

HMA Overlays on Bridge Decks

WSDOT Team Effort:

HQ & Region Program Managers, HQ & Region Pavement Managers, HQ & Region Construction, Region Design, Bridge Manager, and Contractor

Outline

- Why WSDOT uses HMA on bridge decks?
- Inspection to Remove & Replace HMA on the bridge deck

HMA Design: Benefits

- Moves the wheels off the concrete
 - Extends life of deck
 - Economical solution for rutting
 - For bridges within paved roadways
 - Improved Ride
 - Improved construction by removing butt joints in the paving projects.
 - Deck paving managed with the roadway

HMA Design: Drawbacks

- Limits inspection of deck top surface
 - Deck repairs required for quality HMA base
- Water passes thru HMA and concrete
 - Passes salts and oxygen to reinforcement
 - Requires Waterproof Membranes
 - Cost is equal to a 0.15' of HMA
- Full depth planing of concrete can damage the deck.

Resurfacing HMA Depths

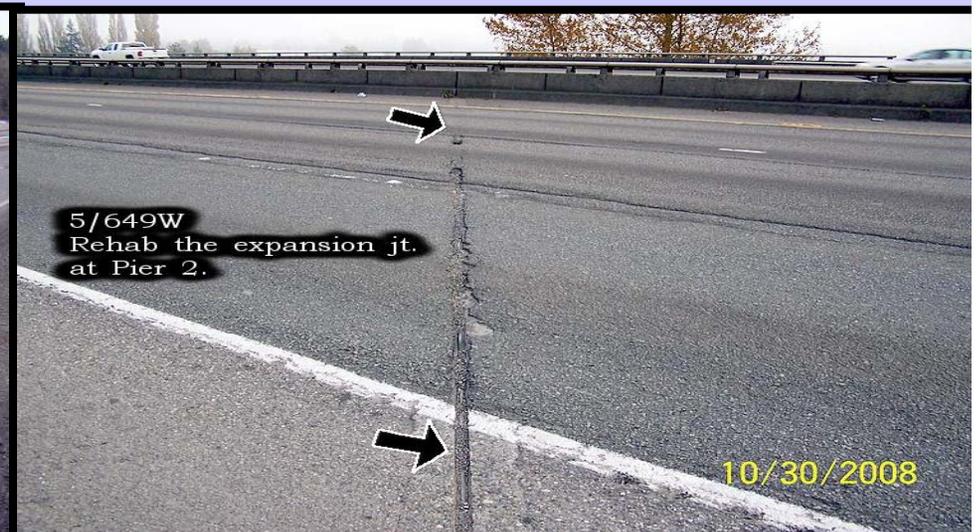
- Optimum paving depth is 0.25' or 3" of HMA.
 - Allows for the standard Mill & Fill depth of 0.15' when resurfacing.
 - Most overlays are 0.15' or 1.8"
- Plan Options:
 - Maintain, Raise, or Lower grade
 - See Std. Plan A60.30 for grade transitions
- When HMA is Removed:
 - Deck Inspection
 - Chain Drag Report Submitted to Bridge
 - Deck Repairs
 - Place membrane

Bridge Paving Overview

1. Contractor Survey of bridge grade profile.
 - Engineer approves Final Grade Profile.
2. Remove HMA based on Final Grade.
3. Chain Drag locates Deck Repair quantity
 - Chain Drag Report submitted to bridge.
4. Complete Deck Repairs & Joint work.
5. Place waterproofing membrane
6. Place HMA
7. Sawcut Std. Plan Transverse Joints

Contractor Survey of Grade/Xsection

- Primary Reason: Provide control for milling and paving depths.
- Secondary Reason: Establish the final grade with smooth transitions on and off bridge.
- Engineer approves Final Grade Profile and can make adjustments as necessary.



Contractor Survey of Grade/Xsection

- Deck Surveyed at 20' spacing with additional points at joints.
- Deck survey extends 100' beyond bridge to measure grade transition.
- Paving depth is documented at all surveyed locations on deck.
 - Contractor's method is not specified: PK nails, small concrete bit, or small cores.

Final Grade Approval

- See internal Bridge website for Construction Inspection for detailed instructions.
- Based field measurements, existing grade is checked for:
 - Plan depths may be significantly different
 - If more than 0.25', over milling may be appropriate.
 - If Plan milling removes deck concrete, then milling and paving depth may need changing.
 - Smooth transition on and off the bridge
- Final grade approval is key bridge deck paving
 - Preserves bridge deck and membranes
 - Allows enforcement of poor contractor performance

Full Depth HMA Removal Specs

- Removing HMA by non-milling methods is encouraged but not required.
- Rotor Head must have $\frac{1}{4}$ " tooth spacing and equipment with good grade control.
 - Contractor with unacceptable equipment must leave 0.04' or $\frac{1}{2}$ " of HMA and remove it with other methods.
- Maximum milling depth is measured from the Final Grade Profile to bottom of the mill head tooth strike.
 - Rotomilling will remove up to $\frac{1}{2}$ " of rebar concrete cover. The third resurfacing overlay will start removing deck rebar.
 - Documents HMA depths @ surveyed points
 - PK nails, small concrete bit, or small cores.
- Small areas < 5 SF tightly bonded may be left in place with approval of engineer.

Mill/Fill Specs

- Rotary Mill head may be the standard 5/8" tooth spacing.
- Maximum mill depth should allow the concrete. Damage to deck or membrane is a change order.
- Survey is still required for control of mill depth more than Final Grade.
 - Several M/F projects a year have excessive removal with damaged membranes and joints.
 - The change order has to pay for final removal, deck repair, new membrane, and extra HMA.

Rotary Milling Specs

- Prior to milling operations
 - Mill head tooth spacing = $\frac{1}{4}$ "
 - Mill head tooth length within $\frac{3}{8}$ "
 - Document HMA depths @ surveyed points
 - Use PK nails or small concrete bit



Ideal Deck Surface after Removal with other methods



1" Mill on 2" HMA??



- This should be scraped off to avoid damaging deck, not milled.

Removing last of old membrane

- Scraping or other means that does not damage concrete cover.



ROTOMILLING DAMAGES BRIDGE DECKS

Rotomill Grooved Surface



- Rotomill groves seriously impact the 1.5" concrete cover.

Rotomill Damage to Steel Joint



Chain Drag Bridge Deck

- Chaining defines deck repair area
- Region Materials should be contacted three days prior to HMA removal.
 - Mats Lab will provide personnel or provide training for chain drag.
- Chain Drag Report is documents critical information used by the Bridge Office to manage the deck. Extremely important!

Marking Repair Area (Worst Case)



SAMPLE BRIDGE DECK CHAIN DRAG REPORT

STATION NUMBER	OFFSET FT	LENGTH (ft along CL)	WIDTH FT	TYPE (D,S, or P)	Comments	Patch AREA (SF)	Spall AREA (SF)	Delam AREA (SF)	
0+07	13.5	1.4	4.3	Patch		6.02	0	0	
0+08	14.5	0.5	0.5	Spall		0	0.25	0	
0+09	22	1.0	1.0	Delam		0	0	1	
0+09.5	10	5.0	3.0		3 Rebar Repaired - 5'-0" long	0	0	0	
0+10	29	1.5	1.5	Spall	3" deep with exposed rebar	0	2.25	0	
0+35	21	2.0	1.3	Delam	Delam around 1x1 patch	0	0	2.6	
0+50	1	3	1		Paving ripped membrane	0	0	0	
0+98	8.5	3.5	1.5	Patch	Several 1x1 patches	5.25	0	0	
						0	0	0	
						0	0	0	
TOTAL DEFECTS						17.4	11.27	2.5	3.6
REMARKS: Transverse cracking sta. 0+90 to 1+05 consistant with exposed rebar spacing. Spalled areas not repaired due to weather									

- Available on Bridge website
 - www.wsdot.wa.gov/eesc/bridge/bridgeoverlays/
 - Download Chain Drag Results Excel Spreadsheet
 - Concrete Overlay Presentation
 - HMA Overlay Presentation

Chain Drag Report Instructions

1. Edit **Blue text** as needed
2. Stationing usually starts at the beginning of bridge pavement seat. Note if otherwise.
3. Defects are estimated to square one foot dimensions or equivalent length and width. Small spalls (< 6"x6") may be ignored.
4. Select from the picklist if the defect is a Patch, Spall or Delamination. Leave blank if noting something else.
5. Cells with **Red Text** are formulas and may be ignored.
6. If you need more lines:
 - A. Copy the ROW and insert the cells or
 - B. Copy the whole sheet to a new page.
7. Blank sheet may be printed for field use.
8. After field data has been input, hit Send button to email file.

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- Note new patches vs. old
- Spalls area will be a problem for the HMA
- All information is helpful & stored with the deck for the next overlay or rehabilitation
- Photos are welcomed in the email

Exposed Rebar



- Exposed rebar near the surface must be noted in the chain drag results. These bars will be ripped out during next HMA removal. This is different than exposed rebar at the bottom of a spall. Photos are nice.

Over Milling Area: Severe deck damage



- Comments should locate and size over milling or locate exposed rebar.
- Photos can be attached with Chain Drag Report email!

Deck Damage that requires Grout



Deck Repairs



Std Item 4451 Bridge Deck Repair (SF)

- Traditional patching techniques apply
 - Square up deteriorated area with ½” sawcut
 - Patch smooth and level with top of deck
 - Equipment will tear membrane if rough or a bump
 - Good for HMA compaction
 - Engage rebar if possible.
- Make sure contractor follows fast setting patch material instructions exactly or it will usually fail completely.
- Bridge maintenance is a good source.

Bad Patch Material under HMA



- Typical fast setting patch failure.
- Helpful if ROM states patch product used.

Deck Repair Quantities

- Usually unknown quantity below HMA
 - May have Chain Drag Report from previous contracts.
 - Bare concrete can be Chained prior to work
- Normally HMA will look worse than the deck



162/15 Good Deck w/HMA patches



162/22 Very Bad Deck

Deck Repair Quantities

- Contract Quantity is an estimate
 - Contract should attempt to complete all repairs
 - If repairs are excessive, get the worst areas.
 - Chain Drag Report documents this for the next contract.
 - Future concrete overlay may be required instead of HMA.
- Extending closure for deck repair is justified



Completed Deck Repairs



- Not all delaminations were repaired
- Clean up not done
- Unacceptable planing

Joint Repairs & Headers

- Many times repairs will not fit standard traffic closures. Header replacement requires extensive prep and cure time.
- Sawcut Poured Joints and Seals can be placed separately in night time closures



Typical Header Repair



Place Membrane

- Type: Liquid, Fabric, Rubberized Asphalt



Membrane Prep

- Clean, smooth concrete surface



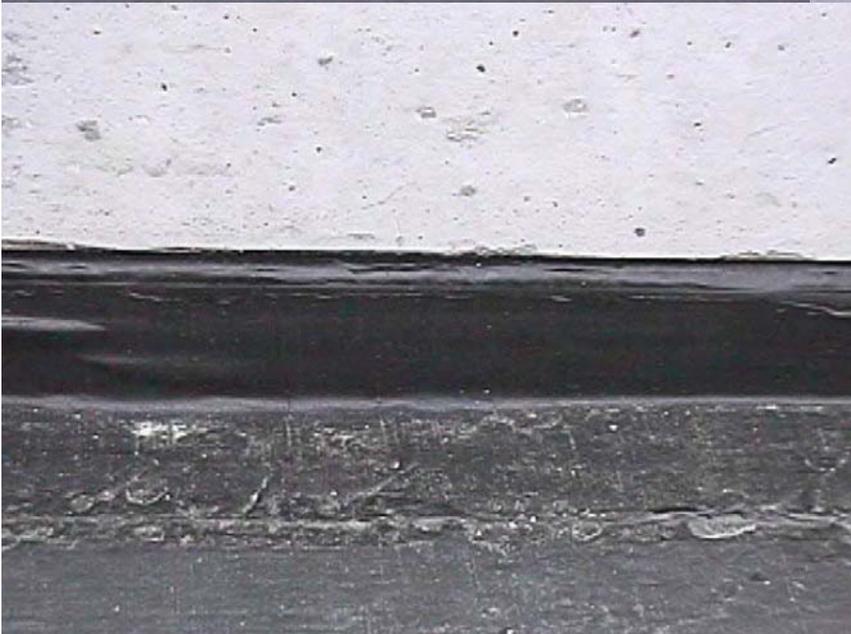
Apply Primer or Tack Coat



Allow Tack to Cure

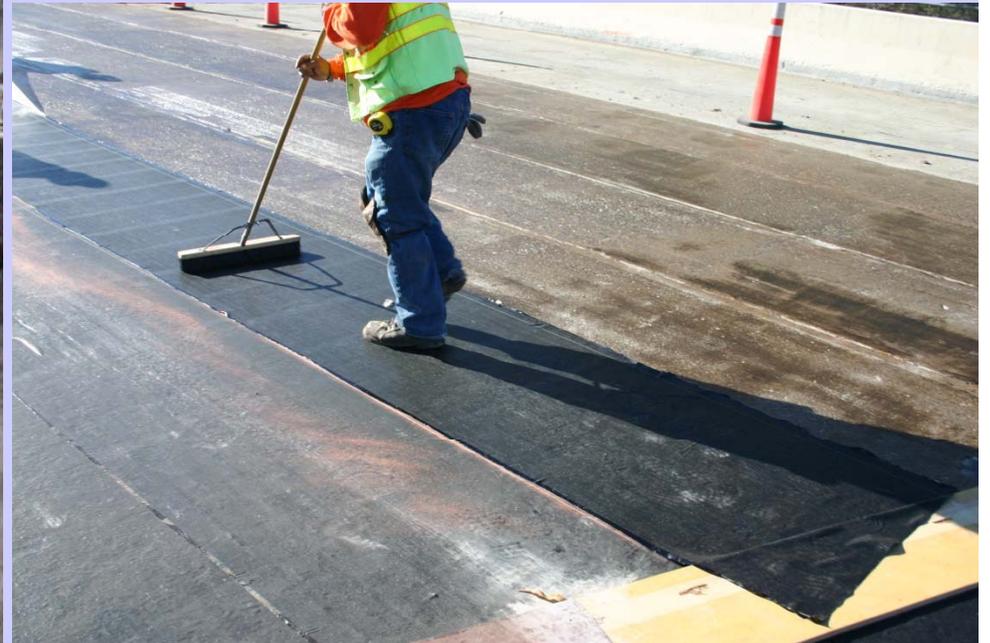


Details





Membrane Placement



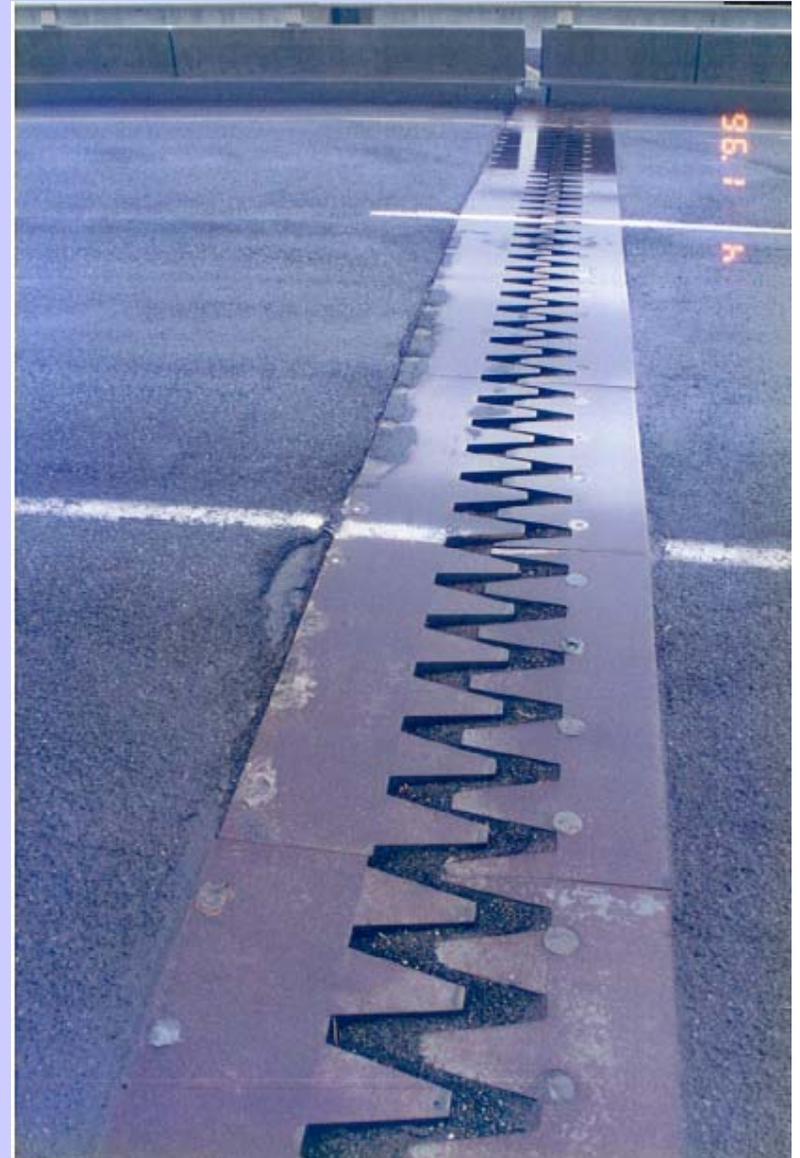
Equipment on Membrane



- Equipment on membrane OK – No turning movements allowed!
- Plywood @ joints to debond HMA
- Approach repair prior to paving

Placing HMA

- Do not allow contractor to fill the joints with HMA or chip seal.
- Monitor depth for accurate removal next time.



Paving



Sawcut Std. Plan Transverse Joints

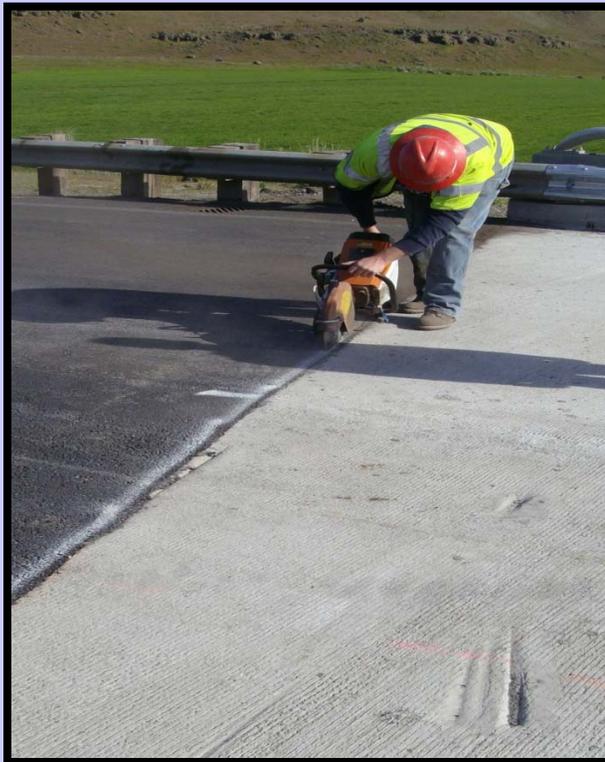
- Improve ride and wear at the joint



Typical Joint Wear (w/o sawcut)

Sawcut Std. Plan Transverse Joints

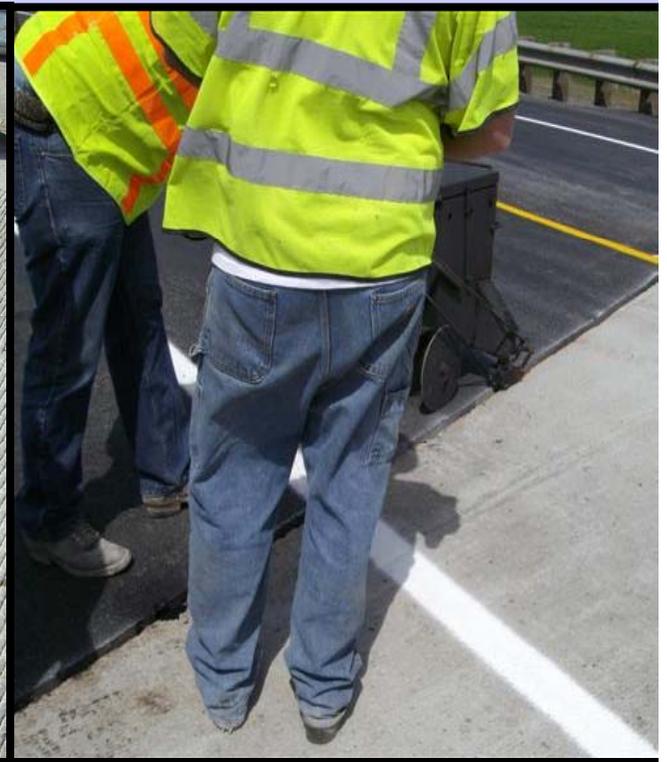
- Bridge Transverse Joint Seals for HMA
 - Standard Plan A40.20.00 Details 1-8
 - Std Item 6517: Bridge Transverse Joint



Sawcut

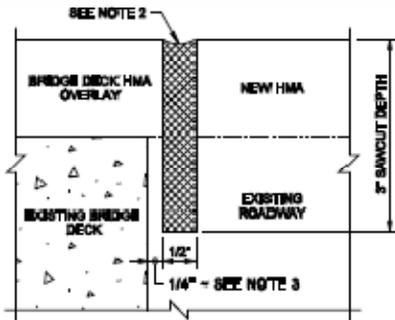


Clean

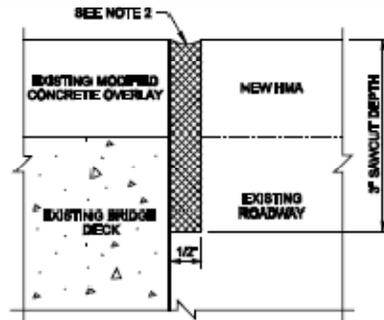


Joint Filler

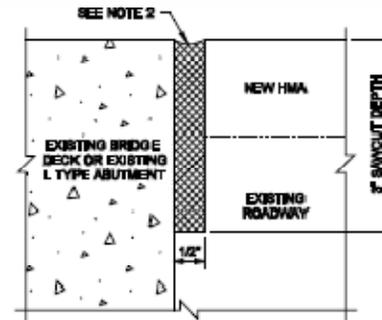
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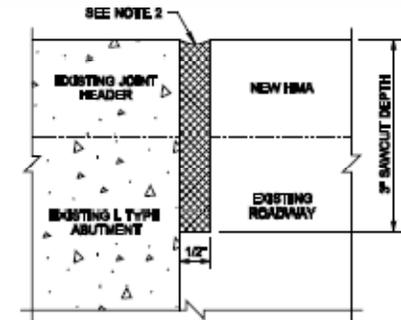
DETAIL 1
1/2" JOINT SEAL
BRIDGE DECK WITH HMA OVERLAY



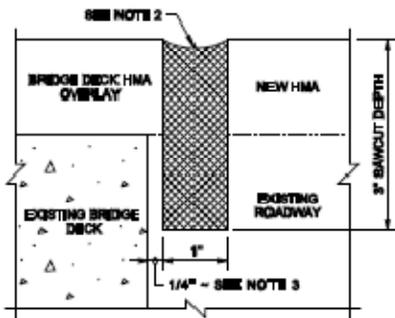
DETAIL 2
1/2" JOINT SEAL
BRIDGE DECK WITH CONCRETE OVERLAY



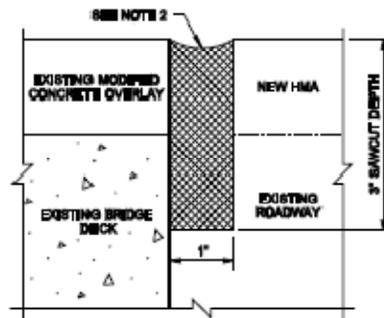
DETAIL 3
1/2" JOINT SEAL
BRIDGE DECK OR L TYPE ABUTMENT



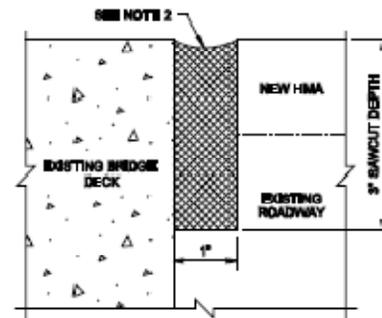
DETAIL 4
1/2" JOINT SEAL
L TYPE ABUTMENT WITH HEADER



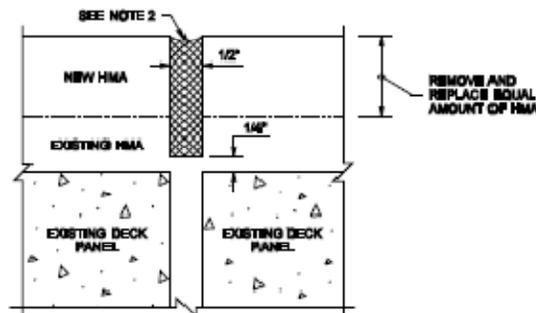
DETAIL 5
1" JOINT SEAL
BRIDGE DECK WITH HMA OVERLAY



DETAIL 6
1" JOINT SEAL
BRIDGE DECK WITH CONCRETE OVERLAY



DETAIL 7
1" JOINT SEAL
BRIDGE DECK



DETAIL 8
1/2" JOINT SEAL
BRIDGE DECK PANELS WITH HMA OVERLAY

NOTES

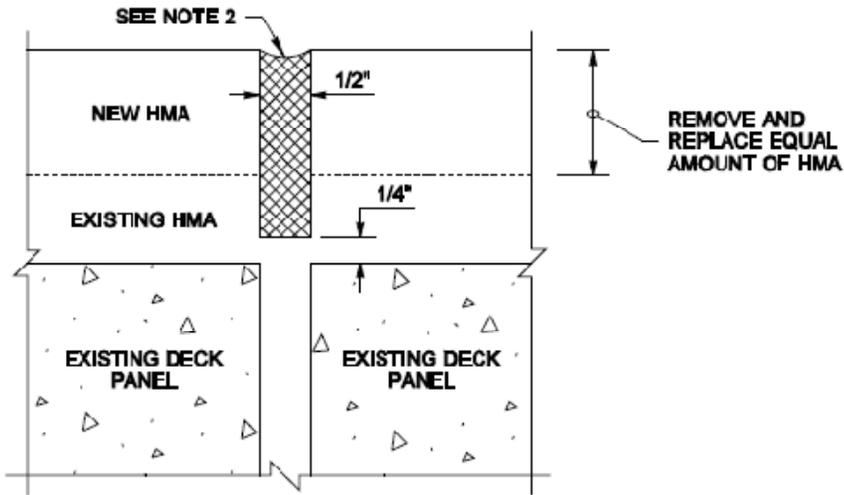
1. Use the 1/2" joint details for bridges with a length less than 100' and for bridges with L type abutments. Use the 1" joint details for other applications. Use DETAIL 8 on steel trusses and timber bridges with concrete deck panels.
2. Sawcut shall be filled with hot-poured compound in accordance with Standard Specification 9-04.2(1) and sealed in accordance with Standard Specification 5-05.3(8)B.
3. The contractor shall avoid sawing existing concrete. The construction tolerance to locate the saw cut is $\pm 1/4"$ (0 min. to 1/2" max.) from the existing concrete (DETAILS 1 and 5).



BRIDGE TRANSVERSE JOINT SEALS FOR HMA
STANDARD PLAN A-40.20-00

SHEET 1 OF 1 SHEET
APPROVED FOR PUBLICATION
Pasco Bakotich III 09-20-07
STATE ENGINEER
Washington State Department of Transportation

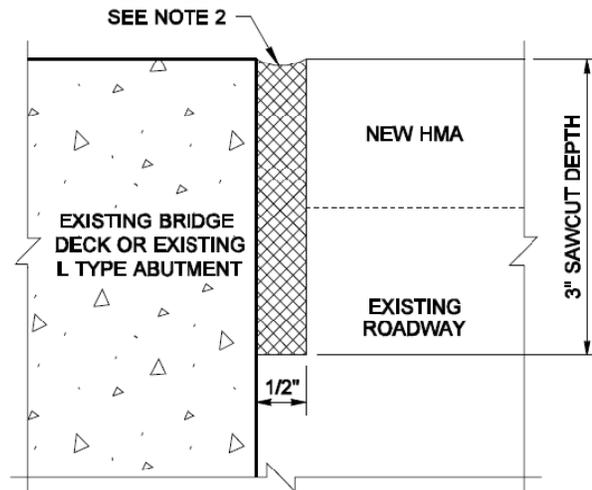
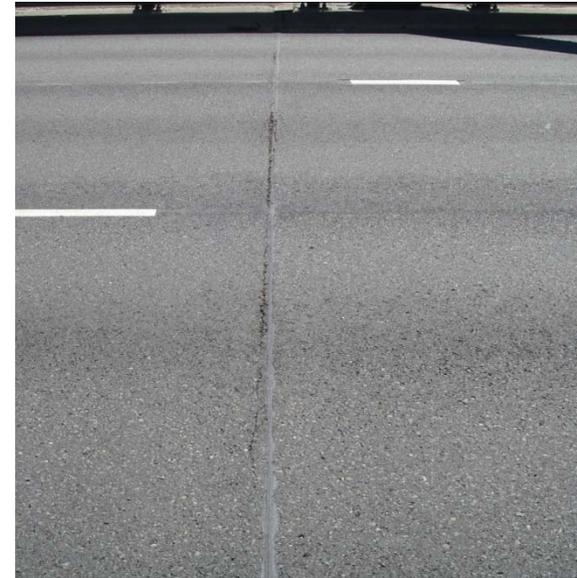
Typical Sawcut Joints



DETAIL 8

1/2" JOINT SEAL

BRIDGE DECK PANELS WITH HMA OVERLAY



DETAIL 3

1/2" JOINT SEAL

BRIDGE DECK OR L TYPE ABUTMENT

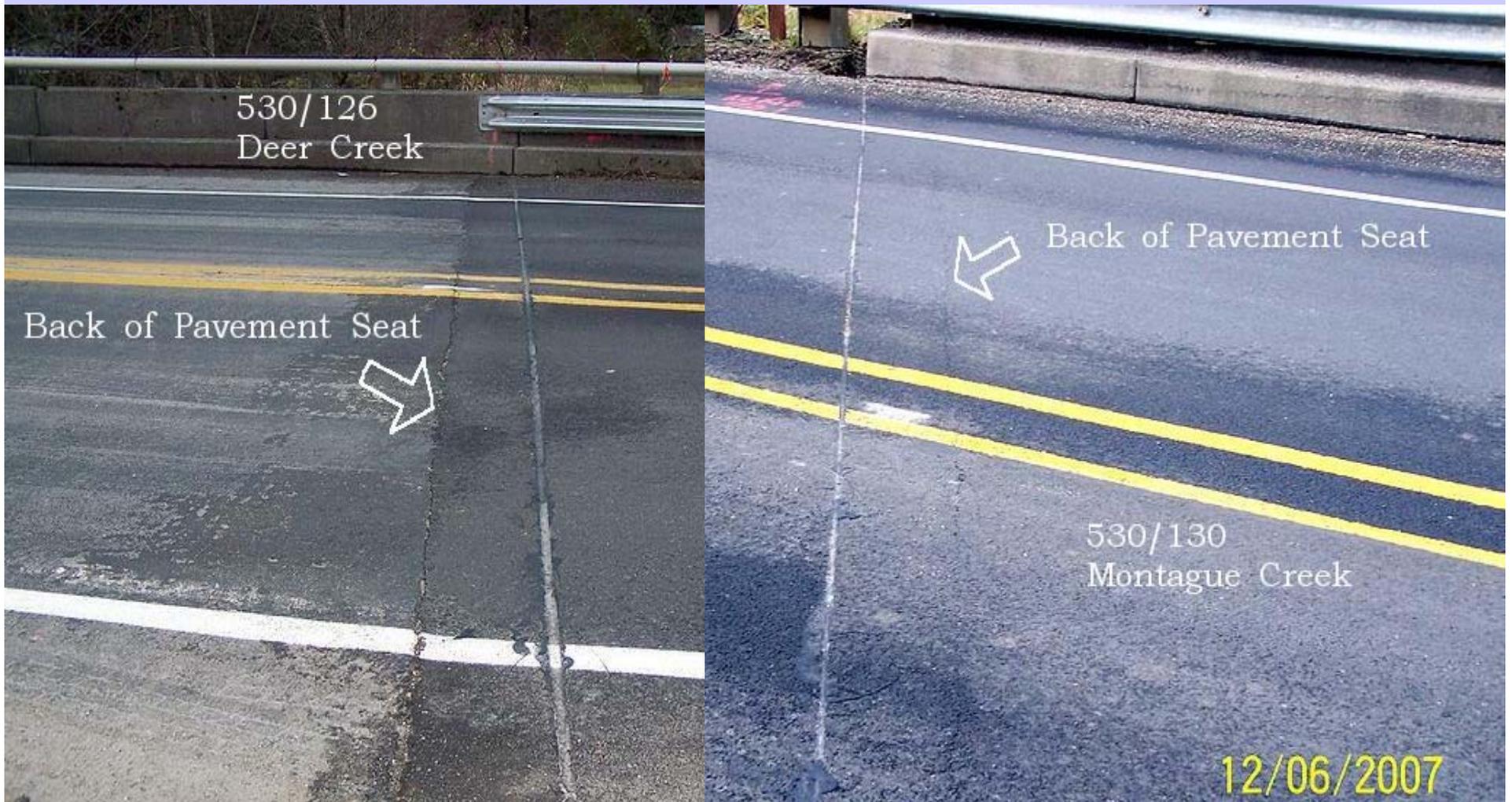
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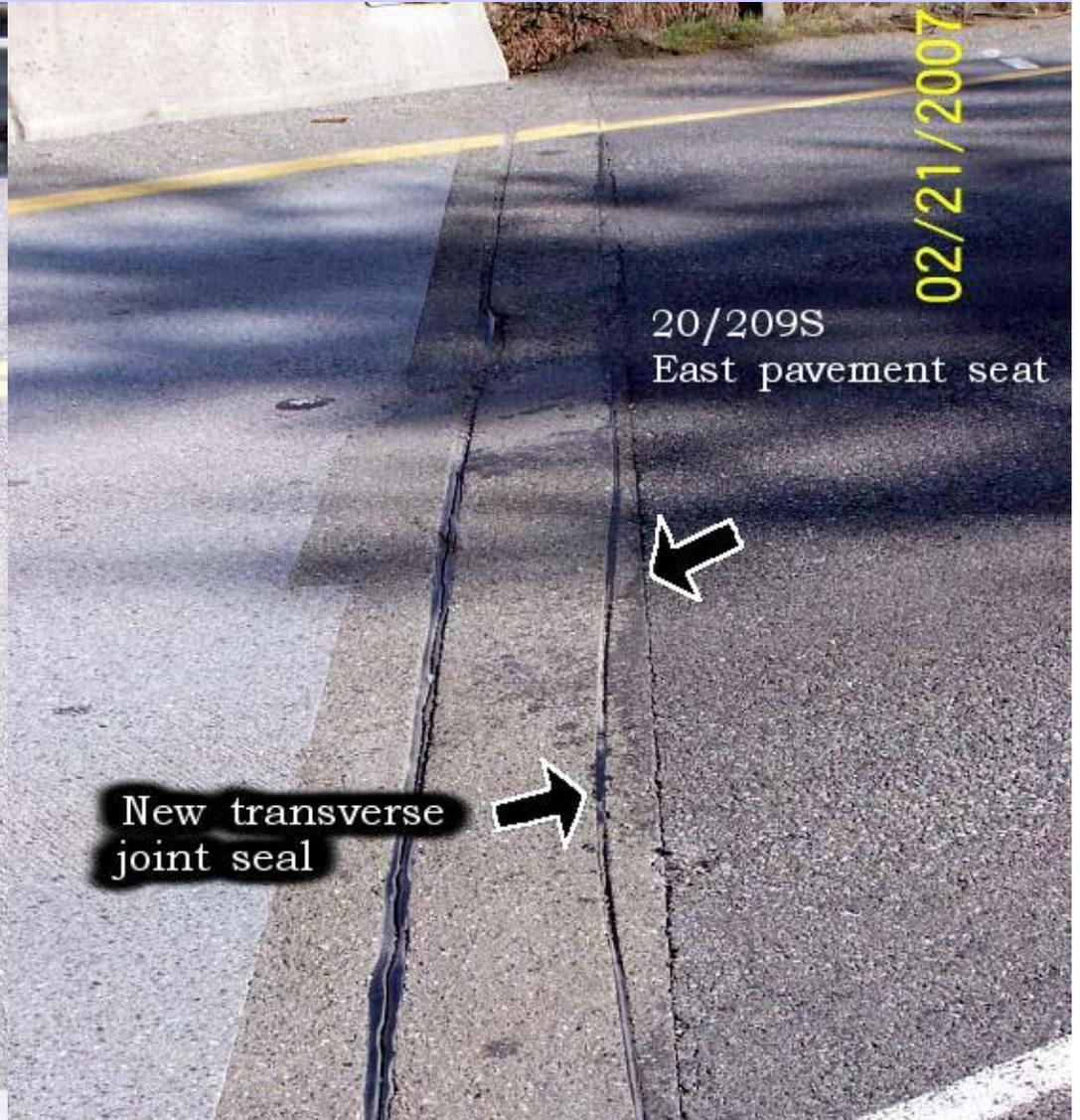
- Nice saw cutting equipment is available.

Sawcut Locations not Marked



- Saw cuts at the wrong locations are not useful or can damage material under HMA.

Sawcut Locations not Marked



Joint Repairs

- Can be complex and may not fit standard traffic closures.

