SEAL COATING EMULSIONS

SELECTING THE CORRECT ASPHALT EMULSION FOR CHIP SEALS AND SURFACE TREATMENTS

SEAL COATING OVERVIEW

Seal coatings are a family of surface treatments that include types of systems that can be classified in different ways. One way to classify these processes is by aggregate gradation. Nomenclature can be a bit confusing and depends on the jurisdiction, but in Canada the treatments utilizing one-size stone (or close to one-size) are known as *"chip seals"*. Seal coatings that use aggregate having a continuous gradation are known as *"graded seals"* (also sometimes known generically as *"surface treatments"*). Both chip seals and graded seals can be applied single, double, multiple or in combination (example: a double treatment consisting of a graded seal as the first lift and a chip seal as the top lift).

SEAL COATING AGGREGATE

Seal coating aggregate can be classified in three larger groups, depending on the amount of fine aggregate present (passing the 75 ηm sieve):

- **Washed chip** – clean, single size stone having fines between 0-1%. Sometimes unwashed but very clean stone can also fall under this category.
- **Unwashed (dirty) chip** – usually has fines contents between 1-3%. The general gradation is still that of a single size stone (or close).
- **Graded aggregate** – continuous gradation band that contains a stone fraction, a sandy fraction and a fines fraction. The fines are usually between 2-7%.

An example of gradation band falling under these three categories are shown in the following table, outlining the most common gradation for seal coatings in Ontario.

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The role played by an emulsified asphalt in a seal coating is the same regardless of the gradation of the cover aggregate: it has to spray uniformly, get a good bond to the substrate, have sufficient stability to wet the cover aggregate and then break and cure quickly, while creating a strong bond to the aggregate particles. Given the difference in gradation between the different aggregate bands, and therefore in surface area, the emulsion property have to be chosen correctly in order to perform adequately.

For this purpose, we have grouped the seal coating emulsions into three groups: **rapid setting**, **fast medium setting** and **slow medium setting**. Each and every one of these emulsion types can be polymer-modified or not.

SEAL COATING AGGREGATE GRADATIONS (ONTARIO)

SIEVE (mm)	CLS 1	CLS 2	CLS 3	CLS 5	CLS 6
16		98-100	96-100		100
13.2	100	75-95	67-86		96-100
9.5	75-100	50-80	29-52	100	50-73
6.7	0-40	…	…	40-85	…
4.75	0-10	20-50	0-10	5-25	0-10
2.36	…	…	…	0-10	5-30
1.18	…	10-40	…	0-5	…
0.600	…	…	…	…	…
0.300	…	2-20	…	…	…
0.150	…	2-13	…	…	…
0.075	0-1	2-7	0-2	0-1	0-2
NOTES	Washed	Graded	Un-washed	Washed	Un-washed

SEAL COATING EMULSION GENERAL PROPERTIES

EMULSION / PROPERTY	RAPID SET	FAST MEDIUM SET	SLOW MEDIUM SET
TYPES	RS-2 RS-2(P) CRS-2 CRS-2(P)	HFMS-2 HFMS-2(P) HP-200 HP-200(P)	HF-100S HF-100S(P) HF-150S HF-150S(P) HF-250S HF-250S(P)
BREAKING	Instant	Fast	Slower
WETTING POWER	Low	Medium	High
CURING	Very Fast	Fast	Slower

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AGGREGATE / EMULSION	RAPID SETTING	FAST MEDIUM SETTING	SLOW MEDIUM SETTING
WASHED CHIP	**OPTIMUM COMBINATION** Emulsion breaks instantly in contact with the aggregate Emulsion requires clean surfaces for gripping the stone	**LESS IDEAL** Less ideal combination but can still perform well Slower curing in the early stages will make the seal more vulnerable to traffic damage or rain showers	**NOT RECOMMENDED** Emulsion breaking and curing will be very slow Early traffic can damage the seal and turn the stones Rain showers can wash away uncured emulsion for days after application Cured seal can still be tender and fragile, especially in hot weather Binder can be too soft because of lack of fines and sandy fraction it was designed to incorporate
UNWASHED CHIP	**NOT RECOMMENDED** Emulsion is likely too fast for the amount of fines in the aggregate Breaking of emulsion can happen in contact with the dust film on the aggregate, resulting in poor grip of the stone High risk of aggregate loss due to poor wetting of the dust film and low stone adhesion	**OPTIMUM COMBINATION** Emulsion has sufficient wetting capability to grip the stone even if a dust film is present Emulsion curing is fast enough Cured binder is hard enough to confere seal strenght even without a large amount of fines	**LESS IDEAL** Less ideal combination but can still perform well, provided the fines content in the aggregate is not below 1 % Slower curing in the early stages will make the seal more vulnerable to traffic damage or rain showers. Flushing in hot temperatures is also likelier to happen
GRADED AGGREGATE	**NOT RECOMMENDED** Aggregate surface area is much too high for a rapid setting emulsion Emulsion will break before most of the aggregate particles are bonded, leading to significant aggregate loss	**NOT RECOMMENDED** Emulsion is still too fast for graded aggregate Risk of poor bonding to the aggregate is high	**OPTIMUM COMBINATION** Emulsion is designed to wet a high amount of fines before breaking Softer emulsion residue will incorporate many of the finer particles and stiffen slightly, similar to a mortar

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