Procedure for Collecting Reference Transverse Profiles

(TxDOT Project 0-6663)

Invited Presentation for TPF-5(299)

27th Annual Road Profile Users' Group (RPUG) Meeting

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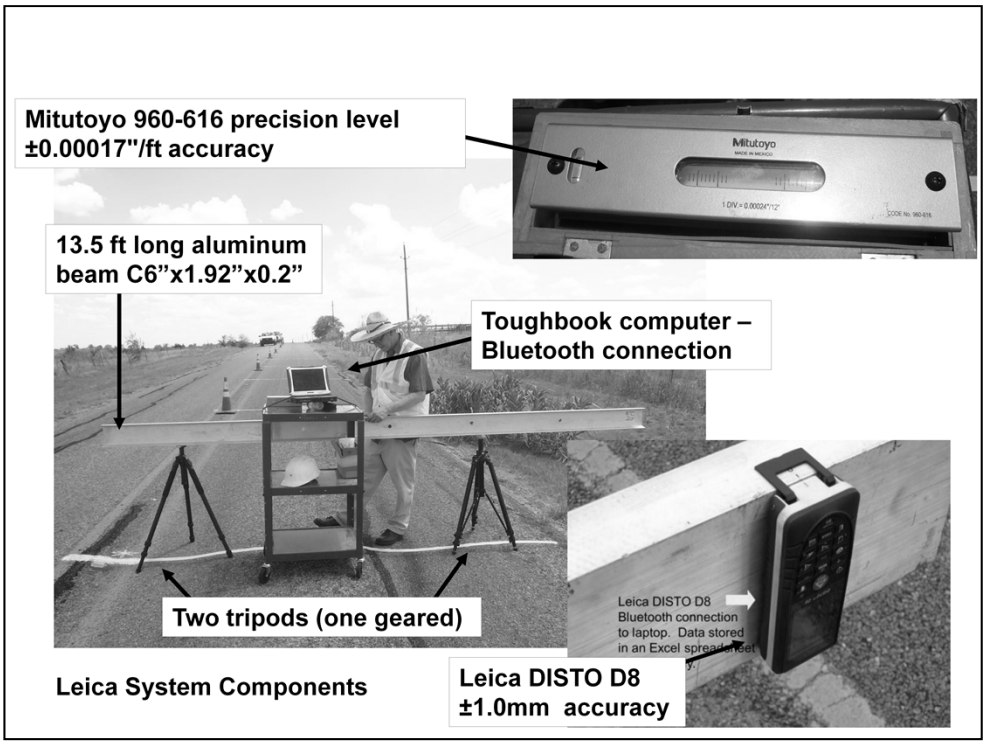
TxDOT Transverse Profiler for MLS

0-6663 Reference Transverse Profiles

Leica Laser System transverse profile measurements
27 points per profile – total width 150”

Level aluminum beam provided reference plane
23 profiles per test section - 552 profiles total


Mitutoyo 960-616 precision level
±0.00017"/ft accuracy
13.5 ft long aluminum
beam C6”x1.92”x0.2”
Toughbook computer –
Bluetooth connection
Two tripods (one geared)
Leica DISTO D8
Bluetooth connection
to laptop. Data stored
in an Excel spreadsheet
Leica DISTO D8
±1.0mm accuracy
Leica System Components

System Setup procedure:

1. Placing masking tape
    1. Marking transverse profile with chalk line
    2. Placing 2in wide masking tape over marked line
    3. Smoothing masking take
2. Positioning and leveling beam
    1. Moving tripods until laser light at two extremes of beam projected over the masking tape
    2. Moving beam until zero marking point projected to center of inner line
    3. Adjusting tripod height until beam was leveled
3. Taking the readings
    1. Placing laser on initial mark and triggering reading from computer
    2. Moving laser between consecutive marks (readings every 4 seconds) and stopping after having measured all points within entire lane width

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Tape placed to reduce the noise due to macro-texture and bridge cracks.

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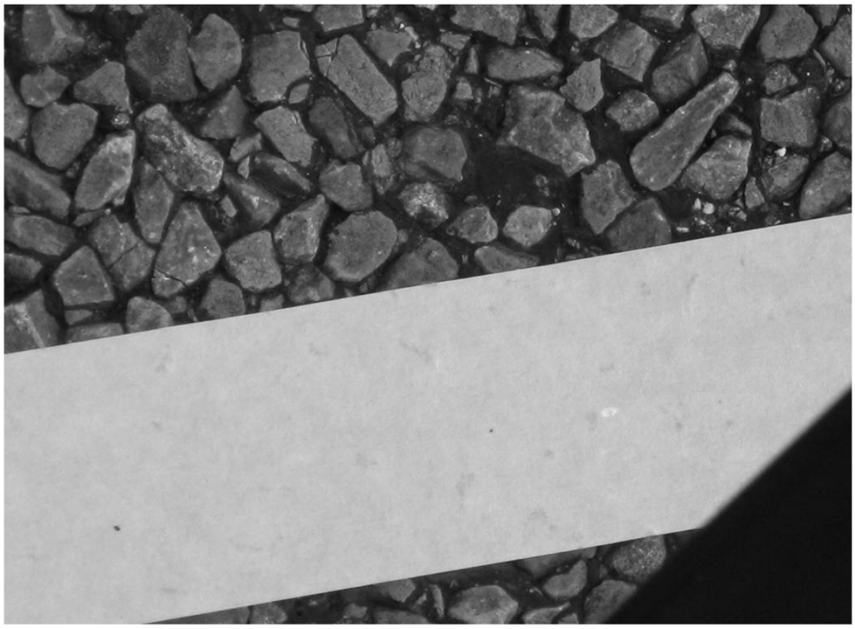
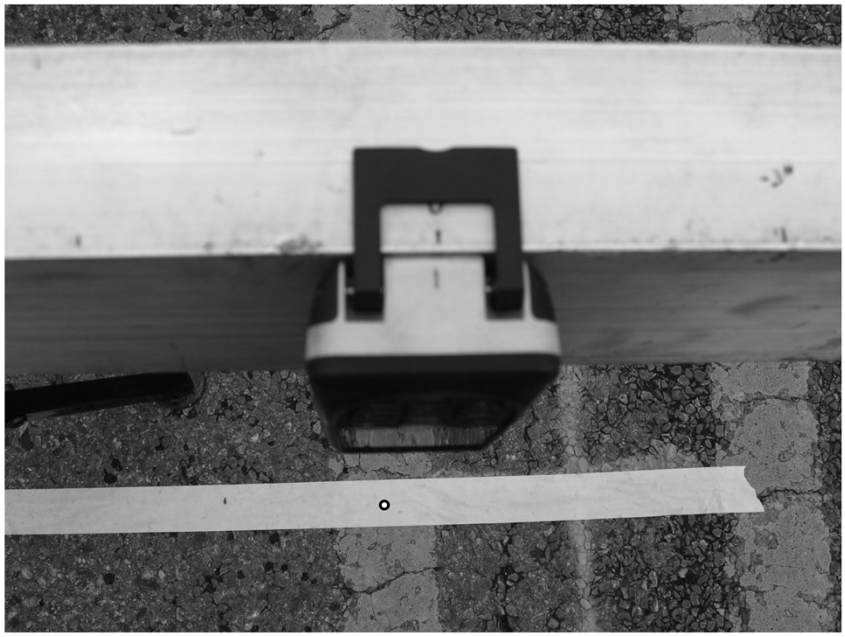
Outer tripod – adjustable height for leveling

Inner tripod – fixed height





Precision Level – Used to level the beam

Precision Level and Outer tripod–
Leveling the beam

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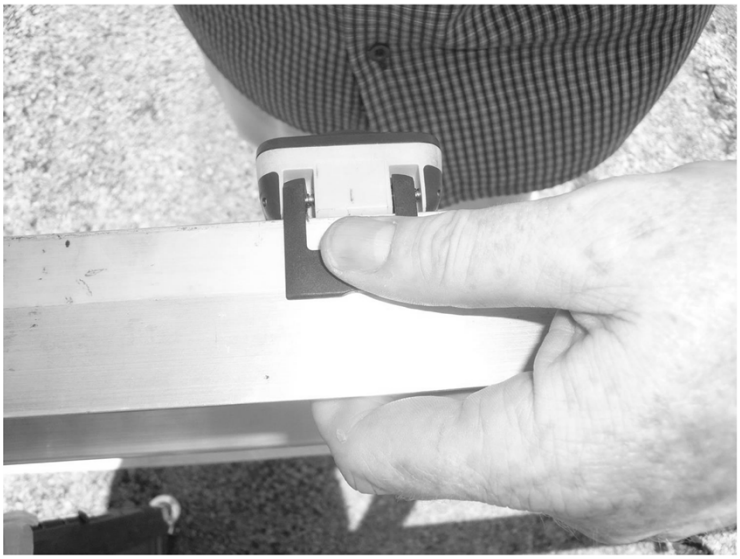
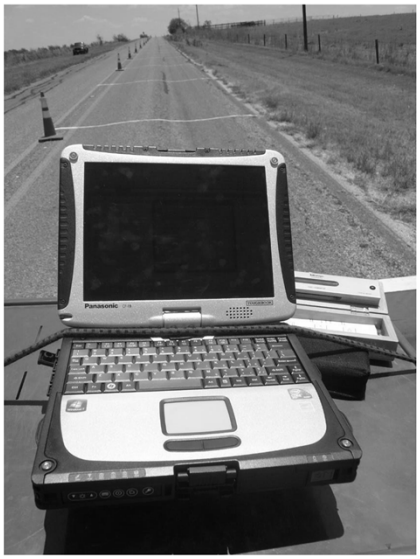
Laser distancemeter – DISTO D8

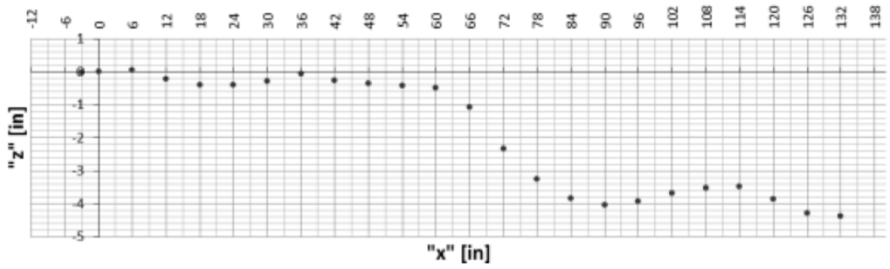


Aligning the laser

Leica System – Data collection on section 23



Data acquisition – Bluetooth connection with Leica laser.



Collected reference profile

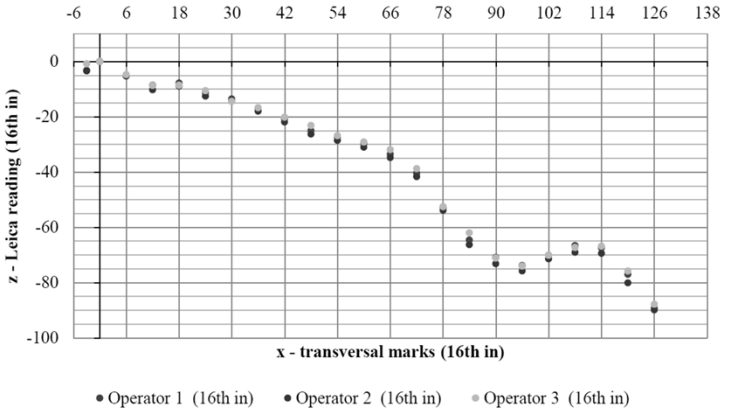
PRECISION OF REFERENCE PROFILES

Precision of Reference Profiles

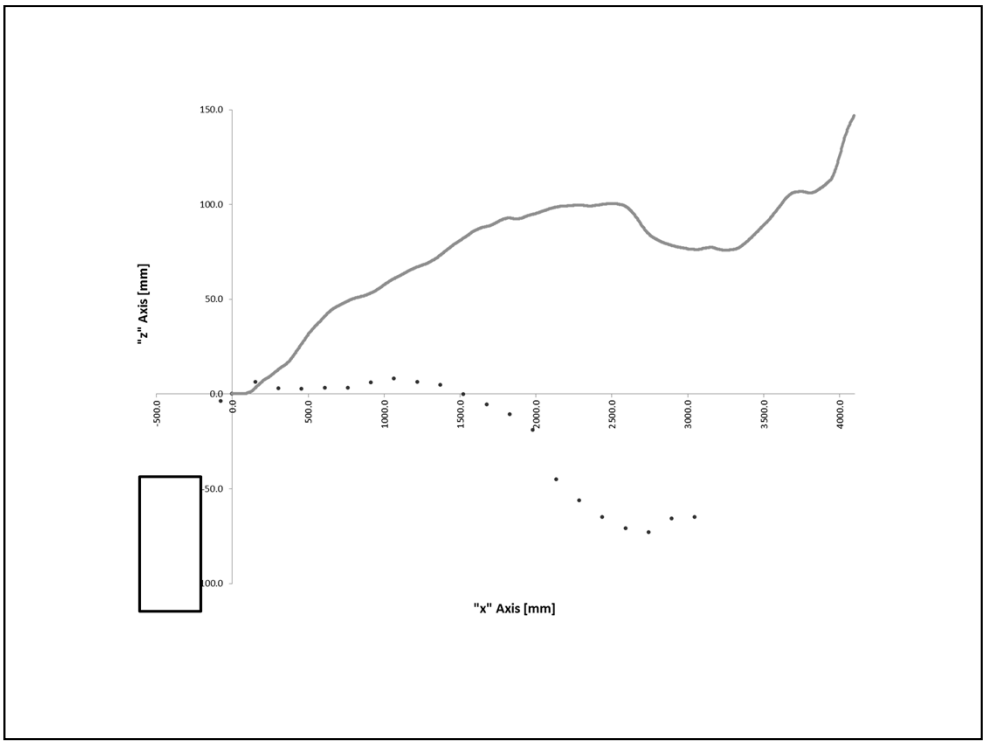
- The three operators involved collected the same five profiles under worst case scenario
  - Fatigued: High temperature and last profiles of the day
  - Coarse texture
  - No painted lines
- Each operator performed all steps of procedure
  - Placed tape
  - Placed and leveled the beam and
  - Took the readings

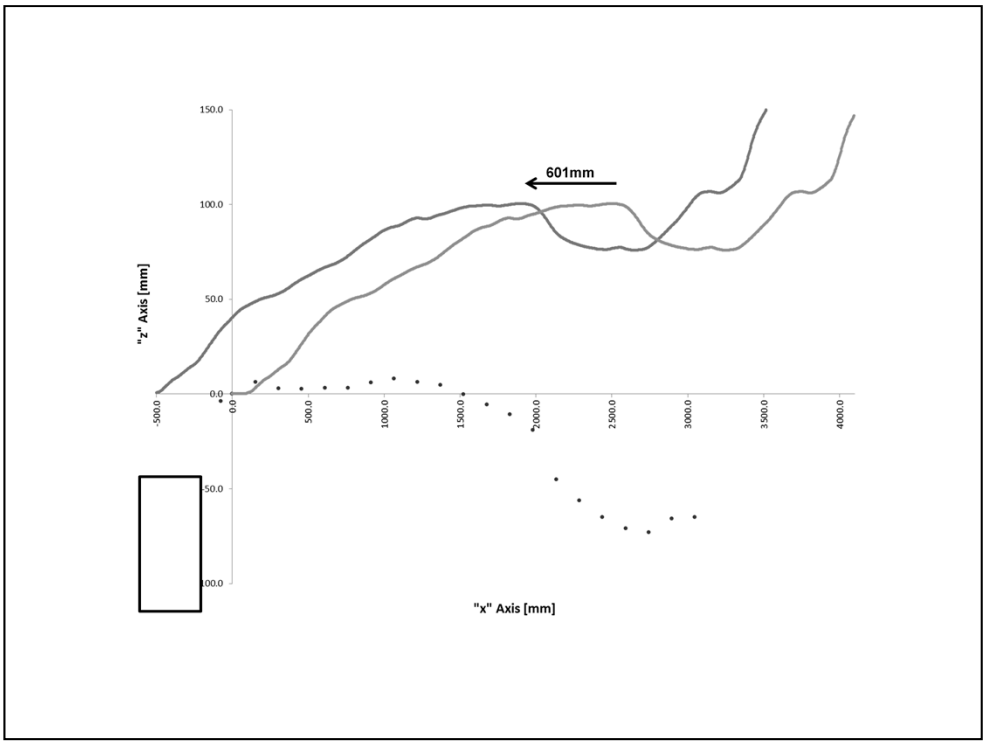
- 327 measurements errors
- Error_std = 0.89 16th in
- $Avg_{n=3}$_std = Error_std/sqrt(3) = 0.51 16th in

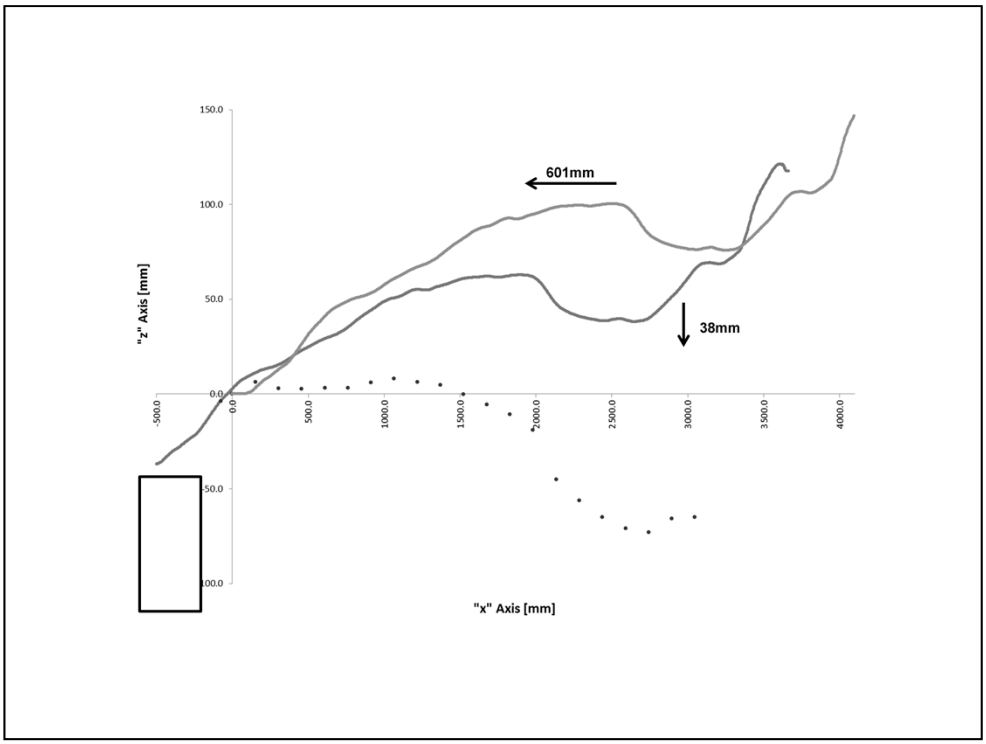
Cumulative (%)	Error, e [16th in]
75%	e < ±1.04
90%	e < ±1.44
95%	e < ±1.76
99%	e < ±2.28

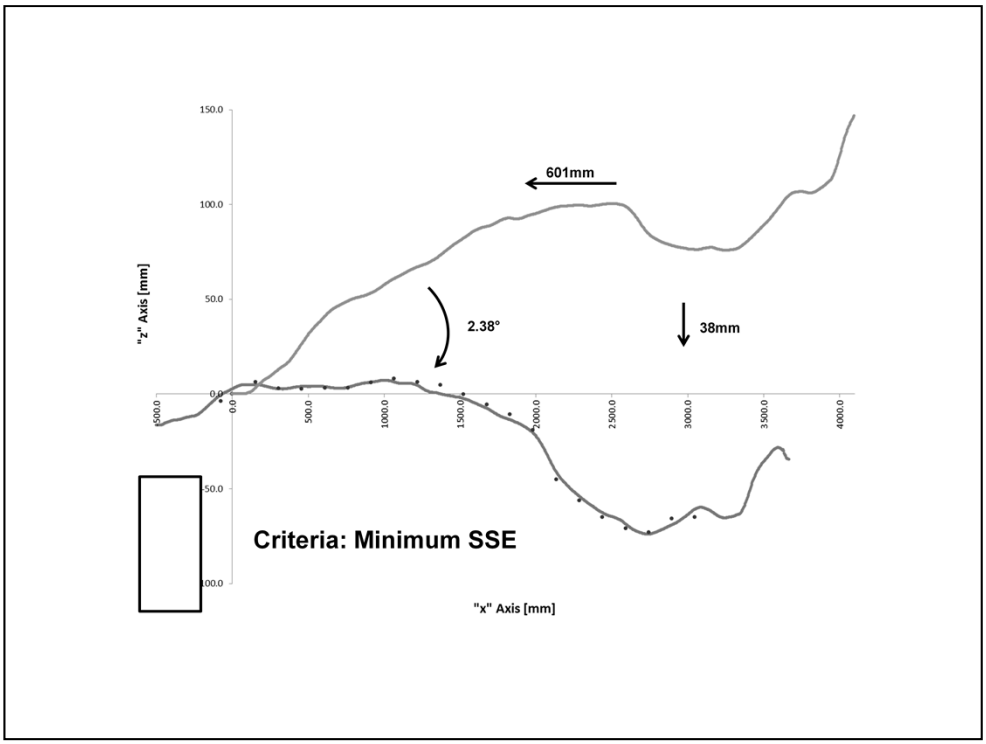


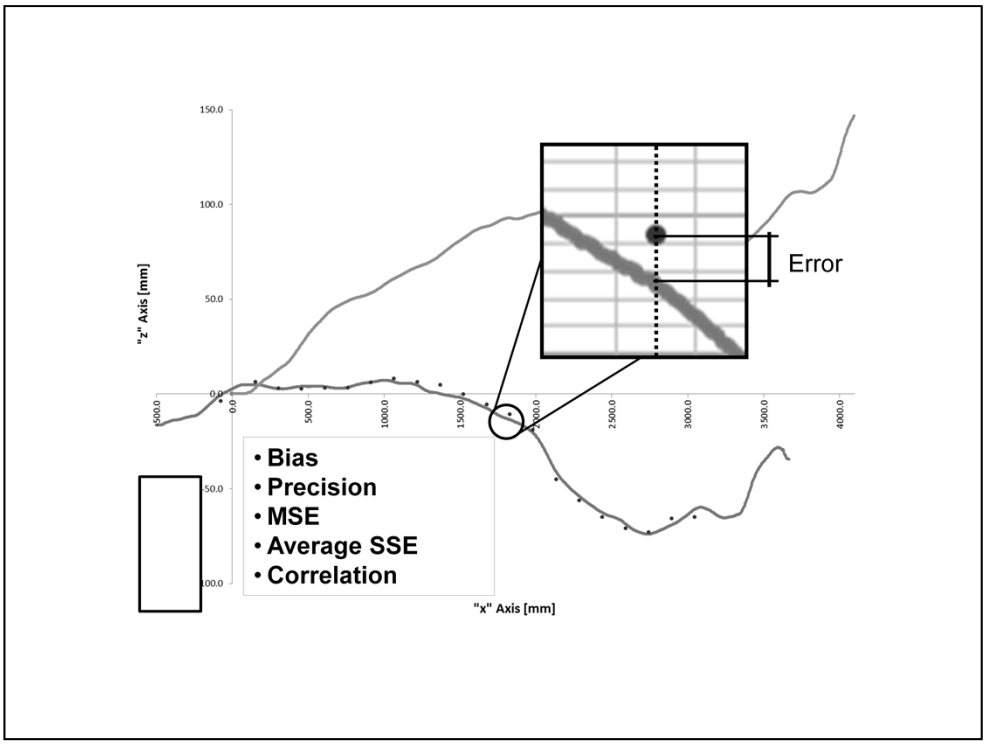
PROCESSING OF AUTOMATED PROFILES

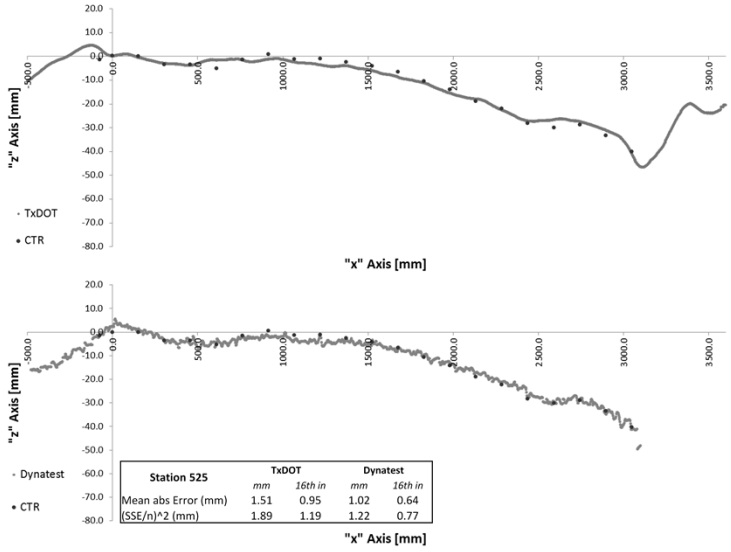

150.0
100.0
50.0
0.0
-50.0
-100.0
"z" Axis [mm]
-500.0
0.0
500.0
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0
"x" Axis [mm]


601mm
"z" Axis [mm]
"x" Axis [mm]
150.0
100.0
50.0
0.0
-50.0
-100.0
-500.0
0.0
500.0
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0


601mm
38mm
"z" Axis [mm]
"x" Axis [mm]
150.0
100.0
50.0
0.0
-50.0
-100.0
-500.0
0.0
500.0
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0


601mm
2.38°
38mm
Criteria: Minimum SSE
"z" Axis [mm]
"x" Axis [mm]
150.0
100.0
50.0
0.0
-50.0
-100.0
-500.0
0.0
500.0
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0

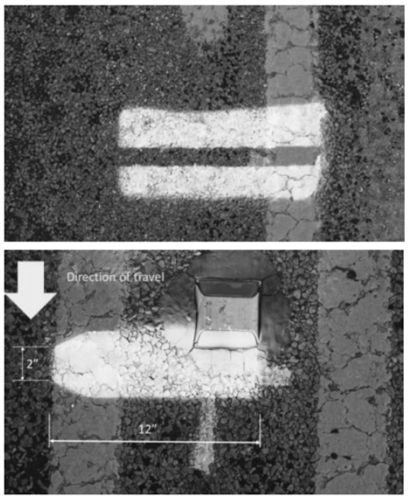

150.0
100.0
50.0
0.0
-50.0
-100.0
"z" Axis [mm]
-500.0
0.0
500.0
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0
"x" Axis [mm]
Error
• Bias
• Precision
• MSE
• Average SSE
• Correlation



Station 525	TxDOT		Dynatest	
	mm	*16th in*	*mm*	*16th in*
Mean abs Error (mm)	1.51	0.95	1.02	0.64
(SSE/n)^2 (mm)	1.89	1.19	1.22	0.77

TEST SECTION MARKING

Test Section Marking



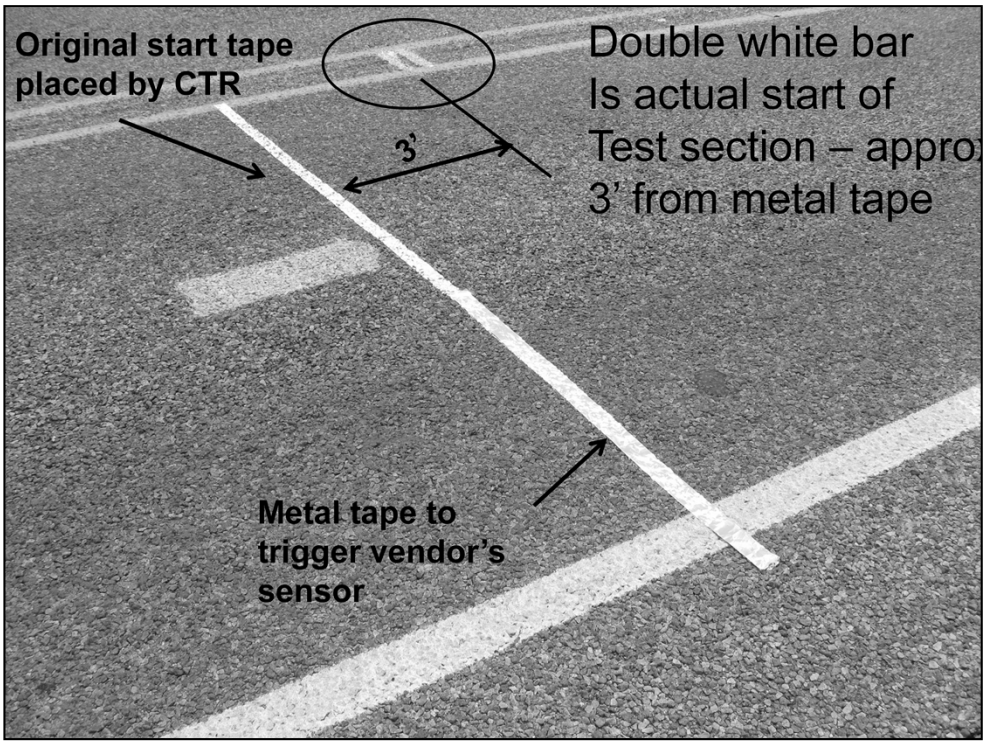

Original start tape
placed by CTR
3’
Double white bar
Is actual start of
Test section – appro
3’ from metal tape
Metal tape to
trigger vendor’s
sensor


Photo of a start sensor
Used to trigger on metal
Tape.

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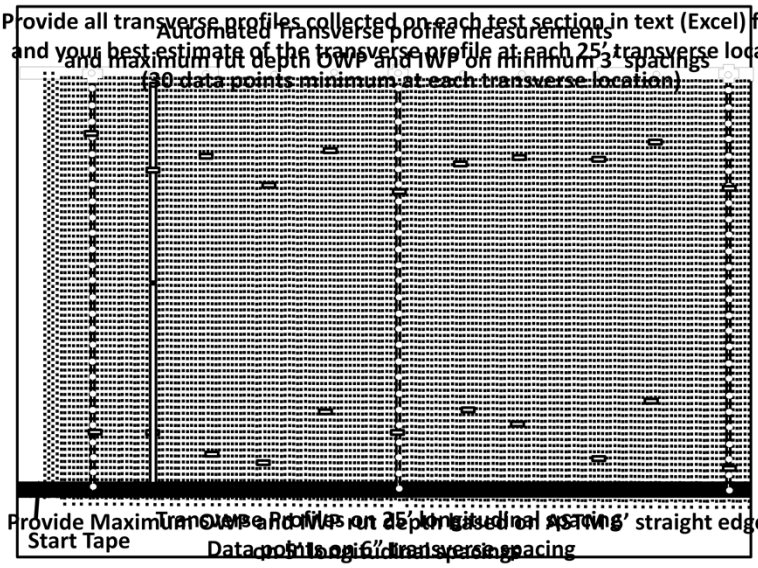
THANKS FOR YOUR ATTENTION, QUESTIONS?

EXTRA SLIDES

Provide all transverse profiles collected on each test section in text (Excel) format
and your best estimate of the transverse profile at each 25' transverse location
and maximum rut depth OWP and IWP on minimum 3' spacings
(30 data points minimum at each transverse location)



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