

PROFILER CERTIFICATION PROGRAM AND NEW TEST TRACKS AT TxDOT



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PRESENTATION TOPICS



- ***Background***
- ***Certified inertial profilers***
- ***Certification of inertial profilers***
- ***Where we are headed***

FROM PROFILOGRAPH TO INERTIAL PROFILER-BASED SPECIFICATION



IMPLEMENTATION OF RIDE SPECIFICATION



- ***Test method for operating surface profilers***
- ***Construction of profiler certification track***
- ***Certification of surface profilers and operators***



Inertial Profilers



INERTIAL PROFILER CERTIFICATION TESTS

- ***0.1-mile test sections***
 - ***Smooth***
 - ***Medium-smooth***

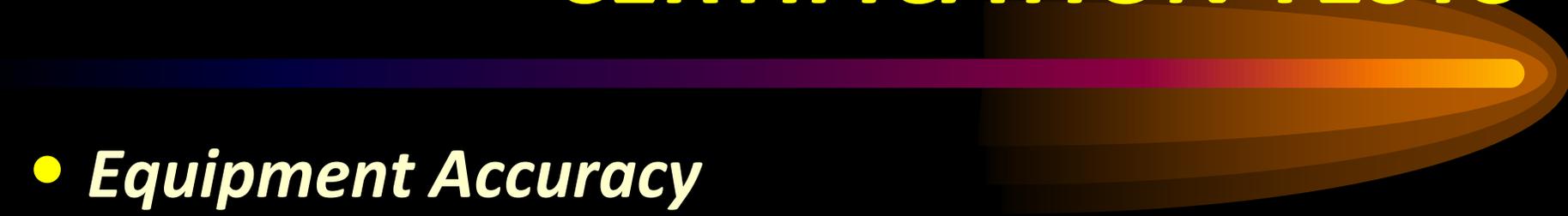


INERTIAL PROFILER CERTIFICATION TESTS



- ***Equipment Repeatability***
 - ***Based on 10 repeat runs***
 - ***Measured using average standard deviation***
 - ***Evaluated for each wheelpath surveyed***

INERTIAL PROFILER CERTIFICATION TESTS



- ***Equipment Accuracy***
 - ***Evaluated against benchmark profiles***
 - ***Same profiler filter applied to benchmark profiles***
 - ***Average profiles determined***
 - ***Point-to-point differences in average profiles obtained***

INERTIAL PROFILER CERTIFICATION TESTS



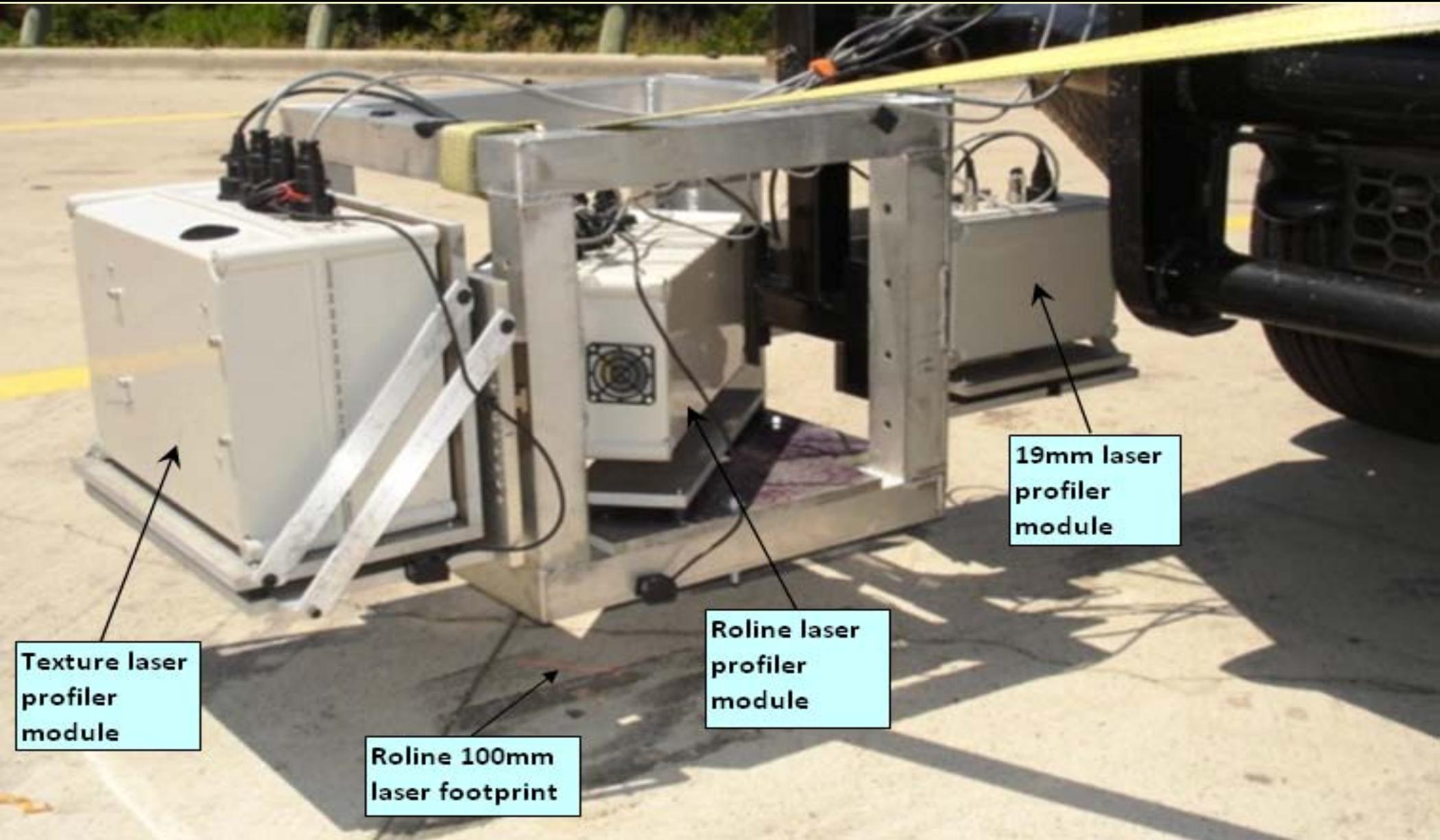
- ***Test Results***
 - ***Summary report provided***
 - ***Profiler must comply with all requirements***
 - ***Decal placed on certified profiler***

WHERE WE ARE HEADED



- ***Addition of test sections in stages***
 - ***CRCP transversely tined sections***
 - ***CRCP longitudinally tined sections***
 - ***Flexible pavements with textured surfaces***
- ***Evaluation of criteria for ride-quality testing of textured surfaces***
 - ***TxDOT smoothing filter parameters for wide-footprint lasers***
 - ***Adapting new standards for profiler certification***

Three-Laser Profiling System



Texture laser profiler module

Roline 100mm laser footprint

Roline laser profiler module

19mm laser profiler module

Roline Laser Test Results (TxDOT Test Method Tex-1001S)

Criteria	Section	
	Smooth	Medium Smooth
Profile repeat.	9 mils	11 mils
Profile acc. (μ_1)	0 mil	0 mil
Profile acc. (μ_2)	17 mils	22 mils
IRI repeat.	0.82 in/mile	0.43 in/mile
IRI accuracy	2.01 in/mile	0.37 in/mile

Texture Laser Test Results (TxDOT Test Method Tex-1001S)

Criteria	Section	
	Smooth	Medium Smooth
Profile repeat.	10 mils	10 mils
Profile acc. (μ_1)	0 mil	0 mil
Profile acc. (μ_2)	20 mils	25 mils
IRI repeat.	0.77 in/mile	0.31 in/mile
IRI accuracy	1.92 in/mile	0.13 in/mile

19mm Laser Test Results (TxDOT Test Method Tex-1001S)

Criteria	Section	
	Smooth	Medium Smooth
Profile repeat.	17 mils	17 mils
Profile acc. (μ_1)	1 mil	1 mil
Profile acc. (μ_2)	18 mils	27 mils
IRI repeat.	0.70 in/mile	0.75 in/mile
IRI accuracy	0.51 in/mile	2.29 in/mile

19mm Laser Test Results (AASHTO R56 cross-correlation)

Statistic	Repeatability		Accuracy	
	Smooth	Medium smooth	Smooth	Medium smooth
Comparison count	45	45	10	10
% Passing	100	100	50	100
Mean	95	98	89	91
Minimum	92	96	87	90
Maximum	98	99	92	92
Grade	Pass	Pass	Fail	Pass

Review of 19mm Laser Test Results

Run	Cross-correlation (percent)	IRI (in/mile)	IRI difference (in/mile)
1	90	56.3	0.7
2	88	56.9	1.3
3	92	56.0	0.4
4	90	55.4	-0.2
5	88	57.0	1.4
6	87	57.0	1.4
7	91	55.6	0.0
8	88	57.7	2.1
9	88	56.6	1.0
10	90	56.2	0.6
Reference		55.6	

19mm Laser Test Results (based on replicate reference profiles)

Statistic	Repeatability		Accuracy	
	Replicate #2	Replicate #3	Replicate #2	Replicate #3
Comparison count	45	45	10	10
% Passing	100	100	60	50
Mean	95	95	90	90
Minimum	92	92	89	89
Maximum	98	98	91	92
Grade	Pass	Pass	Pass	Pass

Repeatability of Reference Profiles on Smooth Section

Reference profile	IRI (in/mile)
1	55.6
2	56.4
3	56.3

Run	2	3
1	96	95
2		96

Texture Laser Test Results (AASHTO R56 cross-correlation)

Statistic	Repeatability		Accuracy	
	Smooth	Medium smooth	Smooth	Medium smooth
Comparison count	45	45	10	10
% Passing	98	100	60	100
Mean	95	99	90	94
Minimum	92	97	88	94
Maximum	100	100	92	95
Grade	Pass	Pass	Pass	Pass

Roline Laser Test Results (AASHTO R56 cross-correlation)

Statistic	Repeatability		Accuracy	
	Smooth	Medium smooth	Smooth	Medium smooth
Comparison count	45	45	10	10
% Passing	93	100	60	100
Mean	96	98	90	95
Minimum	89	95	86	93
Maximum	99	100	92	96
Grade	Pass	Pass	Pass	Pass



Tests on Other Profilers

Single-Point Laser Test Results (AASHTO R56 cross-correlation at 300-ft cutoff)

Statistic	Repeatability		Accuracy	
	Smooth	Medium smooth	Smooth	Medium smooth
Comparison count	45	45	10	10
% Passing	82	100	90	100
Mean	93	98	92	95
Minimum	88	96	86	93
Maximum	96	99	94	96
Grade	Pass	Pass	Pass	Pass

Roline Laser Test Results (AASHTO R56 cross-correlation at 300-ft cutoff)

Statistic	Repeatability		Accuracy	
	Smooth	Medium smooth	Smooth	Medium smooth
Comparison count	45	45	10	10
% Passing	100	100	100	100
Mean	97	99	91	92
Minimum	92	97	90	91
Maximum	99	100	92	93
Grade	Pass	Pass	Pass	Pass

Single-Point Laser Test Results (lightweight inertial profiler, 300-ft cutoff)

Statistic	Repeatability		Accuracy	
	Smooth LWP	Smooth RWP	Smooth RWP	Smooth LWP
Comparison count	45	45	10	10
% Passing	93	60	90	100
Mean	94	92	92	93
Minimum	91	89	89	91
Maximum	96	95	94	94
Grade	Pass	Pass	Pass	Pass

Single-Point Laser Test Results (lightweight inertial profiler, 300-ft cutoff)

Statistic	Repeatability		Accuracy	
	Medium smooth LWP	Medium smooth RWP	Medium smooth RWP	Medium smooth LWP
Comparison count	45	45	10	10
% Passing	100	100	100	100
Mean	98	98	97	97
Minimum	97	97	97	96
Maximum	99	99	98	98
Grade	Pass	Pass	Pass	Pass

TESTS ON OTHER PAVEMENTS



**Delineating Test
Wheel Path**

Collecting SurPRO Data

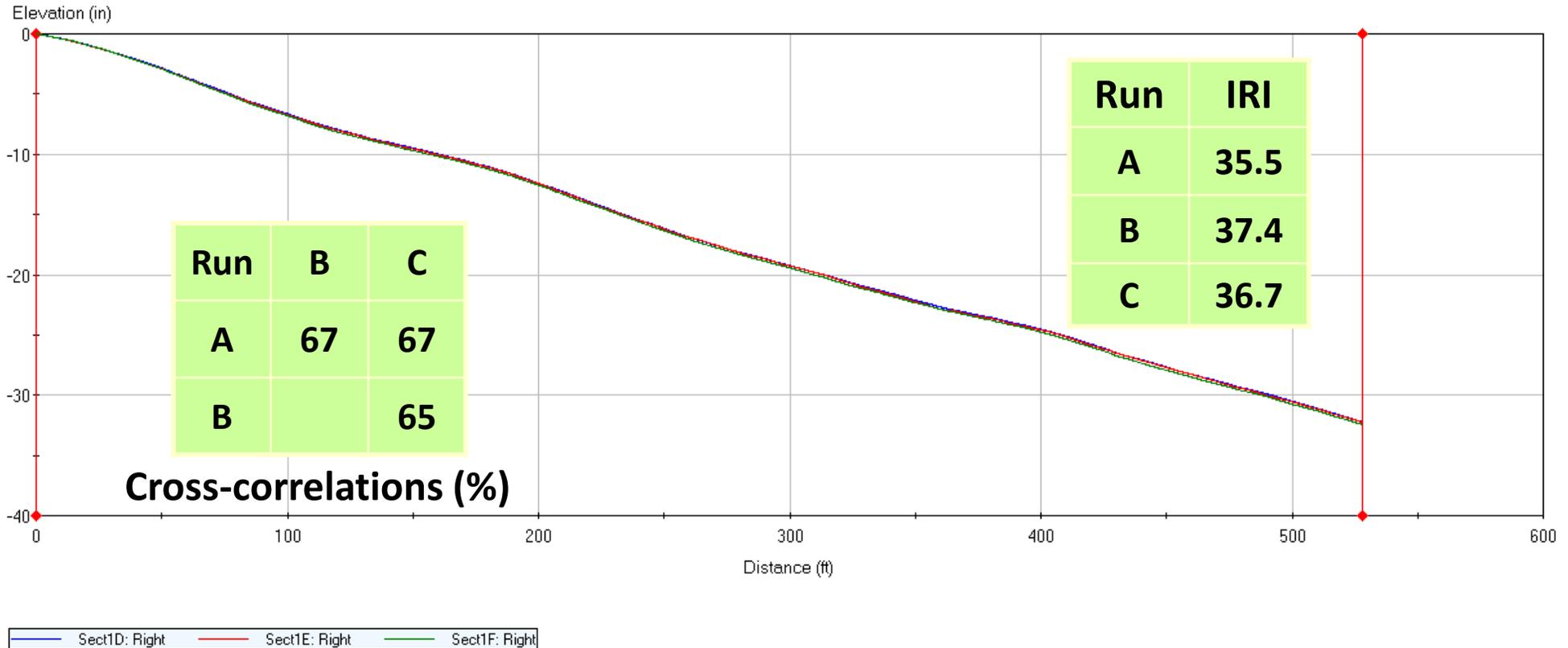


Evaluation of Reference Profile Measurements

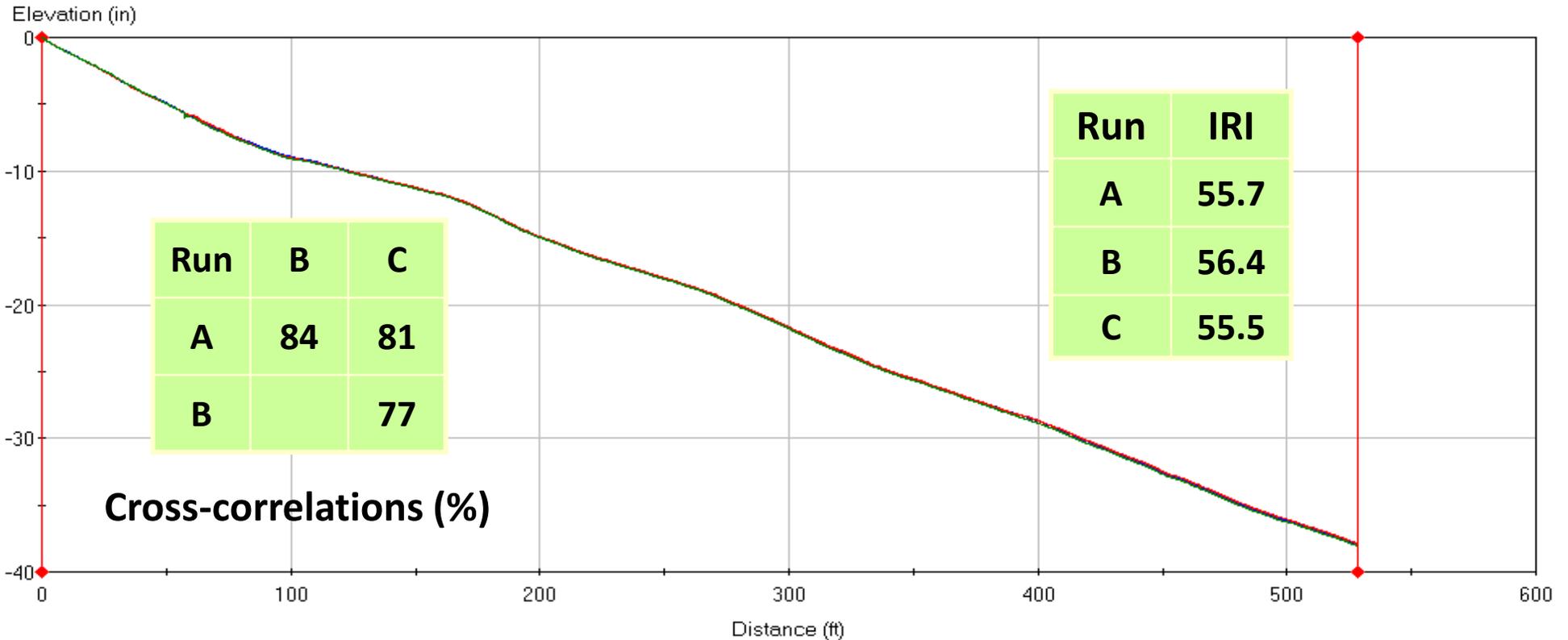


- *View plots of repeat runs*
- *Look at cross-correlation of IRI filtered profiles from repeat runs*
- *Look at differences between calculated IRIs from repeat runs*

Comparison of Repeat Runs

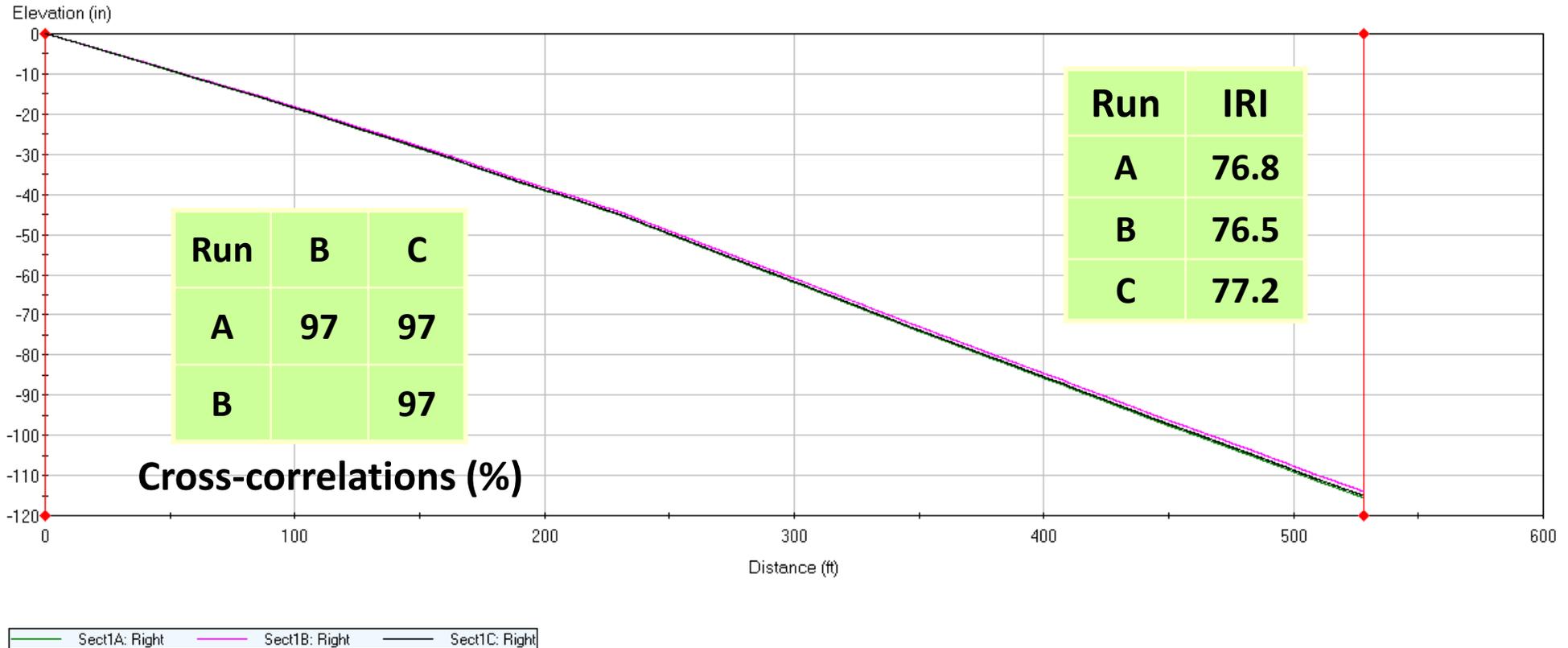


Comparison of Repeat Runs



07A: Right 07B: Right 07C: Right

Comparison of Repeat Runs on CRCP Section



**SH36 CRCP section 1 in Milam County
(conventional transverse tines)**

Preliminary Findings from Tests



- ***Difficult to get high cross-correlations (> 92%) on very smooth pavement surfaces (IRI < 60 in/mile)***
- ***Review applicability of cross-correlation on very smooth pavements***

Preliminary Findings from Tests



- ***Need to also check the differences between test and reference IRIs***
- ***Consider collecting replicate reference profiles for profiler certification.***

SUMMARY



- *TxDOT began its inertial profiler certification program to support implementation of a ride-specification based on inertial profile measurements*
- *TxDOT developed an adaptation of ASTM E950 for its inertial profiler certification program, adding a requirement for IRI repeatability and IRI accuracy*
- *TxDOT's profiler certification program is continuing to evolve as the Department considers adapting new technology and standards developed in recent years*

THANK YOU!

