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Evaluation of Thin Asphalt Overlay Pavement Preservation in Nebraska: Laboratory Tests, MEPDG, and LCCA (17-2624)



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MOTIVATION

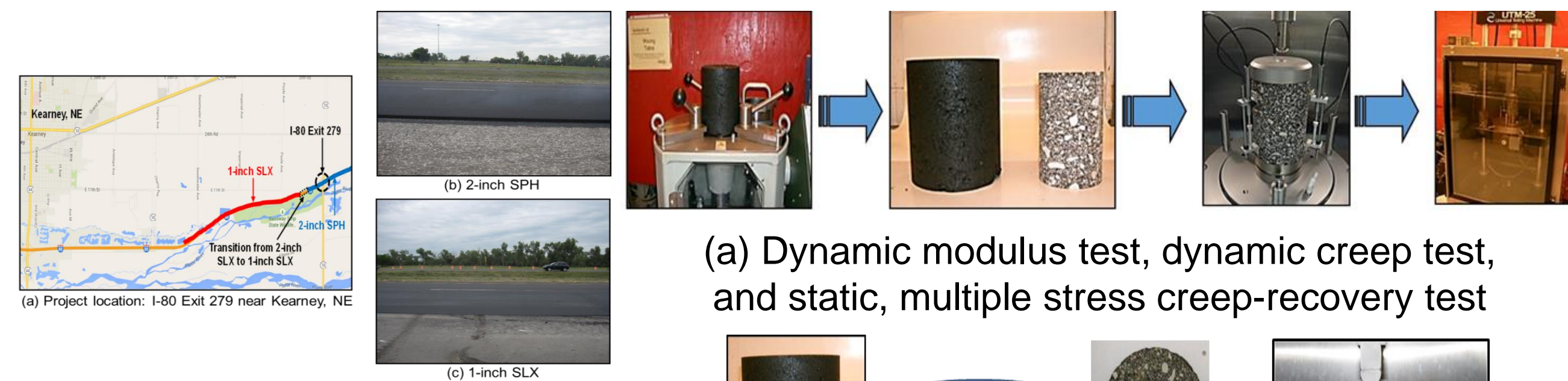
- Thin asphalt overlays offer an economical resurfacing, preservation, and renewal paving solution for roads that require safety and smoothness improvements.
- Recently, thin asphalt overlays have been used in Nebraska as a promising pavement preservation technique that needs evaluations.

OBJECTIVE

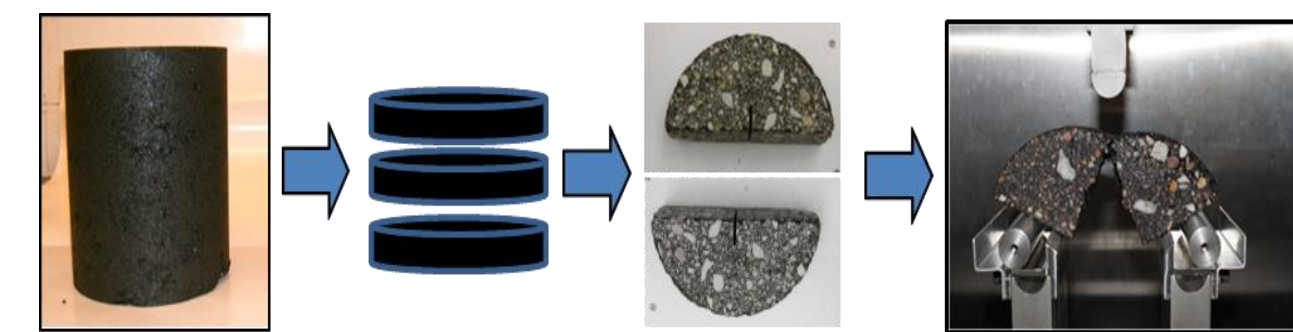
- To evaluate the thin asphalt overlay practice recently implemented in Nebraska: SPH (2-inch conventional practice) vs. SLX (1-inch thin-lift) practice)

RESEARCH METHOD

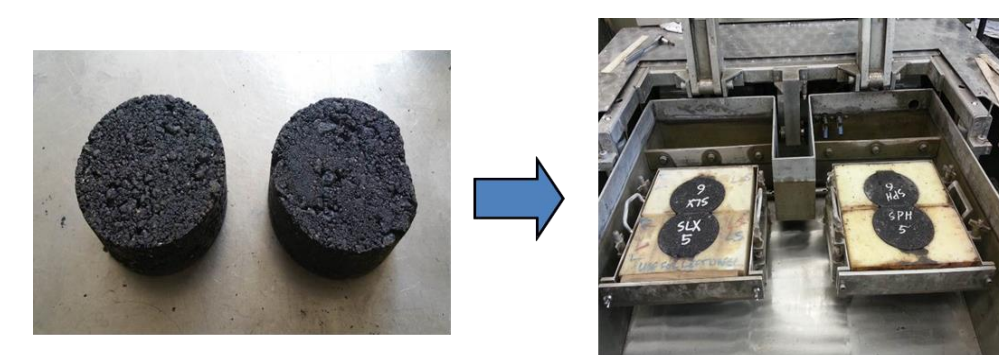
- Step 1:** Collecting Mixes from Field Project
- Step 2:** Performing Laboratory Tests



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

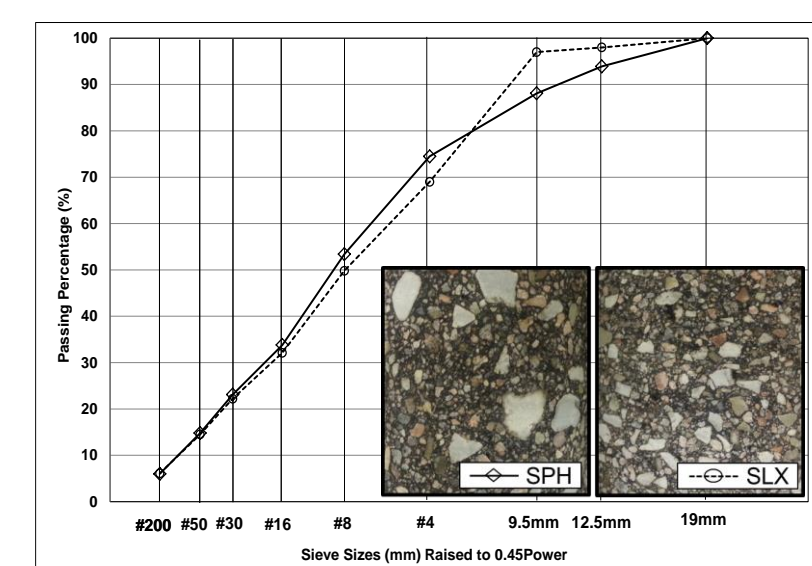


(b) Semicircular bending (SCB) fracture test



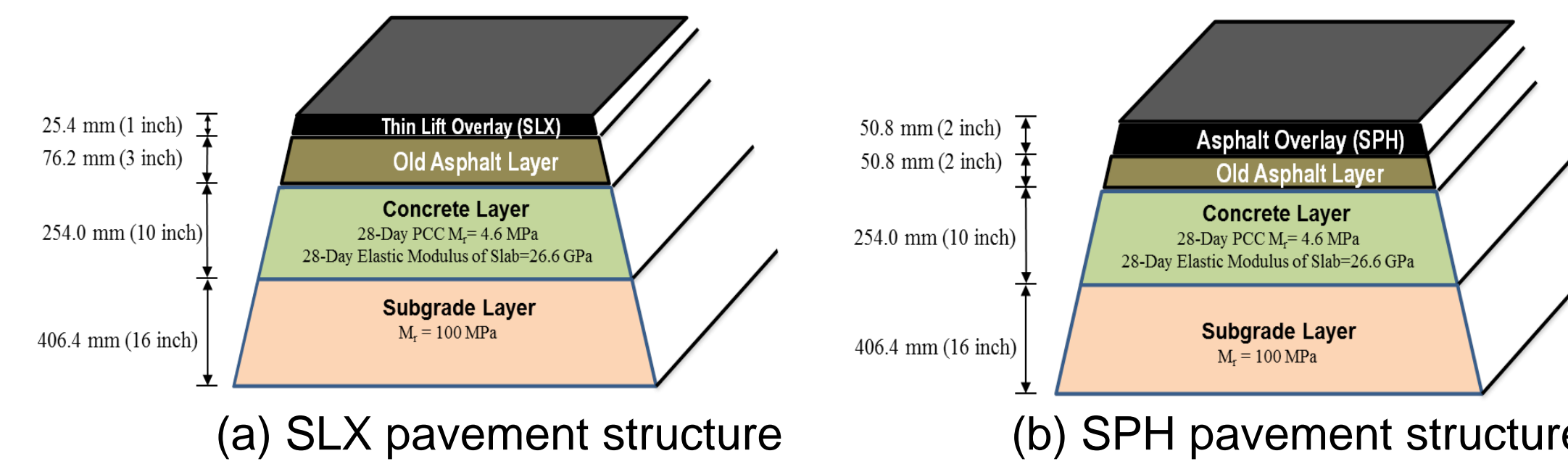
(c) Hamburg wheel tracking test

Project location and after overlay



Gradation of mixes

Step 3: Conducting MEPDG and LCCA Analyses



Alternative 1: SPH overlay at high volume traffic (10 year service life)					
Activity	No. of activities	Construction Cost (\$/1-mile length)	Maintenance Frequency (years)	Maintenance cost (\$/1-mile length)	Work duration (days)
2" Mill & 2" SPH Overlay	3*	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*	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*	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*	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*	
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	

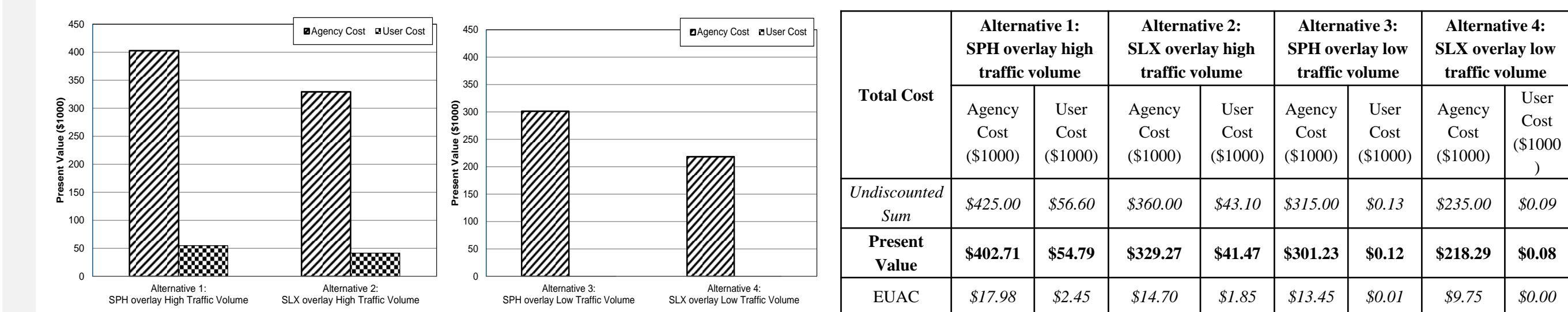
(c) LCCA Inputs (a)Typical, (d)Default inputs, and *Inputs provided by NDOR)

MEPDG & LCCA RESULTS

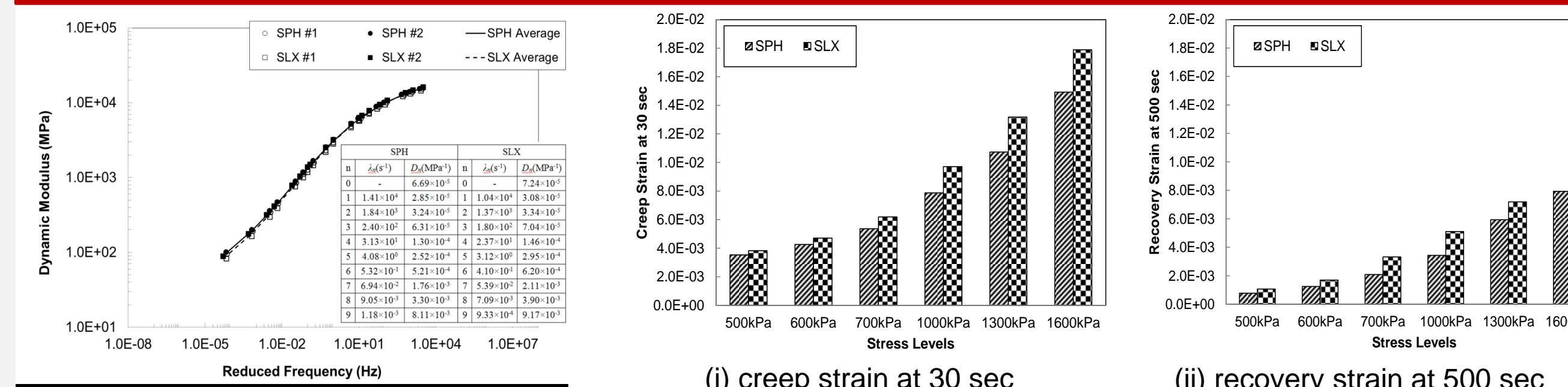
(a) MEPDG Results

Performance Criteria	SLX structure		SPH Structure	
	Distress Predicted	Reliability Predicted	Distress Predicted	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

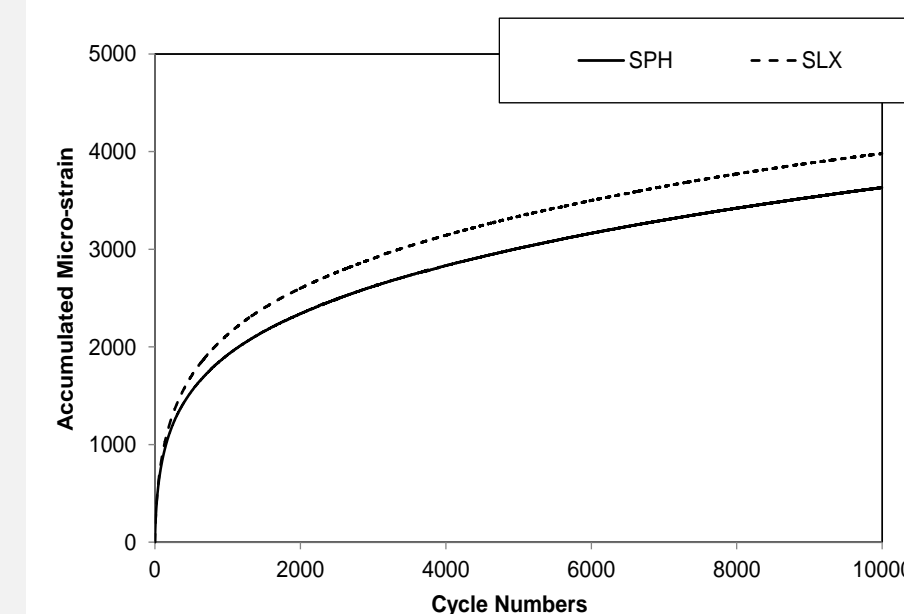


LABORATORY TEST RESULTS

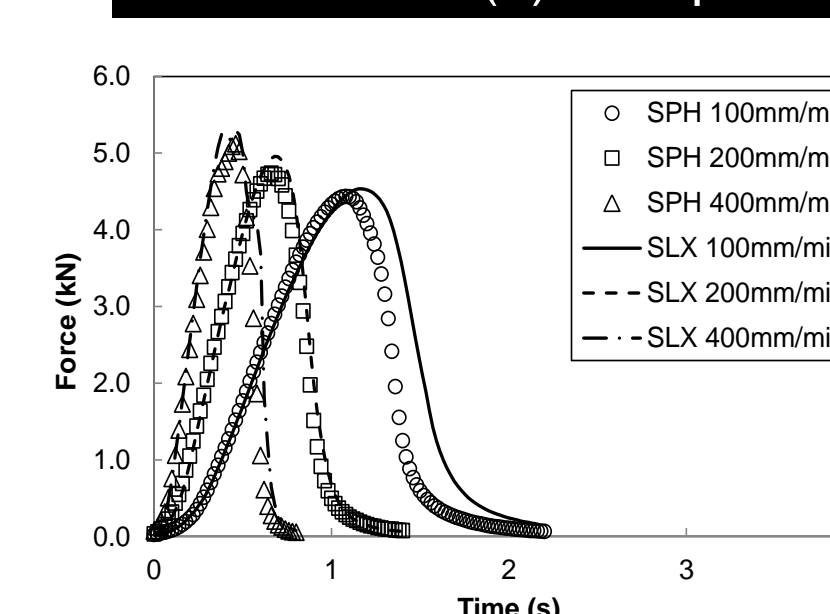


(i) creep strain at 30 sec (ii) recovery strain at 500 sec

(a) Dynamic Modulus



(c) Dynamic Creep



(d) SCB Fracture

Number of Passes	1 st . Round Test		Number of Passes
	SPH	SLX	
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)
2 nd . 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

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.

