

**Quantification Protocol for the Substitution of Bitumen Binder in Hot Mix Asphalt Production and Usage: Summary of Comments & Revisions**  
**January 2008: First Technical Review**

Page Number	Comment	Resolution (Round 1)
Page 1, 14, Table 2.4	In Alberta hot mix asphalt is produced at temperatures ranging from 130 to 150 degrees Celsius (and not 150-180 degrees Celsius) as indicated in the protocol. The maximum production temperature in Alberta is 155 degrees Celsius.	Typical mix temperatures for Alberta were adjusted accordingly.
Page 1, 14, Table 2.4	There was some discussion about the use of default values to represent conventional hot mix asphalt composition (i.e. relative quantities of aggregate and bitumen as 94.7% and 5.3% by weight, respectively). It was indicated that the composition of conventional hot mix asphalt will vary depending on the type of road being paved (i.e. highway versus city street) and default values provided may not be appropriate for all types of roads. It was indicated that these values should be expanded to delineate default values for highways, city streets, etc.	An explanation was included in Section 1.1 and Section 2.2 explaining that the composition of hot mix asphalt will vary depending on the type of road being paved and should be assigned accordingly on a per project basis. Default values previously included in Table 2.4 were updated accordingly for different road types using values provided by Alberta Transportation. New values were included as Appendix B.
Page 1	<p>There was some discussion about the difference between SEAM without and SEAM with a wax additive and whether emission reductions would be achieved using the product without a wax additive.</p> <p>Shell indicated that reductions would still be achieved due to lower mix temperatures.</p>	For clarity further explanation on the projects included under the protocol (i.e. SEAM and SEAM plus) was provided in Section 1.1: The protocol is applicable to SEAM with or without a wax additive and reduced mix temperatures will be achieved even without the wax additive.
Page 1	There was a comment about functional equivalence in terms of paving performance in the project and baseline and concern that the protocol implies that the use / performance of SEAM is validated by the highway agency.	A note was added to clarify that this is not the case. The note reads as follows: It should be noted that this protocol in no way indicates that the use of Sulphur Extended Asphalt Modifier (SEAM) is an accepted alternative to conventional bitumen binder for paving projects in Alberta. As such,

		approval from the relevant government authority is required prior to the use of such products.
Page 5, 14Table 2.4	There was some discussion about the appropriateness of using historical fuel usage data to quantify fuel usage in the baseline condition (i.e. for conventional asphalt mix). Consensus was that because fuel consumption has the potential to vary significantly depending on mix formulation and aggregate moisture content, it would be more appropriate to calculate fuel consumption using the heat equation and considering the moisture content of the aggregate used for a given project.	<p>The methodology previously presented as Flexibility mechanism 1 and outlined in Appendix B (i.e. use of a heat equation) was determined to be more appropriate and accurate than that contained in Table 2.4 for calculating emissions under SS B11.</p> <p>The flexibility mechanism was removed and the methodology was incorporated in Table 2.4 in place of the pre-existing one. Basically, this approach uses the heat equation and aggregate moisture content to determine fuel usage in the baseline instead of using historical fuel consumption data.</p> <p>Flexibility Mechanism 4 was also removed as it referred to alternatives to the use of historical fuel consumption data and is no longer relevant.</p> <p>Section 2.2 (Identification of the Baseline) was changed significantly to address the changes to the protocol.</p>
Page 5, Appendix C	There was some disagreement about the potential for SEAM use to reduce pavement thickness. A flexibility mechanism allowing project developer's to quantify reductions in pavement thickness if evidence can be provided was originally included to address this potential reduction. For the most part this mechanism was intended for future use after future study has been conducted on potential reductions to pavement thickness.	The decision was made by the technical group to exclude this flexibility mechanism and the associated quantification methodology (included as Appendix C). Reevaluation may be appropriate once further research is available / the highway agency has validated this claim.
Page 6, throughout	Discussion about the use of the terms asphalt, bitumen, and binder determined that definitions should be modified for clarity	Definitions of binder and asphalt were modified as recommended by the technical review session participants. A

	and to ensure consistent use of these terms throughout the protocol.	definition of hot mix asphalt was also included.  The use of each of these terms throughout the protocol was tracked to ensure the correct term was used. The term asphalt was changed to bitumen, the term hot mix was changed to hot mix asphalt, and the term binder was checked to ensure it applied to the sum of SEAM and bitumen used.
Page 14, Appendix B	There was some discussion about the feasibility of using historical emission stack sampling data to quantify hot mix stack emissions in the baseline and project conditions. Consensus was that because stack sampling is not required, facilities may not have the data and sampling is a fairly involved and expensive process, emission factors should be provided. Further, non combustion related emissions from the stack (i.e. from bitumen handling) are not generally significant, therefore use of emission factors is appropriate.	The quantification approach for SS's P15 and B11 was modified to use EPA emission factors based on the quantity of bitumen consumed, with site specific sampling being included as a flexibility mechanism.  Table 2.5 was modified accordingly for these SS's. Emission factors for hot mixing in Appendix A were also reviewed.
Table 2.4	The protocol requires monthly measurement of various parameters; however a project may be significantly shorter than a month in length. Given that the mix formulation, location of paving and type of road paved may vary over this time it would be more appropriate to quantify variables on a Per Project basis.	The quantification approach was modified to require measurement on a Per Project basis.
Table 2.4	The default mix temperatures specified in the original protocol may have been too high for Alberta conditions.	Temperatures were examined and a default temperature of 145 degrees Celsius was included. Note that this value may not be appropriate for softer asphalts and a note to this effect was also included.
Table 2.4	No comment.	Further detail was included to explain that the aggregate emission factor as stated in Appendix A of the protocol is applicable to sand, gravel or crushed stone. If other materials are used, an alternate emission factor may be derived or they

		may be assumed to have an emission factor of zero. This is conservative as more aggregate is consumed in the baseline versus the project condition
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