Technical Circular: T-5-90
December 5, 1990

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

SUBJECT: STANDARDS FOR QUALITY CONTROL, GRAVEL CRUSHING

REFERENCE: General Specifications
Contract Agreement

PURPOSE:

To define a methodology of systematic actions to provide adequate confidence that the crushed gravel meets the required specifications and that the public is well served.

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:

The crushing and sizing of pit run sand and gravel is required for a variety of end products such as base courses, asphaltic and Portland cement concrete, chip seals and winter abrasives. Specifications defining the physical properties of the processed gravel vary according to the end product manufacturing and performance requirements. Quality control of crushing operations center on a few tests common to all products such as wet and dry gradation analyses, crushed particle contents and product uniformity.
Before 1987, quality control testing for gravel crushing operations was all done by Ministry personnel. Some earlier efforts to have quality control of Ministry crushers done by the foreman, failed. Now, crushing is done exclusively by contract and the quality control is done in one of four ways: by Ministry personnel or its agents (Technical Services Contractors); or by crushing Contractor personnel or his agents. It is therefore necessary to supplement the product specifications with a set of minimum standards required for quality control.

PROCEDURE:

Regional Managers will indicate in crushing 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 November, 1990.

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

STANDARDS FOR QUALITY CONTROL
GRAVEL CRUSHING

1. PRODUCTION AND QUALITY CONTROL

This Standard applies to the crushing of aggregates produced for Granular subbase, Granular base, Asphalt cement concrete, Portland cement concrete, High fines granular surfacing, Graded seal, Winter abrasives, and other granular materials used for the construction and maintenance of highways.

Where specified, the Contractor shall provide and operate an appropriate testing facility, or shall obtain such services to ensure gradation limitations are adhered to and that gradation adjustments can be made.

The Contractor will be responsible for quality control testing during production, and for the provision of required test results. The tests are as follows:

Test	Specification Reference	BCH Test Reference
Method for Dry Sieve Analysis of Aggregate Gradation	ASTM C-136	BCH I - 1
Method for Materials Finer than 75 um Sieve in Mineral Aggregates by Washing	ASTM C-117	BCH I - 2
Method for Fracture Count of Coarse Aggregates		BCH I -13

Records of test results shall be kept on the following forms:

- Aggregate Gradation Chart (H187) or Grading Chart for Aggregate and Asphalt Mixtures
- Mechanical Analysis of Aggregates (H.295)
- Suitable Contractor's Record of Quality Control Testing

All completed forms are to be made available to the Ministry's Representative on request at all times. Immediately after the completion of production, and prior to payment, all test forms shall be submitted to the Ministry.

All quality control activities are to be conducted by engineers or technicians fully competent to perform the work.

2. FREQUENCY OF TESTING

a. During aggregate production, sieve analysis, in accordance with ASTM C-136, shall be conducted as follows:

Materials Produced	Testing Frequency
50 and 75 mm Base Course & Sub-base	1 test/2 hrs.
All others	1 test/hr.

NOTE:

(i) As discussed in ASTM C-136, the size of the sample required for aggregates with large nominal maximum sizes is such as to preclude testing except with large mechanical sieve shakers. However, the intent of this method will be satisfied for samples of aggregate larger than 50 mm nominal maximum size if a smaller mass of sample is used, provided that the criterion for acceptance or rejection of the material is based on the average of results of several samples, such that the sample size used times the number of samples averaged equals or exceeds the minimum mass of sample specified.

(ii) For control purposes, it is generally not necessary to dry coarse aggregate for the sieve analysis test. The results of the test will be little affected by the moisture content unless the nominal maximum size is less than 19.0 mm or the coarse aggregate is highly absorptive.

b. During the production of most aggregates, one wash test analysis, in accordance with ASTM C-117, shall be conducted once each production shift or after eight sieve analysis, whichever occurs first, as outlined in 2 a.

This test shall be performed on a composite sample consisting of the final half of the split not used for the dry sieve analysis. A minimum of three portions from consecutive sieve analysis shall form the composite sample.

In the case of Chip Seal Aggregates, one wash test shall be conducted after every third sieve analysis. Where shifts are excessive in length, i.e. greater than 10 hours, the number of tests required may be increased accordingly at the discretion of the Engineer.

Revised January 21, 1991

This test shall be performed on a composite sample consisting of the final half of the split not used for the dry sieve analysis. A minimum of three portions from consecutive sieve analysis shall form the composite sample.

c. Fracture counts, in accordance with BCH I - 13, shall be performed on every third sample of gradation analysis. Fracture counts are not required for the production of Winter Abrasive, Sub-Base aggregates, or Concrete aggregates.

d. The testing frequency (any of a, b, or c above) does not preclude the Contractor from increasing ther testing frequency in order to provide adequate quality control.

3. GRADATION

If the gradation of the aggregate being produced or supplied does not fall within the gradation limits as specified in the contract, the Contractor shall make such refinements to the gradation as are necessary to comply with their contract gradation limits, utilizing alternative materials from within the pit and by screen adjustment, before any final product is accepted.

Once the grading curve is established by the Contractor according to the Method for Dry Sieve Analysis of Aggregate Gradation, ASTM C-136, and the Method for Wash Test Analysis of Aggregate Fines, ASTM C-117, within the specified limits, the maximum permissible variation of the mean of any five consecutive tests from the grading curve shall be within the tolerance specified below:

Sieve Size (mm)	Maximum Permissible Tolerance % Passing by Mass	
	(Paving and Sealcoat)	(All Others)
25.0 & larger	± 5.0	±5.0
4.75 to 19.0	± 4.5	±5.0
1.18 and 2.36	± 4.0	±3.5
0.600	± 3.5	±2.0
0.300	± 2.5	±2.0
0.150	± 1.5	±1.0
0.075	± 1.0	±1.0

These tolerances do not waive the requirement that the running average of 5 consecutive tests must be maintained at all times inside the limits specified in the pertinent General Specification or special provisions.

The Grading Curve shall normally be established on or prior to the completion of 5% of the contracted quantity. Before acceptance, its suitability will be judged only by the Ministry Representative.

4. MINISTRY ACCEPTANCE INSPECTION

The Contractor shall make available an appropriate testing facility for use by the Inspector per General Specification Section 190.13 b). This facility shall be located within or adjacent to the crusher operation set-up. The Inspector for the Ministry may do random or periodic acceptance testing.

Any disputes arising from disagreements between the Inspector and the Contractor shall be resolved by the Ministry Representative prior to final payment.

5. REJECTED OR UNACCEPTABLE FINAL PRODUCTS

Any final products deemed rejected or unacceptable based on final acceptance testing shall remain the property of the Ministry, if produced in a Ministry pit, and shall be stockpiled separately from acceptable products.

Rejected final products which have been supplied from a private source shall become the property of the Ministry if left at the Ministry designated stockpile location(s) after completion of the contract.

Payment for Rejected Materials will be in accordance with the pertinent specifications and or Special Provisions detailed in the crushing contract.

6. PAYMENT FOR QUALITY CONTROL SERVICES

Payment for the quality control services as outlined shall be on a lump sum basis on satisfactory completion of the production contract. The fee for quality control shall be clearly identified in the Contractor's original bid statement.

November, 1990

Province of British Columbia

Ministry of Transportation and Highways

MEMORANDUM

SEE ATTACHED LIST:

DATE: January 30, 1991
BRANCH: Geotechnical & Materials
Victoria, B.C.
PHONE: 387-1881
FILE: 31-21-05

RE: [redacted] TO [redacted] TECHNICAL CIRCULAR T-5-90
STANDARDS FOR QUALITY CONTROL, GRAVEL CRUSHING

Please replace page two of the attachment with T-Circular 5-90 with the enclosed revised page. Thank you.

for O. Tisot, P. Eng.
Director of Geotechnical
and Materials Engineering

Enclosure

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Revised January 21, 1991