



**Key Decisions for Concrete Deck
Overlays**

Virginia Concrete Conference
March 7, 2007

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Overlays

Overlays are usually placed on bridge decks to reduce the infiltration of water and chloride ions and to improve the skid resistance, ride quality, and surface appearance.



HCC Deck Overlays

The objective of this presentation is to describe the key decisions with respect to hydraulic cement concrete (HCC) deck overlays that have provided long lasting chloride resistant overlays.



Key Overlay Decisions

1. Select a Good Contractor
2. Use Concrete that Provides the Required Properties
3. Achieve High Bond Strength (Key to Long Service Life)
4. Achieve Good Surface Properties
5. Achieve Good Protection Properties



1. Select a Good Contractor

- Overlays are difficult to construct.
- An experienced overlay contractor is less likely to have problems with the construction.
- Obtaining and maintaining the high bond strengths for long lasting overlays requires that appropriate construction decisions be made with respect to the selection and use of concrete removal and surface preparation equipment and procedures, mixture proportions, and placement and curing procedures.



2. Use Concrete that Provides the Required Properties

- Latex-modified concrete (LMC)
- Low water to cement ratio mixtures
- Silica fume (SF)
- Fly ash and SF
- Slag and SF
- LMC- very early (LMC-VE)



Typical Mixture Proportions

Mixture	LMC	SF	Fly Ash	Slag
I/II Cement, lb/yd ³	658	658	526	395
Silica Fume, lb/yd ³	-	46	33	33
Fly Ash, lb/yd ³	-	-	99	-
Slag, lb/yd ³	-	-	-	230
Fine Agg., lb/yd ³	1552	1269	1351	1369
Coarse Agg., lb/yd ³	1187	1516	1510	1510
Water, lb/yd ³	146	282	254	254
Air, percent	5	7	7	7
Admixtures	Latex	HRWR	HRWR	HRWR



High-Early Strength Overlays

24 hour cure time

- 15 % latex and type III cement (LMC-HE)
- 7 % SF and type I/II cement

3 hour cure time

- 15 % latex and calcium sulfoaluminate and dicalcium silicate cement (LMC-VE)



3. Achieve High Bond Strength

- Deck concrete must be in good condition
- Minimal damage from concrete removal
- Surface preparation provides a sound, clean, textured and damp surface
- Concrete is properly consolidated
- Concrete is properly cured
- Minimal construction joints
- Minimal full depth cracks



Deck concrete must be in good condition

- Concrete has adequate strength
- Concrete has few cracks
- Reinforcement is not corroding
- Concrete is properly air entrained
- Concrete is not deteriorating (ASR, etc.)

Overlays should not be used to cover concrete that should be removed.



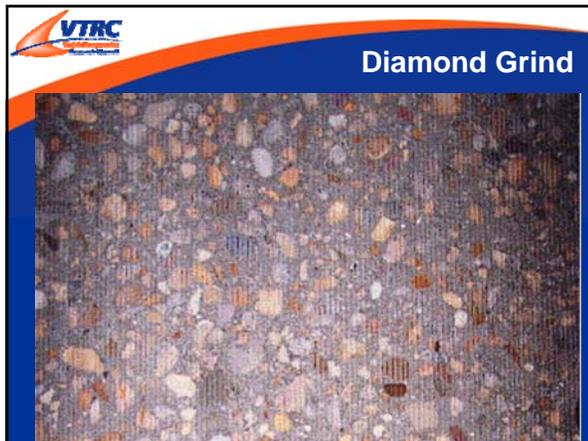
Concrete Removal Options and Typical Removal Depths

- Grit blasting < 2mm
- Shot blasting < 6mm
- Diamond grinding < rebar depth
- Scarification (milling) < rebar depth
- Hydro demolition 1mm to full depth



Fine Milling Drum (impact heads ≤ 8 mm apart) causes less fractures









 **Good Surface Preparation**

Performance Specifications:

- Specify the macro texture that provides good surface preparation (≥ 0.06 in*).
- Specify the surface tensile strength that results from good surface preparation (≥ 250 psi*).
- Specify the overlay bond strength that results from good surface preparation (≥ 250 psi*).

*Different values may be appropriate.

 **Techniques for Preparing Concrete Surfaces**

- Grit blasting
- Shot blasting
- Hydro demolition/power washing
- Power washing
- Air blasting

 **Grit Blasting**
Preparation depends on operator



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Surface Preparation by Shot Blasting



Steel shot clean the surface, shot are recycled, cuttings and dust are contained

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Surface Preparation Quality Control

- Monitor the macro texture of the prepared deck surfaces.
- Monitor the tensile strength of the prepared deck surfaces.
- Monitor the overlay bond strength.

The macro texture, tensile strength or bond strength should equal or exceed the minimum values for good surface preparation.

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Insuring the Macro texture of the Prepared Surface is Acceptable

- Conduct macrottexture depth measurements (ASTM E 965)
- Compare the surface to the International Concrete Repair Institute molded profile that best represents the required texture (ICRI Guideline No. 03732, 9 concrete surface profiles)













 Broom overlay mortar over surface, screed consolidates and strikes-off overlay



 Proper Consolidation Required for High Bond Strength



vibrating pan on front of screed works well for overlays < 2.5 in thick

 Curing: wet burlap is placed on overlay as soon as practical





Curing: polyethylene is placed on wet burlap as soon as practical



4. Achieve Good Surface Properties

- Drainage
- Ride quality
- Surface appearance
- Skid resistance (saw cut grooves)



5. Achieve Good Protection Properties

- Overlay Thickness of 1.25 to 2.0-in
- Low permeability to Chloride Ion (AASHTO T 277)
- Low Shrinkage (ASTM C 157)
- Minimal cracks
- Minimal joints

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Permeability, coulombs

Age	LMC	SF	Fly ash	Slag	LMC-VE
28 day	1500 - 2560	950 - 2330	1000 - 1160	1040 - 1390	300 - 1400
1 year	200 - 2060	590 - 1280	290 - 300	570 - 820	0 - 10
3 year	300 - 710	520 - 1460	300 - 360	500 - 590	-
5 year	450 - 500	780 - 910	-	-	-
9 year	100 - 400	-	-	-	0 - 60

Low: 1000 – 2000; very low: 100-1000; neg. < 100

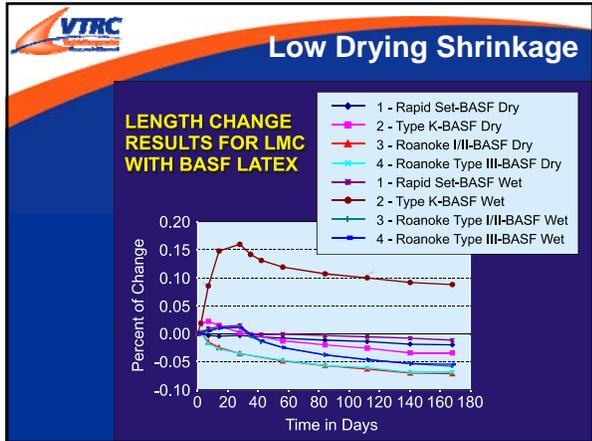


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- ### Factors That Contribute Cracking in Overlay
1. Plastic shrinkage
 2. Autogenous shrinkage
 3. Drying shrinkage
 4. Thermal contraction
 5. Cracks in deck
 6. Live loads

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Factors Contributing to Plastic Shrinkage Cracking

- Evaporation rate greater than 0.1 lb/ft²/hr
- Low relative humidity
- High concrete temperature
- High wind
- Delay in application of wet burlap
- Application of dry burlap
- Delay in application of plastic cover



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Summary: Key Overlay Decisions

- Select a Good Contractor
- Use Concrete that Provides the Required Properties
- Achieve High Bond Strength (Key to Long Service Life)
- Achieve Good Surface Properties
- Achieve Good Protection Properties



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Thank You
Questions?
