Effectiveness and Timing of Preventive Maintenance

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WHAT IS OLD?



Evaluate effectiveness & optimum time for single application of slurry seal

Evaluate effectiveness & optimum time for sequential application of slurry seal



WHAT IS NEW?

- Evaluate the long-term performance of Cape Seals:
 - Slurry Seal
 - Micro-surfacing

Phase I: Slurry Seal *Performance Life* & Extension in Pavement Service Life





Phase I: SS Performance Life & Extension in Pavement Service Life



- In general, performance life ranged between 2 & 4 years.
 - Except when slurry seal was applied at year 0 and 1, performance life ranged from 0 to 1 year.
- Except few cases, the <u>pavement service life</u> was not <u>extended by application of the single slurry seal</u>.



Phase I: Slurry Seal Effectiveness



Relative Benefit = $100 \times B / B_0$ Benefit Cost Ratio = B / C

Phase I: Effectiveness Analysis -**New Construction**





7

Phase I: Effectiveness Analysis – **Overlay**







Phase I: Conclusion

- Application of SS *immediately* or *one year after* construction of asphalt layer is not effective in terms of:
 the benefit to the users and
 - the benefit-cost ratio for the agency.

Optimum time for application of a <u>Single Slurry Seal</u>:

- Newly constructed pavements: 3 years after construction.
- Pavements subjected to overlays: 3-5 years after construction.

Phase II: *Newly Constructed* Pavements: 1st SS at year 3, 2nd SS at year 7













- Application of first SS <u>immediately or one year</u> <u>after</u> construction is <u>not effective</u> in terms of both the benefit to users and benefit cost ratio for the agency.
- Regardless of construction activity, <u>optimum time</u> for a <u>sequential slurry seal</u> is when
 first SS is applied in year 3
 &
 second SS is applied in year 7 (i.e. 4 years after the application of the first SS)





- For both new and overlay constructions, it is recommended that the agency applies
 - First slurry seal 3 years after the construction of the asphalt layer and the second slurry seal 7 years after the construction.



CAPE SEALS: Slurry or Micro





WHY CAPE SEALS

Snow-Plow Damage

Chip Loss



Longer Life



Chip Seal





Chip Seal





Cape Seal: Slurry Seal





Cape Seal: Microsurfacing





Evaluated Sections

Age (Service Life)													
	4	5	6	7	8	9	10	П	12	13	14	15	TOTAL
Number of Roadways	2	9	3	8	3	0	0	0	0	4	0	0	29
Number of Sections	3	15	5	21	6					5			55
Location/Environment													
Incline Village		П	3	4						3			21
Reno/Sparks	3	4	2	13	6								28
Gerlach				4						2			6
Traffic													
A - Arterial	2	2	2	П	3								20
B - Collector	Т	П	Т										13
C - Residential		2	2	6						3			13
D – Industrial					3					2			5
E – Rural Hwy				4									4
Surface Type													
Micro-Surfacing	3	13	3	10	4					0			33
Slurry Seal	0	2	2	П	2					5			22



Performance Data





Emulsions Grades

Year	Emulsion Grade						
	Chip Seal	Slurry Seal	Micro-surfacing				
2000	PASS/LMCRS	LMCQS	N/A				
2001	PASS	LMCQS	N/A				
2002	PASS	LMCQS	N/A				
2006	LMCRS	N/A	LMCQS				
2007	LMCRS	N/A	RTE				
2008	LMCRS	N/A	RTE				
2009	LMCRS	N/A	RTE				
2010	LMCRS	N/A	MSE				

LMCRS: Latex-Modified Cationic Rapid Set LMCQS: Latex-Modified Cationic Quick Set PASS - "Proprietary" Polymer-Modified Emulsion MSE – Micro-surfacing Surfacing Emulsion RTE - Rapid Traffic Emulsion - Polymer-Modified



Quality Control

Year	Slurr	y Seal	Micro-Surfacing				
	Aggregate	Emulsion	Aggregate	Emulsion			
2000	Pass	Pass	No Results	No Results			
2001	No Results	No Results	No Results	No Results			
2002	Pass	Pass	No Results	No Results			
2006	No Results	No Results	No Results	Failing Residue Failing Softening Pt. Failing Torsional Recovery			
2007	No Results	No Results	No Results	Failing Penetration Failing Softening Pt. Failing Torsional Recovery			
2008	No Results	No Results	Failing L.A. Abrasion	Failing Torsional Recovery			



Impact of Construction Practice: Micro



Age, years



Impact of Traffic Level: Micro





Impact of Traffic Level: Slurry







Impact of Pre-PCI: Micro



Age, years

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PCI



Impact of Pre-PCI: Slurry





Benefit Cost Ratio

Location	Cape Seal	Effective Performance Life (yrs)	Unit Cost (\$/yd²)	Benefit Cost Ratio (yr/\$)
Truckee Meadows	Micro- surfacing	7.0	4.46	I.57
	Slurry Seal	3.5	3.50	1.00
Incline Village	Micro- surfacing	5.0	4.46	1.12
	Slurry Seal	3.0	3.50	0.86

Micro-Cape Seal: 9yrs/Pre-PCI:34





Micro-Cape Seal: 6yrs/Pre-PCI: 56





Micro-Cape Seal: 1yr





FINGINGS



- The effective performance life of micro-surfacing cape seals is 7 years in the Truckee Meadows and 5 years in Incline Village
- The effective performance life of slurry seal cape seals is
 3.5 years in the Truckee Meadows and 3 years in Incline
 Village
- The LCCA indicates that the micro-surfacing cape seal is more cost effective than the slurry seal cape seal at both locations of Truckee Meadows and Incline Village.



RECOMMENDATIONS

- Continue to use the micro-surfacing cape seal as a preventive maintenance treatment
- Conduct full mix designs and implement an effective QA testing program for the cape seal projects
- Implement an effective crack sealing program prior to the application of the cape seal treatment
- Investigate the various individual distresses on the existing pavement



THANK YOU FOR YOUR ATTENDANCE



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