Topics

1. Chip Seal Preservation/Funding
2. BST Summits (2006, 2007, 2009, 2010)
3. Double Seal Experiments (2008 and 2010)

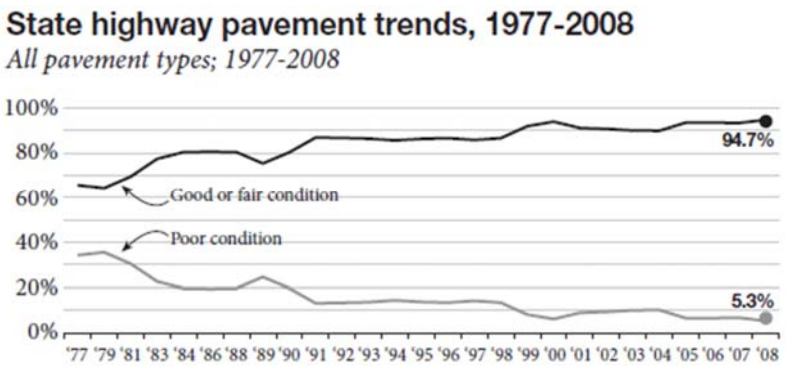
WSDOT Lane-miles

Pavement Type	Lane-miles	% of Total
HMA	11,558	60
BST	4,434	27
PCC	2,416	13
Totals	18,424	100

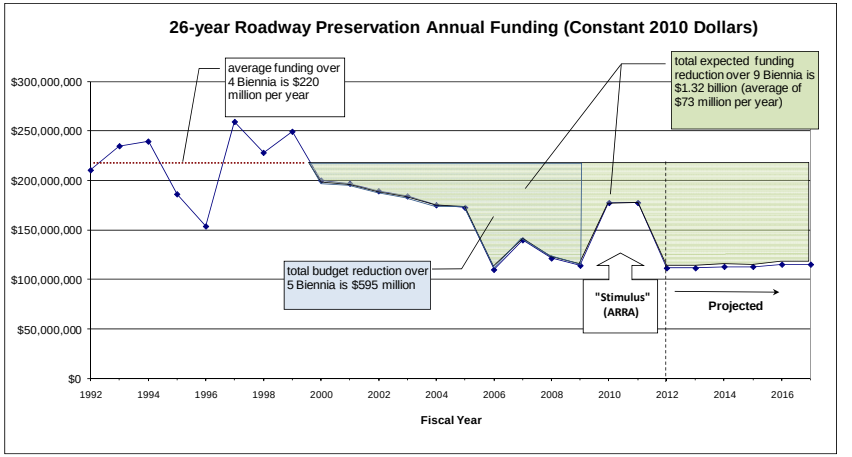
WSDOT Typical Budget (Biennial Basis)

Budget Element	Total
Operating (take care of what you own)	27%
Pavement Preservation	(10%)
Bridge/Structures Preservation	(6%)
Highway Maintenance	(8%)
Capital Projects (new stuff)	73%
Total Budget = $3.4 billion	100%

WSDOT Pavement Condition



Pavement Management/Funding



Pavement Preservation

Increased use of Chip Seal roadways

- Policy changes in recent years
  - Required for roadways less than 5,000 ADT to utilize HMA with BST cycles
  - Transition from **Tons** and **Tons** of HMA to **Tons** of HMA and **Chip Seal**
- Chip Seal Biennium Spending
  - 09-11 - $57.5 million
  - 11-13 - $88.5 million
  - 13-15 - $70.0 million

WSDOT Lane-Miles by ADT

AADT	Lane-miles					
	BST	HMA	Flexible (BST+HMA)	All Types (BST+HMA+PCC)		
0-2000	3,157	1,834	4,991	4,993	(28%)	42%
2000-4000	819	1,645	2,464	2,486	(14%)	
4000-6000	190	1,423	1,613	1,631	(9%)	18%
6000-8000	8	840	848	934	(5%)	
8000-10000	1	567	568	660	(4%)	
10000-20000	4	2,094	2,098	2,572	(15%)	
20000-40000	0	1,610	1,610	2,029	(11%)	
40000-80000	0	1,032	1,032	1,360	(8%)	
80000-160000	0	436	436	640	(4%)	
>=160000	0	132	132	360	(2%)	

AADT and lane-miles are a bit out of date. Actual BST lane-miles higher than shown.

Pavement Preservation

- Preventative Maintenance Preservation
  - Extend pavement life due to budge limitations
  - Integration of Preservation and Maintenance

BST Summit Topics (2006, 2007, 2009 and 2010)

1. Initial topics
2. Materials
3. Construction processes
4. Performance
5. Safety
6. Recommended changes for consideration by WSDOT and paving contractors

BST Summit Topics

- **Chip seal design**
  - General view was this would be a good tool to have. [Becomes more important if aggregate payment by the SY becomes standard.]
- **Max surface temperature**
  - Max surface temperature dropped from 140°F to 130°F in 2010 Standard Specifications.
- **P200**
  - Should be no more than 1%. Actual statistics show average for WSDOT projects about 0.9% given the 1.5% P200 in the statistic acceptance specification.

Materials

- **Binder**
  - 5-02.1(1) Need to update "language." Do not use "prime coat and tack coat." Future Standard Specification will be modified to refer to single shots or double shot applications.
  - Recommended that WSDOT update Table 9-02.1(6) Cationic Emulsified Asphalt and includes (1) demulsibility (time), (2) coating test (eliminate), (3) solubility and use of trichloroethylene (eliminate trichlor), and (4) addition of elastic recovery in "Test on Residue from Distillation"
  - Add other types of seals including microsurfacing, slurry seal, cape seal, and hot applied chip seals.

Materials

- **Binder**
  - Dilution of CSS-1. Was this resolved? It appears so. Applies to 5-02.3(2)C "Pavement Sealing—Fog Seal" of 2010 SS.
  - Current table in 2010 SS

Pavement Sealing		
Grade	**Diluted/Undiluted**	**Application Rate (gal/SY)**
CSS-1 or CSS-1h	Diluted (1 part water, 1 part emulsion)	0.10-0.18
CSS-1 or CSS-1h	Undiluted	0.05-0.09

Materials

- Aggregate gradations: Class 2 Sand vs Choke Stone

Sieve Size	Class 2 Fine Aggregate for PCC	Choke Stone No.4 - 0
3/8	100	100
No. 4	95-100	76-100
No. 10	--	30-60
No. 16	45-80	--
No. 50	10-30	--
No 100	2-10	--
No. 200	0-2.5	0-10

Materials

- **Aggregate gradations**
  - Do we need all of the current gradations in the 2010 Standard Specifications?
  - ½ to No. 4 was modified from 2008 SS to 2010 SS **[more top size was added as requested]**
  - 3/8 to No. 4 was modified as requested **[eliminated #8 sieve]**
  - 3/8 to No. 10 was modified as well **[#4 sieve range reduced; 3/8 sieve 95-100 changed to 90-100]**
  - Choke Stone: Allow Class 2 concrete sand.

Construction Processes

- **Fog Seal**
  - ER, SCR, and OR fog their seal coats.
  - SS requires min of 3 days and not more than 14 days following application of a seal coat before application of the fog.
  - NCR does not fog their seal coats.
- **Pay by SY**
  - In general, contractors not in favor of aggregate payment by the SY as of 2009 meeting.
  - In general, WSDOT felt aggregate payment by SY is a good approach.
  - Idaho uses SY payment.

BST Aggregate paid by the SY

- **Comments**
  - Eastern Region Staff reported very favorable results
    Rock embedment and texture were uniform
    Little evidence of excess aggregate on shoulders
  - SY vs. cubic yard or ton measurement provided an incentive for the contractor to better control the aggregate placement and control waste
  - Unit price may have been slightly higher but there were other contributing factors
  - Liquid asphalt placed at a lower rate but aggregate embedment was good. Perhaps there was better coordination between the inspector and the contractor to get the proper coverage
  - 1 less FTE required
  - Future use of a mix design procedure may be necessary
  - Eastern Region recommends payment by sy as standard practice

Construction Processes

- **Prelevel**
  - Pavement policy is 70 tons/lane-mile.
  - NCR: 70 tons/lane-mile OK.
  - OR: 70 tons/lane-mile should be OK.
  - Presealing of prelevel: Most WSDOT responses stated that their regions preseal prelevel.
- **Choke stone**
  - NCR chokes ½ - No. 4. Does not choke 3/8 – No. 4.
  - ER same as NCR. Will choke 3/8 – No. 4 at light duty intersections and grades and then fog.
  - OR chokes and fogs ½ - No. 4.
  - SCR chokes and sometimes fogs ½ - No. 4.

Other Topics Covered (items from 2006 and 2007 meetings)

- **Factors that contribute to success or failure of seal coats**
  - Aggregate cleanliness.
  - Construction operations with specific emphasis on binder and aggregate application rates.
- **Season dates and temperatures**
  - Recommendations were to expand the start and end dates and improve temperatures in SS.

Other Topics Covered (items from 2006 and 2007 meetings)

- **Maximum ADT**
  - No real maximum for seal coats. The larger issue is traffic control.
- **Maximum Grade**
  - Seal coats possible on 12 to 15% grades. Again, key is traffic control. If paving on steep grades, do on very low volume routes.
- **High Float Emulsion vs CRS-2P**
  - Input suggested that it is best to stay with CRS-2P.
- **Aggregate embedment**
  - ≥ 50% but not more than 70%.
  - Less than 50% unlikely to hold aggregate particularly with embedment levels of say 25 to 33%.
- **Training**
  - All about good, well-trained inspectors.
  - ER uses same inspectors for seal coat projects. Better results. Contractors supported ER direction.

Other Topics Covered
(items from 2006 and 2007 meetings)

- **Reduction of rock loss**
- **HMA at intersections**
- **Optimal timing for a BST (converting a new HMA to a BST to maximize long life)**
- **Regional views on seal coat performance**
- **Determination of binder and aggregate application rates**
- **Best methods to fix a flushing BST?**

Item or Data	North Central Region	Eastern Region	South Central Region	SW Region	NW Region	Olympic Region
Preferred BST gradations	3/8" – #4	3/8" – #4	3/8" – #4			½ - #4
Fog or choke practices	Fog on 3/8" - #4 starting in 2010 Choke ½" - #4	- Fog unless it is rich - Choke medium volume county I/S & high snow plow area	Fog on 3/8" - #4 starting in 2006 No choke			Choke #4 -0 Fog yes
Intersection paving—decisions for use of HMA	HMA @ high volume and truck routes	HMA @ high volume county I/S and SR I/S	HMA @ intersections with significant turning movements			HMA in cities with high turning movements anticipated
Prelevel (How much?)	~35 to 40 tons/lane-mi	Pave 0.10'	As needed for greater than 0.5" ruts.			Less than 50 tons /lane-mi typical
Fogging of prelevel? When?	Yes, open surface texture	Min. rut 3/8" as funding allows	--			Always fog new prelevel and digouts
No. of lane-miles per year of BSTs	180 to 250	130 to 160	120 to 230			145 for 2011-13 biennium
Max BST ADT level(s)	7,000 2-way 5,000 – 6,000 directional	-BST routes generally less than 2,000. -HMA conversions up to 7,000	One section @ 6,200. Most under 4,000			Less than 5,000 ADT
Packaged vs individual contracts	Package	Package	Package			Both
When to place BST over HMA?	~ 2 years before due year – Present practice in NCR	As soon as funding allows	When HMA shows early signs of distress. 8 years is typical.			Based on field review of condition thus no regular cycle.
Typical BST cycle time (time between BSTs)	7 years or sooner if needed	In transition. Past practices were 6 yr cycle. Looking to extend some up to 8.	Average 10 year cycle.			Varies but typically at least 6 years
Binder types used for BSTs	CRS-2P	CRS-2P	CRS-2P			CRS-2P & RSLTP
Traffic control practices	Mobile variable speed zones and pilot car	Pilot car	Pilot cars (2 cars on high volume roads).			Varies
Use of double seals to control bleeding	None to date	Yes	No			None

2008 Double Seal

Condition prior to application

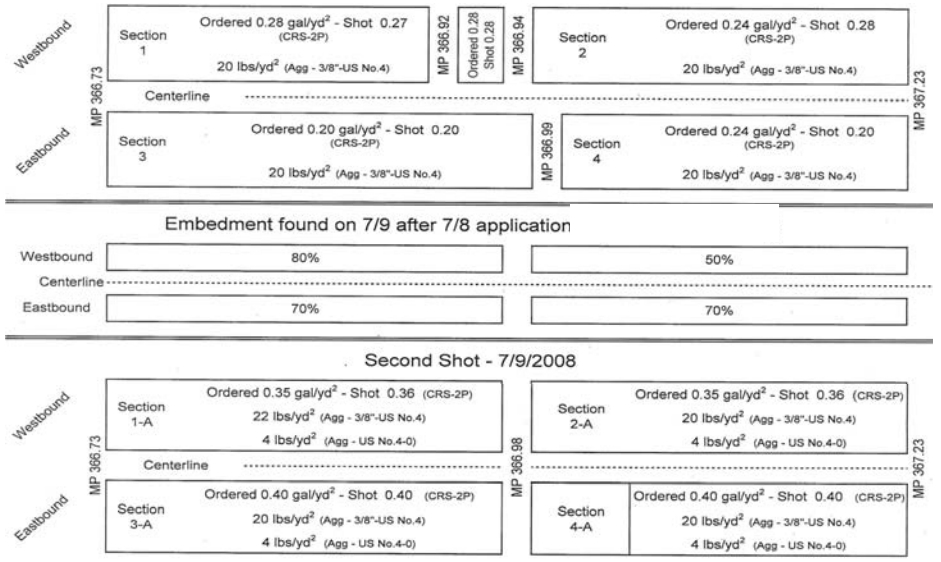
Background

- SR 20, MP 363.61 to MP 373.01 (15 miles E. of Colville)
- Rural-Minor Arterial
  - 21-22% Trucks
- 1999 paving project
  - HMA Class 3/4 Inch with PG58-34 (0.20')
- Flushing occurred prompting a forensic investigation
  - Lack of gradation control (poor volumetrics)
  - Increased asphalt to meet volumetrics
  - Binder testing revealed hardening process was not occurring

2008 Double Seal

- SR 20, MP 366.73 to MP 367.23 (0.5 mile)
- Wanted to know if a double seal would work on a roadway exhibiting ~85% flushing
- First application
  - Varied shot rates (0.20 – 0.28 gal/yd^2)
  - Aggregate was 3/8”-US No. 4 (20 lbs/yd^2)
- Second application
  - Shot rates of 0.35 gal/yd^2 and 0.40 gal/yd^2
  - Aggregate rate 20 lbs/yd^2 with US No. 4-0 (4 lbs/yd^2)

2008 Double Seal



2008 Double Seal

Condition 8 days after application

2008 Double Seal

Condition 1 year after application

2010 Roadway Condition

2010 Roadway Condition

2010 Roadway Condition

2010 Double Seal

- Based on findings adjustments were made for each roadway segment (category)
- The higher the flushing, the lower the emulsion rate
- Aggregate rates remained fairly constant
- Embedment rates were targeted at ~50%
  - Expecting traffic to increase embedment with time

2010 Double Seal

Roadway rated into four categories

- 1 = no flushing
- 2 = minimal flushing in wheel path

2010 Double Seal

Roadway rated into four categories

- 3 = ~60% - 75% flushing of roadway
- 4 = greater than 85% flushing of roadway

2010 Double Seal

Example of rates for **first** application

Beginning	End	Total Distance	Rating	Emulsion gal/yd²	Emulsion Ordered gal/yd²	Emulsion Applied gal/yd²	Aggregate lbs/yd²	Aggregate Applied lbs/yd²
363.610	364.195	0.585	1	0.45	Skip	Skip	25	Skip
370.202	371.305	1.103	2	Varies	0.23-0.17	0.22	20-25	20
364.195	365.204	1.009	3	(+/-) 0.20	0.18	0.18	20	21
365.204	366.734	1.530	4	0.18	0.15	0.17	20	21

Target rates for **second** application - Standard Spec. 5-02.3(3)

Beginning	End	Total Distance	Rating	5-02.3(3) Emulsion gal/yd²	Emulsion Yield gal/yd²	5-02.3(3) Aggregate lbs/yd²	Aggregate Applied lbs/yd²
363.610	364.195	0.585	1	0.35-0.55	0.34	20-30	---
370.202	371.305	1.103	2	0.35-0.55	0.37	20-30	---
364.195	365.204	1.009	3	0.35-0.55	0.34	20-30	---
365.204	366.734	1.530	4	0.35-0.55	0.36	20-30	---

2010 Double Seal

Embedment rates after first application (* freshly placed with minimal traffic)

Beginning	End	Total Distance	Rating	Embedment (Est. %)
363.610	364.195	0.585	1	Skip
364.195	365.204	1.009	3	45*
365.204	366.734	1.530	4	35 *
366.734	367.233	0.499	2	50
367.233	367.849	0.616	4	30
367.849	367.931	0.082	1	50
367.931	370.202	2.271	4	50
370.202	371.305	1.103	2	50
371.305	372.063	0.758	1	Skip
372.063	372.300	0.237	2	50
372.300	372.840	0.540	1	Skip

2010 Double Seal

First Seal – Day of placement

2010 Double Seal

First Seal – Day of placement

2010 Double Seal

First Seal – Day after placement

2010 Double Seal

Second Seal – Day of placement (moist choke stone)

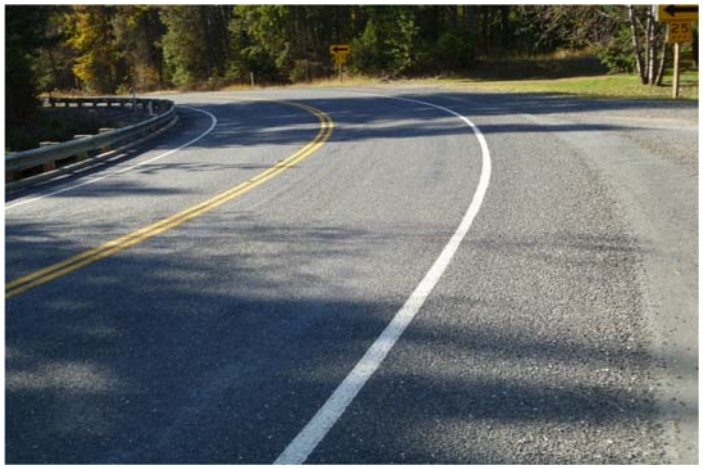
2010 Double Seal

- First application
  - More time consuming because of the amount of segments with various degrees of flushing
  - Embedment was consistent (mostly 50%)
- Second application
  - Same as normal BST application
  - Issues with choke stone aggregate
    - Moisture present from evening showers
    - Numerous passes needed for proper coverage
- Final condition
  - Roadway performing well with a couple locations exhibiting flushing
    - Located within high flushing area (category 4)

2010 Double Seal

Final roadway

2010 Double Seal



Final roadway

Questions

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