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MOTIVATION

- ✓ Thin asphalt overlays offer an economical resurfacing, preservation, and renewal paving solution for roads that require safety and smoothness improvements.
- ✓ Recently, thin asphalt overlays have been used in Nebraska as a promising pavement preservation technique that needs evaluations.

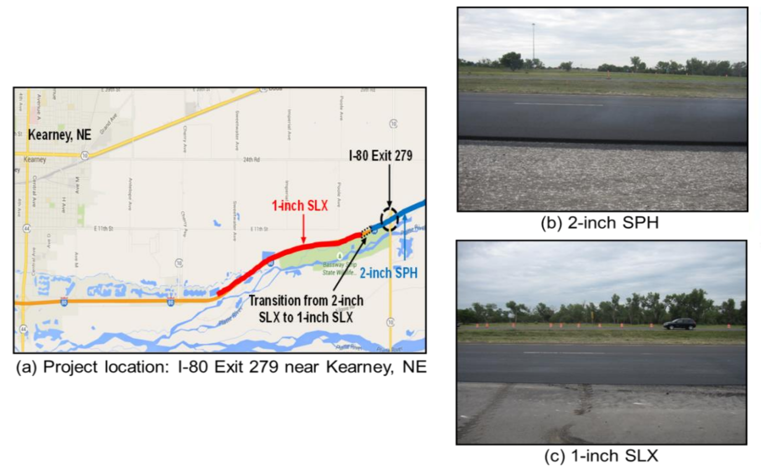
OBJECTIVE

- ✓ To evaluate the thin asphalt overlay practice recently implemented in Nebraska:

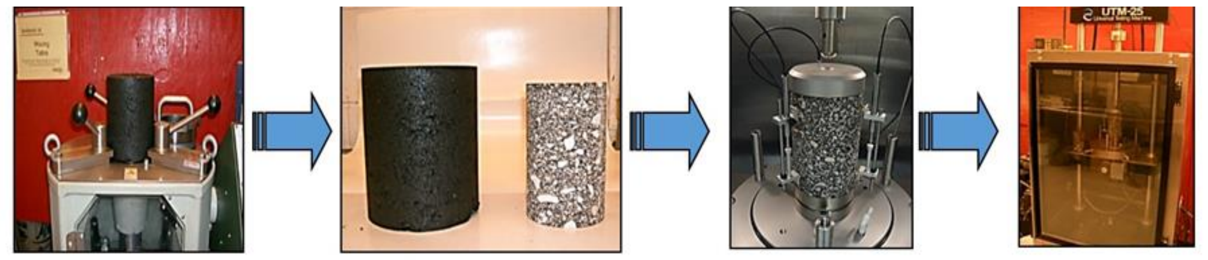
SPH (2-inch conventional practice) vs. SLX (1-inch thin-lift) practice)

RESEARCH METHOD

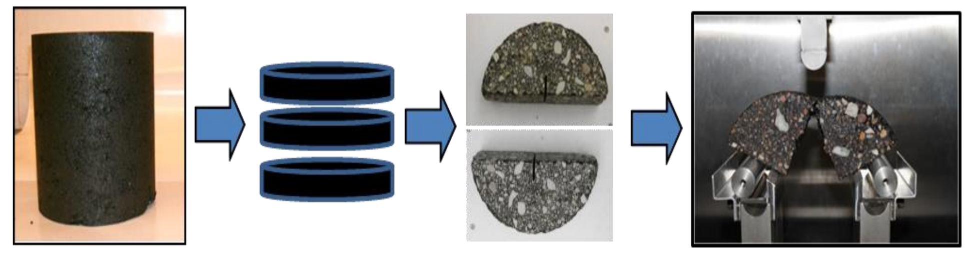
- ✓ **Step 1**: Collecting Mixes from Field Project
- ✓ **Step 2**: Performing Laboratory Tests



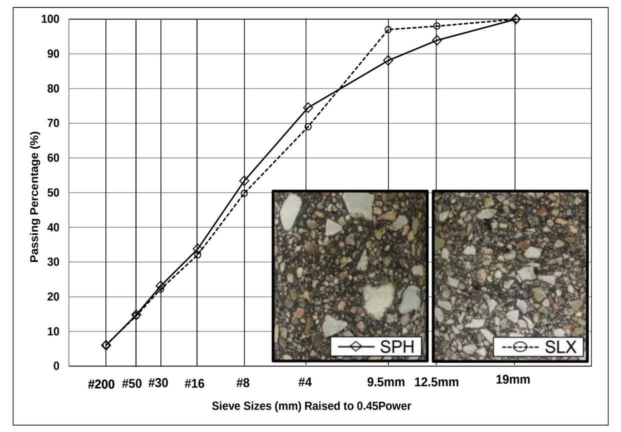
Project location and after overlay



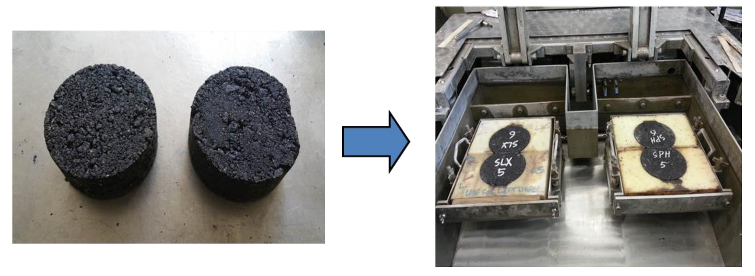
(a) Dynamic modulus test, dynamic creep test, and static, multiple stress creep-recovery test



(b) Semicircular bending (SCB) fracture test

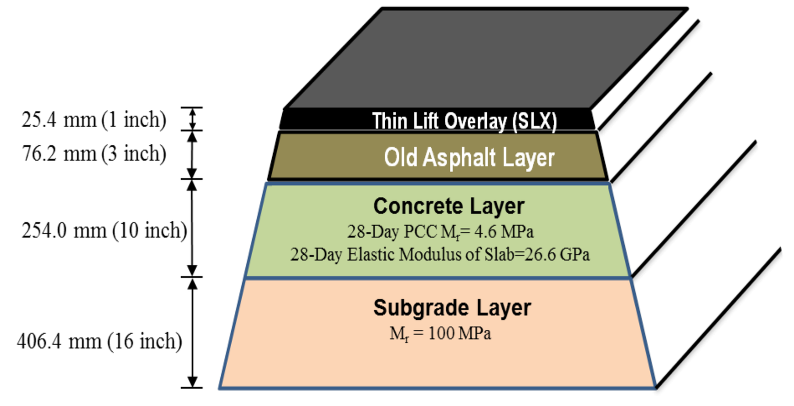


Gradation of mixes

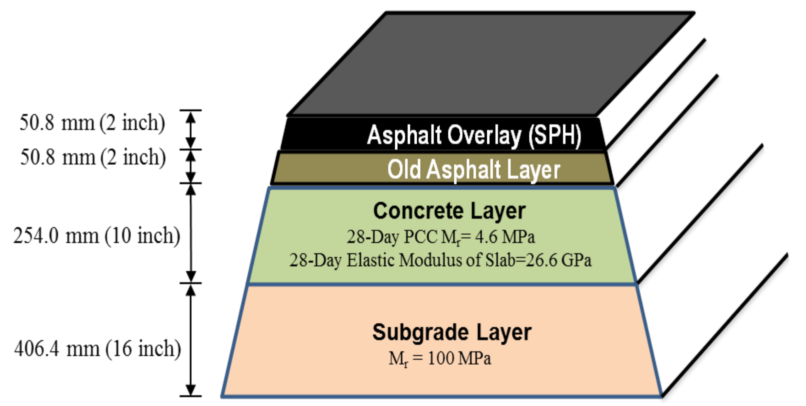


(c) Hamburg wheel tracking test

- ✓ **Step 3**: Conducting MEPDG and LCCA Analyses



(a) SLX pavement structure



(b) SPH pavement structure

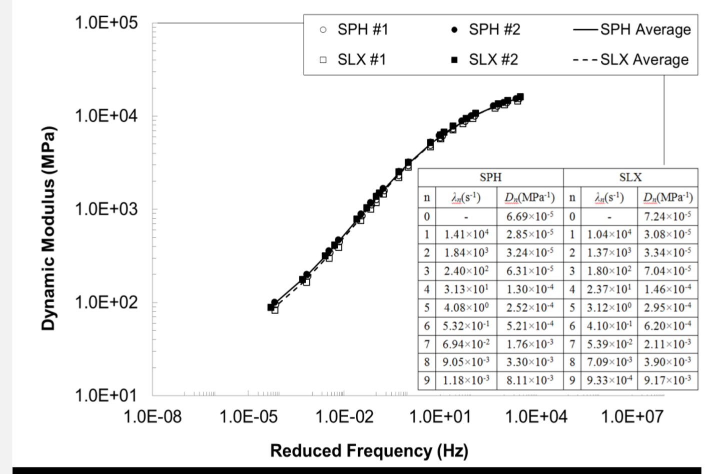
Activity	No. of activities	Construction Cost ($/1-mile length)	Maintenance Frequency (years)	Maintenance cost ($/1-mile length)	Work duration (days)
Alternative 1: SPH overlay at high volume traffic (10 year service life)					
2" Mill & 2" SPH Overlay	3[a]	190,000*	5*	15,000*	0.3*
Alternative 2: SLX overlay at high volume traffic (6-year service life)					
1" Mill & 1" SLX Overlay	5[a]	95,000*	5*	15,000*	0.15*
Alternative 3: SPH overlay at low volume traffic (15-year service life)					
2" Mill & 2" SPH Overlay	2[a]	190,000*	7.5*	15,000*	0.3*
Alternative 4: SLX overlay at Low volume traffic (10-year service life)					
1" Mill & 1" SLX Overlay	3[a]	95,000*	5*	15,000*	0.15*

Traffic inputs

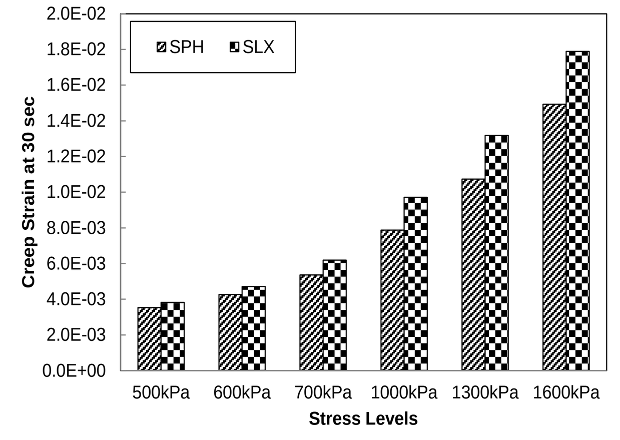
Parameters	High volume traffic	Low volume traffic
AADT Construction Year (total for both directions)	18,098*	2,884*
Total Trucks as Percentage of AADT (%)	39*	14*
Annual Growth Rate of Traffic (%)	2.0*	2.0*
Speed Limit Under Normal Operating Conditions (mph)	75*	60*
Work Zone Speed Limit (mph)	55*	45*
Discount Rate (%)	2.0[a]	
Value of Time for Passenger Cars ($/hour)	13.96[d]	
Value of Time for Single Unit Trucks ($/hour)	22.34[d]	
Value of Time for Combination Trucks ($/hour)	26.89[d]	

(c) LCCA Inputs ([a]Typical, [d]Default inputs, and *Inputs provided by NDOR)

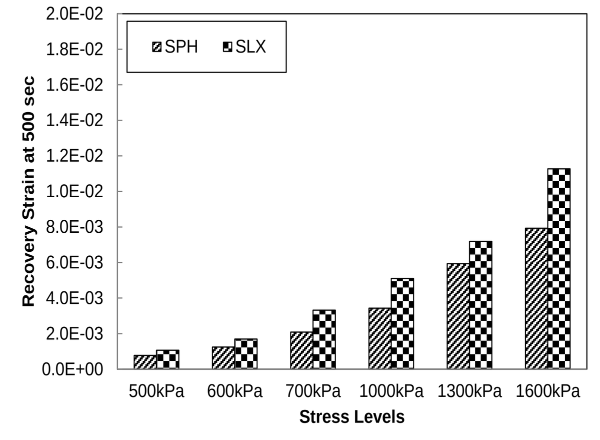
LABORATORY TEST RESULTS



(a) Dynamic Modulus

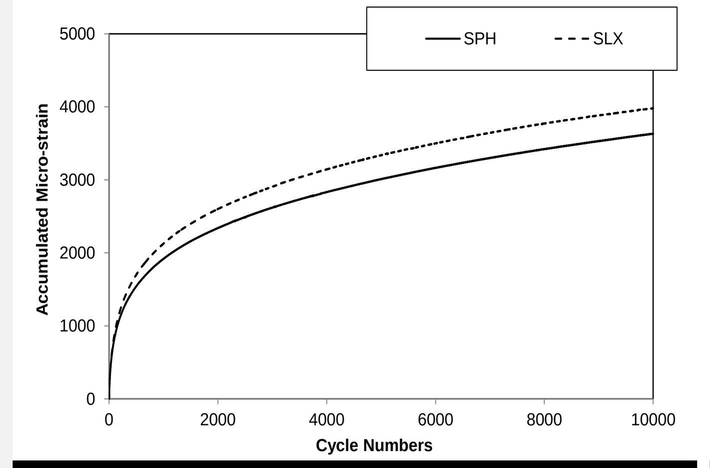


(i) creep strain at 30 sec

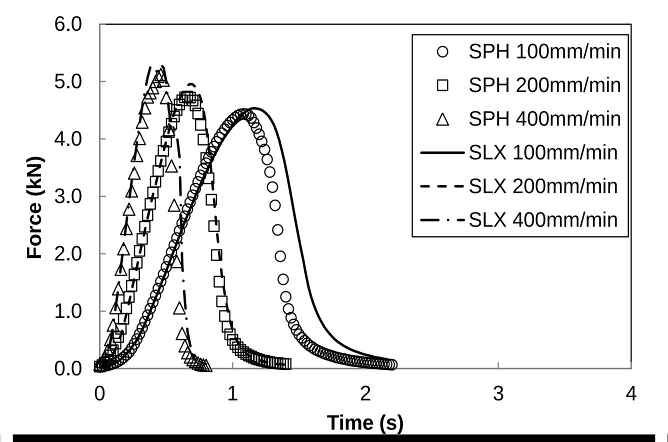


(ii) recovery strain at 500 sec

(b) Multiple Stress Creep-Recovery



(c) Dynamic Creep



(d) SCB Fracture

Number of Passes	Rut Depth (mm) SPH	Rut Depth (mm) SLX	Number of Passes
1st. Round Test			
5,000	-2.27	-3.48	5,000
10,000	-2.69	-5.25	10,000
15,000	-3.41	-11.55	15,000
20,000 (Pass)	-4.38	-12.59	**15,400 (Fail)**
2nd. Round Test			
5,000	-2.54	-3.47	5,000
10,000	-3.18	-5.66	10,000
15,000	-4.00	-11.38	15,000
20,000 (Pass)	-4.80	-12.05	**15,300 (Fail)**

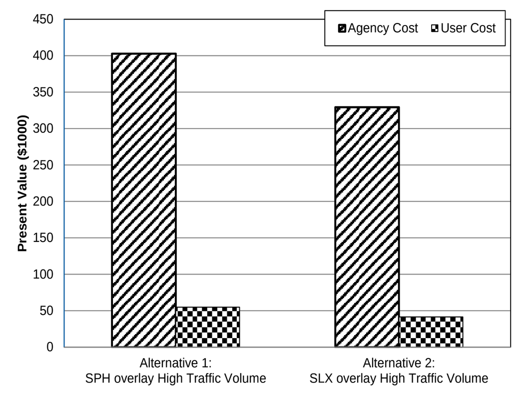
(e) Hamburg Wheel Tracking

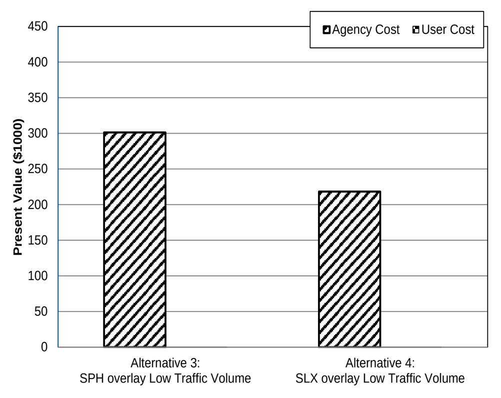
MEPDG & LCCA RESULTS

(a) MEPDG Results

Performance Criteria	SLX structure: Distress Predicted	SLX structure: Reliability Predicted	SPH Structure: Distress Predicted	SPH Structure: Reliability Predicted
Long. Cracking (ft/mile)	7	92.03 (Pass)	0	99.99 (Pass)
Bottom Up Cracking (%)	0	99.99 (Pass)	0	99.99 (Pass)
Rutting (AC Only) (in):	**0.27**	**40.01 (Fail)**	0.11	99.99 (Pass)

(b) LCCA Results





Total Cost	Alternative 1: SPH overlay high traffic volume		Alternative 2: SLX overlay high traffic volume		Alternative 3: SPH overlay low traffic volume		Alternative 4: SLX overlay low traffic volume	
	Agency Cost ($1000)	User Cost ($1000)	Agency Cost ($1000)	User Cost ($1000)	Agency Cost ($1000)	User Cost ($1000)	Agency Cost ($1000)	User Cost ($1000)
Undiscounted Sum	*$425.00*	*$56.60*	*$360.00*	*$43.10*	*$315.00*	*$0.13*	*$235.00*	*$0.09*
Present Value	**$402.71**	**$54.79**	**$329.27**	**$41.47**	**$301.23**	**$0.12**	**$218.29**	**$0.08**
EUAC	*$17.98*	*$2.45*	*$14.70*	*$1.85*	*$13.45*	*$0.01*	*$9.75*	*$0.00*

CONCLUSION

- ✓ Test results indicated that the two mixtures are similar in stiffness characteristics and cracking resistance.
- ✓ It was shown that the SLX mixture was more susceptible to moisture-induced damage than the SPH mixture.
- ✓ Based on the laboratory test results, MEPDG predictions, and LCCA results, the thin-lift overlay pavements that replace 1-inch thick old asphalt with a new SLX mix are expected to perform satisfactorily.
- ✓ The thin-lift overlay practice is expected to provide several benefits, including quickly opening highways to the public due to faster paving and a safer driving surface.