

**EMPIRICAL MIX DESIGN METHOD
FOR CUTBACK ASPHALT DETERMINATION
(Surface Area Method)**

1.0 SCOPE

- 1.1 This Empirical Method is used to determine cutback asphalt content for Asphalt Stabilized Base Coarses intended to be produced by plant mixing at elevated temperatures.
- 1.2 This method was developed based on observations that there were no known incidences of ASBC failures due to over- or under-asphalting when the MC-250 asphalt design contents were generally adhered to. It was also observed that a fairly strong geographical relationship with aggregate source and MC-250 design content on a large-scale basis.
- 1.3 Evaluation of the original McKesson formula (Surface Area Method) indicated that it underestimated the MC-250 design content. The Alberta Transportation modified McKesson formula closely approximated, on average, the actual mix design values.
- 1.4 This procedure will not apply if any of the following conditions exist:
 - 1.4.1 High Float Emulsion Mixture;
 - 1.4.2 Aggregate from areas of the province where no previous performance records exist;
 - 1.4.3 Aggregates that exhibit uncommon gradation characteristics;
 - 1.4.4 High traffic volumes are present.If any of these conditions exist a full mix design will be carried out.

2.0 APPLICABLE DOCUMENTS

- 2.1 Map: Geographical Estimated MC-250 Design Contents (attached)
- 2.2 [TLT-302](#) Mix Design Method for Cutback Asphalt Mixtures

3.0 PROCEDURE

- 3.1 Historical data review:
 - 3.1.1 Based on past ASBC designs of the specified aggregate source an average MC-250 asphalt design content is determined. Only those results obtained from mix designs following procedures outlined in [TLT-302](#) are applicable.

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3.2 Geographical MC-250 design content determination:

3.2.1 Using the aggregate source location and historical data, design asphalt contents have been plotted. Where sufficient data exists boundaries have been established for areas of similar design asphalt contents. These areas have been colour coded for easier interpretation.

3.3 Surface Area Method:

3.3.1 The Alberta Transportation modified McKesson formula for determining the MC-250 design asphalt content, is merely an estimation as to how much asphalt is required to coat all the aggregate particles with a minimum film thickness to ensure reasonable durability. Providing that the aggregate is within the Designation 2 Class 16 specified gradation envelope an acceptable MC-250 asphalt design content can be established by the following equation:

$$P = x (0.015a + 0.03b + 0.17c)$$

where P = percentage of MC-250 required.

a = the percentage of aggregate retained on the 1250 μm sieve.

b = the percentage of aggregate passing the 1250 μm sieve and retained on the 80 μm sieve.

c = the percentage of aggregate passing the 80 μm sieve

3.3.2 The multiplier (x) is dependent on the percentage passing the 80 μm sieve and is determined as follows:

x = 1.8 (when the % passing the 80 μm sieve is between 4 - 5.9)

x = 1.65 (when the % passing the 80 μm sieve is between 6.0 - 7.4)

x = 1.5 (when the % passing the 80 μm sieve is between 7.5 - 9.5)

x = 1.4 (when the % passing the 80 μm sieve is between 9.6 - 11)

x = 1.3 (when the % passing the 80 μm sieve is between 11.1 - 13)

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3.4 Gradation Confirmation:

3.4.1 Two (2) to three (3) bags (80-120 kg) of aggregate are required for this test method. The bags should contain materials representative of each component and should be in similar proportions to those estimated for the combined design gradation.

3.4.2 A sieve analysis is carried out to confirm field results and this material will be used if a full design is required. If the conditions stated above indicate that a full design is not required the Empirical Method is applied.

4.0 REPORT

4.1 Design cutback asphalt and residual asphalt contents based on dry weight of aggregate.

4.2 Residual asphalt is determined at the design cutback asphalt content and is calculated based on the cutback asphalt asphalt/solvent ratio.

4.3 Design gradings are provided highlighting any modification (e.g., blend sand addition).

NOTE: Cutback asphalt mixtures are designed slightly below optimum. This allows for a fog coat which is applied to the completed asphalt stabilized base course (normally 50% solution of SS-1 and water).

