



# NEW GENERATION COLD MIXES FOR LOW VOLUME ROADS

*Presenter:*

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## Presentation Content

- Technologies
- Challenges
- Benefits of Cold Paving Mixtures
- History of Cold Mix Paving in Alberta
- New Generation Binder Composition
- Why Solvent Free???
- New Generation Mix Design Methods???
- Limitations and Drawbacks





## technologies

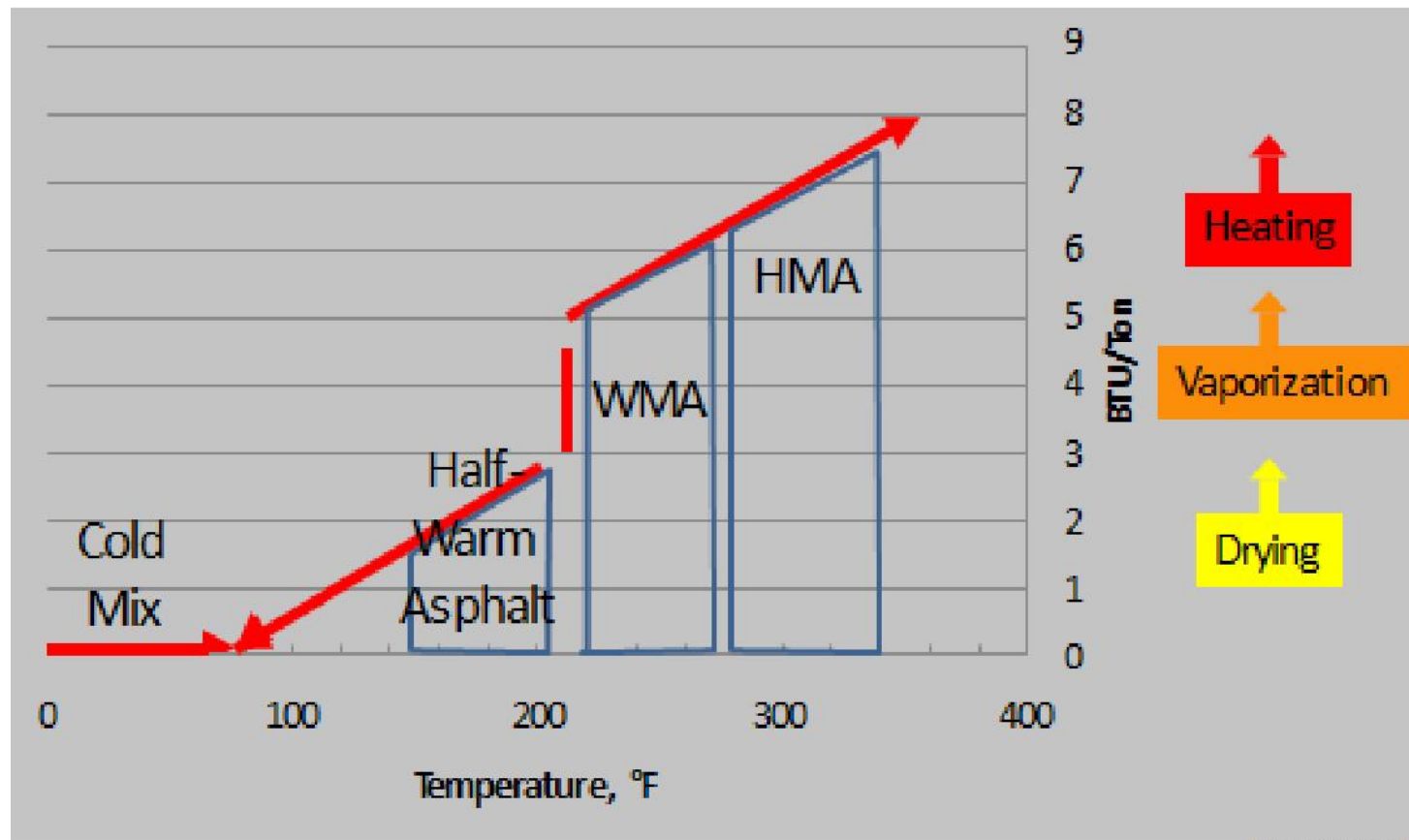
- Hot Mix Asphalt > 135 °C (275 °F)
- Warm Mix Asphalt > 100 °C (212 °F)
- Half-Warm Asphalt (Full) < 100°C (212 °F)
- Semi-Cold Mixes (Partial) < 100°C (212 °F)
- Cold Mix Asphalt = manufactured at ambient air temperature (no heating, no aggregate drying)





# Classification by Temperature

asphalt institute





## hallenges

Behaviour

- Durable
- Flexible
- Workable at low temperature

Binder composition

Design Method

Production, storage and laydown

Pavement design

Economics





## enefits of Cold Paving Mixtures

- Produced with reduced energy
- Highly flexible – can withstand movement where base strength is marginal
- Slight cracking during freeze-thaw conditions tend to heal itself
- Aggregate structure maintains its strength
- Repairable





## History of Cold Mix/HWM in Alberta

### Asphalt Stabilized Base Course (ASBC)

- Temporary wearing surface
  - staged construction (1-3 years)
- Repairable
- Binders:
  - SC 250 (dust abatement, road mix)
  - MC 250, 800 (plant mix, cold laid, paver laid)
  - HF 500m, 1000m (1000m stockpiling over winter)





# Alberta: ASBC (High Volume)

Based on AI Method an Advisory Supplement to MS-2, 1974

Binder	Cutback	Emulsion
Blows (#)	75	75
Stability (N) 25° C	6,700+	3,000+
Air Voids (%)	3-6	3-6
*Visual Appearance	Normal -	Normal -
Binder Content (%)	4.6 – 5.2	5.5 – 7.5

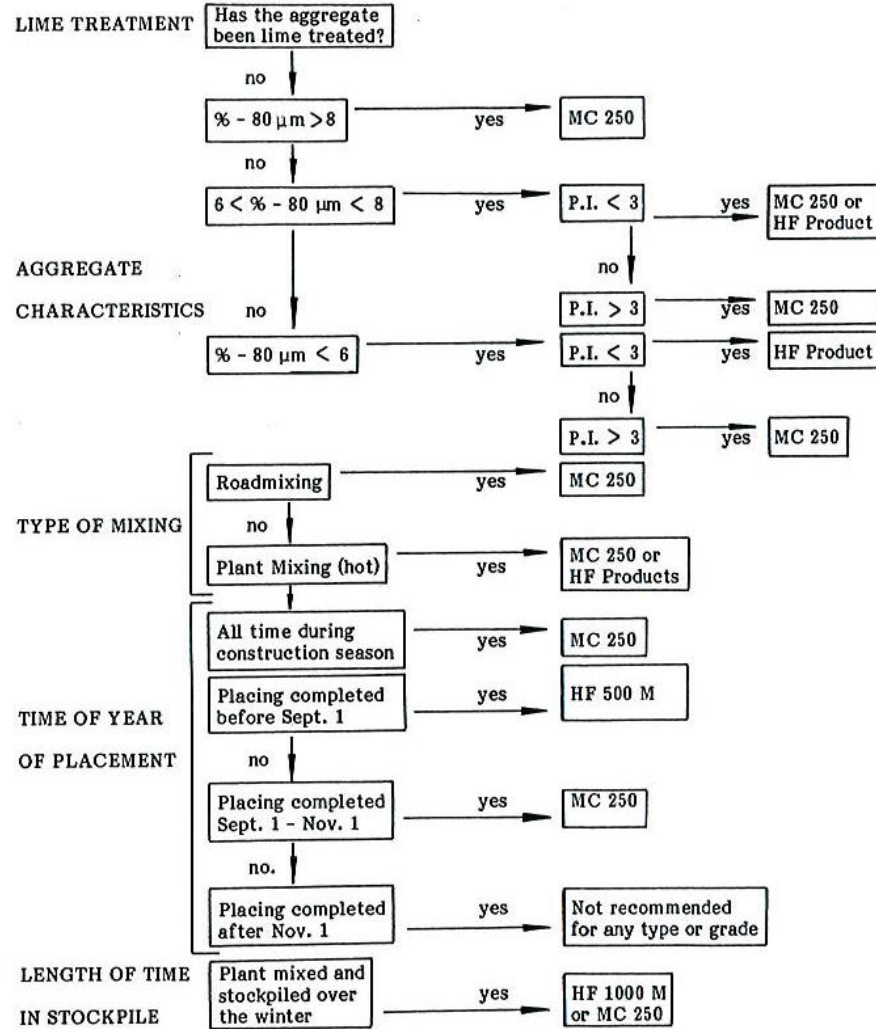
Cutback properties at 50% solvent removed (agg. 120° C, Compaction 100 ° C)

Emulsion at 1.5% moisture content (agg. 90° C, Compaction 60 ° C)





**CRITERIA FOR SELECTION OF TYPE AND GRADE  
OF ASPHALT BINDER FOR ASBC PROJECTS**





## Alberta: ASBC (Low Volume)

Empirical Formula (Modified McKesson)

Coat all aggregate with minimum film thickness

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

P = % MC 250

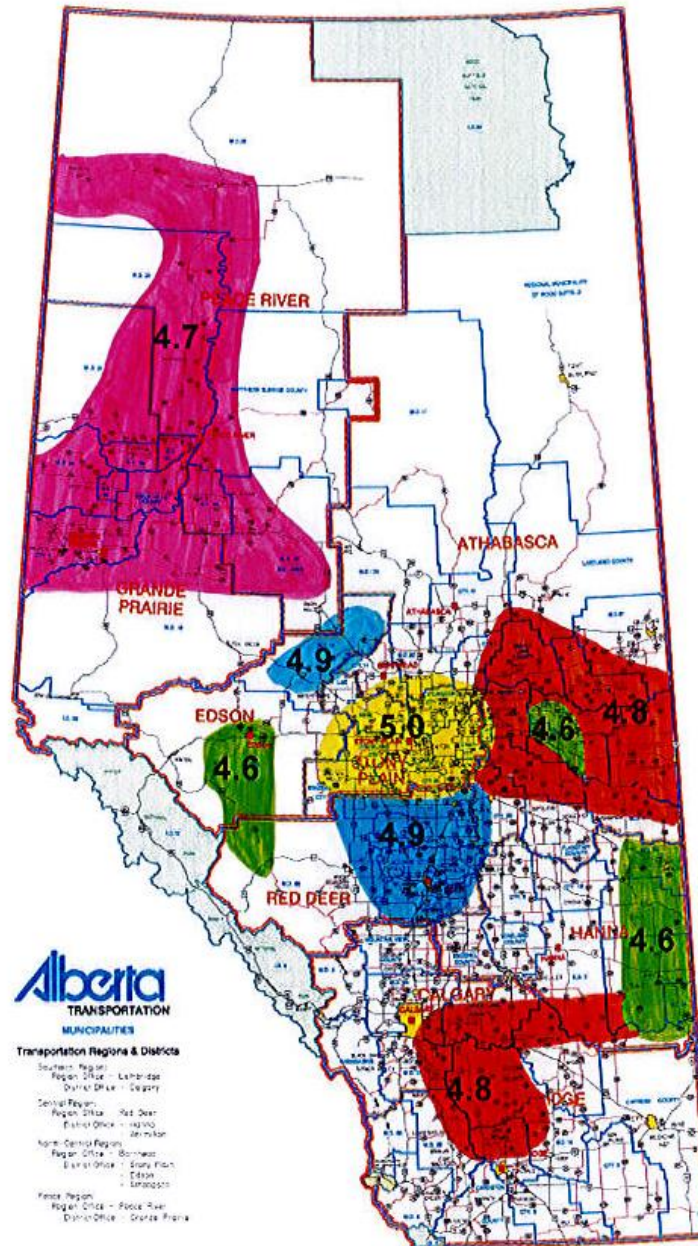
a = % retained on 1250

b = % passing 1250 retained on 80

c = % passing 80

x =	1.8 (when % passing 80)	4.0 – 5.9
	1.65	6.0 – 7.4
	1.5	7.5 – 9.5
	1.4	9.6 – 11.0
	1.3	11.1 – 13.0





**Alberta**  
TRANSPORTATION  
MUNICIPALITIES

**Transportation Regions & Districts**

- Southern Region  
Region Office - Lethbridge  
District Office - Calgary
- Central Region  
Region Office - Red Deer  
District Office - Hinton  
District Office - Jernigan
- North-Central Region  
Region Office - Banff  
District Office - Stony Plain  
District Office - Edson  
District Office - Lacombe
- Peace Region  
Region Office - Peace River  
District Office - Grande Prairie



PROJECT BY: PROJECT MANAGEMENT BRUNNEN-HORNIG-DEMPSEY-BECKER  
ALBERTA TRANSPORTATION - DISTRICT #02

2007 04 14 10:00





## Alberta: Problems ASBC

- Laydown - more art than science

### Cutback

- High solvent content (Total liquids)
  - Rutting, shoving, flushing
  - Also high moisture: stripping, flushing
- Low solvent content
  - Dead mix
  - Permeable
  - Ravel





## Alberta: Problems ASBC

### Emulsion

- High Float must be placed when emulsion is at the breaking point (ATT-65)
- Over working resulted in lumping
- Curing or set time



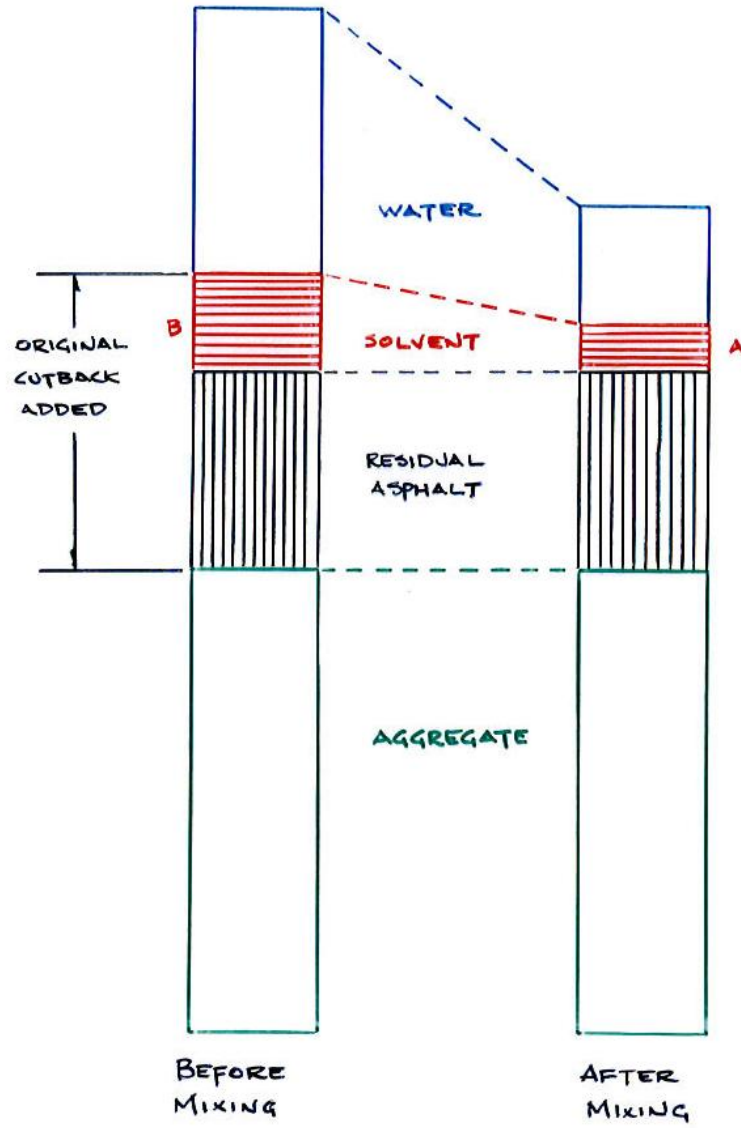


## ew Generation: Binder Composition

Solvent free or reduced solvent systems

- New processes or chemistries to provide workability and coating
- Means to drive out the water
- Storable





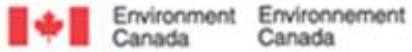


## Why Solvent Free???

- Reduce use of solvent – environmental issues
  - Limits on products that produce GHG
- No concerns of trapping solvents in mix
  - When used in conjunction with chemistries that aid in the release of water from the mix, tighter less permeable mixes are possible
  - Shorten curing time – quicker build up of strength







## Reduction of Volatile Organic Compounds Emissions from the use of asphalt

Denis Pineault  
Environment Canada  
Western Canada Pavement Workshop  
February 5, 2013





## Estimated emission factors of VOCs

- Different types of asphalt products are associated with different emission factors of VOCs.

Emission Factors for Product Groupings	
Product Group	Emission Factor
<b>Cutback Asphalt</b>	
Slow cure (SC)	3.5%
Medium cure (MC)	15%
Rapid cure (RC)	28%
<b>Emulsified Asphalt</b>	
Low or no VOC emulsions	0.5%
High float surface treatment emulsions	1.5%
High float mixing grade emulsions	3.0%





## Actions in other jurisdictions – California

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- The most stringent regulations in the U.S. are those which have been promulgated by the California districts, under the California Air Resources Board (CARB). In these districts, rules are specified for rapid cure, medium cure and slow cure of cutback asphalt and emulsified asphalt.
- The following is an example from San Luis Obispo County:
  - A person shall not sell, offer for sale, use, or apply for paving, construction, or maintenance of parking lots, driveways, streets, or highways, any cutback asphalt material which contains more than **0.5 percent by volume VOCs which evaporate at 260 degrees Celsius or less.**
  - A person shall not sell, offer for sale, use, or apply for paving, construction, or maintenance of parking lots, driveways, streets, or highways, any emulsified asphalt material which contains more than **3.0 percent by volume VOCs which evaporate at 260 degrees Celsius or less.**





## ew Generation: Mix Design Method???

- Recipe
- Empirical based on volumetrics and standardized testing
- Guidelines for evaluation
- End-performance-based necessary to:
  - Characterize products more completely
  - Help Agencies develop appropriate specifications
  - Assist in developing new products
  - Improve pavement design





## ew Generation: Mix Design Method???

### cont'd

- Compatibility of binder/aggregates
- Adhesion properties
- Moisture damage
- Coating at different mixing temperatures
- Cohesion properties in storage
- Optimum moisture content
- Optimum residual binder
- Workability – low temperatures



acy of structure and durability





# COLD MIXES EVOLVE OVER TIME

## CONSOLIDATION - CURING



Initial state  
~unbound

Long-term state  
~similar to hot mix

reversible

irreversible

cohesion



density





## imitations and Drawbacks

- Traffic Limitation
  - low volume, low % truck traffic
- Early fragility
- Working Season Limitations
  - Rate of cohesion build-up depends on weather
  - Work season much shorter
- Lack of Design Method and Specifications





Photo 3







## SUMMARY

- New Generation Cold Mixes for low volume roads are on the radar
- New generation binders (Bio-fluxes)
  - High %RAP quantities (100%???)

Thank you!

