive extended weekend closures, revisions of the Construction Management Plan for the immediate subsequent extended weekend closure based upon the progress of the immediately preceding extended weekend closure shall be submitted to the Engineer by Tuesday of the subsequent week. The Contractor shall not proceed with the subsequent extended weekend closure unless written approval of the revision is issued by the Engineer at least one day before the subsequent extended weekend closure.

Attention is directed to the profile index requirements in "Asphalt Concrete" of these special provisions.

At the end of extended weekend closures, the Contractor shall finish initial asphalt concrete layers within 113 mm below final grade.

Full compensation for preparing, updating, and obtaining written approval of Construction Management Plans for extended weekend closures shall be considered as included in the lump sum price paid for progress schedule (critical path method) and no separate payment will be made therefor.

10-1.025 MIGRATORY BIRD PROTECTION

The Contractor shall protect migratory birds, their occupied nests, and their eggs as specified in these special provisions. Nesting or attempted nesting by migratory birds is anticipated to occur between February 15 and September 1.

The Federal Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), Title 50 Code of Federal Regulations part 10, and California Department of Fish and Game Code Sections 3503, 3513, and 3800, protect migratory birds, their occupied nests, and their eggs.

The Federal and California Endangered Species Acts protect occupied and unoccupied nests of some threatened and endangered bird species. The Bald Eagle Protection Act (16 U.S.C. 668) prohibits the destruction of bald and golden eagles occupied and unoccupied nests.

When evidence of migratory bird nesting that may be adversely affected by construction activities is discovered, or when birds are injured or killed as a result of construction activities, the Contractor shall immediately stop work within 46 m (152 m for raptors) of the nests and notify the Engineer. Work shall not resume until the Engineer provides written notification that work may begin in this location.

When ordered by the Engineer, the Contractor shall use exclusion devices or remove and dispose of partially constructed and unoccupied nests of migratory birds on a regular basis to prevent their occupation.

Nest removal activities shall not allow nest materials to be deposited into, permit to pass into, or be placed into the waters of this state.

Penalties as used in this section, "Migratory Bird Protection," shall include fines, penalties, and damages; whether proposed, assessed, or levied against the Department or the Contractor. Penalties shall also include payments made or costs incurred in settlement for alleged violations of applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

Notwithstanding other remedies authorized by law, the Department may retain or withhold monies due the Contractor under the contract, in an amount determined by the Department, up to and including the entire amount of penalties proposed, assessed, or levied as a result of the Contractor's violation of Federal or State law, regulations or requirements. The Department may retain funds until final disposition has been made as to the penalties. The Contractor shall remain liable for the full amount of penalties until they are finally resolved with the entity seeking the penalties. Upon final disposition, the Department will inform the Contractor of the withheld amount.

Full compensation for migratory bird protection shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

Nesting prevention measures performed by the Contractor will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

A delay to the controlling item due to migratory birds or their nests will be considered a temporary suspension of work in accordance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Adjustments will be made for delays that the Engineer determines are not due to the Contractor's failure to perform the provision of the contract in the same manner as for suspensions due to unsuitable weather in Section 8-1.05.

10-1.39 ASPHALT CONCRETE (PG 64-28 PM AND PG 70-10)

Asphalt concrete for Asphalt Concrete (PG 64-28 PM) and Asphalt Concrete (PG 70-10) shall be Type A and shall conform to these special provisions. The locations of Asphalt Concrete (PG 64-28 PM), Asphalt Concrete (PG 70-10) (Rich Bottom) and Asphalt Concrete (PG 70-10) (Leveling Course) shall be as shown on the plans.

Rubberized Asphalt Concrete (Type G) shall conform to the provisions in "Rubberized Asphalt Concrete (Type G)" of these special provisions. The location of Rubberized Asphalt Concrete (Type G) shall be as shown on the plans.

Asphalt Concrete (Type B) Textured Paving shall conform to the provisions in "Asphalt Concrete (Type B) Textured Paving" of these special provisions. The location of Asphalt Concrete (Type B) Textured Paving shall be as shown on the plans.

Surfacing of miscellaneous areas with asphalt concrete shall conform to the provisions in "Asphalt Concrete (Miscellaneous Areas)" of these special provisions.

Asphalt concrete dikes shall be constructed with asphalt concrete (PG 70-10) and shall conform to the provisions in "Asphalt Concrete (Miscellaneous Areas)" of these special provisions.

The grade of asphalt binder to be mixed with aggregate for Asphalt Concrete (PG 70-10) (Rich Bottom) and (PG 70-10) (Leveling Course) shall be Grade PG 70-10 and shall conform to the requirements in Section 92, "Asphalts," of the Standard Specifications. The rubber-asphalt binder to be mixed with aggregate for Rubberized Asphalt Concrete (Type G) shall conform to the requirements in "Rubberized Asphalt Concrete (Type G)" of these special provisions. The grade of asphalt binder to be mixed with aggregate for Asphalt Concrete/Textured Paving shall be Grade PG 64-10 and shall conform to the requirements in Section 92, "Asphalts," of the Standard Specifications.

The grade of asphalt binder to be mixed with aggregate for Asphalt Concrete (PG 64-28 PM) shall be PG 64-28 PM and shall conform to the following provisions.

Asphalt Concrete (PG 70-10) (Rich Bottom) shall have 0.5 percent additional asphalt binder content over Asphalt Concrete (PG 70-10). Asphalt concrete (PG 70-10) (Leveling Course) shall have the same asphalt binder content as Asphalt Concrete (PG 70-10).

The aggregate for Type A asphalt concrete for the rich bottom and leveling course shall conform to the provisions of Section 39-2.02, "Aggregate," in Section 11-1, "Asphalt Concrete," of these special provisions. The aggregate for Rubberized Asphalt Concrete (Type G) shall conform to the requirements in "Rubberized Asphalt Concrete (Type G)" of these special provisions. The aggregate for Asphalt Concrete/Textured Paving shall conform to provisions of Section 39-2.02, "Aggregate," in Section 11-1, "Asphalt Concrete," of these special provisions.

The samples of each separately sized coarse aggregate shall have a minimum Cleanness Value of 57, as determined by California Test 227, modified as follows:

- A. Tests shall be performed on the material retained on the 2.36 mm sieve from each sample of separately sized aggregate.
- B. Each test specimen shall be prepared by hand shaking a single loading of the entire sample for 30 seconds on a 305 mm diameter, 4.75 mm sieve nested on top of a 305 mm diameter, 2.36 mm sieve.
- C. Where a coarse aggregate sample contains material which will pass the maximum size specified and be retained on a 9.5 mm sieve, the test specimen mass and volume of wash water specified for 25 mm x 4.75 mm aggregate size shall be used.
- D. Samples will be obtained from the weigh box area during or immediately after discharge from each bin of the batching plant or immediately prior to mixing with asphalt in the case of continuous mixers.
- E. The Cleanness Value of the test sample from each of the separately sized aggregates shall be separately computed and reported. Results shall not be combined or averaged.

The samples of each separately sized coarse aggregate for asphalt concrete shall have a minimum Crushed Particle Value of 98 percent, as determined by California Test 205, modified as follows:

- A. Tests shall be performed on the material retained on the 4.75 mm sieve from each sample of separately sized aggregate. The weighted average will not be required.
- B. Prepare sample by hand shaking representative portions of the "as received" material for 30 seconds on a 305 mm diameter, 4.75 mm sieve. Additional sieves may be added for convenience providing that the material retained on the 4.75 mm and larger sieves are recombined to form one sample.
- C. Sample size shall be 1000 ± 10 g for material retained on a 4.75 mm sieve.
- D. Any particle having two or more fresh mechanically fractured faces shall be considered a crushed particle.
- E. Calculate the Crushed Particles to the nearest 0.1 percent. If the Crushed Particles percentage is not a whole number, report it as the next higher whole percentage.

The Contractor may obtain a copy of the Department's "Quality Control Quality Assurance Manual for Asphalt Concrete Production and Placement" from the Department's home page at www.dot.ca.gov/hq/construc/qcqa.html.

In addition to the provisions in Section 39-9.01, "Spreading Equipment," in Section 11-1, "Quality Control / Quality Assurance," of these special provisions, asphalt paving equipment shall be equipped with automatic screed controls and a sensing device or devices.

When placing asphalt concrete to lines and grades established by the Engineer, the automatic controls shall control the longitudinal grade and transverse slope of the screed. Grade and slope references shall be furnished, installed, and maintained by the Contractor.

When placing the initial mat of asphalt concrete on existing pavement, the end of the screed nearest the centerline shall be controlled by a sensor activated by a ski device not less than 9 m long. The ski device shall be a rigid one piece unit and the entire length shall be utilized in activating the sensor. The end of the screed farthest from centerline shall be controlled by a sensor activated by a similar ski device, or an automatic transverse slope device set to reproduce the cross slope designated by the Engineer.

When paving contiguously with previously placed mats, the end of the screed adjacent to the previously placed mat shall be controlled by a sensor that responds to the grade of the previously placed mat and will reproduce the grade in the new mat within a 3 mm tolerance. The end of the screed farthest from the previously placed mat shall be controlled in the same manner the screed was controlled when placing the initial mat.

If the methods and equipment furnished by the Contractor fail to produce a layer of asphalt concrete conforming to the provisions, including straightedge tolerance, in Section 39-10.04, "Compacting," in Section 11-1, "Quality Control / Quality Assurance," of these special provisions, the paving operations shall be discontinued and the Contractor shall modify the equipment or methods, or furnish substitute equipment.

If the automatic screed controls fail to operate properly during a day's work, the Contractor may use manual control of the spreading equipment for the remainder of that day. However, the equipment shall be corrected or replaced with alternative automatically controlled equipment conforming to the requirements in this section before starting another day's work.

In addition to the straightedge provisions in Section 39-10.04, "Compacting," in Section 11-1, "Quality Control/Quality Assurance," of these special provision, the asphalt concrete pavement shall conform to the surface tolerances specified herein.

The uppermost layer of the asphalt concrete surfacing shall be profiled in the presence of the Engineer using a California Profilograph or equivalent in conformance with California Test 526 and as specified in these special provisions.

The California Profilograph or equivalent will not be required for the following areas of the pavement surface but shall conform to the straightedge requirements in Section 39-6.03, "Compacting," of the Standard Specifications:

- A. Pavement with a total thickness less than 75 mm.
- B. Pavement on horizontal curves with a centerline curve radius of less than 300 m and the pavement within the superelevation transition on those curves.
- C. Pavement placed in a single lift when required by the special provisions.
- D. Pavement with extensive grade or cross slope correction which does not receive advance leveling operations in conformance with the provisions in Section 39-6.02, "Spreading," of the Standard Specifications.

- E. Pavement for ramps and connectors with steep grades and high rates of superelevation, as determined by the Engineer.
- F. Pavement sections of city or county streets and roads, and turn lanes and collector lanes that are less than 500 m in length.
- G. Shoulders and miscellaneous areas.
- H. Pavement placed within one meter from and parallel with the joint between asphalt concrete pavement and existing curbs, gutters or existing pavement.
- I. Pavement surface within 15 m of a transverse joint that separates the pavement from an existing pavement, approach slab or structure surface not constructed under the contract.

The Contractor shall conform to California Test 526, except a zero (null) blanking band shall be used for determining the Profile Index. Prior to beginning profiles, the profilograph shall be calibrated in the presence of the Engineer. Two profiles shall be obtained within each traffic lane, one meter from and parallel with the edges of the lane.

Pavements profiled shall conform to the following Profile Index requirements:

- A. Pavement on tangent alignment and pavement on horizontal curves having a centerline curve radius of 600 m or more shall have a Profile Index of 48 mm or less for each 0.1-km section profiled.
- B. Pavement on horizontal curves having a centerline curve radius of 300 m or more but less than 600 m, including the pavement within the superelevation transition of these curves, shall have a Profile Index of 96 mm or less for each 0.1-km section profiled.
- C. Pavement within any 0.1-km section, containing high point areas with deviations in excess of 7.5 mm in a length of 7.5 m or less, when tested in conformance with the requirements in California Test 526, shall be corrected by the Contractor regardless of the Profile Index.

The Contractor shall complete initial runs of the profilograph prior to opening the pavement to public traffic. Profilograph operations shall be in conformance with the lane closure requirements in "Maintaining Traffic" of these special provisions. If initial profiles can not be made prior to opening the pavement to public traffic, the initial runs of the profilograph shall be made the next day that traffic control is permitted for the area to be profiled.

Areas of the top surface of the uppermost layer of asphalt concrete pavement that do not meet the specified surface tolerances shall be brought within tolerance by abrasive grinding.

Abrasive grinding shall be performed to reduce individual deviations in excess of 7.5 mm, and to reduce the Profile Index of the pavement to be within the specified tolerance. Areas which have been subjected to abrasive grinding shall receive a seal coat. Deviations in excess of 7.5 mm which cannot be brought into specified tolerance by abrasive grinding shall be corrected by either (1) removal and replacement or (2) placing an overlay of asphalt concrete. The corrective method for each area shall be selected by the Contractor and shall be approved by the Engineer prior to beginning the corrective work. Replacement or overlay pavement not meeting the specified tolerances shall be corrected by the methods specified above. Corrective work shall be at the Contractor's expense except that flagging costs will be paid for in conformance to the provisions in Section 12-2, "Flagging," of the Standard Specifications. The Contractor shall run profilograms on the areas that have received abrasive grinding or corrective work until the final profilograms indicate the Profile Index of the area is within the specified tolerance.

When abrasive grinding is used to bring the top surface of the uppermost layer of asphalt concrete surfacing within the specified surface tolerances, additional abrasive grinding shall be performed as necessary to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel with, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines normal to the pavement centerline, within a ground area. All corrective abrasive grinding shall be performed before Open Graded Asphalt Concrete is placed. Ground areas shall be neat rectangular areas of uniform surface appearance.

The original of the final profilograms that indicate the pavement surface is within the Profile Index specified shall become the property of the State and shall be delivered to the Engineer prior to acceptance of the contract.

Full compensation for performing all profile checks for Profile Index and furnishing final profilograms to the Engineer, for performing all corrective work to the pavement surface including abrasive grinding, removing, and replacing asphalt concrete or placing an asphalt concrete overlay to bring the surface within the tolerance specified shall be considered as included in the contract price paid per tonne for the asphalt concrete and no separate payment will be made therefor.

The area to which paint binder has been applied shall be closed to public traffic. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

A drop-off will not be allowed at any time between adjacent lanes open to public traffic.

The Contractor shall schedule paving operations such that each layer of asphalt concrete is placed on contiguous lanes of a traveled way each work shift. At the end of each work shift, the distance between the ends of the layers of asphalt concrete on adjacent lanes shall not be greater than 3 m nor less than 1.5 m. Additional asphalt concrete shall be placed along the transverse edge at the end of each lane in a taper of 50:1 or flatter and along the exposed longitudinal edges between adjacent lanes, hand raked, and compacted to form temporary conforms. Kraft paper, or other approved bond breaker, may be placed under the conform tapers to facilitate the removal of the taper when paving operations resume.

At the Contractor's option, a 300 mm wide tapered notched wedge joint may be used as a longitudinal joint between adjacent lanes open to traffic, if the lift thickness is greater than 45 mm. A vertical notch of 20 mm maximum shall be placed at the top and bottom of the tapered wedge. The tapered portion of the wedge shall be constructed with a strike-off device approved by the Engineer. The strike-off device shall provide a uniform slope and shall not restrict the main screed of the paver. The adjacent lane shall be paved within one day. In addition, the tapered wedge shall retain its shape while exposed to traffic. The completed longitudinal joint shall have a maximum theoretical density of 93 percent and in conformance with these special provisions. The percent of maximum theoretical density shall be determined in conformance with California Test 375 modified to use maximum theoretical density in accordance with California Test 309 (Rice Method) in lieu of test maximum density (TMD) as provided in Part 5, "Determining Test Maximum Density".

Where the existing pavement is to be widened by constructing a new structural section adjacent to the existing pavement, the new structural section shall be completed to match the elevation of the edge of the existing pavement for the entire length of the project prior to spreading and compacting asphalt concrete over the adjacent existing pavement.

Shoulders or median borders adjacent to a lane being paved shall be surfaced prior to opening the lane to public traffic.

Immediately prior to placing binder, pavement reinforcing fabric, and asphalt concrete surfacing, the pavement shall be cleaned of loose and extraneous materials such as, but not limited to, vegetation, sand, dirt, gravel and water.

Before placing the pavement reinforcing fabric, a binder of paving asphalt Grade PG 70-10 shall be applied uniformly to the surface to receive the pavement reinforcing fabric at a rate of not less than 1.15 L per square meter of surface covered. When pavement reinforcing fabric is placed in areas of conform tapers, the binder shall be spread at the approximate rate of 1.4 L per square meter of surface covered. The exact rate of application of asphalt binder will be determined by the Engineer.

Pavement reinforcing fabric shall not be placed in areas of conform tapers when the thickness of the overlying asphalt concrete will be less than 40 mm.

Asphalt concrete surfacing shall be placed over the pavement reinforcing fabric in the same work shift that the fabric is placed.

Pavement reinforcing fabric shall not be exposed to public traffic, Contractor's equipment or elements that will damage the fabric prior to placement of asphalt concrete surfacing.

Asphaltic emulsion shall not be substituted for paving asphalt binder for pavement reinforcing fabric.

Full compensation for cleaning pavement immediately in advance of placing binder, pavement reinforcing fabric, and asphalt concrete surfacing shall be considered as included in the contract price paid per square meter for pavement reinforcing fabric and no separate payment will be made therefor.

10-1.46 REPLACE CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE)

Replace concrete pavement (Rapid Strength Concrete) shall consist of removing existing Portland cement concrete pavement and underlying cement treated base and constructing rapid strength concrete (RSC) pavement as shown on the plans and in conformance with Section 40, "Portland Cement Concrete Pavement," of the Standard Specifications and these special provisions.

DEFINITIONS

The following definitions shall apply to this section:

- A. EARLY AGE. – A time less than 10 times the final set time of the concrete.
- B. FINAL SET TIME. – The elapsed time after initial contact of cement and water, or accelerator, if used, at which a specific penetration resistance of 27.6 MPa is achieved in conformance with the requirements in ASTM Designation: C 403.
- C. OPENING AGE. – The age at which the concrete will achieve the specified strength for opening to public or Contractor traffic.

PRE-OPERATION CONFERENCE

The Contractor and subcontractors involved in construction operations of RSC shall meet with the Engineer at a pre-operation conference, at a mutually agreed time, to discuss methods of accomplishing all phases of the construction operation, contingency planning, and standards of workmanship for the completed item of work.

The Contractor shall provide the facility for the pre-operation conference. The Contractor's superintendent, foremen, subcontractors, field staff, plant personnel including plant supervisors, manager, and operator involved with RSC shall attend the pre-operation conference. The Contractor shall submit a list of participants to the Engineer for approval. The complete listing shall identify each participant's name, employer, title and role in construction of RSC. The pre-operation conference shall be held for no less than 2 hours. Construction operations of RSC shall not begin until the specified personnel have completed the mandatory pre-operation conference.

JUST-IN-TIME TRAINING

Just-In-Time Training (JITT) shall be mandatory, and consist of a formal joint training class on rapid strength concrete. Construction operations for rapid strength concrete shall not begin until the Contractor's and the Engineer's personnel have completed the mandatory JITT. The Contractor's personnel included in the list of participants for the Pre-Operation Conference along with the Engineer's representatives shall attend JITT.

The JITT session will be conducted for not less than 4 hours on rapid strength concrete. The training class may be an extension of the Pre-Operation Conference and shall be conducted at the project field location convenient for both the Contractor's and the Engineer's project staffs. Scheduling and completion of the JITT session shall be completed at least 5 working days prior to the start of construction of rapid strength concrete. The class shall be held during normal working hours.

The JITT instructor shall be experienced in the construction methods, materials, and test methods associated with rapid strength concrete. The instructor shall not be an employee of the Contractor or a member of the Engineer's field staff. A copy of the syllabus, handouts, and presentation material shall be submitted to the Engineer at least 7 days before the day of the training. Selection of the course instructor, the course content and training site shall be as mutually agreed to by the Contractor and the Engineer. The instructor shall issue a certificate of completion to the participants upon the completion of the class. The certificate shall include the course title, date and location of the class, the name of the participant, instructor's name, location and phone number.

The Contractor's or Engineer's personnel involved with rapid strength concrete operations will not be required to attend JITT if they have completed similar training within the previous 12 months of the date of the JITT for this project. The Contractor shall provide a certificate of class completion as described above for each staff member to be excluded from the JITT session. The final determination for exclusion of any staff member's participation will be as determined by the Engineer. All attendees of the JITT shall complete, and submit to the Engineer, an evaluation of the training. The course evaluation form will be provided by the Engineer.

It is expressly understood that Just-In-Time Training shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformity with the requirements of the plans and specifications.

TRIAL SLAB

Prior to beginning work on replacement concrete pavement (RSC), the Contractor shall successfully complete one or more trial slabs for each RSC mix design to be used in constructing RSC pavement. Trial slabs shall be constructed, finished, cured and tested with the materials, tools, equipment, personnel and methods to be used in completing RSC pavement. Trial slabs shall demonstrate that the Contractor is capable of producing RSC pavement in conformance with the provisions in this section, within anticipated time periods including delivery, placement, finishing and curing times, and under similar atmospheric and temperature conditions expected during replacement operations. Multiple trial slabs for each RSC mix design may be required to envelop variable atmospheric and temperature conditions.

The minimum trial slab dimensions shall be 3 m by 6 m and shall be 260 mm thick. Trial slabs shall be placed near the project site at a location mutually acceptable to the Engineer and the Contractor except slabs shall not be placed on the roadway or within the project limits.

During trial slab construction and within 20 minutes of RSC delivery, beams shall be fabricated in conformance with the requirements in California Test 524. Beams shall be used to determine early age and 7-day modulus of rupture values. Beams fabricated for early age testing shall be cured so that the monitored temperature in the beams and the trial slab are within 3°C at all times. Internal temperatures of trial slab and early age beams shall be monitored and recorded at minimum time intervals of 5 minutes by installing thermocouples and or thermistors connected to strip-chart recorders or digital data loggers. Temperature recording devices shall be accurate to within $\pm 1^\circ\text{C}$. Internal temperature readings shall be measured at 25 mm from the top and 25 mm from the bottom, no closer than 75 mm from any edge of the concrete elements, until early age testing is completed. Beams fabricated for 7-day testing shall be cured in conformance with California Test 524 except they shall be placed into sand at between 5 and 10 times final set time or 24 hours, whichever is earlier. Trial slabs shall have an early age modulus of rupture of not less than 2.8 MPa and a 7-day modulus of rupture of not less than 4.2 MPa. Beams failing early age or 7-day modulus of rupture requirements shall be cause for rejection of the trial slab.

Materials resulting from construction of trial slabs and test specimens shall become the property of the Contractor and shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

REMOVING EXISTING PAVEMENT

Exact limits of concrete pavement to be replaced will be determined by the Engineer.

Existing concrete pavement shall be removed and replaced with base material and RSC pavement within the same work period. In the event existing pavement or base materials are removed and the Contractor is unable to construct, finish, and cure RSC pavement prior to the specified traffic opening time, a temporary roadway structural section shall be constructed. RSC used for replacement base material, shall conform to the requirements of Section 28, "Lean Concrete Base" of the Standard Specifications and these special provisions.

The outline of concrete pavement to be removed shall be sawed full depth with a power-driven saw except where the pavement is located adjacent to an asphalt concrete shoulder. Saw cuts within concrete pavement slabs shall be cut no more than 2 days prior to concrete pavement slab removal. Saw cuts made in work shifts prior to the actual removal work shift shall not be made parallel or diagonal to the traveled way and shall be cut so that traffic will not dislodge any pieces or segments.

Tie bars are located at longitudinal joints and shall be sawn through prior to concrete pavement slab removal.

Concrete pavement shall be removed by non-impacting methods. Each pavement panel shall be removed in one or more pieces without disturbance or damage to the underlying base.

Equipment used to remove concrete pavement within the sawed outline, shall not impact the surface of the concrete to be removed within 0.5-m of pavement to remain in place. Pavement and base removal shall be performed without damage to pavement or base to remain in place. Damage to pavement or base to remain in place, shall be repaired or removed and replaced. Repair, or removal and replacement of the damaged pavement and base shall be at the Contractor's expense and will not be measured nor paid for.

Existing base and cement treated base which, in the opinion of the Engineer, is not in a condition suitable as a base for the replacement pavement shall be removed and replaced to the same thickness with new base material and covered with a bond breaking material, as directed by the Engineer, prior to the construction of the replacement pavement.

Removed materials shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The material remaining in place, after removing pavement and base to the required depth, shall be graded to a uniform plane, moisture conditioned, and compacted by methods that will produce a firm and stable base. The finished surface of the remaining material shall not extend above the grade established by the Engineer. Areas that are low as a result of over excavation during base removal shall be filled, at the Contractor's expense, with base replacement material at the time and in the same operation that the base replacement layer is placed.

TEMPORARY ROADWAY STRUCTURAL SECTION

Asphalt concrete and aggregate base, equal to the quantity of pavement removed during the work shift, shall be provided on site for construction of a temporary roadway structural section where existing pavement is to be replaced. The quantity and location of standby material shall be included in the Contractor's contingency plan in conformance with the requirements of these special provisions. Temporary roadway structural section shall be maintained and later removed as the first order of work when replace concrete pavement (Rapid Strength Concrete) operations resume. The temporary roadway structural section shall consist of 90-mm thick asphalt concrete over aggregate base. RSC not conforming to these special provisions for RSC may be used for temporary roadway structural section with the Engineer's approval.

Aggregate base for temporary roadway structural section shall be produced from commercial quality aggregates consisting of broken stone, crushed gravel, natural rough-surfaced gravel, reclaimed concrete and sand, or any combination thereof. Grading of aggregate base shall conform to the 19-mm maximum grading specified in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications.

Asphalt concrete for temporary roadway structural section shall be produced from commercial quality aggregates and asphalt binder. Grading of aggregate shall conform to the 19-mm maximum, medium grading in Section 39-2.02, "Aggregate," of the Standard Specifications and asphalt binder shall conform to requirements for liquid asphalt SC-800 in Section 93, "Liquid Asphalts," of the Standard Specifications. Amount of asphalt binder to be mixed with the aggregate shall be approximately 0.3 percent less than the optimum bitumen content determined in conformance with the requirements in California Test 367.

Aggregate base and asphalt concrete for the temporary roadway structural section shall be spread and compacted by methods that will produce a well-compacted, uniform base, with a surface of uniform smoothness, texture and density. Surfaces shall be free from pockets of coarse or fine material. Aggregate base may be spread and compacted in one layer. Asphalt concrete may be spread and compacted in one layer. Finished surface of asphalt concrete shall not vary more than 15 mm from the lower edge of a 3.6-m \pm 0.06 m long straightedge placed parallel with the centerline and shall match the elevation of existing concrete pavement along the joints between the existing pavement and temporary surfacing.

Removed temporary roadway structural section materials shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications, except that removed aggregate base may be stockpiled at the project site and reused for construction of temporary roadway structural sections. When no longer required, standby material or stockpiled material for construction of temporary roadway structural sections shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

RAPID STRENGTH CONCRETE

General

Rapid Strength Concrete (RSC) shall be a concrete made with hydraulic cement that develops opening age and 7-day specified modulus of rupture strengths.

Requirements of Sections 40-1.015, "Cement Content," 40-1.05, "Proportioning," and 90-1.01, "Description," of the Standard Specifications shall not apply.

Combined aggregate grading used in RSC shall be either the 37.5-mm, maximum grading, or 25-mm, maximum grading, at the option of the Contractor.

Cement for RSC shall be hydraulic cement as defined in ASTM Designation: C 219 and shall conform to the following requirements:

Test Description	Test Method	Requirement
Contraction in Air	California Test 527, W/C Ratio = 0.39 ± 0.010	0.053 %, max.
Mortar Expansion in Water	ASTM Designation: C 1038	0.04 %, max.
Soluble Chloride*	California Test 422	0.05 %, max.
Soluble Sulfates*	California Test 417	0.30 %, max.
Thermal Stability	California Test 553	90 %, min.
Compressive Strength @ 3 days	ASTM Designation: C 109	17 MPa

*Test is to be done on a cube specimen, fabricated in conformance with the requirements in ASTM Designation: C 109, cured at least 14 days and then pulverized to 100% passing the 300- μ m sieve

At least 45 days prior to intended use, the Contractor shall furnish a sample of cement from each lot proposed for use and all admixtures proposed for use in the quantities ordered by the Engineer.

The Contractor shall submit uniformity reports for cement used in RSC to the Engineer. Uniformity reports shall conform to the requirements in ASTM Designation: C 917, except that testing age and water content may be modified to suit the particular material. Uniformity reports shall be submitted at least every 30 days during RSC pavement operations.

Non-chloride Type C accelerating chemical admixtures and Type E, accelerating and water reducing admixtures conforming to the provisions in Section 90-4, "Admixtures," of the Standard Specifications may be used. In addition to the admixtures listed on the Department's current list of approved admixtures, citric acid or borax may be used if requested in writing by the cement manufacturer and a sample is submitted to the Engineer. Chemical admixtures, if used, shall be included in the testing for requirements listed in the table above.

At least 10 days prior to use in the trial slab, the Contractor shall submit a mix design for RSC that shall include the following:

- A. Opening age
- B. Proposed aggregate gradings
- C. Mix proportions of hydraulic cement and aggregate
- D. Types and amounts of chemical admixtures
- E. Maximum time allowed between batching RSC and placing roadway pavement
- F. Range of ambient temperatures over which the mix design is effective (10°C maximum range)
- G. Final set time of the concrete
- H. Any special instructions or conditions, including but not limited to, water temperature requirements when appropriate

The Contractor shall submit more than one mix design to plan for ambient temperature variations anticipated during placement of the roadway pavement. Each mix shall be designed for a maximum ambient temperature range of 10°C. The Contractor shall develop and furnish modulus of rupture development data for each proposed mix design. Modulus of rupture development data for up to 7 days shall be provided to the Engineer prior to beginning paving operations. Modulus of rupture development data may be developed from laboratory prepared samples. The testing ages for modulus of rupture development data shall include one hour before opening age, opening age, one hour after opening age, 24 hours, 7 days and 28 days.

Concrete pavement penetration requirements in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications shall not apply to RSC.

RSC pavement shall develop a minimum modulus of rupture of as specified in "Pay Factor Adjustment for Low Modulus of Rupture" of these special provisions before opening to public or Contractor traffic. In addition, RSC pavement shall develop a minimum modulus of rupture of 4.2 MPa in 7 days after placement. RSC pavement that attains a modulus of rupture of less than specified may be accepted in conformance with "Pay Factor Adjustment for Low Modulus of Rupture" specified herein. Modulus of rupture shall be determined by averaging results from 3 beam specimens tested in conformance with the requirements in California Test 524. Beam specimens may be fabricated using an internal vibrator in conformance with the requirements in ASTM Designation: C 31. No single test shall represent more than the production of that day or 100 cubic meters, whichever is less.

Modulus of rupture at early age may be estimated using the correlation established during trial slab placement or by using results from beam specimens cured under atmospheric conditions and at a temperature within 3°C of the pavement. Modulus of rupture at other ages will be determined using beams cured and tested in conformance with California Test 524 except beams will be placed into sand between 5 and 10 times final set time or 24 hours, whichever is earlier. The Contractor shall perform the testing to determine modulus of rupture values of the RSC pavement. The modulus of rupture, as determined above, will be the basis for accepting or rejecting the RSC pavement for modulus of rupture requirements.

Pay Factor Adjustment for Low Modulus of Rupture

Payment for replace concrete pavement (Rapid Strength Concrete) will be adjusted for low modulus of rupture tests as follows:

- A. Replace concrete pavement (Rapid Strength Concrete) with modulus of rupture of 2.8 MPa or greater before the lane is opened to the traffic and 7-day modulus of rupture of 4.2 MPa or greater will be paid for at the contract price per cubic meter for replace concrete pavement (Rapid Strength Concrete).
- B. Replace concrete pavement (Rapid Strength Concrete) with a 7-day modulus of rupture of less than 3.4 MPa will not be paid for, and shall be removed and replaced, at the Contractor's expense with replace concrete pavement (Rapid Strength Concrete) conforming to the requirements of these special provisions.

- C. Replace concrete pavement (Rapid Strength Concrete) with modulus of rupture of 2.4 MPa or greater before the lane is opened to traffic and a 7-day modulus of rupture of equal to or greater than 3.4 MPa will be paid for at a percentage of the contract price per cubic meter for replace concrete pavement (Rapid Strength Concrete) in conformance with the percentages in the pay table below.
- D. Replace concrete pavement (Rapid Strength Concrete) with modulus of rupture of less than 2.4 MPa when the lane is opened to traffic will be rejected and shall be removed and replaced at the Contractor's expense with replace concrete pavement (Rapid Strength Concrete) conforming to the requirements of these special provisions.

Percentage Pay Table

Modulus of Rupture (MPa) at opening to traffic	7-Day Modulus of Rupture (MPa)		
	Greater than or equal to 4.2	Less than 4.2 and greater than or equal to 3.8	Less than 3.8 and greater than or equal to 3.4
Greater than or equal to 2.8	100%	95%	90%
Less than 2.8 and greater than or equal to 2.4	95%	90%	85%
Less than 2.4	zero%*	zero%*	zero%*

The Contractor shall pay to the State adjustments in payment for low modulus of rupture tests in conformance with the requirements specified in the tables in this section. The Department will deduct the amount of the adjustments from moneys due or that may become due, the Contractor under the contract.

Proportioning

Weighing, measuring and metering devices used for proportioning materials shall conform to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications and these special provisions.

Over and under dials, and other indicators for weighing and measuring systems used in proportioning materials shall be grouped so that the smallest increment for each indicator can be accurately read from the point at which the proportioning operation is controlled for ingredients batched at a central batch plant. In addition, indicators for weighing and measuring cement batched from a remote weighing system shall also be placed so that each indicator can be accurately read from the point at which the proportioning operation is controlled

Aggregates shall be handled and stored in conformance with the provisions in Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Liquid admixtures shall be proportioned in conformance with the provisions in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications. Mineral admixtures shall be protected from exposure to moisture until used. Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures to easily track the materials that are 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.

Weighing equipment shall be insulated against vibration or movement of other operating equipment. When the plant is in operation, the mass of each draft of material shall not vary from the designated mass by more than the tolerances specified herein. Each scale graduation shall be 0.001 of the usable scale capacity.

Aggregate shall be weighed cumulatively and equipment for the weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch mass of the aggregate. Equipment for the separate weighing of the cement or mineral admixture shall have a zero tolerance of ±0.5 percent of their designated individual batch drafts. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated mass or volume.

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

Material	Tolerance
Aggregate	± 1.0 percent of designated batch mass
Cement	± 0.5 percent of designated batch mass
Mineral Admixture	± 1.0 percent of designated batch mass
Water	± 1.5 percent of designated batch mass or volume

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 special provisions. Dry ingredients shall be proportioned by mass. Liquid ingredients shall be proportioned by mass or volume.

At the time of batching, aggregates shall have been dried or drained sufficiently to result in stable moisture content, so that no visible separation of water from aggregate will take place during the proportioning process. 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.

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

Cement shall be kept separate from the aggregates until released for discharge into the mixer. Cement shall be free of lumps and clods when discharged into the mixer. Fabric containers used for transportation or proportioning of cement shall be clean and free of residue before reuse.

Weigh systems for proportioning aggregate, cement, and 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 distinct material-weighing device.

For batches with a volume of one cubic meter or more, proportioning equipment shall conform to one of the following methods:

- A. All ingredients shall be batched at a central batch plant and charged into a mixer truck for transportation to the pour site. Ingredient proportioning shall meet the requirements of Section 90-5, "Proportioning," of the Standard Specifications.
- B. All ingredients except the cement shall be batched at a central batch plant and charged into a mixer truck for transportation to a remote located silo and weigh system for the proportioning of the cement. The remote system shall proportion cement for charging the mixer truck.
- C. All ingredients except the cement shall be batched at a central batch plant and charged into a mixer truck for transportation to a remote location where pre-weighed, containerized cement shall be added to the mixer truck. The cement pre-weighing operation shall utilize a platform scale. The platform scale shall have a maximum capacity of 2.5 tonnes with a maximum graduation size of 0.5 kilograms. Cement shall be pre-weighed into a fabric container. The minimum amount of cement to be proportioned into any single container shall be one half of the total amount required for the load of RSC being produced.
- D. Cement, water, and aggregate shall be proportioned volumetrically in conformance with these special provisions.

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

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

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. Water added to the truck mixer at the job site shall be measured through a meter that conforms to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

Aggregate discharged from several bins shall be controlled by gates or by mechanical conveyors. The means of discharge from the bins and from the weigh hopper shall be interlocked so that no more than one bin can discharge at a time, and so that the weigh hopper can not be discharged until the required quantity from each of the bins has been deposited in the weigh hopper.

Weighmaster Certificates

Weighmaster certificates for RSC, regardless of the proportioning method used, shall include all information necessary to trace the manufacturer, and manufacturer's lot number for the cement being used. When proportioned into fabric containers the weighmaster certificates for the cement shall contain date of proportioning, location of proportioning and actual net draft mass of the cement. When proportioned at the pour site from a storage silo the weighmaster certificates shall contain date of proportioning, location of proportioning and the net draft mass of the cement used in the load.

Volumetric Proportioning

When RSC is proportioned by volume, the method shall conform to requirements specified herein.

Aggregates shall be handled and stored in conformance with the provisions in Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Liquid admixtures shall be proportioned in conformance with the provisions in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications. Mineral admixtures shall be protected from exposure to moisture until used. 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 batch-mixer storage hopper or in the feed line.

Batch-mixer trucks shall be equipped to proportion cement, water, aggregate and additives by volume. Aggregate feeders shall be connected directly to the drive on the cement vane feeder. The cement feed rate shall be tied directly to the feed rate for the aggregate and other ingredients. Any change in the ratio of cement to aggregate shall be accomplished by changing the gate opening for the aggregate feed. The drive shaft of the aggregate feeder shall be equipped with a revolution counter reading to the nearest full or partial revolution of the aggregate delivery belt.

Aggregate shall be proportioned using a belt feeder operated with an adjustable cutoff gate delineated to the nearest quarter increment. Height of the gate opening shall be readily determinable. Cement shall be proportioned by a method that conforms to the accuracy requirements of these special provisions. Water shall be proportioned by a meter conforming to the provisions in Section 9-1.01, "Measurement and Payment," of the Standard Specifications and these special provisions.

Delivery rate of aggregate and cement per revolution of the aggregate feeder shall be calibrated at appropriate gate settings for each batch-mixer truck used on the project and for each aggregate source. Batch-mixer trucks shall be calibrated at 3 different aggregate gate settings that are commensurate with production needs. Two or more calibration runs shall be required at each of the different aggregate gate openings. The actual mass of material delivered for aggregate proportioning device calibrations shall be determined by a platform scale as specified in these special provisions.

Aggregate belt feeder shall deliver aggregate to the mixer with volumetric consistency so that deviation for any individual aggregate delivery rate check-run shall not exceed 1.0 percent of the mathematical average of all runs for the same gate opening and aggregate type. Each test run shall be at least 500 kg. Fine aggregate used for calibration shall not be reused for device calibration.

At the time of batching, aggregates shall be dried or drained sufficiently to result in stable moisture content, so that no visible separation of water from aggregate takes place during the proportioning process. 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.

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

Rotating and reciprocating equipment on batch-mixer trucks shall be covered with metal guards.

The cement proportioning system shall deliver cement to the mixer with a volumetric consistency so that the deviation for any individual delivery rate check-run shall not exceed 1.0 percent of the mathematical average of 3 runs of at least 500 kg each. Cement used for calibration shall not be reused for device calibration.

Water meter accuracy shall be such that, when operating between 50 percent and 100 percent of production capacity, the difference between the indicated mass of water delivered and the actual mass delivered shall not exceed 1.5 percent of the actual mass for each of two individual runs of 1200 liters. The water meter shall be calibrated in conformance with the requirements of California Test 109 and shall be equipped with a resettable totalizer and display the operating rate.

Calibration tests for aggregate, cement and water proportioning devices shall be conducted with a platform scale located at the calibration site. Weighing of test run calibration material shall be performed on a platform scale having a maximum capacity not exceeding 2.5 tonnes with maximum graduations of 0.5-kg. The platform scale shall be error tested within 8 hours of calibration of batch-mixer truck proportioning devices. Error testing shall be performed with test masses conforming to California Test 109 and shall produce a witness scale that is within 2 graduations of the test mass load. The scale shall be available for use at the production site throughout the production period. Equipment needed for the calibration of proportioning systems shall remain available at the production site throughout the production period. A Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished with each delivery of aggregate, cement, and admixtures used for calibration tests and shall be submitted to the Engineer with a certified copies of the mass of each delivery. The Certificate of Compliance shall state that the source of materials used for the calibration tests is from the same source as to be used for the planned work. The Certificate of Compliance shall state that the material supplied conforms to the Standard Specifications and these Special Provisions and shall be signed by an authorized representative who shall have the authority to represent and act for the Contractor.

The batch-mixer truck shall be equipped so that an accuracy check can be made prior to the first operation for the project and at any other time as directed by the Engineer. Further calibration of proportioning devices shall be required every 30 days after production begins or when the source or type of any ingredient is changed. A spot calibration shall consist of calibration of the cement proportioning system only. A two run spot re-calibration of the cement proportioning system shall be performed each time 50 tonnes of cement has passed through the batch-mixer truck. Should the spot re-calibration of the cement proportioning system fall outside the limitations specified herein, a full calibration of the cement proportioning system shall be completed before the resumption of production.

Liquid admixtures shall be proportioned by a meter.

Cement storage shall be located immediately before the cement feeder and shall be equipped with a device that will automatically shut down the power to the cement feeder and aggregate belt feeder when the cement storage level is lowered to a point where less than 20 percent of the total volume is left in storage.

The Contractor shall furnish aggregate moisture determinations, made in conformance with the requirements of California Test 223, at least every 2 hours during proportioning and mixing operations. Moisture determinations shall be recorded and presented to the Engineer at the end of the production shift.

Each aggregate bin shall be equipped with a device that will automatically shut down the power to the cement feeder and the aggregate belt feeder when the aggregate discharge rate is less than 95 percent of the scheduled discharge rate of any bin.

Indicators specified herein shall be in working order prior to commencing proportioning and mixing operations and shall be visible when standing near the batch-mixer truck.

Identifying numbers of batch-mixer trucks shall be at least 75 mm in height, and be located on the front and rear of the vehicles.

Volumetric proportioned RSC shall be mixed in a mechanically operated mixer of adequate size and power for the type of RSC to be placed. Mixers may be of the auger type and shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers that have an accumulation of hard concrete or mortar shall be removed from service until cleaned. Other types of mixers may be used provided mixing quality will meet the requirements of these special provisions.

Charge or rate of feed to the mixer shall not exceed that which will permit complete mixing of the materials. Dead areas in the mixer, where material does not move or is not sufficiently agitated, shall be corrected by a reduction in the volume of material or by other adjustments. The mixer shall be designed to provide sufficient mixing action and movement to produce properly mixed RSC. Mixing shall continue until a homogeneous mixture is produced at discharge from the mixer. There shall be no lumps or evidence of non-dispersed cement at discharge from the mixer. No water shall be added to the RSC after discharge from the mixer.

Equipment having components made of aluminum or magnesium alloys, which may have contact with plastic concrete during mixing or transporting of RSC, shall not be used.

Uniformity of concrete mixtures will be determined by differences in penetration measurement made in conformance with the requirements in California Test 533. 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 15 mm. The Contractor shall furnish samples of freshly mixed concrete and provide facilities for obtaining the samples. Sampling facilities shall be safe, accessible, clean and produce a sample which is representative of production. Sample devices and sampling methods shall also conform to the requirements of California Test 125.

Ice shall not be used to cool RSC directly. When ice is used to cool water used in the mix, all of the ice shall be melted before entering the mixer.

Cement shall be proportioned and charged into the mixer by means that will result in no losses of cement due to wind, or due to accumulation on equipment, or other conditions which will vary the required quantity of cement.

Each mixer shall have a metal plate or plates, prominently attached, on which the following information is provided:

- A. Uses for which the equipment is designed.
- B. Manufacturer's guaranteed capacity of the mixer in terms of the volume of mixed concrete.
- C. Speed of rotation of the mixer.

Consistency and workability of mixed concrete when discharged at the delivery point shall be suitable for placement and consolidation.

Information generated by volumetric devices will not be used for payment calculations.

The device that controls the proportioning of cement, aggregate and water shall produce a log of production data. The log of production data shall consist of a series of snapshots captured at 15-minute intervals throughout the period of daily production. Each snapshot of production data shall be a register of production activity at that time and not a summation of the data over the preceding 15 minutes. The amount of material represented by each snapshot shall be the amount produced in the period of time from 7.5 minutes before to 7.5 minutes after the capture time. The daily log shall be submitted to the Engineer, in electronic or printed media, at the end of each production shift or as requested by the Engineer, and shall include the following:

- A. Mass of cement per revolution count.
- B. Mass of each aggregate size per revolution count.
- C. Gate openings for each aggregate size being used.
- D. Mass of water added to the concrete per revolution count.
- E. Moisture content of each aggregate size being used.
- F. Individual volume of all other admixtures per revolution count.
- G. Time of day.
- H. Day of week.
- I. Production start and stop times.
- J. Batch-mixer truck identification.
- K. Name of supplier.
- L. Specific type, size, or designation of concrete being produced.
- M. Source of the individual aggregate sizes being used.
- N. Source, brand and type of cement being used.
- O. Source, brand and type of individual admixtures being used.
- P. Name and signature of operator.

Required report items may be input by hand into a pre-printed form or captured and printed by the proportioning device. Electronic media containing recorded production data shall be presented in a tab delimited format on a 90-mm diskette with a capacity of at least 1.4 megabytes. Each snapshot of the continuous production shall be followed by a line-feed carriage-return with allowances for sufficient fields to satisfy the amount of data required by these specifications. The reported data shall be in the above order and shall include data titles at least once per report.

Replacement Base Layer

Base materials removed shall be replaced with replacement base layer. Replacement base layer shall consist of rapid strength concrete and shall be placed in a separate and distinct operation from that of replacing concrete pavement.

Replacement base layer shall be finished to the grade of the original base layer. The surface shall not be textured and shall be finished to a smooth surface, free of mortar ridges and other projections. The finished surface shall be free from voids and porous areas.

Bond Breaker

Bond breaker shall be placed between replacement pavement and existing lean concrete base, cement treated base or new base replacement layer. Bond breaker shall be one of the following:

- A. Curing paper conforming to the requirements in ASTM Designation: C 171, white.
- B. Polyethylene film conforming to the requirements in ASTM Designation: C 171, except that the minimum thickness shall be 0.15 mm, white opaque.
- C. Paving asphalt, Grade PG 64-10, conforming to the provisions in Section 1, "Specifications and Plans," of these special provisions.
- D. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A, containing a minimum of 22 percent nonvolatile vehicles consisting of at least 50 percent paraffin wax.

When curing paper or polyethylene film is used, material shall be placed in a wrinkle free manner. Adjacent sheets shall be overlapped a minimum of 150 mm.

When curing compound or paving asphalt is used, all foreign and loose materials remaining from slab removal shall be removed prior to application.

When paving asphalt is used, no water shall be added before applying asphalt to the surface of the base. The paving asphalt shall be applied in one even application at a rate of 0.10 to 0.45-L/m² over the entire base surface area. Concrete pavement shall not be placed until the paving asphalt has cured.

When curing compound is used, the curing compound shall be applied in two separate applications. Each application shall be applied evenly at a rate of 0.3 to 0.5-L/m² over the entire base surface area.

Spreading, Compacting and Shaping

Metal or wood side forms may be used. Wood side forms shall not be less than 38-mm thick. Side forms shall be of sufficient rigidity, both in the form and in the connection with adjoining forms, that movement will not occur under the force from subgrading and paving equipment or from the pressure of concrete.

Side forms shall remain in place until the pavement edge no longer requires the protection of forms. Side forms shall be thoroughly cleaned and oiled prior to each use.

Consolidation of RSC shall be by means of high-frequency internal vibrators after the RSC is deposited on the subgrade. Vibrating shall be done in a manner to assure uniform consolidation adjacent to forms and across the full paving width. RSC shall be placed as nearly as possible in its final position and use of vibrators for extensive shifting of the mass of RSC will not be permitted.

RSC shall be spread and shaped by suitable powered finishing machines and supplemented by hand finishing as necessary. Methods of spreading, shaping and consolidating that result in segregation, voids or rock pockets shall be discontinued. The Contractor shall use methods that will produce dense homogeneous pavement conforming to the required cross section.

After the RSC has been mixed and placed, no additional water shall be added to the surface to facilitate finishing. Surface finishing additives, when used, shall be as recommended by the manufacturer of the cement and shall be approved by the Engineer prior to use.

Joints

Prior to placing concrete against existing concrete, a 6-mm thick commercial quality polyethylene flexible foam expansion joint filler shall be placed across the original transverse and longitudinal joint faces and extend the full depth of the excavation. The top of the joint filler shall be placed flush with the top of pavement. Joint filler shall be secured to the joint face of the existing pavement by a method that will hold the joint filler in place during the placement of concrete.

Transverse weakened plane joints in pavement widenings shall be constructed to match the spacing and skew of the weakened plane joints in the adjacent existing pavement. Where the existing transverse weakened plane joint spacing in an adjacent lane exceeds 4.6 m, an additional transverse weakened plane joint shall be constructed midway between the existing joints. The provisions in the second and third paragraphs in Section 40-1.08B, "Weakened Plane Joints," and the third paragraph in Section 40-1.08B(1), "Sawing Method," of the Standard Specifications shall not apply. Sawing of weakened plane joints shall be completed within 2 hours of completion of final finishing. Minimum depth of cut for weakened plane joints shall be 70 mm.

Replacement Tie Bars

Tie bars shall be installed at longitudinal joints where existing tie bars were sawn through. Locations of new tie bars shall be placed as directed by the Engineer.

Tie bars shall be deformed reinforcing steel bars conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 300 or 420 and shall be epoxy-coated in conformance with the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that references made to ASTM Designation: D 3963/D 3963M shall be deemed to mean ASTM Designation: A 934/A 934M or A 775/A 775M. Tie bars shall not be bent.

Tie bars shall not be used at joints where RSC and asphalt concrete pavements join.

Tie bars shall be installed at longitudinal joints by drilling and bonding with epoxy. Epoxy shall be a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V, Grade 3 (None-Sagging). The class used shall be dependent on the internal temperature of the existing hardened concrete at the time of tie bar installation as follows: Class A for below 4.5°C, Class B for 4.5°C to 15.5°C, and Class C for above 15.5°C. Epoxy shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 7 days prior to the start of work. Drilled holes shall be cleaned in conformance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during curing and shall remain undisturbed until epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Engineer, will be rejected. If rejected, new holes shall be drilled adjacent to the rejected holes, as directed by the Engineer, and new tie bars shall be placed and securely bonded to the concrete. Work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.

Final Finishing

Tests to determine coefficient of friction of the final textured surface will be made only if the Engineer determines by visual inspection that the final texturing may not have produced a surface having the specified coefficient of friction. Any tests to determine the coefficient of friction will be made after the pavement is opened to public traffic, but not later than 5 days after concrete placement. Pavement areas having a coefficient of friction as determined in conformance with the requirements in California Test 342 of less than 0.30 shall be grooved in conformance with the provisions in Section 42-1.02, "Construction," of the Standard Specifications. Grooving shall be performed prior to the installation of any required edge drains adjacent to the areas to be grooved.

Transverse straightedge and longitudinal straightedge requirements will not apply to the pavement surface within 300 mm of the existing concrete pavement except as required in these special provisions. Longitudinal straightedge requirements in Section 40-1.10, "Final Finishing," of the Standard Specifications, shall be applied at transverse contact joints with existing concrete pavement where the straightedge is to be placed with the midpoint coincident with the joints. Pavement not meeting this straightedge requirement shall be corrected within 48 hours by grinding or other methods as approved by the Engineer.

Profiles of the completed pavement surface specified in Section 40-1.10, "Final Finishing," of the Standard Specifications will not be required. The Profile Index requirements in Section 40-1.10, "Final Finishing," of the Standard Specifications shall not apply.

Curing Method

The curing method for replacement pavement shall be as recommended by the manufacturer of the cement and as approved by the Engineer.

QUALITY CONTROL PROGRAM

General

The Contractor shall establish, provide and maintain a quality control program that will provide assurance to the Engineer that all materials and completed construction conform to the contract requirements specified herein.

At least 21 days prior to the placement of the trial slab the Contractor shall submit to the Engineer for approval a written Quality Control Plan (QCP) that shall be used to ensure the quality of the product and the work. At the request of the Engineer or Contractor, the Contractor and Quality Control Managers (QCMs) shall meet with the Engineer to discuss the QCP. The Engineer will have 14 days to approve the Quality Control Plan (QCP). Should the Engineer fail to complete the review of the Quality Control Plan (QCP) within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the Quality Control Plan (QCP), the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

If in the judgement of the Engineer, the Contractor has not implemented or is not complying with the approved QCP, production and placement shall be suspended. Production and placement shall not resume until approved by the Engineer.

Quality Control Plan

The Contractor shall provide a QCP that describes the procedures that the Contractor will use to control the production process, to determine when changes to the production process are needed, and to propose procedures for implementing changes for replacement pavement operations. The QCP shall also include an outline for the placement and testing of the trial slab.

Replacement pavement production and placement shall not begin until the QCP has been approved by the Engineer. Approval of the QCP will be based on the inclusion of all required information. Approval of the QCP does not imply any warranty by the Engineer that adherence to the QCP will result in replacement pavement that complies with these specifications. It shall remain the responsibility of the Contractor to demonstrate this compliance.

The QCP shall include the names and qualifications of the lead QCM and the assistant QCM. The lead QCM shall be responsible for the administration of the QCP. The lead QCM shall have current American Concrete Institute (ACI) certification as "Concrete Field Testing Technician-Grade I" and "Concrete Laboratory Testing Technician-Grade II." The assistant QCM shall have current ACI certification as "Concrete Field Testing Technician-Grade I" and either "Concrete Laboratory Testing Technician-Grade I" or "Concrete Laboratory Testing Technician-Grade II." All sampling, inspection and test reports shall be reviewed and signed by the QCM responsible for the production period involved prior to submittal to the Engineer. At least one QCM shall be present for each stage of mix design, trial slab construction, during production and construction of replacement pavement and for all meetings between the Contractor and Engineer relating to production, placement or testing of replacement pavement. The QCMs shall not be members of production or paving crews, inspectors or testers on the project during production or placement of replacement pavement. QCMs shall have no duties other than those referenced in these special provisions during the production and placement of replacement pavement.

The QCP shall include an outline of the production, transportation and placement of the replacement pavement. The QCP shall include a contingency plan for correcting situations if there is a problem in production, transportation or placement. The Contractor shall have equipment and personnel present to meet the requirements of the contingency plan. The QCP shall contain provisions for determining when placement of the replacement pavement will be suspended and temporary roadway will be substituted.

The QCP shall include the names of quality control personnel to be used and an outline of sampling, testing to be performed during and after construction of replacement pavement. At the time of submission of the QCP, quality control samplers and testers must be Caltrans qualified by the Department through the Independent Assurance Program (IAP) for the sampling and testing for which they will be responsible.

Before production and placement begins, the Contractor, QCMs and Engineer shall have a meeting with all production, transportation, placement, inspection, sampling and testing personnel to familiarize them with the requirements of the project. Items to be discussed include the production, transportation and placement processes for replacement pavement; contingency plan; and sampling and testing. The Contractor shall provide the facility for this meeting. The meeting date and location will be approved by the Engineer. Attendance at this meeting is mandatory for key personnel including the project manager, QCMs, production plant manager, plant inspector, all concrete delivery truck drivers, paving superintendent, paving foreman, paving machine operator, and all inspectors, samplers and testers. All meeting attendees shall sign in at the meeting. Production and placement operations shall not begin unless the above key personnel have attended the mandatory meeting.

Quality Control Inspection, Sampling and Testing

The Contractor shall perform quality control inspection, sampling and testing to ensure that replacement pavement production and placement conform to the provisions specified herein.

The Contractor shall provide the required sampling, testing and inspection during all phases of replacement pavement production and placement. The Contractor shall provide a minimum of two working days notice to the Engineer, so the Engineer can witness all sampling and testing. The Engineer shall be given unrestricted access to the Contractor's quality control inspectors, samplers, testers and laboratories. During the production and placement period, the Contractor shall provide results of all testing to the Engineer within 15 minutes of completion of testing. The Contractor shall record all inspection, sampling and testing on forms approved by the Engineer. The Contractor shall provide written results of all inspection and testing to the Engineer within 48 hours of completion of each shift of paving and within 24 hours for all 7-day strength tests.

The Contractor shall provide a testing laboratory with adequate equipment and personnel for the performance of the quality control tests. This laboratory shall be located at a location approved by the Engineer and so that prompt testing requirements will be achieved. All sampling and testing equipment shall be maintained in proper working condition. Sampling shall be performed in conformance with the requirements of California Test 125. The QCP shall include a list the equipment to be used including date of last calibration, the names and certifications of sampling and testing personnel, and the location of the laboratory and testing equipment during and after paving operations.

Testing laboratories, testing equipment, and sampling and testing personnel shall conform to the requirements of the Department's IAP.

Trial Slab and Process Control Testing

Prior to construction of RSC pavement, the Contractor shall construct one or more trial slabs under conditions similar to those that will exist during pavement replacement, for each mix design, to show that personnel, equipment, and mixing, placing, curing, and sawing techniques will produce a concrete pavement conforming to these special provisions in the anticipated time period under similar atmospheric and temperature conditions as pavement construction and to establish the correlation described below. During production and placement, the Contractor shall conform to the requirements of these special provisions and to the procedure outlined in the QCP to ensure that mixing, transporting, placing, finishing, curing and sawing techniques and that personnel and equipment to be used will produce replacement pavement conforming to these special provisions.

A trial slab shall be constructed using the approved mix design, admixtures and conditions for batching. During construction of trial slab, the Contractor shall demonstrate placement at the minimum and maximum times allowed from batching to placement. RSC pavement within the roadway shall not proceed until a trial slab meeting the requirements of these special provisions has been constructed.

The minimum trial slab dimensions shall be 3 m by 6 m and shall be 260 mm thick. Trial slabs shall be placed near the project site at a location mutually acceptable to the Engineer and the Contractor except slabs shall not be placed on the roadway or within the project limits.

During trial slab construction, the Contractor shall sample and split the aggregate for gradings, cleanness value, and sand equivalent testing with the Engineer, at the Contractor's cost. Both sets of test results of these samples shall conform to the provisions in Section 90-2.02, "Aggregates," of the Standard Specifications. If test results do not conform to the requirements, the trial slab will be rejected.

During trial slab construction and within 20 minutes of RSC delivery, beams shall be fabricated in conformance with the requirements in California Test 524. Beams shall be used to determine early age and 7-day modulus of rupture values. Beams fabricated for early age testing shall be cured so that the monitored temperature in the beams and the trial slab are within 3°C at all times. Internal temperatures of the trial slab and early age beams shall be monitored and recorded at minimum time intervals of 5 minutes by installing thermocouples and or thermistors connected to strip-chart recorders or digital data loggers. Temperature recording devices shall be accurate to within $\pm 1^\circ\text{C}$. Internal temperature readings shall be measured at 25 mm from the top and 25 mm from the bottom, no closer than 75 mm from any edge of the concrete elements, until the early age testing is completed. Beams fabricated for 7-day testing shall be cured in conformance with the requirements in California Test 524, except beams shall be placed into sand at between 5 and 10 times the final set time or 24 hours, whichever is earlier. Testing shall be performed by the Contractor and witnessed by the Engineer. At the Engineer's request, the Contractor shall produce samples for the Engineer to test. Strength results from beams shall be the basis for determining whether RSC pavement operations may proceed. Trial slabs shall have an early age modulus of rupture of not less than 2.8 MPa and a 7-day modulus of rupture of not less than 4.2 MPa. Beams failing early age or 7-day modulus of rupture requirements shall be cause for the rejection of the trial slab.

The Contractor shall state in detail the intended location and time; procedure for production, placement and finishing of RSC pavement; sampling, sample curing and sample transportation; testing and reporting of test results for the trial slab in the QCP.

Process Control and Quality Control Testing

The Contractor shall provide continuous process control and quality control sampling and testing throughout production and placement of replacement pavement.

During production of RSC for replacement pavement operations, the Contractor shall sample and test aggregates at least once every 500 cubic meters of RSC produced but not less than once per placement shift. Aggregates shall be tested for conformance with gradations, cleanness value and sand equivalent requirements.

During placement of RSC pavement, the Contractor shall fabricate specimens and test for modulus of rupture within the first 25 cubic meters, within the final truckload and at least once every 100 cubic meters.

During placement of RSC, the Contractor shall sample and test for yield, penetration, air content and unit weight at least once in every 500 cubic meters RSC produced but not less than twice per placement shift.

At the Engineer's request, the Contractor shall provide split samples and fabricate beams for the Engineer to test. The cost of sampling, fabricating and transporting extra samples will be paid for as extra work in conformance with the provisions in Section 4-1.03D, "Extra Work," of the Standard Specifications. When, in the opinion of the Engineer, RSC fails to conform to the mix design requirements or the requirements of these special provisions, the Contractor shall provide samples and testing at the direction of the Engineer. If the material fails to meet requirements of these special provisions, cost of sampling and testing shall be at the Contractor's expense. If the material meets the requirements of these special provisions, the cost of sampling and testing will be paid for as extra work in conformance with the provisions in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Beams used for determining early age modulus of rupture shall be cured under the same conditions as the pavement until one hour prior to testing. Beams fabricated for the 7-day test shall be cured in conformance with California Test 524 as modified in these special provisions. Modulus of rupture test results will be used for accepting or rejecting the replacement pavement and pay factor adjustment for low modulus of rupture.

Materials resulting from the construction of the trial slab, test specimens, temporary roadway structural section, and all rejected replacement pavement shall become the property of the Contractor and shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

REPLACE EXISTING PAVEMENT DELINEATION

Whenever existing pavement delineation is removed, obliterated or damaged due to the work involved in replacing concrete pavement, the Contractor shall replace the delineation in conformance with the requirements of these special provisions.

MEASUREMENT AND PAYMENT

Replace concrete pavement (Rapid Strength Concrete) will be measured and paid for in the same manner specified for concrete pavement in Sections 40-1.13, "Measurement," and 40-1.14, "Payment," of the Standard Specifications, and these special provisions.

Replace concrete pavement (Rapid Strength Concrete) payments will be subject to the pay factor values listed in "Pay Factor Adjustment for Low Modulus of Rupture" of these special provisions.

Full compensation for the pre-operation conference, including furnishing the facility to hold the pre-operation conference in, shall be considered as included in the contract prices paid for the item involving RSC and no additional compensation will be made therefor.

Costs for providing JITT will be made in conformance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications, except no markups shall be added, and the Contractor will be paid for one half of the JITT cost. Costs for providing JITT shall include training materials, class site, and the JITT instructor including the JITT instructor's travel, lodging, meals and presentation materials. All costs incurred by the Contractor or Engineer for attending JITT shall be borne by the party incurring the costs.

The provisions in Section 40-1.135, "Pavement Thickness," of the Standard Specifications shall not apply.

Full compensation for removing and disposing of existing concrete pavement and underlying base, constructing trial slabs, furnishing and placing bond breaker, furnishing and disposing of standby materials for temporary roadway structural section, and constructing, maintaining, removing and disposing of temporary roadway structural section, for furnishing and applying replacement pavement delineation, shall be considered as included in the contract price paid per cubic meter for replace concrete pavement (Rapid Strength Concrete), and no additional compensation will be allowed therefor.

The contract unit price paid for tie bar (drill and bond) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in placing epoxy-coated tie bars, drilling holes and bonding tie bars with epoxy resin, or furnishing and placing threaded dowel splice couplers, in concrete pavement complete in place, including properly aligning tie bars as shown on the plans, as specified in the Standard Specifications, and these special provisions, and as directed by the Engineer.

If calibration of volumetric batch-trucks is performed more than 160 km from the project limits, additional inspection expenses will be sustained by the State. Whereas it is and will be impracticable and extremely difficult to ascertain and determine the actual increase in these expenses, it is agreed that payment to the Contractor for Replace Concrete Pavement (Rapid Strength Concrete) will be reduced \$1000.

SECTION 39: ASPHALT CONCRETE

39-1 GENERAL

39-1.01 DESCRIPTION

This work shall consist in designing an asphalt concrete mixture which meets the permanent deformation and fatigue requirements, defining the quality requirements of the aggregates, asphalt binder and asphalt concrete mixture for use in the Contractor's quality control and the Engineer's verification efforts in conformance with this Section 11-1, "Quality Control / Quality Assurance for Asphalt Concrete," and with "Asphalt Concrete" of these special provisions.

In addition, this work shall consist of furnishing and mixing aggregate and asphalt binder at a central mixing plant, transporting, spreading and compacting the mixture, and furnishing and placing pavement reinforcing fabric, in conformance with this Section 11-1, "Quality Control / Quality Assurance," and with "Asphalt Concrete" of these special provisions.

The Contractor shall be responsible for developing an asphalt concrete mixture that meets permanent deformation and fatigue standards that were used in the mechanistic-empirical structural section design used for this roadway. The Contractor shall be responsible for defining the aggregate grading, asphalt content, stability and laboratory air voids target values that will be required to meet the deformation and fatigue standards.

The Contractor shall be responsible for controlling the quality of the asphalt concrete product entering the work, including aggregate, asphalt binder, additives, and asphalt concrete mixture; for controlling the quality of the work performed, including mix design, and mixing, transporting, spreading, and compacting the asphalt concrete; for controlling the quality of the finished roadway surface; and for developing, implementing, and maintaining a quality control program. The Contractor shall be responsible for the inspection, sampling, and testing required to control the quality of the asphalt concrete and the work performed.

The inspection, sampling, and testing required to control the quality of the workmanship and the asphalt concrete shall conform to this Section 11-1. Sampling shall be in conformance with the requirements of this Section 11-1 and with California Test 125. Sample preparation for permanent deformation and fatigue testing shall be performed using the procedure outlined in the procedure, LLP-AC1, "Sample Preparation and Testing for LA710 – Long-Life Asphalt Concrete," available at <http://www.dot.ca.gov/hq/esc/Translab/fpmlab.htm>. Testing for the permanent deformation and fatigue shall be performed using AASHTO TP7-94 modified and AASHTO TP8-94 modified, respectively, as included in the testing procedure, LLP-AC1, "Sample Preparation and Testing for LA710 – Long-Life Asphalt Concrete," available at <http://www.dot.ca.gov/hq/esc/Translab/fpmlab.htm>.

Testing shall be performed using California Tests unless otherwise directed by the Engineer or this Section 11-1.

Testing for permanent deformation and fatigue testing shall be performed by one of the following laboratories:

1. Department of Civil Engineering
North Carolina State University
P.O. Box 7908
208 Mann Hall
North Yarborough Dr.
Raleigh, NC 27695-7908
Contact: Dr. Akhtar Tayehali
Phone: (919) 515-7611
2. National Center for Asphalt Technology
Auburn University
277 Technology Parkway
Auburn University, AL 36830
Contact: Mr. Timothy W. Vollar
Phone: (334) 844-6228
3. Department of Civil Engineering, 258
University of Nevada
Reno, NV 89557
Contact: Dr. Peter Sebaaly
Phone: (775) 784-6565

4. The Asphalt Institute
P.O. Box 14052
Lexington, KY 40512-4052
Contact: Mr. R. Michael Anderson
Phone: (859) 288-4984

5. Texas Transportation Institute
CE/TTI Building, Room 503F
3136 TAMU
College Station, TX 77843-3136
Contact: Dr. Amy Epps Martin
Phone: (979) 862-1750

The Contractor shall negotiate scheduling for testing for permanent deformation and fatigue with the laboratory chosen, and shall coordinate sampling and testing to deliver the mix design as required by these specifications.

No more than 30 days following award of this project, the Contractor's project manager, project engineer, superintendent and foreman; the asphalt concrete producer, the asphalt concrete paver, and the quality control managers and laboratory supervisors from all testing firms performing mix design, performance testing and quality control testing shall attend a mandatory partnering meeting with the Engineer and his designees to discuss asphalt concrete mix design, asphalt concrete testing, and asphalt concrete placement. All parties shall be present. If a party can not attend this mandatory meeting at the time scheduled, the meeting will be delayed until such time as all parties can be present, or the meeting will be repeated with all parties present.

This meeting shall be in addition to the prepping conference. The meeting may be an extension of the prepping conference and shall be conducted at a location convenient for both the Contractor and the Engineer. The Contractor and the Engineer shall mutually agree to the meeting site. If necessary, the Contractor shall pay for the cost of the meeting site.

This meeting shall not relieve the Contractor of responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and these specifications.

Asphalt concrete is designated as Type A. The type and location of asphalt concrete will be shown on the plans or specified in "Asphalt Concrete" of these special provisions.

39-2 MATERIALS

39-2.01 ASPHALTS

Asphalt binder grade PG 64-16 and PG 70-10 shall be a steam-refined paving asphalt conforming to the provisions in Section 92, "Asphalts," of the Standard Specifications. Asphalt binder grade PG 64-28 PM shall conform to the requirements in "Asphalt Concrete," of these special provisions. Locations of the types of binders to be used in the asphalt concretes shall be as shown on the plans.

Liquid asphalt for prime coat shall conform to the provisions in Section 93, "Liquid Asphalts," of the Standard Specifications and shall be the grade designated by the contract item or conform to the provisions in "Asphalt Concrete," of these special provisions.

Paving asphalt for paint binder (tack coat) shall be Grade PG 64-16 or Grade PG 70-10 or PG 64-28 PM, unless otherwise approved by the Engineer.

Paving asphalt to be used as a binder for pavement reinforcing fabric shall be Grade PG 64-16 or PG 64-28 PM, unless otherwise approved by the Engineer.

Changes in asphalt binder sources shall be considered a change in mix design and shall require a new mix design proposal before work can proceed.

39-2.02 AGGREGATE

Aggregate and combined aggregate shall conform to the quality and gradation provisions in this Section 11-1, "Quality Control / Quality Assurance," for the asphalt concrete types and sizes conforming to the provisions in "Asphalt Concrete" of these special provisions.

Aggregates shall be clean and free from decomposed or organic materials and other deleterious substances. Coarse aggregate is material retained on the 4.75-mm sieve, fine aggregate is material passing the 4.75-mm sieve, and supplemental fine aggregate is added fine material passing the 600- μ m sieve, including, but not limited to, lime, cement and stored fines from dust collectors. Fractured faces of the aggregate shall be obtained by crushing. Fine aggregate shall not contain more than 10 percent of natural (non-manufactured) sand by mass of the total aggregate.

The Contractor shall design an asphalt concrete mixture which meets the requirements of Table 39-3A, "Asphalt Concrete Mixture Performance Requirements," using a blend of aggregates with a 25-mm maximum nominal size. The target value for the percent passing each designated sieve size for the aggregate blend used in the proposed asphalt concrete mix design shall be determined by the Contractor. It is advised that the Contractor may want to consider aggregate gradings that fall within the "Target Value Limits" of following:

Table 39-1 - AGGREGATE GRADATION
(Advisory)
Type A Asphalt Concrete
Percentage Passing

Sieve Sizes	Target Value Limits
25-mm	100
19-mm	93 - 100
12.5-mm	75 - 85
9.5-mm	60 - 71
4.75-mm	37 - 50
2.36-mm	26 - 35
1.18-mm	23 - 32
600- μ m	16 - 24
300- μ m	12 - 18
75- μ m *	3 - 7

* The percent passing the 75- μ m sieve shall be reported to the first decimal place (tenths).

For each asphalt concrete mix proposed to be used, the Contractor shall submit a plot of the gradation of the aggregate on a Federal Highway Administration 0.45-power gradation chart. It is recommended that the proposed aggregate gradation should not vary from the low limit on one sieve size to the high limit on the adjacent sieve size, or vice versa, and should be free of any "sand hump." A sand hump is defined as a deviation of more than 3 percent upward from a straight line drawn from the origin of a 0.45-power gradation chart to the point at which the gradation line crosses the 4.75-mm sieve line.

During asphalt concrete production, aggregate gradation shall be within the limits specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Conformance with the grading requirements shall be determined by California Test 202, modified by California Test 105 when there is a difference in specific gravity of 0.2 or more between the coarse and fine portions of the aggregate or between the blends of the different aggregates. The percent passing the 75- μ m sieve shall be reported to the first decimal place (tenths).

The combined aggregate shall conform to the following quality requirements prior to the addition of the asphalt binder:

Table 39-2 – AGGREGATE QUALITY REQUIREMENTS
Asphalt Concrete

Quality	Test	Quality Requirement
Percent of Crushed Particles ¹ (Min.) Coarse Aggregate Fine Aggregate (Passing 4.75 mm, Retained on 2.36 mm)	CT 205 ²	98% 98%
Fine Aggregate Angularity ¹ (Min.)	AASHTO T304 Method A	45%
Los Angeles Rattler ¹ Loss at 100 Rev. (Max.) Loss at 500 Rev. (Max.)	CT 211	10% 45%
Sand Equivalent ¹ (Min.)	CT 217	50
Cleanness Value ¹ (Min.)	CT 227	57
K _c Factor (Max.)	CT 303	1.7
K _f Factor (Max.)	CT 303	1.7

Notes:

1. Reported value shall be the average of 3 tests from a single split sample.
2. The last sentence of the third paragraph in Section D, "Test Procedure," of CT 205 is modified to read: "Any particle having two or more fresh mechanically fractured faces shall be considered a crushed particle."

Changes in aggregate source shall be considered a change in mix design and shall require a new mix design proposal before work can proceed.

39-2.03 ASPHALT CONCRETE MIXTURE

The Contractor shall determine the aggregate gradings and asphalt content of the asphalt concrete mixture in accordance with the requirements of these special provisions. Guidance regarding the procedure that is recommended for asphalt concrete mixture development can be found in procedure, LLP-AC1, "Sample Preparation and Testing for LA710 – Long-Life Asphalt concrete," available at <http://www.dot.ca.gov/hq/esc/Translab/fpmlab.htm>.

The asphalt concrete mixture, composed of the proposed aggregate blend and the proposed asphalt binder content shall conform to the following performance requirements:

Table 39-3A - ASPHALT CONCRETE MIXTURE PERFORMANCE REQUIREMENTS

Design Parameters	Test Method	Requirement
Permanent Deformation (min.) PG 64-28 PM ²	AASHTO TP7-94 modified ¹	275,000 stress repetitions ^{3,4}
PG 70-10 ²		55,000 stress repetitions ^{3,4}
Fatigue (Min.) PG 64-28 PM ^{5,6}	AASHTO TP8-94 modified ¹	950,000 repetitions ^{4,8} 8,000,000 repetitions ^{4,9}
PG 70-10 ^{5,7}		50,000 repetitions ^{4,8} 2,000,000 repetitions ^{4,9}

Notes:

- 1 Included in the testing procedure, LLP-AC1, "Sample Preparation and testing for LA-710 – Long-Life Asphalt Concrete," available at <http://www.dot.ca.gov/hq/esc/Translab/fpmlab.htm>.
- 2 At proposed asphalt binder content and with mix compacted to 3%+/-0.3% air voids
- 3 In repeated simple shear test at constant height (RSST-CH) at a temperature of 50° C
- 4 Minimum test value from tests on 3 specimens

- 5 At proposed asphalt binder content and with mix compacted to 6%+/-0.3% air voids (determined using AASHTO 209 (Method A))
- 6 At proposed asphalt binder content, minimum stiffness at 20° C and a 10 Hz load frequency must be equal to or greater than 1000 MPa. At proposed asphalt binder content, minimum stiffness at 30° C and a 10 Hz load frequency must be equal to or greater than 300 MPa.
- 7 At proposed asphalt binder content and 6%+/-0.3% laboratory air voids (determined using AASHTO 209, Method A), minimum stiffness at 20° C and a 10 Hz load frequency must be equal to or greater than 6200 MPa. At proposed asphalt binder content plus 0.5 percent and 3%+/-0.3% laboratory air voids (determined using AASHTO 209, Method A), minimum stiffness at 20° C and 10 Hz load frequency must be equal to or greater than 6800 MPa.
- 8 At 400×10^{-6} mm/mm. Min. test value from tests on 3 specimens. Results shall be reported for this strain level but may be obtained by extrapolation. Minimum number of repetitions required prior to extrapolation defined within test procedure.
- 9 At 200×10^{-6} mm/mm. Min. test value from tests on 3 specimens. Results shall be reported for this strain level but may be obtained by extrapolation. Minimum number of repetitions required prior to extrapolation defined within test procedure.

The Contractor shall design an asphalt concrete mixture that meets the requirements of Table 39-3A, "Asphalt Concrete Mixture Performance Requirements," and shall report the stability and laboratory percent air voids target values to the Engineer. During production and placement, asphalt concrete shall conform to the requirements of Table 39-4, "Minimum Process Control Requirements," and Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1.

Table 39-3B – CONTRACTOR REPORTED ASPHALT CONCRETE MIXTURE TARGET VALUES

Design Parameters	Test Method	Requirement ¹	Recommended
Hveem Stabilometer Value ^{2,3} (Min.) PG 64-28 PM	CT 366	TV _{S1} ⁴ TV _{S2} ⁵	37 35
PG 70-10		TV _{S3} ⁴ TV _{S4} ⁵	37 35
Laboratory Percent Air Voids ^{2,6} PG 64-28 PM PG 70-10 PG 70-10 (rich bottom)	CT 367	TV _{AV1} TV _{AV2} TV _{AV3}	3 - 5 3 - 5 2 - 4
Voids in Mineral Aggregate (Min.)	LP-2 ⁷	TV _{VMA}	13%
Voids Filled with Asphalt	LP-3 ⁷	TV _{VFA}	65% - 75%
Dust Proportion	LP-4 ⁷	TV _{DP}	0.6 - 1.2
Swell Max. ⁸ (mm)	CT 305	- - -	0.76
REPORT ONLY			
Hveem Stabilometer Value ² (Min.) PG 70-10 (rich bottom)	CT366	TV _{SS} ³ TV _{S6} ⁴	Note 3 Note 4

- Notes: 1 The Contractor shall establish and report the requirements using the asphalt concrete mixture that meets the performance requirements of Table 39-3A, "Asphalt Concrete Mixture Performance Requirements". Contractor established requirements shall be used for target values in quality control and process control.
2. Sets of 3 briquettes (from a single split sample) must be prepared and tested separately for each stability determination.
- 3 If the range of stability for the 3 briquettes is more than 12 points, the results shall be reported and all briquettes shall be discarded.. A new set of 3 briquettes shall be fabricated and tested for each failed stability determination.
- 4 Do not modify CT304
- 5 Perform CT304, and then apply an additional 500 tamping blows at 3400kPa at 60° C.
- 6 For evaluation of air voids, use CT 309 to measure theoretical maximum specific gravity (Rice) in lieu of calculating maximum specific gravity in CT 367. Determine the theoretical maximum specific gravity once for a single split sample. For bulk specific gravity, reported value shall be the average of 3 tests from a single split sample.
- 7 Procedure located at <http://www.dot.ca.gov/hq/esc/Translab/fpm.htm>
- 8 Measured at Mix Design only.
- 9 For PG 70-10 (rich bottom), the recommended minimum voids in mineral aggregate is 12%.

The Contractor shall test the proposed asphalt concrete mixture using the proposed grading and asphalt binder content. Samples to be used for stability and air voids shall be prepared as outlined in CT 304.

During production and placement, the asphalt concrete mixture shall conform to the requirements of Table 39-4, "Minimum Process Control Requirements," and Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Changes in cold feed or hot bin proportions to conform to the aggregate grading requirements shall not be considered changes in the mix design.

Multiple plants will be allowed only if the asphalt concrete mix from multiple plants to a single location and lift is from a single approved mix design.

Whenever asphalt concrete production has been suspended for longer than 30 days, the Contractor, on the first day of resumption of production, shall sample and test the asphalt concrete to demonstrate conformance with the requirements of Table 39-3B, "Asphalt Concrete Mixture Requirements," Table 39-4, "Minimum Process Control Requirements," and Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1.

The target value for asphalt content may be changed by as much as ± 0.2 percent during the production start-up evaluation specified in Section 39-10.02A, "Production Start-Up Evaluation," of this Section 11-1 or after production start-up evaluation and before the first day of regular production with the Engineer's approval. The Contractor shall demonstrate that asphalt concrete that has been produced through the plant using the modified target value for asphalt content is in conformance with this Section 11-1 by submitting test results for samples obtained from the first 500 tonnes of production. During construction, stability and percent air voids shall be determined using 3 briquettes constructed from a single sample taken from 4 locations across the mat in conformance with the requirements of California Test 125.

Changes from one mix design to another shall not be made during the progress of the work, unless approved by the Engineer. Changes in target asphalt content (other than those allowed during the start-up evaluation process), source, or in aggregate grading target values or aggregate sources shall be considered to be a change in the asphalt concrete mixture and shall require a new mix design proposal. Adjustment to dials at the plant to achieve the target asphalt content in the field is allowed and shall not be considered as a change in the asphalt concrete mixture. Changes in the asphalt content or aggregate grading target values approved by the Engineer will not be applied retroactively for acceptance or payment.

39-2.04 PAVEMENT REINFORCING FABRIC

Pavement reinforcing fabric shall conform to the provisions in Section 88, "Engineering Fabrics," of the Standard Specifications and these special provisions.

39-3 ASPHALT CONCRETE MIX DESIGN PROPOSAL AND REVIEW

39-3.01 CONTRACTOR MIX DESIGN PROPOSAL

The Contractor shall submit for the Engineer's review a proposed asphalt concrete mix design for each asphalt concrete mixture to be used at least 14 days prior to production of that asphalt concrete mixture. A laboratory (or laboratories) whose proficiency has been reviewed and qualified in conformance with the Department's Independent Assurance Program shall prepare the asphalt concrete mix design, except the laboratory performing testing for permanent deformation and fatigue. Aggregate quality and asphalt concrete mix design test results shall be no more than one year old when production of the asphalt concrete mixture starts. For projects of more than one year's duration, asphalt concrete may be produced using the asphalt concrete mix design that was reviewed and accepted at the start of the project provided the asphalt concrete mixture continues to conform to the provisions of this Section 11-1, "Quality Control / Quality Assurance."

The Contractor shall submit a mix design letter that contains test results indicating compliance for permanent deformation and fatigue value. The mix design letter shall also indicate the target values proposed for gradation, asphalt content, and percent air voids. This submittal shall include test results for aggregate and asphalt mixture quality; plots of the combined gradings showing the production tolerances; plots of unit weight, stability, and percent air voids versus asphalt content for the asphalt contents considered in the design process. In addition, this submittal shall include test results for stability, percent air voids, and swell for 3 briquettes constructed using the submitted aggregate and asphalt blended at the proposed target values for each asphalt concrete mixture to be used.

The Contractor shall submit the following for each asphalt concrete mixture proposed:

A. Aggregate and mineral filler:

1. Target values for percent passing each sieve size for the aggregate blend;
2. Results of tests for aggregate quality requirements;
3. Source of each aggregate to be used, including producer, location and California Mine Identification number;
4. Percentage of each aggregate stockpile, cold feed or hot bin to be used;

5. Gradation of each aggregate stockpile, cold feed or hot bin to be used; and
6. Samples of the combined aggregate obtained in advance of the point where the aggregate enters the pugmill or drier-drum mixer, samples of each aggregate storage bin, or samples from stockpiles that are representative of the aggregate to be used. Minimum sample sizes shall be as follows:

60 kg of each coarse aggregate;
40 kg of each fine aggregate; and
5 kg of each supplemental fine aggregate.

B. Asphalt binder:

1. Asphalt binder source and target value;
2. Four one-liter samples of the asphalt binder (modified binders shall be canned in cylindrical shaped can with an open top, friction lid);
3. Results of the asphalt binder quality tests conforming to the provisions in Section 92, "Asphalts," of the Standard Specifications;
4. Certificate of compliance from the asphalt binder supplier certifying conformance with the requirements of the requirements for the type and grade of binder; and
5. Material Safety Data Sheets.

The proposed asphalt concrete mix design submittal will be considered complete only when the mix design letter, test results, plots, and samples have been received by the Engineer.

39-3.02 ENGINEER REVIEW OF ASPHALT CONCRETE MIX DESIGN

The Engineer will review the proposed aggregate and asphalt concrete mixture for conformance with this Section 11-1, "Quality Control / Quality Assurance." The proposed asphalt concrete mixture will be reviewed at the proposed target value for asphalt content blended with "as-received" aggregate in conformance with the requirements of California Test 304. The Engineer will have 14 days to review each submittal of a proposed mix design. Production of asphalt concrete shall not begin until written notification has been received from the Engineer that the aggregates and proposed mix design meet the quality requirements of this Section 11-1. Should the Engineer fail to complete the review within the time allowance and, if in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review of the proposed asphalt concrete mixture, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of Standard Specification.

The Engineer will reject a proposed asphalt concrete mixture that, during review, fails to meet the quality requirements of Table 39-2, "Aggregate Quality Requirements," Table 39-3A, "Asphalt Concrete Mixture Performance Requirements," and Table 39-3B, "Asphalt Concrete Mixture Requirements," of this Section 11-1. The Contractor shall resubmit a mix design letter providing new test results, plots, and material samples.

Disagreements in mix design review shall be resolved in conformance with Section 39-6, "Dispute Resolution," of this Section 11-1. The Contractor shall use a mix design on the project only after the Engineer concurs that the aggregate and asphalt concrete represented by the proposed mix design conforms to the provisions of this Section 11-1.

The Engineer will review one proposed asphalt concrete mix design for each asphalt concrete type and aggregate size from each plant proposed for use on this project at the State's expense. Costs for additional reviews due to failure to conform to the quality requirements of this Section 11-1 and for reviewing other proposed asphalt concrete mix designs will be deducted from moneys due or to become due the Contractor. The cost for each review will be \$1,500. Costs for reviewing changes in a mix design that are initiated by the Engineer will be waived. Contractor's re-testing due to errors in the Engineer's testing will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Costs for reviewing mix designs not used in this project will be deducted from moneys due or to become due the Contractor.

39-4 CONTRACTOR QUALITY CONTROL

39-4.01 GENERAL

The Contractor shall be responsible for the quality of the asphalt concrete entering into the work and of the work performed. In addition, the Contractor shall be responsible for the quality of asphalt concrete or ingredients procured from subcontractors or vendors. A quality control system shall be established, maintained, and modified, if needed, that will provide assurance that materials and completed work conform to contract requirements.

At least 14 days prior to the start of production of asphalt concrete, the Contractor shall submit a written Quality Control Plan. At the request of the Engineer or the Contractor, the Contractor shall discuss the Quality Control Plan with the Engineer.

39-4.02 QUALITY CONTROL PLAN

The Quality Control Plan shall describe the organization and procedures that will be used to administer the quality control system including the procedures used to control the production process, the procedures used to determine when changes to the production process are needed, procedures used to determine the quantity of asphalt concrete having stability values below the action limit, and the procedures proposed to be used to implement the required changes. The Quality Control Plan shall meet the minimum standards set forth in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement," available as specified in "Asphalt Concrete" of these special provisions.

Asphalt concrete production and placement shall not begin until the Engineer has approved the Quality Control Plan. Approval of the Quality Control Plan does not imply a warranty by the Engineer that adherence to the plan will result in production of asphalt concrete that complies with this Section 11-1. It shall remain the responsibility of the Contractor to demonstrate such compliance.

The Quality Control Plan shall include the name and qualifications of a Quality Control Manager. The Quality Control Manager shall be responsible for the administration of the Quality Control Plan, including compliance with the plan and plan modifications. The Quality Control Manager shall be responsible to the Contractor, shall have the authority to make decisions concerning quality of the work or product, and shall be present on the project during paving. Except in cases of emergency and with the approval of the Engineer, the Quality Control Manager cannot be a foreman, member of the production or paving crew, an inspector or tester on this project during pavement production and placement.

The Quality Control Plan shall identify personnel, equipment and documentation required for a complete inspection, sampling and testing program. The Quality Control Plan shall include, but not be limited to, a list of inspectors, samplers and testers, their duties, their qualifications, if required, and their experience if no qualification is required. The Contractor shall update the list, when there is a change of inspectors, samplers and testers, their duties, or need for re-qualification. The Quality Control Plan shall also list the name and location of laboratories that shall be providing information to the Engineer, the testers who conducted the tests and their qualifications and the name of the Laboratory Quality Control Manager responsible for oversight of the testing program. It shall also show examples of the test result forms (if different from those in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement,"), the roadway and plant inspection forms, the Quality Control Manager's daily summary form, and the compliance charts. It shall include the method by which random sampling shall be determined, a list of the testing and sampling equipment to be used and the current calibration dates and calibration charts, and copies of nuclear gage licenses.

The Quality Control Plan shall include the name and qualification of a testing consultant to be an Independent Third Party in dispute resolution. By mutual agreement during dispute resolution, the Independent Third Party may be a District Independent Assurance Representative, the testing consultant or both. The proficiency of the testing consultant shall be reviewed and qualified in conformance with the requirements of the Department's Independent Assurance Program before the test consultant participates in dispute resolution. Attention is directed to Section 39-6, "Dispute Resolution," of this Section 11-1.

The Quality Control Plan may be modified as work progresses. A supplement shall be submitted whenever there are changes to quality control procedures or personnel. Asphalt concrete production and placement shall not resume or continue until the Engineer has approved revisions to the Quality Control Plan or quality control personnel.

39-4.03 CONTRACTOR QUALITY CONTROL INSPECTION, SAMPLING, AND TESTING

The Contractor shall perform process and quality control sampling and testing, provide inspection, and exercise management control to ensure that asphalt concrete production and placement conforms to the provisions of this Section 11-1. Staffing for process and quality control shall meet the minimum requirements outlined in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement."

The Contractor shall retain for inspection all records generated as part of the Contractor Quality Control, inspection, sampling, and testing for a period not less than 3 years.

Process and quality control, sampling, testing, and inspection shall be provided during the asphalt concrete work. Sampling, testing, and inspection shall be performed at a rate sufficient to ensure that asphalt concrete conforms to the provisions of this Section 11-1.

A roadway inspector shall be provided while asphalt concrete paving operations are in progress. The roadway inspector shall ensure that asphalt concrete placement conforms to industry standards and to the spreading, compacting, and finishing requirements of this Section 11-1, "Quality Control / Quality Assurance," and the Quality Control Plan. Plant inspection shall be performed as necessary to maintain control of the asphalt concrete production.

Minimum sampling and testing requirements for process and quality control are specified in Table 39-4, "Minimum Process Control Requirements," and Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Sampling shall be statistically based and random.

During production start-up evaluation, the Contractor shall sample and test in conformance with the provisions in Section 39-10.02A, "Production Start-Up Evaluation," of this Section 11-1.

A testing laboratory and personnel shall be provided for the performance of process and quality control testing. The Engineer shall have unrestricted access to mix design, sampling, and testing.

The proficiency of testing laboratories and sampling and testing personnel shall be reviewed and qualified by the Department's Independent Assurance Representative before providing services to the project. Inspectors shall meet the standards set forth in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement."

39-4.04 CONTRACTOR PROCESS CONTROL

Process control sampling and testing shall be performed and control shall be exercised to ensure that asphalt concrete production conforms to this Section 11-1.

Minimum process control sampling and testing shall be performed in compliance with Table 39-4.

Table 39-4 - Minimum Process Control Requirements

Quality Characteristic	Action Limit	Test	Minimum Sampling and Testing Frequency	Point of Sampling	Reporting Time Allowance
Sand Equivalent (Minimum)	50	CT 217	One sample per 2500 tonnes Not less than 1 sample per day	Batch plant - from hot bins or Drum Plant - from cold feed	24 hours
		See note 1			
Percent of Crushed Particles (Minimum.) Coarse Aggregate	98%	CT 205	Not less than 1 sample per day		24 hours
	Fine Aggregate (Passing 4.75-mm, Retained on 2.36-mm) 98%				
Moisture (Maximum)	0.5%	CT 370	One sample for each 500 tonnes, 2 per day minimum.	Mat behind paver	24 hours
Hveem Stabilometer –(Min.) PG 64-28 PM	TV _{S1} ² TV _{S2} ³	CT 366	Sample at least once per 500 tonnes	Mat behind paver	36 hours
		See notes 1, 3, 4, 6	See Note 7 For minimum testing schedule		
PG 70-10	TV _{S3} ² TV _{S4} ³				
REPORT ONLY					
Hveem Stabilometer –(Min.) PG 70-10 (rich bottom)	TV _{S5} ² TV _{S6} ³	CT 366	Sample at least once per 500 tonnes	Mat behind paver	36 hours
		See notes 1, 3, 4, 6	See Note 7 For minimum testing schedule		
Laboratory Percent Air Voids PG 64-28 PM PG 70-10 PG 70-10 (rich bottom)	TV _{AV1} TV _{AV2} TV _{AV3}	CT 367	See Note 7 For minimum Sampling and testing schedule	Mat behind paver	36 hours
		See Notes 1, 4, 8			

- Notes:
1. Reported value shall be the average of 3 test results.
Samples used for the 3 tests to be averaged shall be from a single split sample.
 2. Do not modify CT304
 3. Perform CT304, and then apply an additional 500 tamping blows at 3400kPa at 60° C.
 4. Sets of 3 briquettes must be prepared and tested separately for each stability determination.
 5. Briquettes shall be fabricated from a single, combined sample obtained from at least 4 locations across the mat behind the paver in conformance with the requirements of California Test 125.
 6. If the range of stabilities for the three briquettes is more than 12 points, the results shall be reported and all briquettes shall be discarded. A new set of 3 briquettes shall be obtained before the end of the following shift of paving and tested per Table 39-3 for each failed stability determination.

7. Asphalt concrete will be sampled each 500 tonnes. Each type of asphalt concrete shall be tested each day the first 5 days (or at least once per 2000 tonnes of production) and testing may be decreased to one per each 5000 tonnes thereafter unless stability falls below the action limit. Samples shall be retained to define limits of problem areas should the stability fall below the action limit.
When stability falls below the action limit, testing will be increased to one test for each of the first 2000 tonnes and may be decreased to one per each 5000 tonnes thereafter.
Each asphalt concrete type being produced and placed shall be sampled and tested at least once per 55-hour window if the quantity is less than 2000 or 5000 tonnes as it applies to the interval.
The sequence of the first 5 test results shall not be broken by more than 7 days of non-production.
8. Use CT 308A for determination of bulk specific gravity and CT 309 for maximum theoretical specific gravity

The process control test results shall be plotted on specification compliance charts indicating the action limits for the quality characteristic. When one test result falls below the action limit for an individual measurement, the Contractor shall notify the Engineer, take corrective action, and sample and test within the next 500 tonnes of production.

39-4.04A Suspension of Production Due to Non-Compliance with Process Control Requirements

When 2 consecutive test results for sand equivalent, percent crushed particles or stability fall below the action limit, the Contractor shall suspend production, notify the Engineer, and take corrective action.

When 2 consecutive test results for stability are greater than 10 below the target value shown in Table 39-4, "Minimum Process Control Requirements," of this Section 11-1, the asphalt concrete represented by the results shall be removed at the Contractor's expense.

When asphalt concrete production has been suspended due to failure to comply with process control requirements, it will be necessary to construct a temporary roadway to allow safe passage of traffic on the roadway at the required time. This temporary roadway will be removed and replaced with asphalt concrete that meets the requirements of these specifications at the Contractor's expense at a time agreed to by the Engineer.

The materials and methods for construction of the temporary roadway shall be chosen by the Contractor and submitted for the Engineer's approval in the Quality Control Plan.

The temporary roadway shall be maintained and later removed as a first order of work when the Contractor has demonstrated that asphalt concrete can be produced and placed in conformance with the requirements of these specifications.

Asphalt concrete shall be produced and placed at a location approved by the Engineer to demonstrate that the asphalt concrete is once again in compliance with the provisions of this Section 11-1. Production shall begin only after the Engineer has received test results confirming compliance.

39-4.05 CONTRACTOR QUALITY CONTROL

Quality control, sampling, testing, and inspection shall be provided during asphalt concrete work. Sampling, testing, and inspection shall be performed at a rate sufficient to ensure that the asphalt concrete product conforms to the requirements in this Section 11-1. Sampling for testing to be reported to the Engineer shall be performed at the minimum frequency specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1, "Quality Control / Quality Assurance."

Quality control samples of aggregates and asphalt concrete mixture shall be obtained and split. One split portion of each sample shall be used for quality control testing and the other portion shall be reserved for possible retest during dispute resolution in conformance with Section 39-6, "Dispute Resolution," of this Section 11-1. Quality control samples shall be stored in a location listed in the Quality Control Plan until disposal has been approved by the Engineer.

Whenever the Contractor obtains random samples of asphalt concrete during asphalt concrete placement for determination of maximum theoretical density, the Contractor shall split the samples into 4 portions. The Contractor shall retain 1 portion for determination of maximum theoretical density and 3 portions shall be delivered to the Engineer. The Contractor shall report when the sample is used for determination of maximum theoretical density. The Engineer will store the other three portions for dispute resolution if needed and other usage.

The Contractor shall obtain a one-liter sample of the asphalt binder in conformance with Section 39-7.01C, "Asphalt Binder Storage," of this Section 11-1 for each day of asphalt concrete production. Modified binders shall be canned in one-liter, cylindrical shaped cans with open top, friction lids. The Contractor shall send the sample containers accompanied by a completed Sample Identification Card, Form TL-101, to the Transportation Laboratory at 5900 Folsom Boulevard, Sacramento, CA 95819 on a weekly basis. A copy of Form TL-101 and appropriate shipping documents shall be attached to the daily report of inspection.

When test results for a single quality characteristic deviate beyond the limits specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1 the Contractor shall take corrective action and shall bring the asphalt concrete within the specification limits. The corrective action taken shall be documented in the records of inspection in conformance with Section 39-4.06B, "Records of Inspection and Testing," of this Section 11-1. When a single quality characteristic deviates 3 consecutive times beyond the limits specified in Table 39-9, "Minimum Quality Control Test Requirements," of this Section 11-1, the Contractor shall suspend production, shall notify the Engineer, and shall take corrective action. With the approval of the Engineer, up to 1000 tonnes of asphalt concrete may be placed and the requirements of Section 39-10.02A, "Production Start-Up Evaluation," of this Section 11-1 shall be used to demonstrate that the asphalt concrete is once again in compliance with this Section 11-1. Production of asphalt concrete shall start only after the Engineer has received test results confirming compliance. When an individual quality characteristic deviates 3 consecutive times beyond the specification limits and production of asphalt concrete has been suspended, the lot shall be terminated.

39-4.06 CHARTS AND RECORDS

The Contractor shall record sampling and testing results for both process control and for quality control on forms provided in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement" or on forms approved by the Engineer. Complete testing records shall be maintained and posted in the Contractor's laboratory. Models of forms that are different from those in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement," locations of postings, and times and means of submissions shall be provided in the Quality Control Plan.

For every 5000 tonnes of asphalt concrete produced, the Contractor shall provide an electronic copy of the process and quality control test results using the Department's statistical evaluation program "ACPay" available as specified in "Asphalt Concrete" of these special provisions.

Compliance charts and inspection and testing records, except stability test results used for process control, shall be submitted within 24 hours after completion of that shift of asphalt concrete production. If the record is incomplete or in error, a copy of the record will be returned with the deficiencies noted by the Engineer. The Contractor shall correct deficiencies and return the updated record by the start of the following working day. When errors or omissions in the inspection or testing records repeatedly occur, asphalt concrete production and placement shall be suspended and the procedures by which the records are produced shall be corrected before production and placement will be restarted.

39-4.06A Compliance Charts

The Contractor shall develop and maintain time linear specification compliance charts. The compliance charts shall identify the project, test number, test parameter, applicable upper and lower specification limits, and test results.

Compliance charts shall be kept current and shall be posted at a location designated in the Quality Control Plan. Compliance charts shall be updated each day of asphalt concrete production, and up-to-date copies shall be included in the submittals to the Engineer of each day's test results.

39-4.06B Records of Inspection and Testing

For each day of asphalt concrete production, the Contractor shall prepare an "Asphalt Concrete Construction Daily Record of Inspection," on forms provided in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement." A form shall be submitted for inspection at the plant and at the roadway.

For each day of asphalt concrete production, the Contractor shall prepare an "Asphalt Concrete Inspection and Testing Summary" on a form provided in the Department's "Quality Control and Quality Assurance Manual for Asphalt Concrete Production and Placement." Plant and roadway inspection forms documenting the day's plant production and roadway placement shall be completed. Deviations from the specifications or the Contractor's regular practice shall be listed and explained. Individual inspection forms shall be signed by the inspector and initialed by the Quality Control Manager and attached to the summary at submittal. Test forms documenting test results shall be complete, signed by the tester, checked and initialed by the Quality Control Manager, and attached to the summary at submittal. Sampling and testing data and calculations that support a test result shall be made available to the Engineer within 48 hours when requested.

The "Asphalt Concrete Inspection and Testing Summary" shall include the following certification signed by the Quality Control Manager:

It is hereby certified that the information contained in this record is accurate, and that information, tests or calculations documented herein comply with the requirements of the contract and the standards set forth in the testing procedures. Exceptions to this certification are documented as a part of this record.

39-5 ENGINEER QUALITY ASSURANCE

39-5.01 GENERAL

The Engineer will assure conformance to contract specifications by review of the Contractor's mix design proposal, by inspection of the Contractor's procedures, by oversight of the Contractor's quality control inspection and records, by splitting and testing samples with the Contractor during evaluation of the plant production start-up and the nuclear density test strip, and by independent verification sampling and testing of the asphalt concrete and aggregates during asphalt concrete production.

The Contractor may witness assurance sampling and testing. However, the Engineer will not be required to notify the Contractor of anticipated sampling schedules or locations and will not delay sampling or testing if the Contractor is unable to attend. The Contractor shall not use samples taken for assurance testing for testing and submittal as a quality control test result.

The Engineer will provide the Contractor with copies of the assurance test results not more than 2 working days after receipt of the results. Sampling and testing data and calculations that support a test result shall be made available to the Contractor within 2 working days when requested.

The Engineer may test the asphalt, aggregates or asphalt concrete mixture to determine conformance with this Section 11-1, "Quality Control/Quality Assurance," whenever an asphalt concrete mixture or ingredient appears defective or inconsistent or whenever a test result indicates a change in the characteristics of the asphalt concrete mixture or an ingredient. Asphalt, aggregates or asphalt concrete that does not conform to this Section 11-1 will be rejected in conformance with Section 39-11, "Acceptance of Work," of this Section 11-1.

The Contractor, when directed by the Engineer, shall obtain representative samples of the asphalt concrete mixture or ingredients that appear defective or inconsistent. The samples shall be split into 4 portions. The Contractor shall retain 1 portion for testing if the Contractor chooses and 3 portions shall be delivered to the Engineer. The asphalt concrete or ingredient need not be sampled if the Contractor elects to remove and replace the asphalt concrete, at the Contractor's expense, or if the Contractor uses a method of correcting the situation that has been approved by the Engineer. Test results from these additional samples shall not be used as a basis for a calculated pay factor.

39-5.02 SAMPLING AND TESTING FOR VERIFICATION

Independent of the Contractor's quality control testing, the Engineer will obtain random samples of the aggregate and asphalt concrete mixture and test for in-place density.

Samples of aggregates and asphalt concrete will be obtained during asphalt concrete production and placement, and will be mixed and split into at least 4 portions. One of the split portions will be tested by the Engineer and used to verify quality control test results, one portion will be provided to the Contractor, and 2 portions will be reserved and stored for testing in conformance with the provisions in Section 39-6, "Dispute Resolution," of this Section 11-1.

The Engineer will test for material quality characteristics specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Verification tests will be at a frequency of not less than 10 percent of the minimum quality control sampling and testing frequency and will be performed in conformance with the test methods specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Verification tests will be performed using the same test methods used for quality control testing.

During production start-up evaluation, the Engineer will witness the sampling of asphalt concrete and aggregates and will perform tests on the materials in conformance with Section 39-10.02A, "Production Start-Up Evaluation," of this Section 11-1.

39-5.03 VERIFICATION

The Engineer will determine the acceptability of the quality control test results by using the t -test for sample means to test whether or not the means of the quality control test results and verification test results are within an allowable testing difference. Quality control test results and verification test results for each indexed quality characteristic will be used in the verification process.

The t -value of the group of test data to be verified is computed as follows:

$$t = \frac{|\bar{X}_c - \bar{X}_v|}{S_p \sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

- n_c = Number of Contractor's quality control tests (minimum of 2 required)
- n_v = Number of Verification tests (minimum of 1 required)
- \bar{X}_c = Mean of the Contractor's quality control tests
- \bar{X}_v = Mean of the Verification tests
- S_p = Pooled standard deviation
(When $n_v = 1$, $S_p = S_c$)
- S_c = Standard deviation of the Contractor's quality control tests
- S_v = Standard deviation of the Verification tests (when $n_v > 1$)

The comparison of quality control test results and verification test results will be considered at a level of significance of α . Compute t using the equation above and compare to the critical t -value, t_{crit} , from the following table:

Table 39-5 - CRITICAL t -VALUE FOR VERIFICATION OF QUALITY CONTROL TESTING

degrees of freedom ($nc+nv-2$)	t_{crit} (for $\alpha = 0.01$)	degrees of freedom ($nc+nv-2$)	t_{crit} (for $\alpha = 0.01$)
1	63.657	18	2.878
2	9.925	19	2.861
3	5.841	20	2.845
4	4.604	21	2.831
5	4.032	22	2.819
6	3.707	23	2.807
7	3.499	24	2.797
8	3.355	25	2.787
9	3.250	26	2.779
10	3.169	27	2.771
11	3.106	28	2.763
12	3.055	29	2.756
13	3.012	30	2.750
14	2.977	40	2.704
15	2.947	60	2.660
16	2.921	120	2.617
17	2.898	8	2.576

Quality control test results are verified if the t -value computed is less than or equal to t_{crit} ($t = t_{crit}$). If the quality control test results of any asphalt quality characteristics are not verified by the t -value comparison, then the difference between the means of the quality control test results and verification test results are compared with an allowable testing difference. Quality control test results are not verified if the difference between the means exceeds the allowable testing difference. The allowable testing difference in means, attributable to normal test variation, is determined as follows:

$$d_x = 2S_r \left[\frac{1}{n_c} + \frac{1}{n_v} \right]^{1/2}$$

Where:

- d_x = Allowable difference between means
- S_r = Precision Index for the test method from Table 39-6
- n_c = Number of Contractor's quality control tests (minimum of 2 required)
- n_v = Number of Verification tests (minimum of 1 required)

Table 39-6 – PRECISION INDEX

Quality	California Test	Precision Index
Sand Equivalent (min.)	217	8
Hveem Stabilometer Value (min.)	366	6.6
Percent Air Voids ¹	367	1.6
Asphalt Content	379	0.23%
	382	0.18%
Gradation	202	
19 or 12.5 mm		0.9%
9.5 mm		2.4%
4.75 mm		2.0%
2.36 mm		1.4%
600 μm		1.1%
75 μm		0.7%
Percent of Maximum Theoretical Density	375	0.88%
Maximum Theoretical Density	309	0.03 g/cc

Note 1: Air voids will be tested only during the Production Start Up Evaluation.

If quality control test results of any asphalt quality characteristics are not verified, the Contractor will be notified of the difference. The Engineer will sample asphalt concrete production at a more frequent interval. At the discretion and responsibility of the Contractor, the Contractor can continue the production provided both means of quality control test results and verification test results for all asphalt quality characteristics are within the specification limits of Table 39-9, "Minimum Quality Control Requirements," for that quality characteristic. Resolution of the problem shall be in conformance with the provisions in Section 39-6, "Dispute Resolution," of this Section 11-1.

39-6 DISPUTE RESOLUTION

39-6.01 GENERAL

The Contractor and the Engineer shall work together to avoid potential conflicts and to resolve differences that may arise from a disagreement regarding test result comparisons.

Should the results of the testing fail to meet the criteria of the stage at which the disagreement arose, production shall be suspended or continued conditionally as specified in section 39-5.03 of this section 11-1, "Quality Control/Quality Assurance." If suspended, production shall not start or resume nor shall asphalt concrete be accepted until the differences have been resolved and the Engineer is assured that the asphalt concrete conforms to this Section 11-1.

When the Engineer and the Contractor, together or separately, are unable to determine the source of error, an Independent Third Party shall act as witness and referee.

In disagreements, if the Engineer's testing process meets the requirements of this Section 11-1, costs related to the review shall be borne by the Contractor. The Contractor's sampling and testing program shall be modified as necessary. New test results shall be submitted to the Engineer. Test results judged to be in error shall be removed from consideration and the new test results shall be substituted. If split samples are not available and re-testing is not possible, that portion of the asphalt concrete produced or placed prior to and during the disagreement will be evaluated based on the results of the Engineer's verification test results.

In disagreements, if the Engineer's testing process fails to meet the requirements of this Section 11-1, costs related to the review shall be borne by the State. The Engineer's sampling and testing program will be modified as necessary. Test results judged to be in error shall be removed from consideration and the new test results shall be substituted. Contractor's re-testing due to errors in the Engineer's testing will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. If, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of delays or errors in the Engineer's testing, the delay will be considered a right of way delay as provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

In disagreements, if both the Contractor's and the Engineer's testing processes have failed to meet the requirements of this Section 11-1 or if the cause cannot be determined, each party will bear the costs related to their own review. When appropriate, the Contractor's and the Engineer's sampling and testing programs shall be modified as necessary, split samples of the Contractor's quality control samples or the Engineer's verification samples shall be re-tested, and the new quality control test results shall be submitted to the Engineer. Test results judged to be in error shall be removed from consideration and the new test results shall be substituted. If split samples of aggregates or asphalt concrete mixture from the Contractor's testing are not available where re-testing is required, that portion of the asphalt concrete produced prior to and during the disagreement will be evaluated based on the results of the Engineer's verification test results.

39-6.02 DURING THE ASPHALT CONCRETE MIX DESIGN REVIEW

During the asphalt concrete mix design review, if the Engineer's review does not verify compliance of one or more of the aggregate or the asphalt concrete mixture qualities with this Section 11-1, "Quality Control / Quality Assurance," both parties will review their sampling, testing, and test results and shall share their findings. Testers and laboratories shall be made available for witnessing. Calculations and test results shall be made available for review. If an error in the Contractor's testing is detected during this review, the Contractor shall, as is appropriate, recalculate or retest. The new test results shall be submitted to the Engineer. If an error in the Engineer's testing is detected, the Engineer will, as is appropriate, recalculate or retest.

If the Contractor's and Engineer's review does not reveal the source of conflict, the Contractor's and the Engineer's sampling and testing processes shall be witnessed by the Independent Third Party. Testing to resolve the dispute in results for the mix design shall be performed using samples that were obtained and split while being witnessed by the Independent Third Party. Review of sample preparation and testing will be performed at both the Contractor's and the Engineer's laboratory on a portion of the split material while being witnessed by the Independent Third Party. The resulting mix design shall be used for production.

39-6.03 DURING THE PRODUCTION START-UP EVALUATION

When the Contractor's and Engineer's test results during production start-up fail to meet the provisions in Section 39-10.02, "Production Start-Up Evaluation and Nuclear Density Test Strips," both parties will review their sampling, testing, and test results, and shall share their findings. Testers and laboratories shall be made available for witnessing. Calculations and test results shall be made available for review. If an error in the Contractor's testing is detected during this review, the Contractor shall, as is appropriate, recalculate or retest. The new test results shall be submitted to the Engineer. If an error in the Engineer's testing is detected, the Engineer will, as is appropriate, recalculate or retest.

If the Contractor's and the Engineer's review does not resolve the differences, the Contractor's and the Engineer's testing processes shall be witnessed by the Independent Third Party using the 2 remaining portions of the split samples. If necessary, a 250-tonne to 500-tonne quantity of asphalt concrete shall be placed at a location agreed to by the Engineer to provide asphalt concrete and ingredients for sampling and testing for the Independent Third Party review.

If an error in the Contractor's testing is detected by the Independent Third Party, the Contractor shall take corrective action and, as appropriate, recalculate or retest the split portion of the trial quantity of asphalt concrete in question. The new test results shall be submitted to the Engineer. If an error in the Engineer's testing is detected by the Independent Third Party, the Engineer will take corrective action and, as appropriate, recalculate or retest the split portion of the first trial quantity.

Production shall not start nor shall asphalt concrete be accepted until the differences have been resolved and the test results meet the provisions in Section 39-10.02, "Production Start-Up Evaluation and Nuclear Density Test Strips," of this Section 11-1.

39-6.04 DURING PRODUCTION

When it is determined that the quality control test results could not be verified, both parties will review their sampling, testing, and test results, and shall share their findings. Testers and laboratories will be made available for witnessing. Calculations and results will be made available for review.

If an error in the quality control sampling or testing is detected during the Contractor's or the Engineer's review, the Contractor shall either recalculate or, if appropriate, retest using the reserved split portions of the quality control samples. These new test results shall be submitted to the Engineer. If an error in the verification sampling or testing is detected, the Engineer will recalculate or, if appropriate, retest using a reserved split portion of the verification samples. Using the new test results, the Engineer will verify the quality control test results as specified in Section 39-5.03, "Verification," of this Section 11-1.

When the verification test results do not verify the quality control test results 3 consecutive times, both the Contractor's and the Engineer's testers shall be witnessed by the Independent Third Party while sampling, splitting, and testing samples from the production unit or from the mat. The Contractor may produce and place up to 1000 tonnes of asphalt concrete to provide materials and sampling opportunities. Production and placement of asphalt concrete will be suspended until the Independent Third Party has completed the review of the Contractor's and the Engineer's sampling and testing and resolved the differences.

If an error in the Contractor's testing is detected by the Independent Third Party, the Contractor shall take corrective action and, as appropriate, recalculate or retest the split portion of the quality control samples. The new test results shall be submitted to the Engineer. If an error in the Engineer's testing is detected by the Independent Third Party, the Engineer will take corrective action and, as appropriate, recalculate or retest a split portion of the verification samples. When the error has been detected and corrected, production shall resume and the services of the Independent Third Party will be discontinued.

If a problem is not identified during the Independent Third Party review, the Independent Third Party shall be retained for the duration of the project or until a problem has been identified. Until all asphalt concrete has been produced and placed, the Contractor shall sample and split quality control samples in the presence of the Independent Third Party. One portion of each sample shall be tested by the Contractor in conformance with the intervals specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1, and the other portion shall be delivered to the Engineer by the Independent Third Party. The Engineer will test at least one of every 5 of the split samples for verification purposes. A new lot will be designated for asphalt concrete produced since the Independent Third Party was consulted. The pay factor for this lot will be determined in conformance with Section 39-11.02, "Statistical Evaluation and Determination of Pay Factor," of this Section 11-1 with the exception that both the Contractor's quality control test results and the Engineer's verification test results will be combined and will be the basis for acceptance of that portion of the work. The pay factor for the lot of asphalt concrete which brought about the dispute resolution shall be determined in conformance with Section 39-11.02, "Statistical Evaluation and Determination of Pay Factor," of this Section 11-1 with the exception that both the Contractor's quality control test results and the Engineer's verification test results will be combined and will be the basis for acceptance of that portion of the work.

39-7 STORING, PROPORTIONING AND MIXING MATERIALS

39-7.01 STORAGE

The Contractor shall store the aggregate for asphalt concrete so that separately sized aggregates will not be intermingled and shall store asphalt binder so that different grades of asphalt will not be intermingled. Aggregate that has been intermingled with aggregate of another size shall be removed by the Contractor and replaced with aggregate of specified grading.

When the Contractor adds supplemental fine aggregate, each supplemental fine aggregate used shall be stored separately and kept thoroughly dry.

The measurement and storage provisions of this Section shall not apply to the dust collected in skimmers and expansion chambers (knock-out boxes) or to the dust collected in centrifugal (cyclone) collectors. Dust from these collectors may be returned to the aggregate without being measured or stored separately, provided the dust is returned uniformly at a point in advance of the sampling device in batch-mixing plants or is returned at or before mixing in continuous mixing plants.

Aggregate and asphalt binder shall be stored in conformance with the following requirements.

39-7.01A Aggregate Cold Storage

Material shall be fed from storage with a mechanical feeder. Before being fed to the drier, aggregate shall be separated into 3 or more sizes and stored separately.

39-7.01B Aggregate Hot Storage

Aggregate for asphalt concrete to be mixed in batch mixing plants shall be stored, after being dried, in conformance with the following requirements:

1. Aggregates for asphalt concrete shall be separated into 3 or more sizes.
2. After the aggregate is separated, each size shall be stored in a separate bin, and shall be recombined in conformance with the provisions in Section 39-7.03A, "Proportioning for Batch Mixing," of this Section 11-1 in order to conform to the gradings specified in Section 39-2, "Materials," of this Section 11-1. Storage bins shall be provided with chutes to prevent overflow into adjacent bins.

39-7.01C Asphalt Binder Storage

Asphalt to be used as a binder for asphalt concrete shall be stored in heated tanks.

A suitable sampling device shall be provided in asphalt feed lines connecting plant storage tanks to the asphalt weighing system or spray bar. The sampling device shall consist of a valve with a nominal diameter between 12 mm and 19 mm, constructed in such a manner that a one-liter sample may be slowly withdrawn during plant operations. The valve shall be maintained in good condition and, if the valve fails to function properly, the valve shall be replaced. The sampling device shall be readily accessible and in an area free of dangerous obstructions and shall be between 610 mm and 760 mm above the platform. A drainage receptacle shall be provided for flushing the device prior to sampling.

The discharge end of the asphalt binder circulating pipe shall be maintained below the surface of the asphalt binder in the storage tank to prevent discharging hot asphalt binder into open air.

A temperature sensing device shall be installed in the asphalt feed line. The device shall measure the temperature of the asphalt and shall be accurate to 5°C increments. An automatic, continuous recording device shall be provided and used to maintain accurate records of the asphalt temperature during production. Where the plant controller has the capability of capturing production data electronically, including ingredient temperatures, and when this data represents the temperature at the time of production and is captured at intervals of not greater than 5 minutes, this process will be considered to be continuous recording. Captured data shall be retained for the duration of the contract and shall be submitted to the Engineer on request.

39-7.02 DRYING

Aggregate shall be fed directly to a drier-drum mixer or to a drier at a uniform rate.

Aggregate shall be dried such that, at the time of spreading, the moisture content of the completed asphalt concrete mixture shall not exceed 0.5 percent and the minimum and maximum asphalt concrete mixture temperatures are not exceeded. Moisture content will be determined in conformity with the requirements of California Test 370.

The drier or drier-drum mixer shall be provided with a device that senses the temperature of the material leaving the drier or the drier-drum mixer. The temperature-sensing device shall be accurate to the nearest 5°C. The indicator shall be located and maintained at the point where the proportioning operations are controlled. An automatic continuous recording device shall be provided and used to maintain accurate records of the temperatures during production. Where the plant controller has the capability of capturing production data electronically, including ingredient temperatures, and when this data represents the temperature at the time of production and is captured at intervals of not greater than 5 minutes, this process will be considered to be continuous recording. Captured data shall be retained for the duration of the contract and shall be submitted to the Engineer on request.

The burner used for heating the aggregate shall achieve complete combustion of the fuel.

39-7.03 PROPORTIONING

Proportioning shall be either by hot-feed control or cold-feed control. Hot-feed control and cold-feed control indicate the location of the measuring devices or controls.

The Contractor's mixing equipment shall be equipped with a suitable, safe sampling device that will provide a sample, representative of actual production, of the aggregate being incorporated into the asphalt concrete. The delivery point of samples shall be safe and convenient. When samples are taken from a location above ground level, a means shall be provided for lowering the aggregate samples to the ground.

39-7.03A Proportioning for Batch Mixing

When the Contractor elects to use batch mixing equipment, each aggregate hot storage bin shall be equipped with a sampling device that will provide a sample of the aggregate discharged into the weigh hopper.

Fine material collected in dust control systems, other than centrifugal collectors or knock-out boxes, shall be considered to be supplemental fine aggregate. When supplemental fine aggregate is used, it shall be proportioned by mass.

A sampling device for supplemental fine aggregate shall be installed in each feed line or surge tank preceding the weigh hopper.

39-7.03A(1) Batching Tolerances

Aggregate and asphalt shall be proportioned by mass as follows:

- A. The zero tolerance for aggregate scales shall be 0.5-percent of the total batch mass of the aggregate. The zero tolerance for separate scales for weighing supplemental fine aggregate or asphalt binder shall be 0.05-percent of the total batch mass of the aggregate.
- B. Unless otherwise approved by the Engineer, the indicated mass of material drawn from storage shall not vary from the pre-selected scale setting as defined by target values of the approved mix design by more than the following percentages of the total batch mass of the aggregate:
 1. Aggregate shall be within one percent, except that when supplemental fine aggregate is used and is weighed cumulatively with the aggregate, the draft of aggregate drawn immediately before the supplemental fine aggregate shall be within 0.5-percent.
 2. Supplemental fine aggregate shall be within 0.5-percent.

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Adjustment to dials at the plant to achieve the target asphalt content in field is allowed and shall not be considered as a change in the asphalt concrete mixture. The asphalt binder shall be measured by a tank scale.

39-7.03A(2) Automatic Controls

Batch proportioning shall be by an automatic plant controller. The proportioning devices shall be automatic to the extent that the only manual operation required for proportioning materials for one batch shall be a single operation of a switch or starter.

Proportioning devices shall be of a type in which materials discharged from the several bins are controlled by gates or by mechanical conveyors. The batching devices shall be so interlocked that no new batch may be started until weigh hoppers are empty, the scales are at zero, and the discharge gates are closed. The means of withdrawal from the bins and of discharge from the weigh box shall be interlocked so that not more than one bin can discharge onto a given scale at one time, and so that the weigh box cannot be tripped until the required quantity from each of the bins has been deposited therein. In addition, automatic proportioning devices shall be interlocked so that the weighing cycle will be interrupted whenever the amount of material drawn from storage varies from the pre-selected amount by more than the tolerances specified in this Section 11-1. Whenever the weighing cycle is interrupted, that specific batch shall not be used in the work unless it can be manually adjusted to meet the specified tolerances based on the total mass of the batch. When partial batches are batched, the interlock tolerances, except the zero tolerance, shall apply to the total mass of aggregate in the partial batch.

Proportioning devices shall be operated so that all mass increments required for a batch are preset at the same time. Controls shall be designed so that these settings may be changed without delay and the order of discharge from the several bins can be changed.

Proportioning controls shall be equipped with the means for inspection of the interlock tolerance settings. Instructions for performing the inspection shall be available at the point of operation.

The necessary means shall be provided to check the mass of various proportioned amounts on a separate vehicle scale located at the plant site.

39-7.03B Proportioning for Continuous Mixing

Asphalt binder shall be introduced into the mixer through a meter conforming to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications. The asphalt meter shall automatically compensate for changes in the asphalt temperature, unless the meter is the mass flow, coriolis effect, type. The system shall be capable of varying the rate of delivery of binder proportionate with the delivery of aggregate. During a day's run, the temperature of asphalt binder shall not vary more than 30°C. The meter and lines shall be heated and insulated. The binder storage shall be equipped with a device for automatic plant cut-off when the level of binder is lowered sufficiently to expose the pump suction line.

When supplemental fine aggregate is used, it shall be proportioned by a method that uniformly feeds the material within 2 percent of the required amount. Supplemental fine aggregate shall be discharged from the proportioning device directly into the mixer.

The supplemental fine aggregate proportioning system shall function with a degree of accuracy such that, when operated between 30 percent and 100 percent of maximum operating capacity, the average difference between the indicated mass of material delivered and the actual mass delivered shall not exceed one percent of the actual mass for three individual 15-minute runs. For the 3 individual 15-minute runs, the indicated mass of material delivered shall not vary from the actual mass delivered by more than 2 percent of the actual mass.

The fine material collected in dust control systems may be returned to the aggregate production stream without proportioning if returned at a rate commensurate with overall plant production, and if returned at or before the mixer. A return rate of less than 100 percent of the collection rate shall be metered as specified above for supplemental fine aggregate.

The asphalt feeder, each of the aggregate feeders, the supplemental fine aggregate feeder, if used, and the combined aggregate feeder shall be equipped with devices by which the rate of feed can be determined while the plant is in full operation.

The combined aggregate shall be weighed using a belt scale. The belt scale shall be of such accuracy that, when the plant is operating between 30 percent and 100 percent of belt capacity, the average difference between the indicated mass of material delivered and the actual mass delivered shall not exceed one percent of the actual mass for three individual 3-minute runs. For the 3 individual 3-minute runs, the indicated mass of material delivered shall not vary from the actual mass delivered by more than 2 percent of the actual mass. Meters used for proportioning at the continuous mixing AC plants shall be accurate to within 0.5 percent of the test load for an average of three test runs provided no individual error exceeds 1.0 percent.

The actual mass of material delivered for proportioning device calibrations shall be determined by a vehicle scale located at the plant site conforming to the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications. The vehicle scale shall be error checked within 24 hours of checking the plant's proportioning devices. The plant shall be equipped so that this accuracy check can be made prior to the first production operation for a project and at other times when requested by the Engineer.

The belt scale for the combined aggregate, the proportioning devices for supplemental fine aggregate, if used, and the asphalt proportioning meter shall be interlocked so that the rates of feed of the aggregates and asphalt will be adjusted automatically (at all production rates and production rate changes) to maintain the asphalt ratio (kilograms of asphalt per 100 kg of dry aggregate including supplemental fine aggregate, if used) designated in the mix design in conformance with the provisions in Section 39-2.03, "Asphalt Concrete Mixture," of this Section 11-1. The plant shall not be operated unless this automatic system is functioning and in good working condition.

Asphalt meters and aggregate belt scales used for proportioning aggregates and asphalt shall be equipped with rate-of-flow indicators to show the rates of delivery of asphalt and aggregate. Meters and scales shall be equipped with resettable totalizers so that the total amounts of asphalt and aggregate introduced into the asphalt concrete mixture can be determined. Rate-of-flow indicators and totalizers for like materials shall be accurate within one percent when compared directly. The asphalt cement totalizer shall not register when the asphalt metering system is not delivering material to the mixer.

The bin or bins containing the fine aggregate and supplemental fine aggregate, if used, shall be equipped with vibrating units or other equipment that will prevent hang-up of material while the plant is operating. Each belt feeder shall be equipped with a device to monitor the depth of aggregate between the troughing rollers. The device for monitoring depth of aggregate shall automatically shut down the plant whenever the depth of aggregate is less than 70 percent of the target depth. To avoid erroneous shut down by normal fluctuations, a delay between sensing less than 70 percent flow and shutdown of the plant will be permitted, as determined by the Engineer, at the time of the initial California Test 109. A second device shall be located either in the stream of aggregate beyond the belt or where it will monitor movement of the belt by detecting revolutions of the tail pulley on the belt feeder. The device for monitoring no-flow or belt movement, as the case may be, shall stop the plant automatically and immediately when there is no flow. The plant shall not be operated unless both low-flow and no-flow monitoring devices are in good working condition and functioning properly.

For continuous pugmill mixing plants, an aggregate sampling device that will provide a 25-kg to 40-kg sample of the combined aggregate while the plant is in full operation shall be provided in advance of the point where the aggregate enters the mixer.

For drier-drum mixing plants, an aggregate sampling device that will provide a 25-kg to 40-kg sample of the combined aggregate while the plant is in full operation shall be provided in advance of the point where the aggregate enters the drier-drum mixer.

When supplemental fine aggregate is used, a sampling device shall be installed in each feed line or surge tank preceding the proportioning device for the supplemental fine aggregate.

39-7.04 (BLANK)

39-7.05 MIXING

Aggregate, supplemental fine aggregate, and asphalt binder shall be mixed in a batch mixer, continuous mixing pugmill mixer, or continuous mixing drier-drum. The charge in a batch mixer, or the rate of feed to a continuous mixer, shall not exceed that which will permit complete mixing of the material. Dead areas in the mixer, in which the material does not move or is not sufficiently agitated, shall be corrected by a reduction in the volume of material or by other adjustments.

Asphalt binder shall be at a temperature of not less than 120°C or more than 190°C when added to the aggregate. The temperature of the aggregate before adding the binder shall not be more than 165°C.

39-7.05A Batch Mixing

When asphalt concrete is produced by batch mixing, the mixer shall be equipped with a sufficient number of paddles of a type and arrangement so as to produce a properly mixed batch.

The binder shall be introduced uniformly into the mixer along the center of the mixer parallel to the mixer shafts, or by pressure spraying. When a pan is used, it shall be equipped with movable vanes in order that the flow of binder may be directed across the width of the pan, as desired. The vanes shall be equipped with a means for quick adjustment, and a positive lock to prevent shifting.

The mixer platform shall be of ample size to provide safe and convenient access to the mixer and other equipment. The mixer housing and weighbox housing shall be equipped with gates of ample size to permit ready sampling of the discharge of aggregate from each of the plant bins and from each feed line or surge tank of supplemental fine aggregate, if used. The Contractor shall provide a sampling device capable of delivering a representative sample of sufficient size to permit the required tests.

The mixer shall be equipped with a timing device that will indicate by a definite audible or visual signal the expiration of the mixing period. The device shall measure the time of mixing within 2 seconds.

The time of mixing a batch shall begin on the charging stroke of the weighhopper dumping mechanism and shall end when discharge is started. Mixing shall continue until a homogeneous asphalt concrete mixture of uniformly distributed and properly coated aggregates of unchanging appearance is produced. The time of mixing shall be not less than 30 seconds.

An interval timer shall control the time of mixing. The interval timer shall be interlocked so that the mixer cannot be discharged until the materials have been mixed for the full amount of time specified.

39-7.05B Continuous Mixing

Continuous mixing plants shall utilize pugmill or drier-drum mixers.

When asphalt concrete is produced by pugmill mixing, the mixer shall be equipped with paddles of a type and arrangement to provide sufficient mixing action and movement to the asphalt concrete mixture to produce properly mixed asphalt concrete. The combined aggregate shall be fed directly from the drier to the mixer at a uniform and controlled rate.

Mixing shall continue until a homogeneous asphalt concrete mixture of thoroughly and uniformly coated aggregates of unchanging appearance is produced at the discharge point from the mixer.

The temperature of the completed asphalt concrete mixture shall not exceed 165°C upon discharge from the mixer.

The mixer shall discharge into a storage silo with a capacity of not less than that specified in Section 39-7.06, "Asphalt Concrete Storage," of this Section 11-1. The Contractor shall provide a means of diverting the flow of asphalt concrete away from the silo to prevent incompletely mixed portions of the asphalt concrete mixture from entering the silo.

39-7.06 ASPHALT CONCRETE STORAGE

When asphalt concrete is stored, it shall be stored only in silos. Asphalt concrete shall not be stockpiled. The minimum quantity of asphalt concrete in a silo during mixing shall be 18 tonnes except for the period immediately following a shut-down of the plant of 2 hours or more. A means shall be provided to indicate that storage in each silo is being maintained as required.

Storage silos shall be equipped with a surge-batcher sized to hold a minimum of 1800 kg of material. A surge-batcher consists of equipment placed at the top of the storage silo that catches the continuous delivery of the completed asphalt concrete mix and changes it to individual batch delivery to prevent the segregation of product ingredients as the completed asphalt concrete mix is placed into storage. The surge-batcher shall be center loading and shall be constructed to prevent material buildup. Rotary chutes shall not be used as surge-batchers.

The surge-batcher shall be independent and distinct from conveyors or chutes used to collect or direct the completed asphalt concrete mixture being discharged into storage silos and shall be the last device to handle the material before it enters the silo. Multiple storage silos shall be served by an individual surge-batcher for each silo. Material handling shall be free of oblique movement between the highest elevation (conveyor outfall) and subsequent placement in the silo. Discharge gates on surge-batchers shall be automatic in operation and shall discharge only after a minimum of 1800 kg of material has been collected and shall close before the last collected material leaves the device. Discharge gate design shall prevent the deflection of material during the opening and closing operation.

Asphalt concrete stored in excess of 18 hours shall not be used in the work. Asphalt concrete mixture containing hardened lumps shall not be used. A storage facility that contained the material with the hardened lumps shall not be used for further storage until the cause of the lumps is corrected.

39-7.07 ASPHALT CONCRETE PLANTS

Plants, including commercial plants, that produce asphalt concrete subject to these specifications shall conform to the provisions in Section 7-1.01F, "Air Pollution Control," of the Standard Specifications, and shall be equipped with a wet-tube dust washer or equal and other devices that will reduce the dust emission to the degree that adjacent property is not damaged. The washer and other equipment shall function efficiently when the plant is in operation.

During production, petroleum products such as diesel fuel and kerosene shall not be used as a release agent on belts, conveyors, hoppers, or hauling equipment.

Plants shall be equipped with an inspection dock constructed so that a quality control technician or inspector standing on the dock can inspect the completed asphalt concrete mixture and take samples, as necessary, from the hauling vehicle before the vehicle leaves the plant site. This inspection dock shall allow the hauling vehicle to pull alongside and shall meet applicable safety requirements of the California Division of Occupational Safety and Health. Haul vehicle drivers shall be instructed to stop at the dock whenever a quality control technician or inspector is on the dock and to remain there until directed to leave by that individual.

39-8 SUBGRADE, PRIME COAT, PAINT BINDER (TACK COAT), AND PAVEMENT REINFORCING FABRIC

39-8.01 SUBGRADE

Immediately prior to applying prime coat or paint binder (tack coat), or immediately prior to placing the asphalt concrete when a prime coat or paint binder (tack coat) is not required, the subgrade to receive asphalt concrete shall conform to the compaction requirement and elevation tolerances specified for the material involved and shall be free of loose or extraneous material. If the asphalt concrete is to be placed on an existing base or pavement that was not constructed as part of the contract, the surface shall be cleaned by sweeping, flushing or other means to remove loose particles of paving, dirt, and other extraneous material immediately before applying the prime coat or paint binder (tack coat).

39-8.02 PRIME COAT AND PAINT BINDER (TACK COAT)

A prime coat of liquid asphalt shall be applied to the areas to be surfaced when there is a contract item for the work or when the work is required in "Asphalt Concrete" in of these special provisions.

Prime coat shall be applied only to those areas designated by the Engineer.

Prime coat shall be applied at the approximate total rate of 1.15 L per square meter of surface covered. The exact rate and number of applications will be determined by the Engineer.

Prime coat shall be applied at a temperature conforming to the range of temperatures specified in Section 93-1.03, "Mixing and Applying," of the Standard Specifications for distributor application of the grade of liquid asphalt being used.

A paint binder (tack coat) of asphaltic emulsion shall be furnished and applied in conformance with the provisions in Section 94, "Asphaltic Emulsions," of the Standard Specifications and shall be applied to vertical surfaces of existing pavement, curbs, gutters, and construction joints in the surfacing against which additional material is to be placed, to a pavement to be surfaced, and to other surfaces designated in "Asphalt Concrete" of these special provisions.

Paint binder (tack coat) of asphaltic emulsion shall be applied in one application at a rate of from 0.10-L to 0.45-L per square meter of surface covered. The exact rate of application will be determined by the Engineer.

At the Contractor's option, paving asphalt may be used for paint binder (tack coat) instead of asphaltic emulsion. The paving asphalt shall be applied at a temperature of not less than 140°C or more than 175°C, and to all existing pavement surfaces to be paved and between each layer of asphalt concrete, except when eliminated by the Engineer.

Paint binder (tack coat) of paving asphalt shall be applied in the liter per square meter range limits specified for the surfaces to receive asphalt concrete in the table below. The exact application rate within the range will be determined by the Engineer.

Application Rates for Paint Binder (Tack Coat) on Asphalt Concrete and on Portland Cement Concrete Pavement (PCCP)	
Type of surface to receive paint binder (tack coat)	Paving Asphalt L/m ²
Dense, compact surfaces, between layers, and on PCCP	0.05 – 0.10
Open textured, or dry, aged surfaces	0.10 – 0.25

Prime coat or paint binder (tack coat) shall be applied in advance of placing the surfacing only as far as shall be approved by the Engineer. When asphaltic emulsion is used as a paint binder (tack coat), the asphalt concrete shall not be placed until the asphaltic emulsion has cured.

Immediately in advance of placing asphalt concrete, additional prime coat or paint binder (tack coat) shall be applied as directed by the Engineer to areas where the prime coat or paint binder (tack coat) has been damaged. Loose or extraneous material shall be removed and no additional compensation will be allowed therefor.

39-8.03 PAVEMENT REINFORCING FABRIC

Pavement reinforcing fabric shall be placed on existing pavement to be surfaced or between layers of asphalt concrete when such work is shown on the plans, or specified in "Asphalt Concrete" of these special provisions, or ordered by the Engineer.

Immediately prior to placing binder, pavement reinforcing fabric, and asphalt concrete surfacing, the pavement shall be cleaned of loose and extraneous materials such as, but not limited to, vegetation, sand, dirt, gravel and water.

Before placing the pavement reinforcing fabric, a binder of paving asphalt Grade PG 70-10 shall be applied uniformly to the surface to receive the pavement reinforcing fabric at a rate of not less than 1.15 L per square meter of surface covered. Pavement reinforcing fabric shall not be placed in areas of conform tapers when the thickness of the overlying asphalt concrete will be 40 mm or less. When pavement reinforcing fabric is placed in areas of conform tapers the binder shall be spread at the approximate rate of 1.4 L per square meter of surface covered. The exact rate will be determined by the Engineer. The binder shall be applied to a width equal to the width of the fabric mat plus 75 mm on each side.

Asphaltic emulsion shall not be substituted for paving asphalt binder for pavement reinforcing fabric.

Before applying binder, large cracks, spalls, and depressions in existing pavement shall be repaired as directed by the Engineer and, if not included in the item, the repair work will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

The pavement reinforcing fabric shall be aligned and placed with no wrinkles that lap. The test for lapping shall be made by gathering together the pavement reinforcing fabric in a wrinkle. If the height of the doubled portion of extra fabric is 15 mm or more, the fabric shall be cut to remove the wrinkle, then lapped in the direction of paving. Lap in excess of 50 mm shall be removed.

If manual laydown methods are used, the pavement reinforcing fabric shall be unrolled, aligned, and placed in increments of approximately 9 m.

Adjacent borders of the pavement reinforcing fabric shall be lapped 50 mm to 100 mm. The preceding roll shall be lapped 50 mm to 100 mm over the following roll in the direction of paving at ends of rolls or at a break. At pavement reinforcing fabric overlays, both the binder and the fabric shall overlap previously placed fabric by the same amount.

Seating of the pavement reinforcing fabric with rolling equipment after placing will be permitted. Turning of the paving machine and other vehicles shall be gradual and kept to a minimum to avoid damage to the fabric.

A small quantity of asphalt concrete, to be determined by the Engineer, may be spread over the pavement reinforcing fabric immediately in advance of placing asphalt concrete surfacing in order to prevent fabric from being damaged by construction equipment.

Pavement reinforcing fabric shall not be exposed to public traffic, Contractor's equipment or elements that will damage the fabric prior to placement of asphalt concrete surfacing, as determined by the Engineer. Public access cross traffic may be allowed to cross the fabric under traffic control after the Contractor has placed a small quantity of asphalt concrete over the fabric.

Care shall be taken to avoid tracking binder material onto the pavement reinforcing fabric or distorting the fabric during seating of the fabric with rolling equipment. If necessary to protect the pavement reinforcing fabric, exposed binder material may be covered lightly with sand.

39-9 SPREADING AND COMPACTING EQUIPMENT

39-9.01 SPREADING EQUIPMENT

Asphalt pavers shall be self-propelled mechanical spreading and finishing equipment provided with a screed or strike-off assembly capable of distributing the material to not less than the full width of a traffic lane unless otherwise approved by the Engineer. Screed action shall include cutting, crowding or other practical action that is effective on the asphalt concrete mixture without tearing, shoving or gouging and that produces a surface texture of uniform appearance. The screed shall be adjustable to the required section and thickness. The screed shall be provided with a suitable full width compacting device. Pavers that leave ridges, indentations or other marks in the surface shall not be used unless the ridges, indentations or marks are eliminated by rolling or prevented by adjustment in the operation.

When end dump haul vehicles are used, the asphalt paver shall operate independently of the vehicle being unloaded or shall be capable of propelling the vehicle being unloaded. The load of the haul vehicle shall be limited to that which will insure satisfactory spreading. While being unloaded, the haul vehicle shall be in contact with the machine and the brakes on the haul vehicle shall not be depended upon to maintain contact between the vehicle and the machine.

No portion of the mass of hauling or loading equipment, other than the connection, shall be supported by the asphalt paver. No vibrations or other motions of the loader that could have a detrimental effect on the riding quality of the completed pavement shall be transmitted to the paver.

When asphalt concrete is placed directly upon asphalt treated permeable base, the asphalt concrete shall be placed in a manner and with equipment that will not disturb or displace the asphalt treated permeable base.

39-9.02 COMPACTING EQUIPMENT

A sufficient number of rollers shall be provided to obtain the specified compaction and surface finish required by this Section 11-1. Rollers shall be sized to achieve the required results.

Rollers shall be equipped with pads and water systems that prevent sticking of the asphalt concrete mixtures to the pneumatic or steel-tired wheels. A parting agent that will not damage the asphalt concrete mixture may be used to aid in preventing the asphalt concrete mixture from sticking to the wheels.

39-10 SPREADING AND COMPACTING

39-10.01 GENERAL REQUIREMENTS

Asphalt concrete shall be handled, spread, and compacted in a manner which is in conformance with this Section 11-1, "Quality Control / Quality Assurance."

Asphalt concrete shall be placed in such a manner that cracking, shoving, and displacement will be avoided.

Asphalt concrete shall be placed only when the ambient temperature is above 10°C.

Asphalt concrete shall not be placed when the underlying layer or surface is frozen or not dry or when weather conditions will prevent proper handling, finishing or compaction of the mixture.

Asphalt concrete shall be spread and compacted in the layers and thicknesses indicated in the following table:

Asphalt Concrete Layers and Thickness

Total Thickness Shown on the Plans*	Minimum Number of Layers	Top Layer Thickness (Millimeters)		Next Lower Layer Thickness (Millimeters)		All Other Lower Layers Thickness (Millimeters)	
		Min.	Max.	Min.	Max.	Min.	Max.
75 mm or less	1	----	----	----	----	----	----
76 through 89 mm	2	35	45	35	45	----	----
90 through 135 mm	2	45	60	45	75	—	—
136 mm or more	**	45	60	45	75	45	120

Notes:

*When pavement reinforcing fabric is shown to be placed between layers of asphalt concrete, the thickness of asphalt concrete above the pavement reinforcing fabric shall be considered to be the "Total Thickness Shown on the Plans" for the purpose of spreading and compacting the asphalt concrete above the pavement reinforcing fabric.

**At least 3 layers if total thickness is more than 135 mm and less than 255 mm. At least 4 layers if total thickness is 255 mm or more.

A layer shall not be placed over a layer that exceeds 75 mm in compacted thickness until the temperature of the layer being covered is less than 70°C at mid-depth unless approved by the Engineer.

Asphalt concrete to be placed on shoulders, and on other areas off the traveled way having a width of 1.50 m or more, shall be spread in the same manner as specified above.

The completed mixture shall be deposited on the roadbed at a uniform quantity per linear meter, as necessary to provide the required compacted thickness without resorting to spotting, picking-up or otherwise shifting the mixture. During transporting, spreading and compacting, petroleum products such as diesel fuel and kerosene shall not be used as a release agent on trucks, spreaders or compactors in contact with the asphalt concrete.

Segregation shall be avoided. Surfacing shall be free from pockets of coarse or fine material. Asphalt concrete containing hardened lumps shall not be used.

Longitudinal joints in the top layer of asphalt concrete shall correspond with the edges of planned traffic lanes. Longitudinal joints in other layers shall be offset not less than 150 mm alternately each side of the edges of traffic lanes.

Unless otherwise provided herein or approved by the Engineer, the top layer of asphalt concrete for shoulders, tapers, transitions, road connections, private drives, curve widenings, chain control lanes, turnouts, left-turn pockets, and other areas shall not be spread before the top layer of asphalt concrete for the adjoining through lane has been spread and compacted. At locations where the number of lanes is changed, the top layer for the through lanes shall be paved first. When existing pavement is to be surfaced and the specified thickness of asphalt concrete to be spread and compacted on the existing pavement is 75 mm or less, the shoulders or other adjoining areas may be spread simultaneously with the through lane provided the completed surfacing conforms to the requirement of this Section 11-1. Tracks or wheels of spreading equipment shall not be operated on the top layer of asphalt concrete until final compaction has been completed.

At those locations shown on the plans, as specified in "Asphalt Concrete" of these special provisions, or as directed by the Engineer, the asphalt concrete shall be tapered or feathered to conform to existing surfacing or to other highway and non-highway facilities.

At locations where the asphalt concrete is to be placed over areas inaccessible to spreading and rolling equipment, the asphalt concrete shall be spread by practical means to obtain the specified results and shall be compacted thoroughly to the required lines, grades, and cross sections by means of pneumatic tampers or by other methods that will produce the same degree of compaction as pneumatic tampers.

39-10.02 PRODUCTION START-UP EVALUATION AND NUCLEAR DENSITY TEST STRIPS

The Contractor shall demonstrate that the proposed asphalt concrete mixture is being produced and placed on the roadway in conformance with this Section 11-1, "Quality Control / Quality Assurance." The production start-up evaluation shall demonstrate that the aggregates and asphalt concrete mixture conform to the requirements of Table 39-3B, "Asphalt Concrete Mixture Requirements," Table 39-4, "Minimum Process Control Requirements," and Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1 when produced using the plant proposed for this project. The nuclear density test strip serves to provide the Contractor with a location to develop a correlation between cores taken from the test strip and the Contractor's and Engineer's nuclear density gage readings taken from the same locations on the test strip and for the Contractor to demonstrate the ability to achieve a minimum density of 92.0 percent and a maximum density of 97.0 percent of maximum theoretical density.

Production start-up evaluation and the nuclear density test strip may be constructed separately or at the same time to serve both purposes. Asphalt concrete used in the nuclear density test strip shall be representative of the asphalt concrete that shall be placed in the project.

Should the test results or testing program fail to meet these criteria, production will be suspended and the Contractor shall resolve the problem in conformance with the provisions in Section 39-6, "Dispute Resolution," of this Section 11-1.

Attention is directed to longitudinal and transverse construction joint requirements specified in "Asphalt Concrete" of these special provisions.

Test data used for the production start up evaluation and the nuclear gage test strips shall not be included with the test data used for acceptance of the work in conformance with the provisions in Section 39-11, "Acceptance of Work," of this Section 11-1.

A production start-up evaluation and a nuclear density test strip shall be used when production of asphalt concrete has been resumed following a suspension of production due to unsatisfactory material quality as specified in Section 39-4.04, "Contractor Process Control," Section 39-4.05, "Contractor Quality Control," and Section 39-11, "Acceptance of Work" of this Section 11-1.

39-10.02A Production Start-Up Evaluation

Before or on the first day of asphalt concrete production, the Contractor shall produce a trial quantity of between 250 tonnes and 500 tonnes of asphalt concrete to demonstrate that asphalt concrete produced for this project conforms to the quality characteristics of this Section 11-1. The location of the production start-up evaluation shall be approved by the Engineer.

Asphalt concrete shall be produced by production procedures intended for the entire project. Production of asphalt concrete shall stop after placement of the trial quantity of asphalt concrete. Asphalt concrete production and placement may resume after the quality characteristics of the asphalt concrete mixture have been tested and found to be in conformance with the quality requirements of this Section 11-1.

The Contractor shall randomly obtain 3 aggregate samples from the plant and 3 asphalt concrete mixture samples from the mat behind the paver. Each sample from the plant shall be split into 4 portions and each sample from the mat shall be split into 4 portions. One portion of each sample shall be tested by the Contractor and one portion of each sample shall be provided to the Engineer for testing. The remaining portions shall be delivered to the Engineer and stored for dispute resolution should the test results not conform to this Section 11-1. The Contractor and the Engineer shall evaluate the samples for conformance to the requirements for sand equivalent, stability, percent air voids, and the quality characteristics designated in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. The percent air voids of the asphalt concrete mixture shall be within ± 1.0 percent of the percent air voids designated in the Contractor's mix design.

The trial quantity of asphalt concrete will be accepted if:

- A. Not more than 3 of the test results from the combined 6 test results from the Contractor's and Engineer's samples for quality characteristics indexed 2, 3, 4, and 5 in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1 are outside the specified limits.
- B. Not more than one of the test results from the combined 6 test results from the Contractor's and the Engineer's samples for sand equivalent, stability, percent air voids or critical start-up characteristics designated in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1 are outside the specified limits.

If the test results from the combined 6 test results fail to meet the conditions above, corrective action shall be taken, and a new trial quantity of asphalt concrete shall be placed and evaluated in conformance with the provisions in this section to demonstrate conformance. If the test results from the combined 6 test results fail to meet the requirements above, then the trial quantity of asphalt concrete will be rejected.

The testing program will be considered adequate only if the average of the Contractor's test results and the average of the Engineer's test results for sand equivalent, stability, percent air voids, and the quality characteristics designated in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1 are within the calculated allowable testing difference using the Precision Index designated in Table 39-6, "Precision Index," of this Section 11-1.

The Contractor shall not proceed to regular production until the requirements of this Section 39-10.02A, "Production Start-Up Evaluation" have been met. At the request of the Contractor, the Engineer may elect to leave the asphalt concrete which does not meet the requirements of this Section 39-10.02A in place if mitigation at the Contractor's expense can be agreed to. If this quantity of asphalt concrete is left in place, the Contractor will be paid 75 percent of the contract price paid per tonne for asphalt concrete.

39-10.02B Nuclear Density Test Strip

On the first day of placement of each layer of asphalt concrete the Contractor shall place a test strip in conformance with the requirements of California Test 375 modified to use maximum theoretical density (Rice method) in accordance with California Test 309 in lieu of test maximum density (TMD) as provided in Part 5, "Determining Test Maximum Density." The purpose of the test strip is to determine a correlation (conversion factor) between densities of cores taken from the test strip and the nuclear density gage readings taken at the core locations and to demonstrate that the asphalt concrete can be placed and compacted to the standards of this Section 11-1, "Quality Control / Quality Assurance." Asphalt concrete used in the nuclear density test strip shall be representative of the asphalt concrete that shall be placed in the project. The location for the nuclear density test strip shall be approved by the Engineer.

The Contractor shall place nuclear density test strips until conditions of the test method and this Section 11-1 have been met. The requirements of this section and the test method shall apply for the correlation of each nuclear density gage that is used to determine percent of maximum theoretical density for this project. Percent of maximum theoretical density results will not be accepted if they have been determined using a nuclear gage that has not been correlated using a test strip. A nuclear density test strip shall be required when the nuclear gage(s) used in the project is replaced, modified, repaired or recalibrated.

Asphalt concrete in test strips may be left in place under the following conditions:

- A. If the test strip density is equal to or greater than 92.0 percent and less than 97.0 percent of maximum theoretical density, the Contractor will be paid at the contract price per tonne of asphalt concrete..
- B. If the test strip density is less than 92.0 percent but greater than 90.0 percent of maximum theoretical density, the Contractor will be paid at 50 percent of the contract price per tonne of asphalt concrete. A new test strip will be required, and mitigation measures shall be at Contractor's expense.

Asphalt concrete in test strips will be rejected when the density for the test strip is less than 90.0 percent or greater than 97.0 percent of maximum theoretical density. Production and placement shall not begin until the Contractor has demonstrated the ability to achieve a density of 92.0 percent to 97.0 percent of maximum theoretical density in conformance with the provisions of these special provisions.

A new test strip will not be required for layers of AC placed over previously placed and tested layers (as part of this contract) when the thickness of the composite section of previously placed asphalt concrete is greater than 75 mm and the composite section has the same asphalt quality characteristics. When this situation occurs, use the conversion factor from the previously placed underlying section.

39-10.03 SPREADING

Layers shall be spread with an asphalt paver, unless otherwise specified or approved by the Engineer. Asphalt pavers shall be operated in such a manner as to insure continuous and uniform movement of the paver.

In advance of spreading asphalt concrete over an existing base, surfacing or bridge deck, if there is a contract item for asphalt concrete (leveling) or if ordered by the Engineer, asphalt concrete shall be spread by mechanical means that will produce a uniform smoothness and texture. Asphalt concrete (leveling) shall include, but not be limited to, the filling and leveling of irregularities and ruts. Asphalt concrete used to change the cross slope or profile of an existing surface shall not be considered as asphalt concrete (leveling).

Tack coat (paint binder) shall be applied to each layer in advance of spreading the next layer.

Before placing the top layer adjacent to cold transverse construction joints, the joints shall be trimmed to a vertical face on a neat line. Transverse joints shall be tested with a 3.6-m \pm 0.06-m straightedge and shall be cut back for surface smoothness as required in conformance with Section 39-10.04, "Compacting," of this Section 11-1. Connections to existing surfacing shall be feathered to conform to the requirements for smoothness. Longitudinal joints shall be trimmed to a vertical face and on a neat line if the edges of the previously laid surfacing are, in the opinion of the Engineer, in such a condition that the quality of the completed joint will be affected.

39-10.04 COMPACTING

Compacting equipment shall conform to the provisions in Section 39-9.02, "Compacting Equipment," of this Section 11-1, "Quality Control / Quality Assurance."

Rolling shall commence at the lower edge and shall progress toward the highest portion. When compacting layers that exceed 75 mm in compacted thickness, rolling shall commence at the center and shall progress outwards. No rolling will be permitted after the asphalt concrete temperature is below 60°C.

Asphalt concrete shall be compacted to a minimum density of 92.0 percent and a maximum density of 97.0 percent of maximum theoretical density and shall be finished to the lines, grades and cross sections shown on the plans. In-place density of asphalt concrete will be determined prior to opening the pavement to public traffic.

Percent of maximum theoretical density shall be determined in conformance with the requirements of California Test 375 modified to use maximum theoretical density in accordance with California Test 309 in lieu of test maximum density (TMD) as provided in Part 5, "Determining Test Maximum Density." Test locations will be established for asphalt concrete areas to be tested, as specified in California Test 375. If the Contractor compacts the asphalt concrete in any form or quantity after sites for testing have been chosen in conformance with the requirements of California Test 375 or after California Test 375 has begun, the quality control tester shall choose a new set of random numbers for locating test sites.

Asphalt concrete placed in dig outs, as a leveling course, for slope correction, for detours not included in the finished roadway prism, in areas where in the judgment of the Engineer compaction or compaction measurement by conventional methods is impeded or on the uppermost lift of shoulders with rumble strips shall be compacted by a method approved by the Engineer.

Upon completion of rolling operations, if ordered by the Engineer, the asphalt concrete shall be cooled by applying water. Applying water shall conform to the provisions in Section 17, "Watering," of the Standard Specifications.

The completed surfacing shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. Ridges, indentations or other objectionable marks left in the surface of the asphalt concrete by blading or other equipment shall be eliminated by rolling or other suitable means. The use of equipment that leaves ridges, indentations or other objectionable marks in the asphalt concrete shall be discontinued.

When a straightedge 3.6 m \pm 0.06 m long is laid on the finished surface and parallel with the centerline, the surface shall not vary more than 3-mm from the lower edge of the straightedge. The transverse slope of the finished surface shall be uniform to a degree such that no depressions greater than 6 mm are present when tested with a straightedge 3.6 m \pm 0.06-m long in a direction transverse to the centerline and extending from edge to edge of a 3.6-m traffic lane.

Pavement within 15 m of a structure or approach slab shall conform to the smoothness tolerances specified in Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications.

39-11 ACCEPTANCE OF WORK

39-11.01 GENERAL

The Engineer shall select the procedure used to determine the quantities of asphalt concrete for acceptance and payment determination in conformance with the provisions of this Section 11-1, "Quality Control / Quality Assurance."

Quality control test results that have been verified shall form the basis for statistical evaluation of the work in conformance with Section 39-11.02, "Statistical Evaluation and Determination of Pay Factor," of this Section 11-1. The quality requirements on which statistical evaluation will be based are specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1.

Work determined to be in conformance with the provisions of this Section 11-1 will be accepted and paid for at the contract price per tonne for asphalt concrete and may be subject to compensation adjustment in conformance with Section 39-11.02C, "Pay Factor Determination and Compensation Adjustment," of this Section 11-1.

Work that is not in compliance with the provisions of this Section 11-1 may be rejected by the Engineer and shall be removed and replaced at the Contractor's expense.

When there are fewer than 5 verified quality control tests, the work will be accepted or rejected based on whether the individual test results meet the quality requirements specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Section 39-11.02, "Statistical Evaluation and Pay Factor Determination," of this Section 11-1 shall not apply.

Aggregates, asphalt binder, and asphalt concrete mixtures that do not conform to this Section 11-1 shall not be used.

The Engineer may reject a quantity of material that is determined to be defective based on visual inspection or noncompliance with the provisions of this Section 11-1.

39-11.02 STATISTICAL EVALUATION AND DETERMINATION OF PAY FACTOR

Statistical evaluation of the work shall be used to verify the Contractor's quality control test results to determine compliance with this Section 11-1, "Quality Control / Quality Assurance."

39-11.02A General

The quality characteristics to be evaluated and the specification limits are specified in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. Asphalt content, aggregate gradation (600- μ m and 75- μ m sieves), and percent of maximum theoretical density shall be considered for purposes of this Section 11-1 to be critical quality characteristics.

A lot represents the total quantity of asphalt concrete placed. More than one lot will occur if changes in the target values, material sources or mix design are requested by the Contractor and made in conformance with this Section 11-1 or if production of asphalt concrete is suspended due to unsatisfactory performance. However, asphalt concrete placed in dig outs, as a leveling course, for slope correction, for detours not to be included in the finished roadway prism, in areas where in the judgment of the Engineer compaction or compaction measurement by conventional methods is impeded or on the uppermost lift of shoulders with rumble strips by rolled-in indentations shall be considered as a separate lot from other asphalt concrete. In addition, a new lot may be designated by the Engineer if the production and placement have been suspended for longer than 30 days due to seasonal suspension of phases of work.

A minimum of 5 samples shall be required to perform a statistical evaluation. The maximum obtainable pay factor with the 5 samples shall be 1.01. A minimum of 8 samples shall be required to obtain a pay factor of 1.05. If the sampling frequencies and quantity of work would otherwise result in fewer than 8 samples, the Contractor may submit a written request to increase the sampling frequency to provide a minimum of 8 samples. The request shall be included in the Quality Control Plan.

The lot will be accepted and a final pay factor determined when the Contractor's sampling, inspection, and test results are completed, have been submitted and evaluated, and the Engineer has visually inspected the pavement. Quality control test results shall be verified using the *t*-test in conformance with the provisions of Section 39-5.03, "Verification," of this Section 11-1 before the results will be used in considering the acceptance of asphalt concrete.

If the current composite pay factor of a lot is greater than 0.90, the lot will be accepted, provided the lowest single pay factor is not within the reject portion of Table 39-8, "Pay Factors," of this Section 11-1. If the lowest single pay factor is within the reject portion of Table 39-8, "Pay Factors," of this Section 11-1, the lot will be terminated and the representative quantity of asphalt concrete within the lot will be rejected. Rejected asphalt concrete shall be removed from the project site at the Contractor's expense and the quantity of rejected asphalt concrete will be determined by the Contractor and submitted to the Engineer for verification and approval.

If the current composite pay factor of a lot is less than 0.90, production of asphalt concrete shall be terminated and corrective action taken. Upon approval of the Engineer, "Production Start - Up Evaluation and Nuclear Density Test Strips," as specified in Section 39-10.02, 39-10.02A and 39-10.02B, shall be used to demonstrate that the asphalt concrete is once again in conformance with this Section 11-1. Production of asphalt concrete shall not start until the Engineer has received test results confirming conformance with this Section 11-1. A new lot will be established when production resumes.

If a pay factor for a critical quality characteristic designated in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1 is less than 0.90 for the lot or is within the rejection range for the last 5 tests, production of asphalt concrete shall be terminated and corrective action taken. Upon approval of the Engineer, "Production Start - Up Evaluation or a Nuclear Density Test Strip," as specified in section 39-10.02, 39-10.02A and 39-10.02B, shall be used to demonstrate that the asphalt concrete is once again in conformance with this Section 11-1. Production of asphalt concrete shall not start until the Engineer has received test results confirming conformance with this Section 11-1. A new lot will be established when production resumes.

Defective asphalt concrete may be voluntarily removed and replaced with new asphalt concrete to avoid a low pay factor. Tests representing rejected and removed material shall not be included in the pay factor calculations. New material will be sampled, tested, and evaluated in conformance with this Section 11-1.

39-11.02B Statistical Evaluation

The Variability-Unknown/Standard Deviation Method will be used to determine the estimated percentage of the lot that is outside specification limits. The number of significant figures used in the calculations will be in conformance with the requirements of AASHTO Designation R-11, Absolute Method.

The estimated percentage of work that is outside of the specification limits for each quality characteristic will be determined as follows:

1. Calculate the arithmetic mean (\bar{X}) of the test values;

$$\bar{X} = \frac{\sum x}{n}$$

where: $\sum x$ = summation of individual test values
 n = total number of test values
 Calculate the standard deviation

$$s = \sqrt{\frac{n(\sum x^2) - (\sum x)^2}{n(n-1)}}$$

(s); where: $\sum(x^2)$ = summation of the squares of individual test values
 n = total number of test values
 Calculate the upper quality index

$$Q_u = \frac{USL - \bar{X}}{s}$$

(Q_u); where: USL = upper specification limit
 s = standard deviation
 \bar{X} = arithmetic mean

(Note: The USL is equal to the upper specification limit or the target value plus the production tolerance.)

4. Calculate the lower quality index (Q_L);

$$Q_L = \frac{\bar{X} - LSL}{s}$$

where:
 LSL = lower specification limit or target value minus production tolerance
 s = standard deviation
 \bar{X} = arithmetic mean

5. From Table 39-7, "Estimated Percent of Work Outside Specification Limits," of this Section 11-1, determine P_U ;

where:
 P_U = the estimated percentage of work outside the USL.
 ($P_U = 0$, when USL is not specified.)

- From Table 39-7, "Estimated Percent of Work Outside Specification Limits," of this Section 11-1, determine P_L ;

where:

P_L = the estimated percentage of work outside the LSL.
($P_L = 0$, when LSL is not specified.)

- Calculate the total estimated percentage of work outside the USL and LSL, Percent Defective;

$$\text{Percent Defective} = P_U + P_L$$

where:

P_U = the estimated percentage of work outside the USL
 P_L = the estimated percentage of work outside the LSL

- Repeat Steps 1 through 7 for each quality characteristic listed for acceptance.

39-11.02C Pay Factor Determination and Compensation Adjustment

The pay factor and compensation adjustment for a lot will be determined as follows:

- From Table 39-8, "Pay Factors," of this Section 11-1, determine the pay factor for each quality characteristic, (PF_{QC}), using the total number of test result values and the total estimated percentage outside the specification limits ($P_U + P_L$) from Step 7 in Section 39-11.02B, "Statistical Evaluation," of this Section 11-1.
- The pay factor for the lot is a composite of single pay factors determined for each quality characteristic designated in Table 39-9, "Minimum Quality Control Requirements," of this Section 11-1. The following formula is used:

$$PF_C = \sum_{i=1}^8 w_i PF_{QC_i}$$

where:

PF_C = the composite pay factor for the lot, calculated to 2 decimal places
 PF_{QC} = the pay factor for the individual quality characteristic, calculated to 2 decimal places
 w = the weighting factor listed in Table 39-9, and
 i = the quality characteristic index number in Table 39-9.

- Payment to the Contractor for the lot of asphalt concrete will be subject to a compensation adjustment. The Compensation Adjustment Factor (CAF) will be determined as follows:

$$CAF = PF_C - 1$$

- The amount of the compensation adjustment will be calculated as the product of:
 - the Compensation Adjustment Factor (CAF)
 - the total tonnes represented in the lot, and
 - the contract price paid per tonne for the item of asphalt concrete involved.

If the compensation adjustment is a negative value, the compensation adjustment will be deducted from moneys due, or that may become due, the Contractor under the contract. If the compensation adjustment is a positive value, the compensation adjustment will be added to moneys due, or that may become due, the Contractor under the contract.

Table 39-7.—ESTIMATED PERCENT OF WORK OUTSIDE SPECIFICATION LIMITS

P _U and/or P _L	Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
	Upper Quality Index Q _U or Lower Quality Index Q _L												
0	1.72	1.88	1.99	2.07	2.13	2.20	2.28	2.34	2.39	2.44	2.48	2.51	2.56
1	1.64	1.75	1.82	1.88	1.91	1.96	2.01	2.04	2.07	2.09	2.12	2.14	2.16
2	1.58	1.66	1.72	1.75	1.78	1.81	1.84	1.87	1.89	1.91	1.93	1.94	1.95
3	1.52	1.59	1.63	1.66	1.68	1.71	1.73	1.75	1.76	1.78	1.79	1.80	1.81
4	1.47	1.52	1.56	1.58	1.60	1.62	1.64	1.65	1.66	1.67	1.68	1.69	1.70
5	1.42	1.47	1.49	1.51	1.52	1.54	1.55	1.56	1.57	1.58	1.59	1.59	1.60
6	1.38	1.41	1.43	1.45	1.46	1.47	1.48	1.49	1.50	1.50	1.51	1.51	1.52
7	1.33	1.36	1.38	1.39	1.40	1.41	1.41	1.42	1.43	1.43	1.44	1.44	1.44
8	1.29	1.31	1.33	1.33	1.34	1.35	1.35	1.36	1.36	1.37	1.37	1.37	1.38
9	1.25	1.27	1.28	1.28	1.29	1.29	1.30	1.30	1.30	1.31	1.31	1.31	1.31
10	1.21	1.23	1.23	1.24	1.24	1.24	1.25	1.25	1.25	1.25	1.25	1.26	1.26
11	1.18	1.18	1.19	1.19	1.19	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20
12	1.14	1.14	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
13	1.10	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.11	1.11	1.11
14	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
15	1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
16	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
17	0.97	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94
18	0.93	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90
19	0.90	0.89	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
20	0.87	0.86	0.85	0.85	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83
21	0.84	0.82	0.82	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.79
22	0.81	0.79	0.79	0.78	0.78	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.76
23	0.77	0.76	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73
24	0.74	0.73	0.72	0.72	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70
25	0.71	0.70	0.69	0.69	0.68	0.68	0.67	0.67	0.67	0.67	0.67	0.67	0.66

Table continues below

Table 39-7 (cont.).—ESTIMATED PERCENT OF WORK OUTSIDE SPECIFICATION LIMITS

P _U and/or P _L	Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
	Upper Quality Index Q _U or Lower Quality Index Q _L												
26	0.68	0.67	0.67	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.63
27	0.65	0.64	0.63	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.60
28	0.62	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.57
29	0.59	0.58	0.57	0.57	0.56	0.56	0.55	0.55	0.55	0.55	0.55	0.55	0.54
30	0.56	0.55	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52
31	0.53	0.52	0.51	0.51	0.50	0.50	0.50	0.49	0.49	0.49	0.49	0.49	0.49
32	0.50	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46
33	0.47	0.48	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43
34	0.45	0.43	0.43	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.40
35	0.42	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38
36	0.39	0.38	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
37	0.36	0.35	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32
38	0.33	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30
39	0.30	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
40	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
41	0.25	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
42	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
43	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
44	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
45	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
46	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
47	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
48	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
49	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:

1. If the value of Q_U or Q_L does not correspond to a value in the table, use the next lower value.
2. If Q_U or Q_L are negative values, P_U or P_L is equal to 100 minus the table value for P_U or P_L.

Table 39-8.—PAY FACTOR

Pay Factor	Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
	Maximum Allowable Percent of Work Outside Specification Limits for A Given Pay Factor ($P_U + P_L$)												
1.05				0	0	0	0	0	0	0	0	0	0
1.04			0	1	3	5	4	4	4	3	3	3	3
1.03		0	2	4	6	8	7	7	6	5	5	4	4
1.02		1	3	6	9	11	10	9	8	7	7	6	6
1.01	0	2	5	8	11	13	12	11	10	9	8	8	7
1.00	22	20	18	17	16	15	14	13	12	11	10	9	8
0.99	24	22	20	19	18	17	16	15	14	13	11	10	9
0.98	26	24	22	21	20	19	18	16	15	14	13	12	10
0.97	28	26	24	23	22	21	19	18	17	16	14	13	12
0.96	30	28	26	25	24	22	21	19	18	17	16	14	13
0.95	32	29	28	26	25	24	22	21	20	18	17	16	14
0.94	33	31	29	28	27	25	24	22	21	20	18	17	15
0.93	35	33	31	29	28	27	25	24	22	21	20	18	16
0.92	37	34	32	31	30	28	27	25	24	22	21	19	18
0.91	38	36	34	32	31	30	28	26	25	24	22	21	19
0.90	39	37	35	34	33	31	29	28	26	25	23	22	20
0.89	41	38	37	35	34	32	31	29	28	26	25	23	21
0.88	42	40	38	36	35	34	32	30	29	27	26	24	22
0.87	43	41	39	38	37	35	33	32	30	29	27	25	23
0.86	45	42	41	39	38	36	34	33	31	30	28	26	24
0.85	46	44	42	40	39	38	36	34	33	31	29	28	25
0.84	47	45	43	42	40	39	37	35	34	32	30	29	27
0.83	49	46	44	43	42	40	38	36	35	33	31	30	28
0.82	50	47	46	44	43	41	39	38	36	34	33	31	29
0.81	51	49	47	45	44	42	41	39	37	36	34	32	30
0.80	52	50	48	46	45	44	42	40	38	37	35	33	31
0.79	54	51	49	48	46	45	43	41	39	38	36	34	32
0.78	55	52	50	49	48	46	44	42	41	39	37	35	33
0.77	56	54	52	50	49	47	45	43	42	40	38	36	34
0.76	57	55	53	51	50	48	46	44	43	41	39	37	35
0.75	58	56	54	52	51	49	47	46	44	42	40	38	36
Reject	60	57	55	53	52	51	48	47	45	43	41	40	37
	61	58	56	55	53	52	50	48	46	44	43	41	38
	62	59	57	56	54	53	51	49	47	45	44	42	39
	63	61	58	57	55	54	52	50	48	47	45	43	40
	64	62	60	58	57	55	53	51	49	48	46	44	41

Reject Values Greater Than Those Shown Above

Notes:

1. To obtain a pay factor when the estimated percent outside specification limits from Table 39-7, "Estimated Percent of Work Outside Specification Limits," does not correspond to a value in the table, use the next larger value.
2. The maximum obtainable pay factor is 1.05 (with a minimum of 8 test values).

Table 39-9.—MINIMUM QUALITY CONTROL REQUIREMENTS

Index (i)	Quality Characteristic	Specification Limits	Weighting Factor (w)	California Test	Minimum Sampling and Testing Frequency	Point of Sampling
1	Asphalt Content ^{2,3}	TV ± 0.30% ¹	0.30	379 or 382	One sample per 500 tonnes or part thereof Not less than one sample per day	Mat behind paver
2	Gradation 19 or 12.5 mm	TV ± 5.0	0.01	202	One sample per 500 tonnes or part thereof	Batch Plant - from hot bins
3	9.5 mm	TV ± 6.0	0.01		Not less than one sample per day	Drum Plant - from cold feed
4	4.75 mm	TV ± 7.0	0.05			
5	2.36 mm	TV ± 5.0	0.05			
6	600 µm ^{2,3}	TV ± 4.0	0.08			
7	75 µm ^{2,3}	TV ± 2.0	0.10			
8	Percent of Maximum Theoretical Density ^{2,4} Maximum Theoretical density	92.0% Min. 97.0% Max	0.40	375 309	One sample per 500 Tonnes, or part thereof Not less than one test per day	Finished mat after final rolling Mat behind paver
9	Mix Moisture Content	= 0.5%		370	One sample per 1000 tonnes or part thereof Not less than one sample per day	
	Asphalt and Mix Temperature	120°C to 190°C (Asphalt) =165°C (Mix)			Continuous using an automated recording device	Plant

Notes:

1. TV = Target Value from Contractor's proposed mix design.
2. Quality characteristics 1, 6, 7, and 8 are defined as critical quality characteristics in the verification testing process.
3. Quality characteristics 1, 6, and 7 are defined as critical start-up characteristics in the Production Start-Up Evaluation.
4. CT 375, "Density of Asphalt Concrete Using a Nuclear Gage" modified to use maximum theoretical density (Rice Method) in accordance with CT 309 in lieu of test maximum density (TMD) as provided in Part 5, "Determining Test Maximum Density."

39-12 MEASUREMENT AND PAYMENT

39-12.01 MEASUREMENT

Asphalt concrete will be measured by mass. The quantity to be paid for will be the combined mass of the mixture for the various types of asphalt concrete, as designated in the Engineer's Estimate.

The mass of the materials will be determined in conformance with the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

Quantities of paving asphalt, liquid asphalt, and asphaltic emulsion to be paid for as contract items of work will be determined in conformance with the methods provided in Section 92, "Asphalts," Section 93, "Liquid Asphalts," or Section 94, "Asphaltic Emulsions," of the Standard Specifications, as the case may be.

When recorded batch masses are printed automatically, these masses may be used for determining pay quantities provided the following requirements are complied with:

- A. Total aggregate and supplemental fine aggregate mass per batch shall be printed. When supplemental fine aggregate is weighed cumulatively with the aggregate, the total batch mass of aggregate shall include the supplemental fine aggregate.
- B. The total bitumen mass per batch shall be printed.
- C. Zero-tolerance mass shall be printed prior to weighing the first batch and after weighing the last batch of each truckload.
- D. The time, date, mix number, load number, and truck identification shall be correlated with the load slip.
- E. A copy of the recorded batch masses shall be certified by a licensed weighmaster and submitted to the Engineer.

Pavement reinforcing fabric will be measured and paid for by the square meter for the actual pavement area covered.

39-12.02 PAYMENT

Asphalt concrete placed in the work, unless otherwise specified, will be paid for at the contract price per tonne for asphalt concrete of the types designated in the Engineer's Estimate.

Compensation adjustment for asphalt concrete will be in conformance with Section 39-11.02C, "Pay Factor Determination and Compensation Adjustment," of this Section 11-1, "Quality Control / Quality Assurance."

When there is a contract item for asphalt concrete (leveling), quantities of asphalt concrete placed for leveling will be paid for at the contract price per tonne for asphalt concrete (leveling). When there is no contract item for asphalt concrete (leveling), and leveling is ordered by the Engineer, asphalt concrete so used will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

For asphalt concrete placed in dig outs, as a leveling course, for slope correction, for detours not included in the finished roadway prism, in areas where in the judgment of the Engineer compaction or compaction measurement by conventional methods is impeded or on the uppermost lift of shoulders with rumble strips the percent of maximum theoretical density provisions of Section 39-11.02, "Statistical Evaluation and Determination of Pay Factor," of this Section 11-1, shall not apply. In the computation of the composite pay factor (PF_C) for the lot composed of this asphalt concrete, an individual pay factor of 1.0 for the percent of maximum theoretical density (PF_{QC8}) shall be used.

Full compensation for the Contractor's Quality Control Plan, including furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in developing, implementing, modifying, and fulfilling the requirements of the Quality Control Plan shall be considered as included in the contract price paid per tonne for asphalt concrete of the types designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for Contractor sampling, testing, inspection, testing facilities, and preparation and submission of results shall be considered as included in the contract price paid per tonne for asphalt concrete of the types designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for coordination, sampling, testing, testing facilities, and preparation and submission of results for permanent deformation and fatigue testing shall be considered as included in the contract price paid per tonne for asphalt concrete of the types designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Quantities of pavement reinforcing fabric placed and paving asphalt applied as a binder for the pavement reinforcing fabric will be paid for at the contract price per square meter for pavement reinforcing fabric and per tonne for paving asphalt (binder-pavement reinforcing fabric). Full compensation for furnishing and spreading sand to cover exposed binder material, if necessary, shall be considered as included in the contract price paid per tonne for paving asphalt (binder-pavement reinforcing fabric) and no separate payment will be made therefor.

Small quantities of asphalt concrete placed on pavement reinforcing fabric to prevent the fabric from being displaced by construction equipment or to allow public traffic to cross over the fabric shall be considered as part of the layer of asphalt concrete to be placed over the fabric and will be measured and paid for by the tonne as asphalt concrete of the types designated in the Engineer's Estimate.

When there is a contract item for liquid asphalt (prime coat), the quantity of prime coat will be paid for at the contract price per tonne for the designated grade of liquid asphalt (prime coat). When there is no contract item for liquid asphalt (prime coat) and the special provisions require the application of a prime coat, full compensation for furnishing and applying the prime coat shall be considered as included in the contract price paid per tonne for asphalt concrete of the types designated in the Engineer's Estimate and no separate payment will be made therefor.

When there is a contract item for asphaltic emulsion (paint binder), the quantity of asphaltic emulsion or paving asphalt used as tack coat (paint binder) will be paid for at the contract price per tonne for asphaltic emulsion (paint binder). When there is no contract item for asphaltic emulsion (paint binder), full compensation for furnishing and applying tack coat (paint binder) shall be considered as included in the contract price paid per tonne for asphalt concrete of the types designated in the Engineer's Estimate and no separate payment will be made therefor.

Fog seal coat will be paid for as provided in Section 37-1, "Seal Coats," of the Standard Specifications.

No adjustment of compensation will be made for an increase or decrease in the quantities of tack coat (paint binder) or fog seal coat required, regardless of the reason for such increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to the items of paint binder or fog seal coat.

The above contract prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing asphalt concrete, complete in place, as shown on the plans, as specified in this Section 11-1, "Quality Control / Quality Assurance," and "Asphalt Concrete" of these special provisions, and as directed by the Engineer.

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
21 (S)	150711	REMOVE PAINTED TRAFFIC STRIPE	M	83 900		
22 (S)	150714	REMOVE THERMOPLASTIC TRAFFIC STRIPE	M	21 800		
23 (S)	150722	REMOVE PAVEMENT MARKER	EA	29 200		
24	150742	REMOVE ROADSIDE SIGN	EA	18		
25 (S)	150760	REMOVE SIGN STRUCTURE	EA	34		
26	150771	REMOVE ASPHALT CONCRETE DIKE	M	7530		
27	150806	REMOVE PIPE	M	1710		
28	150820	REMOVE INLET	EA	91		
29	010261	REMOVE CONCRETE PAVEMENT (150 MM PCC)	M2	90		
30	010262	REMOVE CONCRETE PAVEMENT (200 MM PCC)	M2	82 300		
31 (S)	151572	RECONSTRUCT METAL BEAM GUARD RAILING	M	95		
32	152387	RELOCATE ROADSIDE SIGN-TWO POST	EA	1		
33	152430	ADJUST INLET	EA	48		
34 (S)	153103	COLD PLANE ASPHALT CONCRETE PAVEMENT	M2	4210		
35	153210	REMOVE CONCRETE	M3	9		
36	010263	REMOVE CONCRETED-ROCK SLOPE PROTECTION (PORTION)	M3	14		
37	153214	REMOVE CONCRETE CURB	M	7920		
38	153229	REMOVE CONCRETE BARRIER (TYPE K)	M	480		
39	153230	REMOVE CONCRETE BARRIER (TYPE 50)	M	6790		
40	010264	REMOVE CONCRETE BARRIER (TYPE 60GE)	M	6		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
41	010265	REMOVE CONCRETE BARRIER (TYPE 60C)	M	96		
42	010266	REMOVE CONCRETE BARRIER (TYPE 50D)	M	190		
43	153235	CLEAN BRIDGE DECK	M2	3760		
44	155003	CAP INLET	EA	16		
45	157561	BRIDGE REMOVAL (PORTION), LOCATION A	LS	LUMP SUM	LUMP SUM	
46	157562	BRIDGE REMOVAL (PORTION), LOCATION B	LS	LUMP SUM	LUMP SUM	
47	157563	BRIDGE REMOVAL (PORTION), LOCATION C	LS	LUMP SUM	LUMP SUM	
48	157564	BRIDGE REMOVAL (PORTION), LOCATION D	LS	LUMP SUM	LUMP SUM	
49	160101	CLEARING AND GRUBBING	LS	LUMP SUM	LUMP SUM	
50	190101	ROADWAY EXCAVATION	M3	95 100		
51	190105	ROADWAY EXCAVATION (TYPE Z-2) (AERIALY DEPOSITED LEAD)	M3	7670		
52	190110	LEAD COMPLIANCE PLAN	LS	LUMP SUM	LUMP SUM	
53 (F)	192003	STRUCTURE EXCAVATION (BRIDGE)	M3	163		
54 (F)	192020	STRUCTURE EXCAVATION (TYPE D)	M3	132		
55 (F)	040462	STRUCTURE EXCAVATION (RETAINING WALL) (TYPE Z-2) (AERIALY DEPOSITED LEAD)	M3	1311		
56 (F)	192053	STRUCTURE EXCAVATION (TYPE Z-2) (AERIALY DEPOSITED LEAD)	M3	572		
57 (F)	193003	STRUCTURE BACKFILL (BRIDGE)	M3	144		
58 (F)	193013	STRUCTURE BACKFILL (RETAINING WALL)	M3	1183		
59	198001	IMPORTED BORROW	M3	24 300		
60	198007	IMPORTED MATERIAL (SHOULDER BACKING)	TONN	5070		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
61 (S)	200001	HIGHWAY PLANTING	LS	LUMP SUM	LUMP SUM	
62 (S)	203014	FIBER (EROSION CONTROL)	KG	12 000		
63 (S)	203024	COMPOST (EROSION CONTROL)	M3	600		
64 (S)	203045	PURE LIVE SEED (EROSION CONTROL)	KG	72		
65 (S)	203056	COMMERCIAL FERTILIZER (EROSION CONTROL)	KG	600		
66 (S)	203061	STABILIZING EMULSION (EROSION CONTROL)	KG	900		
67 (S)	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM	LUMP SUM	
68 (S)	206401	MAINTAIN EXISTING IRRIGATION FACILITIES	LS	LUMP SUM	LUMP SUM	
69	208038	NPS 3 SUPPLY LINE (BRIDGE)	M	111		
70 (S)	208909	EXTEND 200 MM CONDUIT	M	21		
71 (S)	208910	EXTEND 250 MM CONDUIT	M	15		
72	260210	AGGREGATE BASE (APPROACH SLAB)	M3	83		
73	260301	CLASS 3 AGGREGATE BASE	M3	5730		
74	010267	CLASS 3 AGGREGATE BASE (WORKING PLATFORM)	M3	28 900		
75	280000	LEAN CONCRETE BASE	M3	3720		
76 (S)	010268	ASPHALT CONCRETE (TYPE B) TEXTURED PAVING	M2	9060		
77	010269	ASPHALT CONCRETE (TYPE A) (PG 64-28 PM)	TONN	83 600		
78	010270	ASPHALT CONCRETE (TYPE A) (PG 70-10) (RICH BOTTOM)	TONN	36 100		
79	010271	ASPHALT CONCRETE (TYPE A) (PG 70-10)	TONN	172 000		
80	010272	ASPHALT CONCRETE (TYPE A)(PG 70-10) (LEVELING COURSE)	TONN	64 600		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
81	390126	RUBBERIZED ASPHALT CONCRETE (TYPE G)	TONN	42 400		
82	393001	PAVEMENT REINFORCING FABRIC	M2	446 000		
83	394002	PLACE ASPHALT CONCRETE (MISCELLANEOUS AREA)	M2	42		
84	394040	PLACE ASPHALT CONCRETE DIKE (TYPE A)	M	5420		
85	394044	PLACE ASPHALT CONCRETE DIKE (TYPE C)	M	1270		
86	394046	PLACE ASPHALT CONCRETE DIKE (TYPE D)	M	940		
87	394048	PLACE ASPHALT CONCRETE DIKE (TYPE E)	M	5440		
88	394049	PLACE ASPHALT CONCRETE DIKE (TYPE F)	M	770		
89	401000	CONCRETE PAVEMENT	M3	7440		
90	401102	CONCRETE PAVEMENT (WEIGH-IN-MOTION)	M3	650		
91	401108	REPLACE CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE)	M3	1880		
92	404092	SEAL PAVEMENT JOINT	M	5480		
93	404094	SEAL LONGITUDINAL ISOLATION JOINT	M	6050		
94	406003	TIE BAR (DRILL AND BOND)	EA	7530		
95	415101	CRACK EXISTING CONCRETE PAVEMENT	M2	245 000		
96 (S)	420201	GRIND EXISTING CONCRETE PAVEMENT	M2	9910		
97 (S)	490655	400 MM CAST-IN-DRILLED-HOLE CONCRETE PILING	M	20		
98	490753	FURNISH PILING (CLASS 625)	M	840		
99 (S)	490754	DRIVE PILE (CLASS 625)	EA	61		
100	491007	FURNISH PILING (CLASS 400)	M	1056		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
101 (S)	491008	DRIVE PILE (CLASS 400)	EA	91		
102 (S)	500001	PRESTRESSING CAST-IN-PLACE CONCRETE	LS	LUMP SUM	LUMP SUM	
103 (F)	510051	STRUCTURAL CONCRETE, BRIDGE FOOTING	M3	57		
104 (F)	510053	STRUCTURAL CONCRETE, BRIDGE	M3	619		
105 (F)	510060	STRUCTURAL CONCRETE, RETAINING WALL	M3	709		
106 (F)	510069	STRUCTURE CONCRETE (PUMPING PLANT)	M3	10		
107 (F)	510086	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	M3	72		
108	510087	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R)	M3	808		
109	040463	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R) (MODIFIED)	M3	34		
110 (F)	510413	CLASS 1 CONCRETE (BOX CULVERT)	M3	0.5		
111 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	M3	393		
112	510800	PAVING NOTCH EXTENSION	M3	15		
113	511035	ARCHITECTURAL TREATMENT	M2	21		
114	010273	ARCHITECTURAL TEXTURED IMAGE	EA	380		
115	511106	DRILL AND BOND DOWEL	M	136		
116	511109	DRILL AND BOND DOWEL (EPOXY CARTRIDGE)	M	12		
117	040464	CLEAN EXPANSION JOINT (DEPTH=2085MM)	M	88		
118	511118	CLEAN EXPANSION JOINT	M	207		
119	511124	RAPID SETTING CONCRETE (PATCH)	M3	1		
120	515020	REFINISH BRIDGE DECK	M2	262		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
141	641132	300 MM PLASTIC PIPE	M	110		
142	650067	300 MM REINFORCED CONCRETE PIPE	M	44		
143	650069	450 MM REINFORCED CONCRETE PIPE	M	860		
144	650075	600 MM REINFORCED CONCRETE PIPE	M	150		
145	681135	100 MM PLASTIC PIPE (EDGE DRAIN)	M	1540		
146	681136	50 MM PLASTIC PIPE (EDGE DRAIN OUTLET)	M	50		
147	681141	100 MM PLASTIC PIPE (EDGE DRAIN OUTLET)	M	60		
148	690156	200 MM CORRUGATED STEEL PIPE DOWNDRAIN (2.01 MM THICK)	M	8		
149	705222	450 MM CONCRETE FLARED END SECTION	EA	1		
150	719589	MINOR CONCRETE (BACKFILL)	M3	300		
151	721009	ROCK SLOPE PROTECTION (FACING, METHOD B)	M3	46		
152	010274	GROUTED ROCK SLOPE PROTECTION	M3	14		
153 (S-F)	750001	MISCELLANEOUS IRON AND STEEL	KG	50 700		
154 (S-F)	750501	MISCELLANEOUS METAL (BRIDGE)	KG	51		
155 (S)	800391	CHAIN LINK FENCE (TYPE CL-1.8)	M	14		
156	820180	INSTALL MEDIAN MILEAGE PANEL	EA	80		
157 (S)	832001	METAL BEAM GUARD RAILING	M	780		
158 (F)	833032	CHAIN LINK RAILING (TYPE 7)	M	108		
159 (F)	833033	CHAIN LINK RAILING (TYPE 7 MODIFIED)	M	108		
160	833165	CONCRETE BARRIER (TYPE 27B MODIFIED)	M	200		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
161	839541	TRANSITION RAILING (TYPE WB)	EA	12		
162	839581	END ANCHOR ASSEMBLY (TYPE SFT)	EA	48		
163 (S)	839584	ALTERNATIVE IN-LINE TERMINAL SYSTEM	EA	2		
164 (S)	839585	ALTERNATIVE FLARED TERMINAL SYSTEM	EA	58		
165 (S)	839604	CRASH CUSHION (REACT 9CBB)	EA	3		
166	010275	CONCRETE BARRIER (TYPE 60G MODIFIED)	M	2670		
167	839704	CONCRETE BARRIER (TYPE 60D)	M	230		
168	010276	CONCRETE BARRIER (TYPE 60D MODIFIED)	M	780		
169 (F)	040465	CONCRETE BARRIER (TYPE 60GA MODIFIED)	M	44		
170 (F)	839707	CONCRETE BARRIER (TYPE 60GA)	M	160		
171	010277	CONCRETE BARRIER (TYPE 60GC MODIFIED)	M	2130		
172	010278	CONCRETE BARRIER (TYPE 60R MODIFIED)	M	900		
173	010279	CONCRETE BARRIER (TYPE 60GE MODIFIED)	M	220		
174	010280	CONCRETE BARRIER (TYPE 60S MODIFIED)	M	50		
175	010281	CONCRETE BARRIER (TYPE 60SW MODIFIED)	M	980		
176	010282	PORTABLE CONCRETE BARRIER (TYPE 60K)	M	1250		
177 (F)	839725	CONCRETE BARRIER (TYPE 736)	M	87		
178 (F)	839726	CONCRETE BARRIER (TYPE 736A)	M	405		
179 (F)	839727	CONCRETE BARRIER (TYPE 736 MODIFIED)	M	150		
180 (F)	040466	CONCRETE BARRIER (TYPE 736A MODIFIED)	M	18		

**ENGINEER'S ESTIMATE
07-183114**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
221 (S)	010306	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB153)	LS	LUMP SUM	LUMP SUM	
222 (S)	010307	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB160)	LS	LUMP SUM	LUMP SUM	
223 (S)	010308	VIDEO NODE (LOCATION LB153)	LS	LUMP SUM	LUMP SUM	
224 (S)	010309	DATA NODE (LOCATION LB153)	LS	LUMP SUM	LUMP SUM	
225 (S)	010310	CABLE NODE (LOCATION LB131)	LS	LUMP SUM	LUMP SUM	
226	010311	CABLE NODE (LOCATION LB157)	LS	LUMP SUM	LUMP SUM	
227 (S)	869039	COMMUNICATION PULL BOX	EA	91		
228 (S)	869047	SPLICE VAULT	EA	25		
229 (S)	869075	SYSTEM TESTING AND DOCUMENTATION	LS	LUMP SUM	LUMP SUM	
230 (S)	010312	WORK AT LOS ANGELES AIRPORT (LAX) HUB BUILDING	LS	LUMP SUM	LUMP SUM	
231	BLANK					
232	839710	CONCRETE BARRIER (TYPE 60S)	M	1040		
233	011908	CONCRETE BARRIER (TYPE 60S MODIFIED)	M	198		
234	999990	MOBILIZATION	LS	LUMP SUM	LUMP SUM	

TOTAL BID: _____