Technical Circular: T-7-91
May 9, 1991

TO: ASSISTANT CHIEF HIGHWAY ENGINEER
ALL H.Q. DIRECTORS: Prof. Services, Planning & Major Projects
ALL REGIONAL MANAGERS: Prof. Services, Planning & Operations
ALL DISTRICT HIGHWAYS MANAGERS

SUBJECT: STANDARDS FOR QUALITY CONTROL, PAVING

REFERENCE:

Standard Specifications for Highway Construction Contract Agreement

PURPOSE:

The attachments to this circular specify quality control testing and frequency, when quality control is the responsibility of the contractor. The standard provided is intended to ensure that Standard Specifications for Highway Construction, 223 and 311 are satisfied. This Technical Circular addresses reporting requirements, minimum test frequencies, mix design, materials quality control, asphalt mix production and placement. Ministry quality assurance procedures are briefly described.

DEFINITIONS:

Quality Control - means the examination, measurement and testing of the product to determine contract compliance, regardless of who undertakes the required activities.

Quality Assurance - means all planned and systematic actions required needed to provide adequate confidence that the product meets specified requirements; the owner, as purchaser of the product, is responsible for quality assurance.

BACKGROUND:

Prior to 1988, mix design for asphalt pavements and quality control was done exclusively by Ministry staff. Now both functions may be done either by Ministry Staff or by the Contractors. Therefore, it is necessary to supplement the Standard Specifications for Highway Construction with a document that clarifies the specifications.

PROCEDURE:

Regional Managers will indicate in paving contract documentation whether or not the Contractor is responsible for quality control. If so, the minimum standard of quality control and the payment for these services are as detailed on the attached document dated May, 1991.

Contact:

O. Tisot, P. Eng.
Director of Geotechnical
and Materials Engineering
387-1881

E.A. Lund, P. Eng.
Chief Highway Engineer

Attachment
c.c. ADM, Highways Operations
c.c. ADM, Planning and Major Projects
c.c. All Regional Directors

1.0 REQUIREMENTS

The Contractor shall provide qualified personnel and operate an appropriate testing facility, or shall obtain such services to perform the testing specified.

The contractor shall be responsible for the provision of all quality control test results and control charts, where appropriate. Minimum test frequencies are indicated in this standard. However, the Contractor shall adopt suitable test frequencies which equal or exceed those presented herein to ensure that Standard Specifications for Highway Construction, Sections 223 and 311 are satisfied.

2.0 ASPHALT PAVEMENT MIX DESIGN

Conditions pertaining to mix design are:

a) The types of asphalt materials, aggregate size, as well as the mix classes to be used in the asphalt mix designs, will be specified by the Ministry.

b) The Ministry will give the Contractor the names of the oil companies supplying asphalt materials and the purchase order numbers for each project. The Contractor will take full responsibility for obtaining samples of asphalt materials from suppliers in sufficient quantity to perform the mix design.

c) The Ministry will notify the Contractor of the start of each pertinent gravel crushing activity or, in the case of recycling, at the start of reclaiming operations. The Contractor shall be responsible for obtaining and testing samples of aggregate from stockpiles to be used on the particular projects.

d) The average gradation of the granular aggregate placed in each stockpile shall be determined by the Contractor. It is the responsibility of the Contractor to confirm gradations, by sampling the stockpiles in sufficient quantity and frequency.

e) Available stockpiled aggregates may fail to yield a satisfactory design even though gradations are within the specified limits. When this occurs, blending with supplementary aggregates may be considered. Priority must be given to using supplementary aggregates readily available within the project area.

f) Asphalt mix designs for asphalt concrete pavements, using an asphalt cement as a binder, shall be determined by the Marshall Method.

g) All Marshall Method designs designated for top lift pavement Classes 1 and 2 shall be further investigated for deformation, cohesion and resistance by means of the Hveem Apparatus. The Ministry will run this test from material supplied by the Contractor as specified in Section 3.4.

h) Final mix gradation shall result from the combination of materials from two or more aggregate stockpiles. The Contractor must combine available aggregate accordingly to achieve the design final mix gradation.

i) The asphalt mix design shall establish the design grading curve which will define the proportional amounts of coarse, fine and supplementary aggregates required in the mix.

j) Asphalt mixes for asphalt concrete pavement shall meet the criteria specified in the Standard Specifications for Highway Construction, Section 223.8.

2.1 Mix Design Report

The Contractor shall submit the proportions and Marshall design data to the Ministry representative seven days prior to the commencement of the work. The following information shall be provided:

a) The gradation of each aggregate, from stockpiles, used in the design mix.

b) The percentage of each aggregate component used in the mix.

c) The combined aggregate, mix design gradation.

d) Marshall Stability and Flow of the mix design.

e) Air Voids in compacted mixture and Minimum percent Voids in Mineral Aggregate (VMA).

f) The selected asphalt content.

2.2 Job Mix Variation

Maximum permissible variation of the job mix shall be governed by Standard Specifications for Highway Construction, Section 223.8, and Section 223.9.

3.0 MATERIAL TESTING

3.1 Asphalt Materials

a) Upon receipt of the asphalt, the Contractor shall obtain the certified batch analysis for each separate batch delivered. It is the responsibility of the Contractor to verify that the asphalt is that required for the mix. The Contractor shall deliver a copy of this certificate to the Ministry Representative with a signed acknowledgement of compliance of the asphalt with the original order and its suitability for the mix.

b) It is the responsibility of the contractor to ensure that asphalt cements, cutback asphalts, and asphalt emulsions meet the requirements of the "Standard Specifications for Highway Construction, Section 311. For quality control, each new batch of asphalt cement shall be field tested for Penetration of Asphalt Materials, (BCH III-1).

Should there be any doubts as to the quality of asphalt cement, cutback asphalts and asphalt emulsions, the following tests, described in B.C.M.O.T.H. Geotechnical & Materials Engineering Branch Manual of Test Procedures, shall be required to evaluate the physical properties of the asphalt materials.

Test Designation		Title of Test
BCH	ASTM	
III-1	D-5	Penetration of Asphalt Materials
III-3	D-2171	Absolute Viscosity of Asphalts
III-4	D-2170	Kinematic Viscosity of Asphalts
III-5	D-1754	Effect of Heat and Air on Asphalt Materials
III-6	D-402	Distillation of Liquid Asphalt
III-7	D-70	Relative Density of Asphalt Cement and Liquid Asphalt
III-15	D-88	Saybolt Furol Viscosity
IV-1	D-244	Testing Emulsified Asphalts

3.2 Granular Materials

a) Ministry supplied materials shall be subjected to verification with respect to gradation. If gradation is not as specified, the Ministry Representative shall be notified within 24 hours of completion of the gradation test.

b) Contractor produced materials shall be tested as specified in the Ministry Technical Circular, T-5-90, "Standards for Quality Control, Gravel Crushing". Materials produced from private sources or sources of unknown quality shall be tested in accordance with the tests listed below:

Test Designation		Title of Test
BCH	ASTM	
I - 1	C-136	Dry Sieve Analysis of Aggregates
I - 2	C-117	Sieve Analysis for Materials Finer than 75 um by Washing
I - 3	C-127	Bulk Relative Density & Absorption of Coarse Aggregate
I - 4	C-128	Bulk Relative Density & Absorption of Fine Aggregate
I - 5	C-88	Soundness of Aggregate by Use of Magnesium Sulphate
I - 6	C-566	Moisture Content of Aggregate by Drying
I - 8	C-2419	Sand Equivalent Test
I - 9	---	Degradation Test
I - 13	---	Method for Fracture Count of Coarse Aggregates

Tests I-5, I-8 and I-9 shall be conducted on a minimum of three samples collected seven days prior to production and three samples collected during production.

c) Supplementary aggregate, if needed, shall be selected by the Contractor. If from a private source, or a source of unknown quality the aggregate shall be subjected to the tests listed in 3.2,b).

3.3 Asphalt Concrete Pavement

Tests shall be selected to ensure that Asphalt Mixes meet the requirements of the Standard Specifications for Highway Construction, Section 232. The following tests and procedures are required for quality control at the plant.

Test Designation		Title of Test
BCH	ASTM	
II - 1	D-2726	Relative Density of Compacted Mixes, or
II - 2	D-1188	Relative Density of Compacted Mixes, using Paraffin Coated Method
II - 3	D-1559	Resistance to Plastic Flow Using Marshall Apparatus
II - 4	---	Immersion Compression Test
II - 5	D-2401	Maximum Relative Density of Uncompacted Mixes
II - 6	D-2172	Quantitative Determination of Asphalt
"	"	Method A
"	"	Method C - Nuclear
II - 15	---	Forming Plant Briquettes

Tests II-1, II-3, II-4, II-5, II-6 and II-15 shall be run once each day. The test frequency may be increased to provide adequate quality control.

3.4 Ministry Run Tests

The Ministry will conduct a number of specified tests to monitor material quality and design performance. The Contractor shall:

a) Arrange to deliver two, 1 litre samples of asphalt cement from each batch to the Ministry Materials Testing Laboratory at Kamloops or Burnaby. Each sample shall be labelled as to: project number, product type, supplier oil company, batch identification, purchase order number, location and date sampled. A copy of the pertinent oil company batch analysis certificate shall be included with each sample. Samples shall be delivered each week.

b) Provide 5 kg of laboratory prepared asphalt mix, representing the final mix design gradation, the Marshall design gradations and the asphalt cement content selected. This sample shall be sent to the Ministry Materials Testing Laboratory in Burnaby within 24 hours of design mix preparation, and well in advance of top lift paving.

c) Ministry tests will include:

i) Testing of mixes for Hveem criteria
ii) Asphalt ductility

4.0 CONSTRUCTION QUALITY

The asphalt concrete pavement shall be tested in accordance with the standard tests and procedures listed below. These shall be used by the Contractor for quality control and will also be used by the Ministry to evaluate the quality of in-place asphalt concrete pavement.

BCH	ASTM	Title of Test
II - 7	---	Degree of Compaction of In-Place Asphalt Mix
II - 8	---	Coring Procedure
II - 9	---	In-situ Density by Nuclear Gauge Methods
II -10	---	Procedure for the Determination of the British Columbia Pavement Smoothness Rating

All of the above tests excluding the smoothness test shall be conducted by the Contractor for quality Control at a rate of two per lane kilometer. Frequency of testing for smoothness is described in BCH test II-10. The inspector for the Ministry may perform random or periodic acceptance testing, as required, for quality assurance.

5.0 TEST REPORT FREQUENCY

Unless otherwise directed herein, summary test results shall be submitted to the Ministry Representative every two weeks or more frequently as required.

6.0 PAYMENT FOR QUALITY CONTROL SERVICES

Payment for quality control services by the production Contractor will be on a lump sum basis as indicated on the Schedule. Payment shall be accepted as full compensation for everything furnished and done in connection with quality control services by the production Contractor.