Observations and Suggestions Related to Overlay Tester

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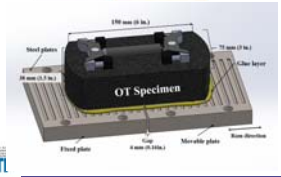
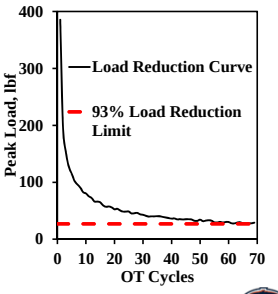
Presentation Outline

1. Performance of the current OT test procedure
2. Suggested improvements
3. Surrogate approach/parameters for OT test

OT Test Procedure



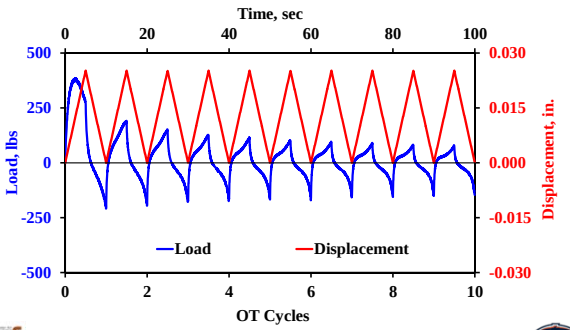


Multi-Laboratory Study

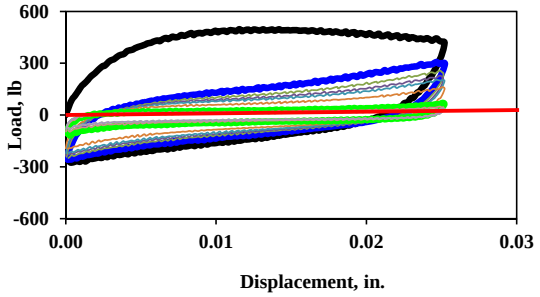
Where	Parameter	Cycle to Failure	Max Load (lbs)	Cut Density, (%)	Sample Size
UTEP	Average	58	838	93.0	32
	Std Dev	49	63	0.4	
	COV, %	83	7	0.5	
TxDOT	Average	57	908	92.8	32
	Std Dev	41	65	0.5	
	COV, %	73	7	0.5	

All specimens were prepared by same person

OT Raw Data

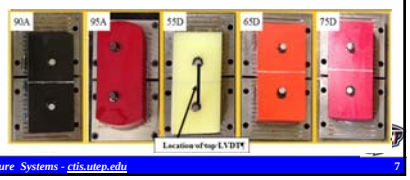


Data Analysis

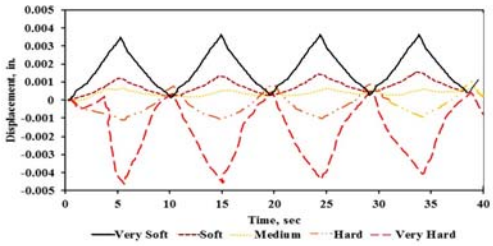


Evaluation of OT Test Procedure

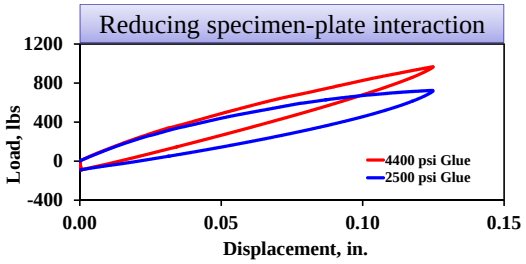
Material	Polyurethane				
Name	Very Soft	Soft	Medium	Hard	Very Hard
Color	Black	Red	Natural	Orange	Red
Durometer	90A	95A	55D	65D	75D
Tensile Strength, psi	4500	5500	5500	6500	7500
Modulus of Elasticity, psi	50	90	110	125	-
Elongation, %	450	320	310	300	225



Effect of Specimen Stiffness



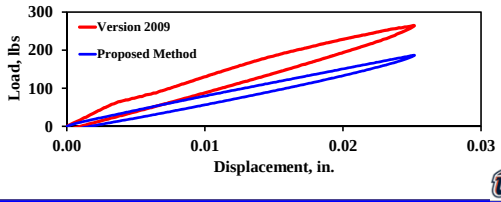
Glue Type



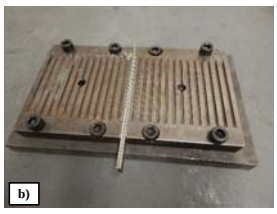
A glue with greater strength is recommended to achieve a strong bond between the specimens and the OT plates

Different Sample Preparation

- **Version 2009** - Adhesive tape placed between OT plates and hardened glue removed with a hacksaw.
- **Version 2014** - Spacer bars were used to remove excess glue
- **Proposed Method** - Spacer bars were used to remove the glue between the OT plates. A tape covered with a thin layer of petroleum jelly to provide a uniform glued area near the gap between the OT plates.



Proposed Sample Preparation



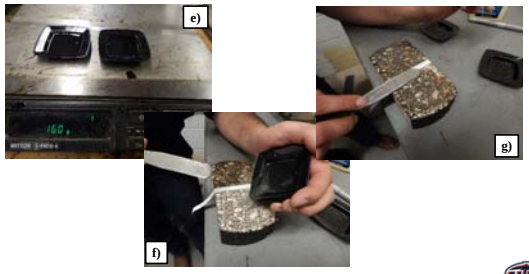
a) Materials required for mounting OT specimens
b) Alignment of OT plates and positioning of the space bar

Proposed Sample Preparation

c) Tape mounting
d) Application of Petroleum Jelly

Proposed Sample Preparation

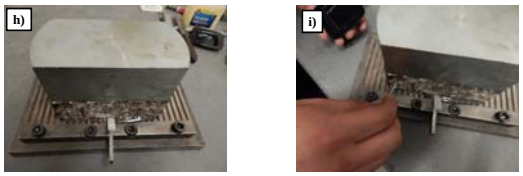
Application of glue



Proposed Sample Preparation

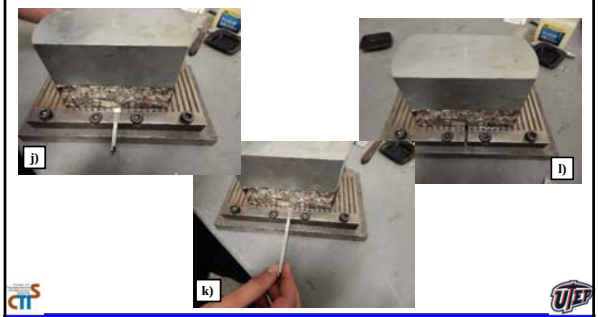
h) Placing weight on top of specimen

i) Cleaning accumulated glue on sides of specimen

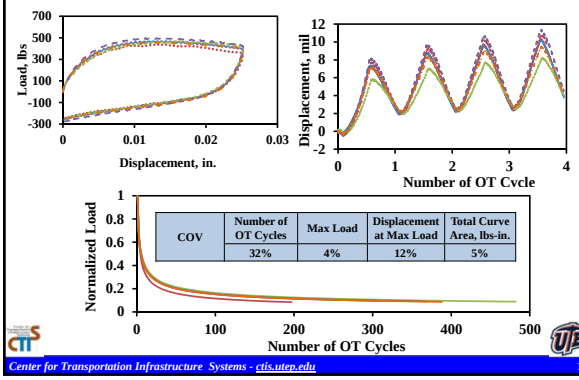


Proposed Gluing Method

Removal of the tape and space bars

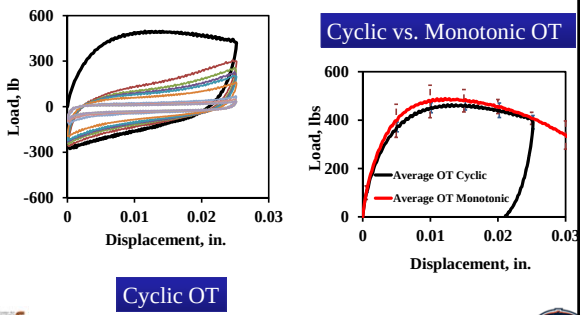


Performance with Proposed Sample Preparation



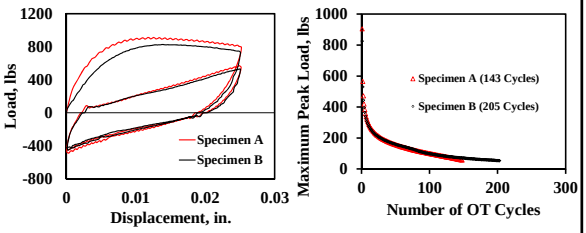
COV	Number of OT Cycles	Max Load	Displacement at Max Load	Total Curve Area, lbs-in.
	32%	4%	12%	5%

Loading Regime *(cyclic vs. monotonic)*



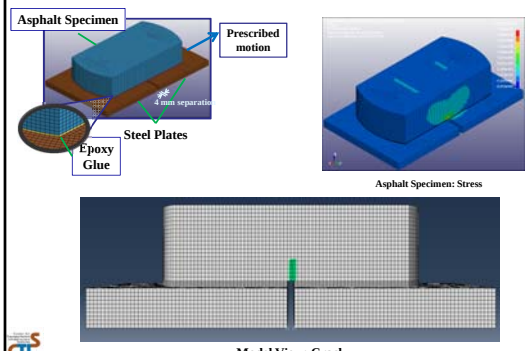
Cyclic OT

Performance of Current OT Test



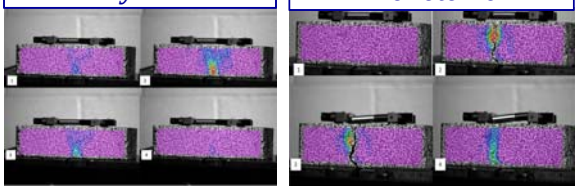
Although the hysteresis loops and load reduction curves presented similar paths, the number of cycles to failure reported by the OT were different

Finite Element Model



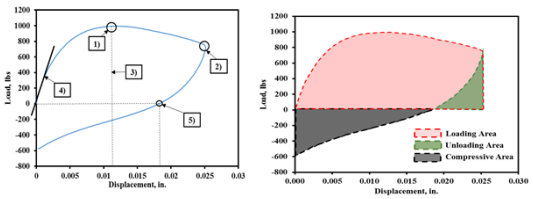
Digital Image Correlation Analysis

Cyclic	Monotonic



Work is under way to compare and calibrate the FEA model using DIC results

Alternative Parameters Measured with OT



1) Maximum Load
2) Load at Maximum Displacement
3) Displacement at Maximum Load
4) Initial Slope
5) Displacement at Zero Load

Performance of Alternative Parameters

Parameters	Average	Median	COV
Maximum Load, lbs	849	854	6%
Displacement at Max. Load, in.	0.013	0.013	12%
Load at Max. Displacement, lbs	683	703	9%
Initial Slope, lbs/in.	192339	174739	29%
Displacement at Zero Load, in.	0.019	0.019	2%
Total Area, lbs-in.	21.0	21.0	5%
Loading Area, lbs-in.	18.0	17.9	6%
Unloading Area, lbs-in.	-1.2	-1.3	17%
Compressive Area, lbs-in.	4.2	4.2	5%
Number of Cycles	57	43	82%

Maximum load and total area presented promising performance as surrogate parameters

Ongoing Work

- Concentric Jig
- Semi-Circular Bend Test
- Disk-Compact Tension Test
- Load Controlled OT

Validation

1. Type-C
2. SMAR-F
3. TOM
4. Type-D
5. SP-D
6. SMA-D

Conclusions

- Lots of Work!!
- Lots of Progress!!
- Need Validation!!

We can use your OT legacy data if you have solid performance data!!

Thank you

Texas Department of Transportation