



# ALL SPEED PROFILER AND AASHTO R56 PROVISIONAL CHANGES

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PATHWAY SERVICES INC.



**RPUG**  
Road Profile Users' Group



*And how have we  
How is IRI Measured?  
been doing it wrong?*



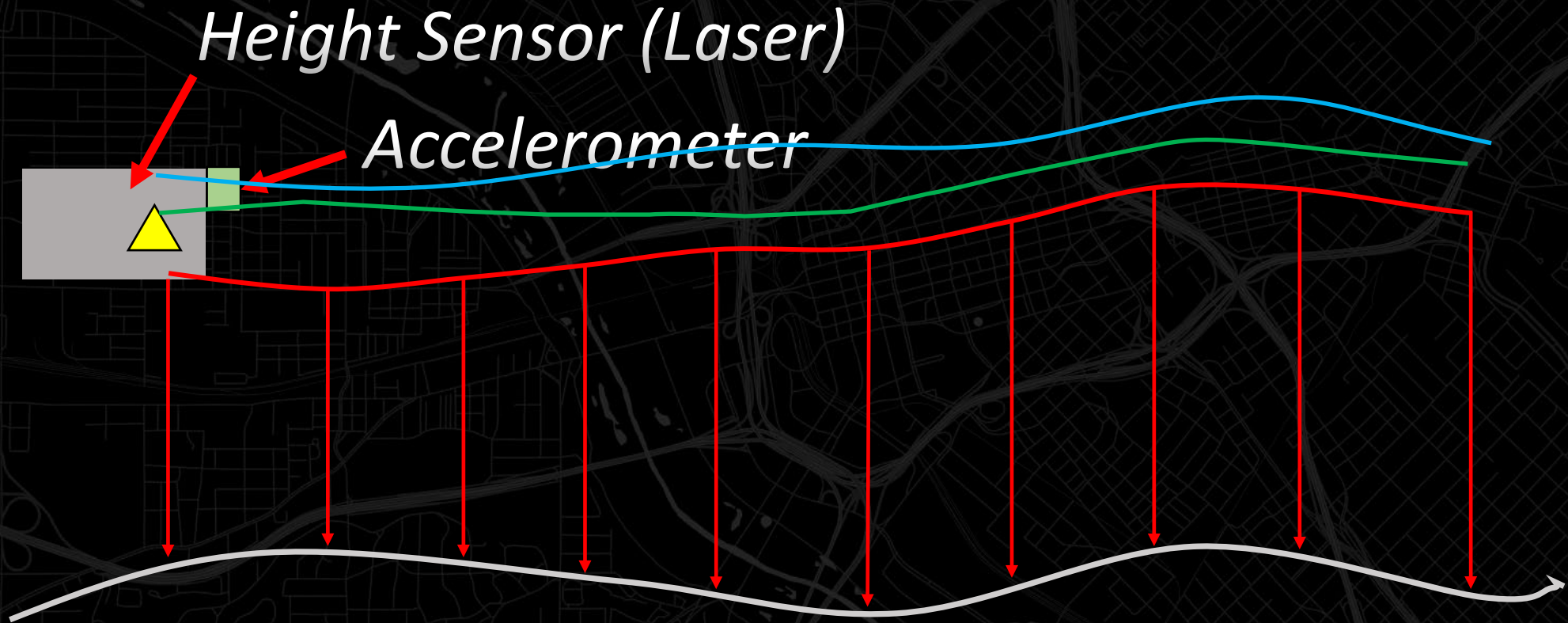
# Traditional Inertial Profiler



## Traditional South Dakota Style Profiler



# Traditional IRI Measurement





## Benefits of IRI/Ride Quality

- *IRI- Arguably one of the fastest measurement methods for initial road condition assessment*
- *Cost Effective*
- *Requires little interpretation*
- *Simple\**





## IRI/Ride Quality Data

- *Legacy method for “snapshot” road condition assessment*
- *Predominantly measured with Inertial Style Profilers*
  - *Single Laser/Single Accelerometer*



# The Problem(s)

- *Stopping*
- *Accelerating*
- *Merging/Yielding*
- *Slow moving traffic*
- *Stop and go traffic*
- *Turns*



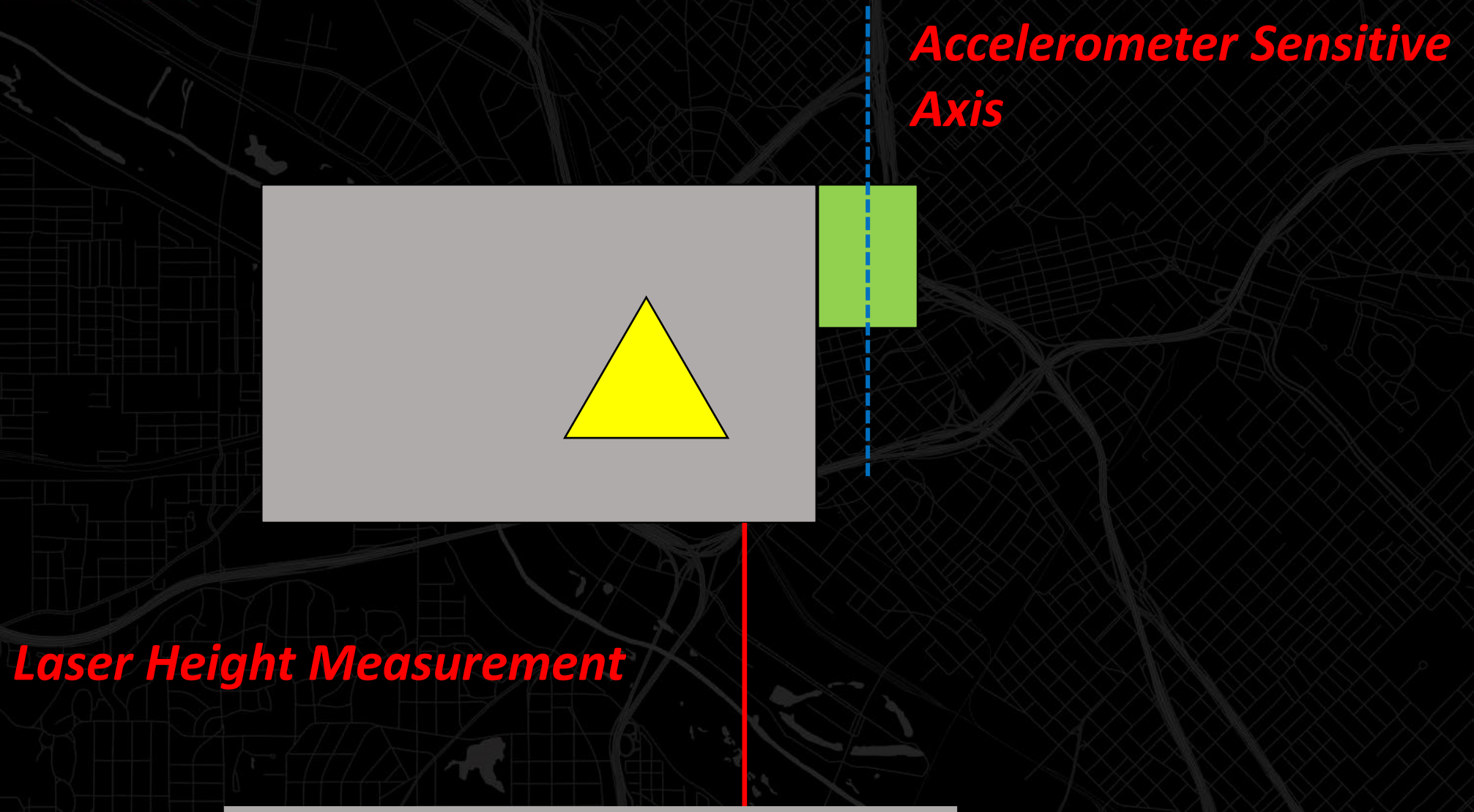


# Traditional IRI Measurement





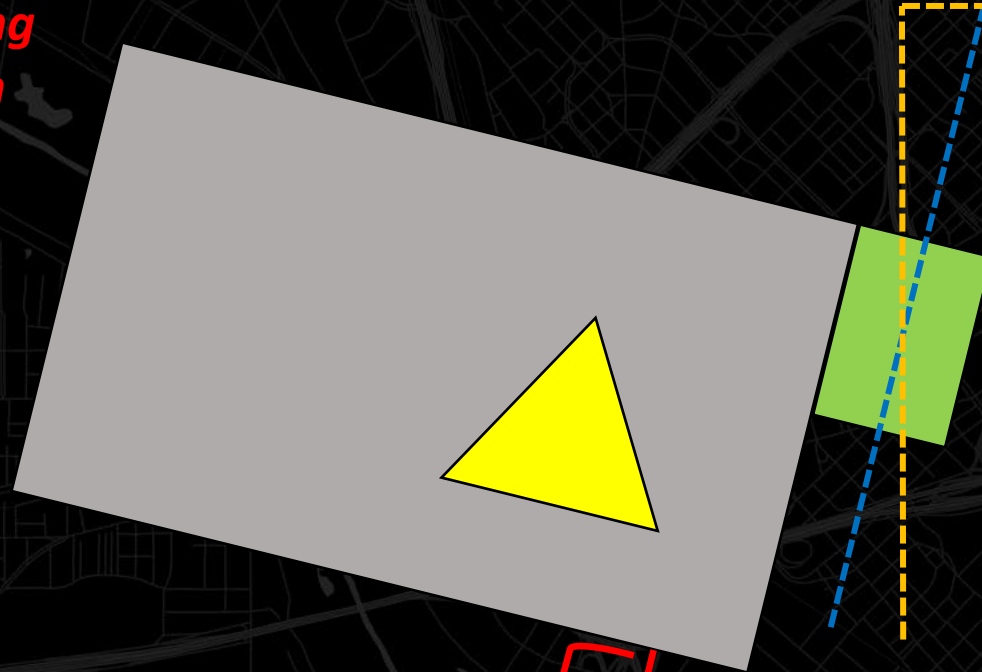
# Current IRI/Ride Quality Data Limitations





# Current IRI/Ride Quality Data Limitations

**Compounding problem of varying laser height measurements with substantially less accurate vertical compensation results in increased IRI response that is wrong.**



**Problem #1: Accelerometer becomes exponentially less accurate. (It turns out vertical accelerometers like to be kept vertical!)**

**Problem #2: Lasers don't lie.**



## Current IRI/Ride Quality Data Limitations

- *Low Speed vs High Speed Profilers– One or the other*
- *Urban environments limit travel speed*
- *Difficult to collect data in dynamic traffic patterns (turns, ramps, roundabouts, merge lanes, etc...)*



# Example of IRI Measurement



**Average Speed (MPH)**



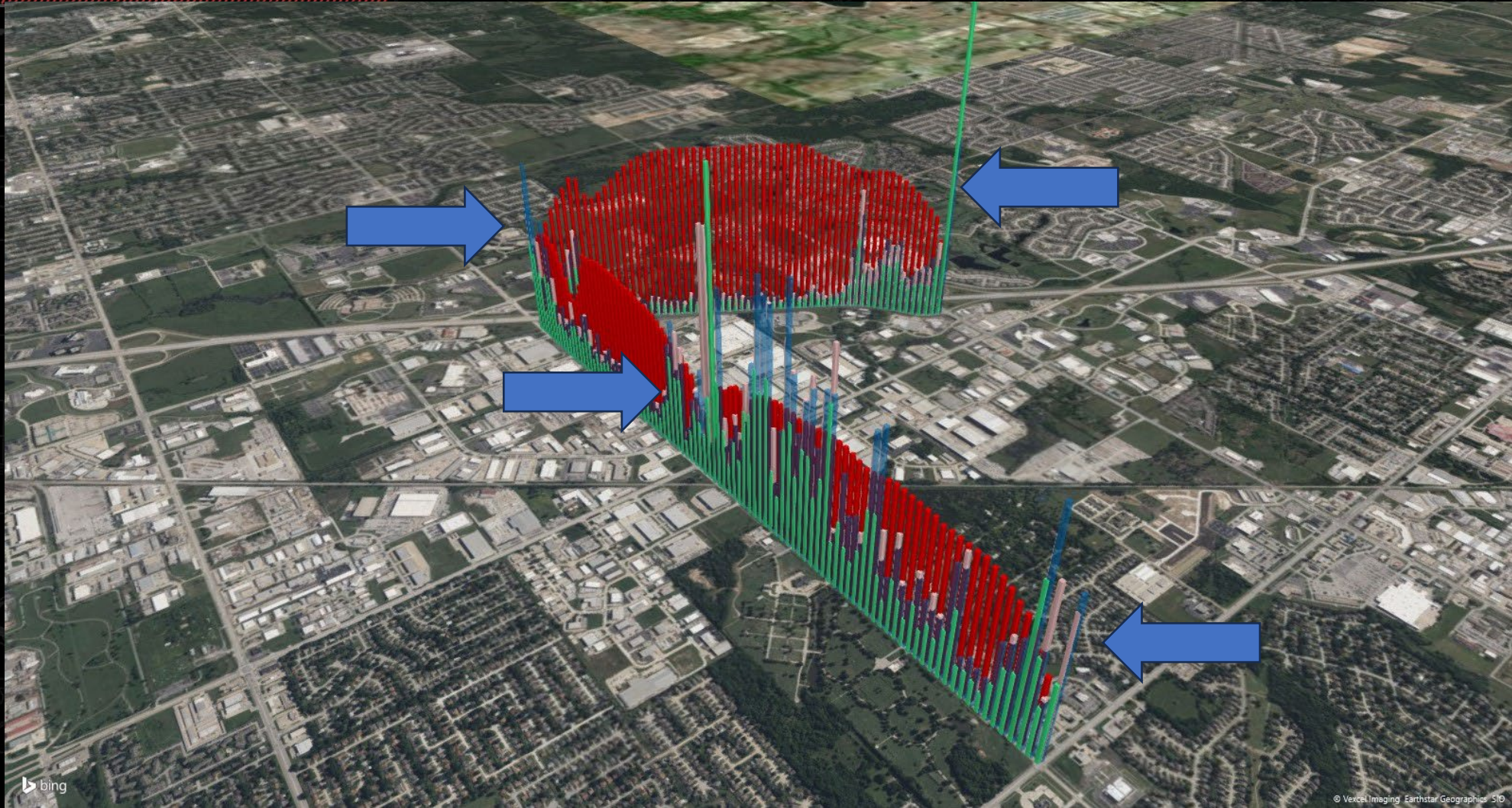
# Example of IRI Measurement



**Average Speed (MPH) with traditional IRI (100ft interval)**



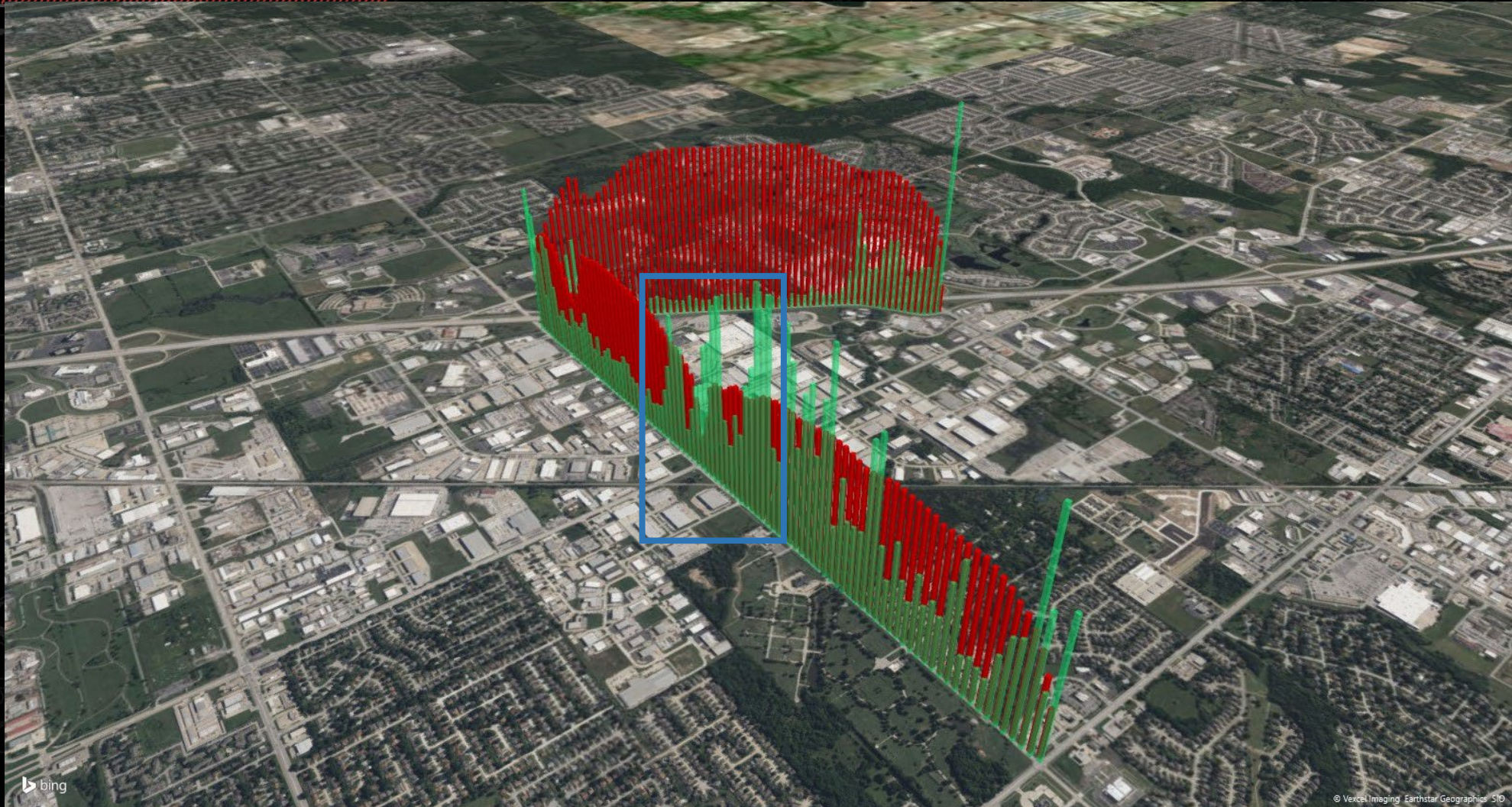
# Example of IRI Measurement



**Average Speed (MPH) with traditional IRI x4 runs (100ft interval)**



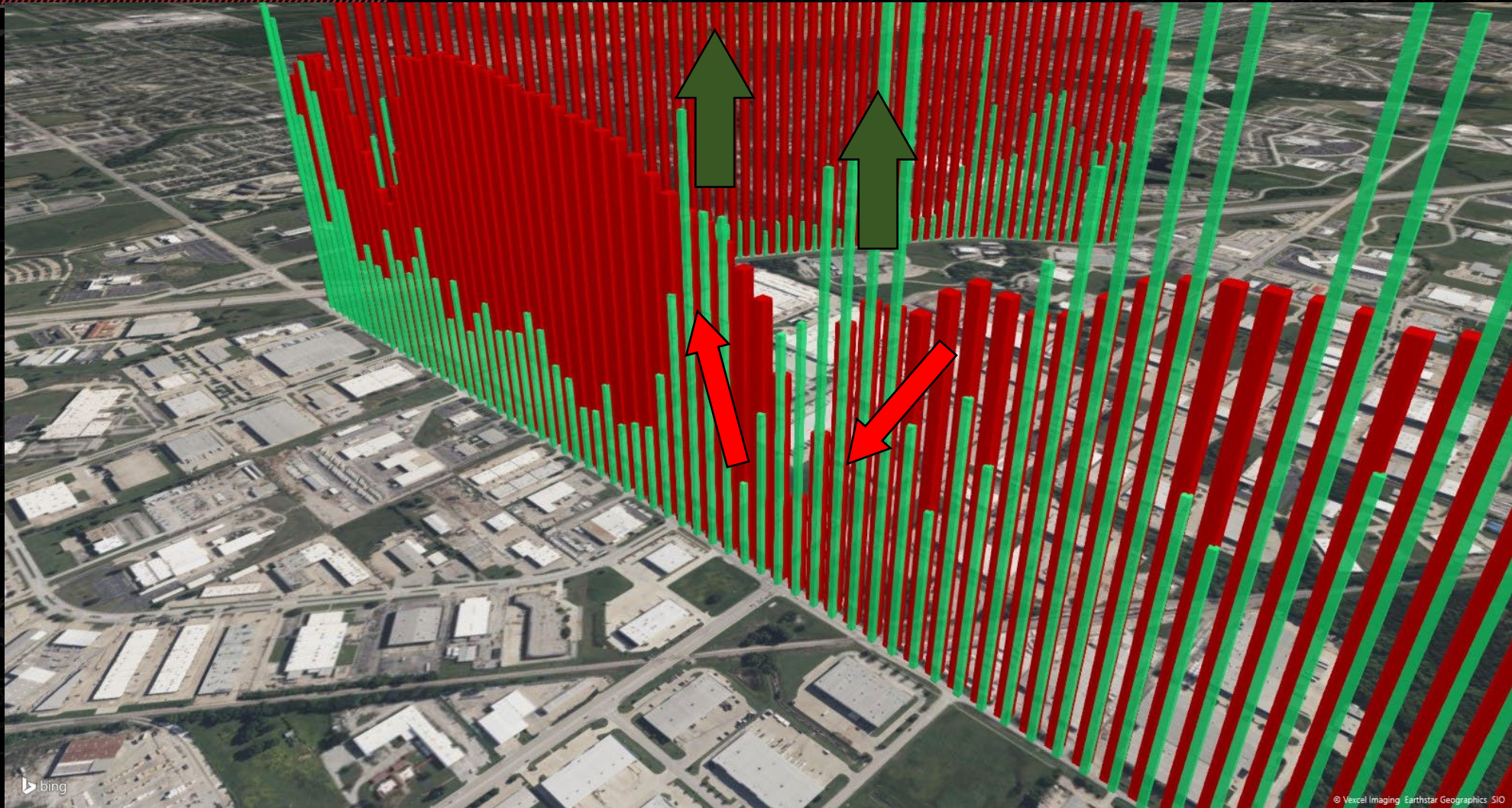
# Example of IRI Measurement



**Average Speed (MPH) with traditional IRI Average (100ft interval)**



# Example of IRI Measurement



**As speed goes down and up, traditional IRI goes up**



## *Solution(s)?*

- *How do we overcome the compromised data?*
- *Why is this important?*
  - *Large amount of compromised data in areas of high interest*
    - *Intersections*
    - *Ramps/merge lanes*
    - *High volume roads*
  - *These areas are subject to more failure due to traffic patterns*



*Solution:*  
*All Speed Profiler (ASP)*



# *Provisional AASHTO R56 Tests...*





*Tests performed at ICART IN Trenton, IL*

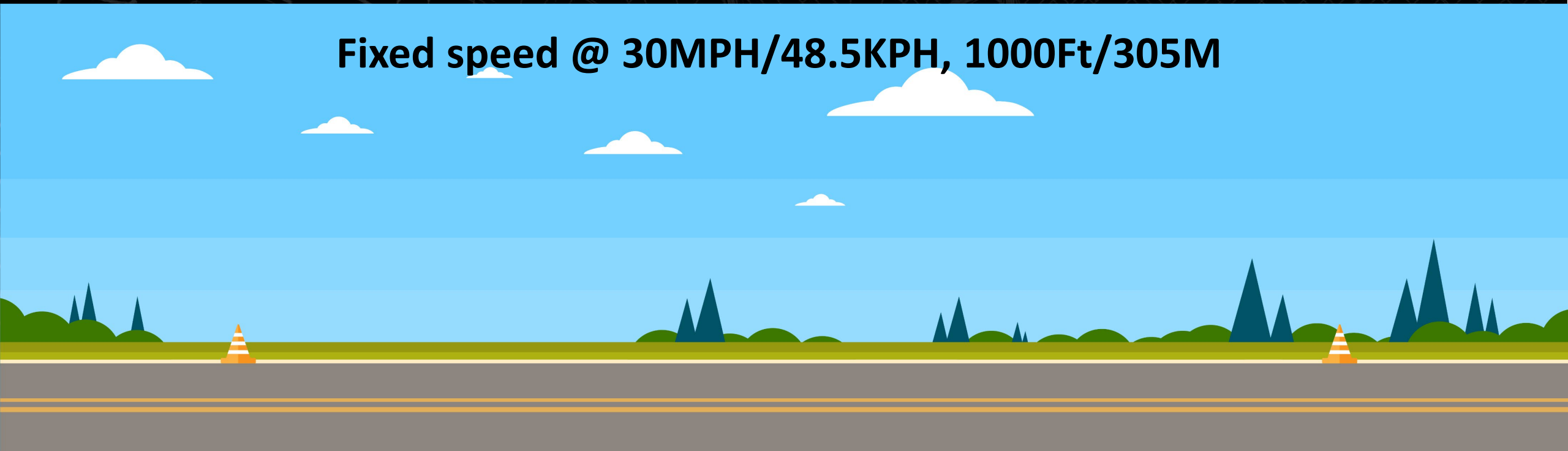




# Pathway Services Inc.

*“Normal” Driving Conditions, fixed speed*



A stylized landscape illustration featuring a grey road with yellow double lines, green hills, blue trees, and a blue sky with white clouds. Two orange and white traffic cones are positioned on the road. The background is a dark grey map grid.

**Fixed speed @ 30MPH/48.5KPH, 1000Ft/305M**



# Profilograph Simulation and Profiler Certification Results (ProVAL)



Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	100.00	100.00	100.00	100.00
Mean	98.64	98.35	92.09	94.87
Minimum	98.20	97.66	91.08	94.00
Maximum	99.39	98.96	92.84	95.88
Standard Deviation	0.7	0.7	0.9	0.9
Grade	Passed	Passed	Passed	Passed

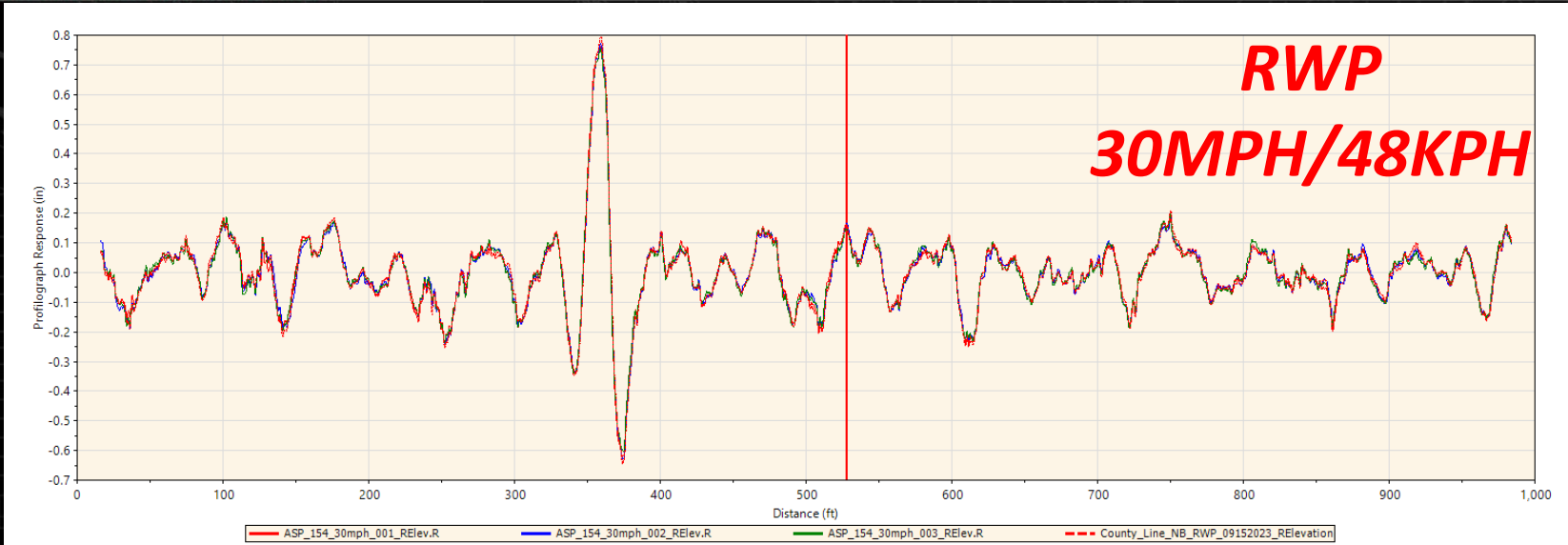
  

Accuracy			Repeatability - Left Correlations (%)			Repeatability - Left Offsets (ft)			Repeatability - Right Correlations (%)			Repeatability - Right Offsets (ft)		
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3	Run	2	3
1	91.08	94.00	1	98.32	98.20	1	0.1	0.1	1	98.96	97.66	1	0.1	0.2
2	92.36	94.74	2		99.39	2		0.1	2		98.43	2		0.1
3	92.84	95.88												

**Inertial profiler (x3 runs) 1000 Ft, fixed speed**



# Profilograph Simulation and Profiler Certification Results (ProVAL)



Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	100.00	100.00	100.00	100.00
Mean	97.82	98.02	93.74	97.87
Minimum	97.55	97.85	93.66	97.28
Maximum	98.04	98.26	93.84	98.26
Standard Deviation	0.2	0.2	0.1	0.5
Grade	Passed	Passed	Passed	Passed

Accuracy			Repeatability - Left Correlations (%)				Repeatability - Left Offsets (ft)				Repeatability - Right Correlations (%)				Repeatability - Right Offsets (ft)			
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3	Run	2	3	Run	2	3	
1	93.66	98.06	1	97.55	98.04	1	0.3	0.3	1	98.26	97.94	1	0.0	0.3				
2	93.84	98.26	2		97.87	2		0.0	2		97.85	2		0.3				
3	93.73	97.28																

**ASP (x3 runs) 1000 Ft, fixed speed**



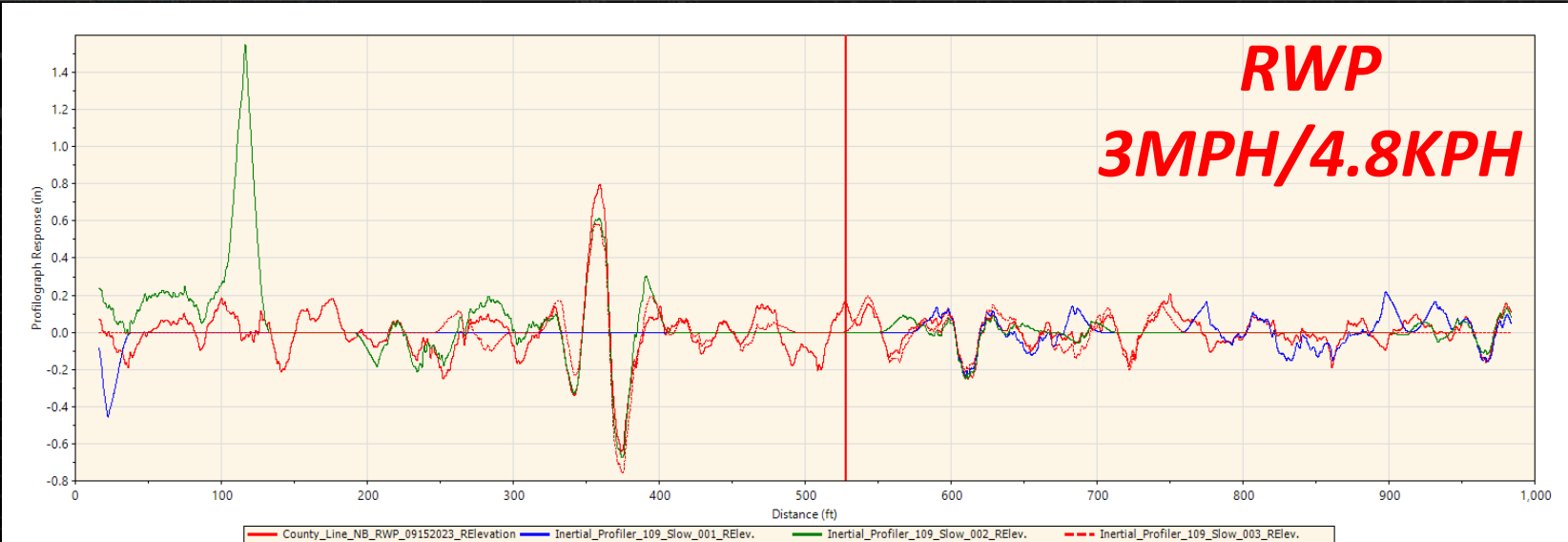
# *Slow/Idle Driving Conditions*



**Fixed speed @ 3MPH/4.8KPH, 1000Ft/305M**



# Profilograph Simulation and Profiler Certification Results (ProVAL)



Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	0.00	0.00	0.00	0.00
Mean	2.53	19.46	22.09	42.90
Minimum	-8.33	7.58	13.22	16.70
Maximum	11.13	40.58	31.33	58.05
Standard Deviation	9.9	18.3	9.1	22.8
Grade	Failed	Failed	Failed	Failed

Accuracy			Repeatability - Left Correlations (%)			Repeatability - Left Offsets (ft)			Repeatability - Right Correlations (%)			Repeatability - Right Offsets (ft)		
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3	Run	2	3
1	13.22	16.70	1	-8.33	4.80	1	5.1	0.0	1	7.58	10.22	1	0.0	-0.1
2	21.73	53.95	2		11.13	2		0.1	2		40.58	2		0.0
3	31.33	58.05												

**Inertial profiler (x3 runs) 1000 Ft, fixed speed**



# Profilograph Simulation and Profiler Certification Results (ProVAL)



Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	100.00	100.00	100.00	100.00
Mean	96.82	97.57	94.57	95.80
Minimum	96.22	97.05	93.39	93.97
Maximum	97.52	97.86	95.34	97.18
Standard Deviation	0.7	0.5	1.0	1.7
Grade	Passed	Passed	Passed	Passed

Accuracy			Repeatability - Left Correlations (%)			Repeatability - Left Offsets (ft)			Repeatability - Right Correlations (%)			Repeatability - Right Offsets (ft)		
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3	Run	2	3
1	94.97	96.25	1	97.52	96.71	1	0.0	0.0	1	97.86	97.80	1	0.0	0.0
2	95.34	97.18	2		96.22	2		0.3	2		97.05	2		0.0
3	93.39	93.97												

**ASP (x3 runs) 1000 Ft, fixed speed**



Close Add Files Save Report Viewer Editor Analysis Analysis Use Mileposts Screenshot  
 Project Project View Profile Selection Display Tools Analysis

### Profiler Certification: Summary Results

Statistics

Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	100.00	100.00	100.00	100.00
Mean	99.01	98.27	97.57	96.32
Minimum	98.72	97.96	97.48	95.85
Maximum	99.18	98.79	97.65	96.68
Standard Deviation	0.3	0.5	0.1	0.4
Grade	Passed	Passed	Passed	Passed

Accuracy			Repeatability - Left Correlations (%)			Repeatability - Left Offsets (ft)			Repeatability - Right Correlations (%)		
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3
1	97.57	95.85	1	99.13	98.72	1	-0.2	-0.4	1	98.07	97.96
2	97.48	96.68	2		99.18	2		-0.1	2		98.79
3	97.65	96.43									

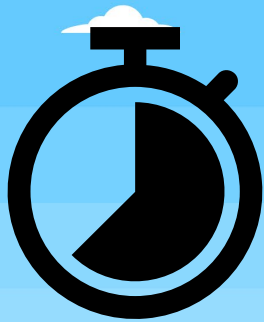




*Stopping*



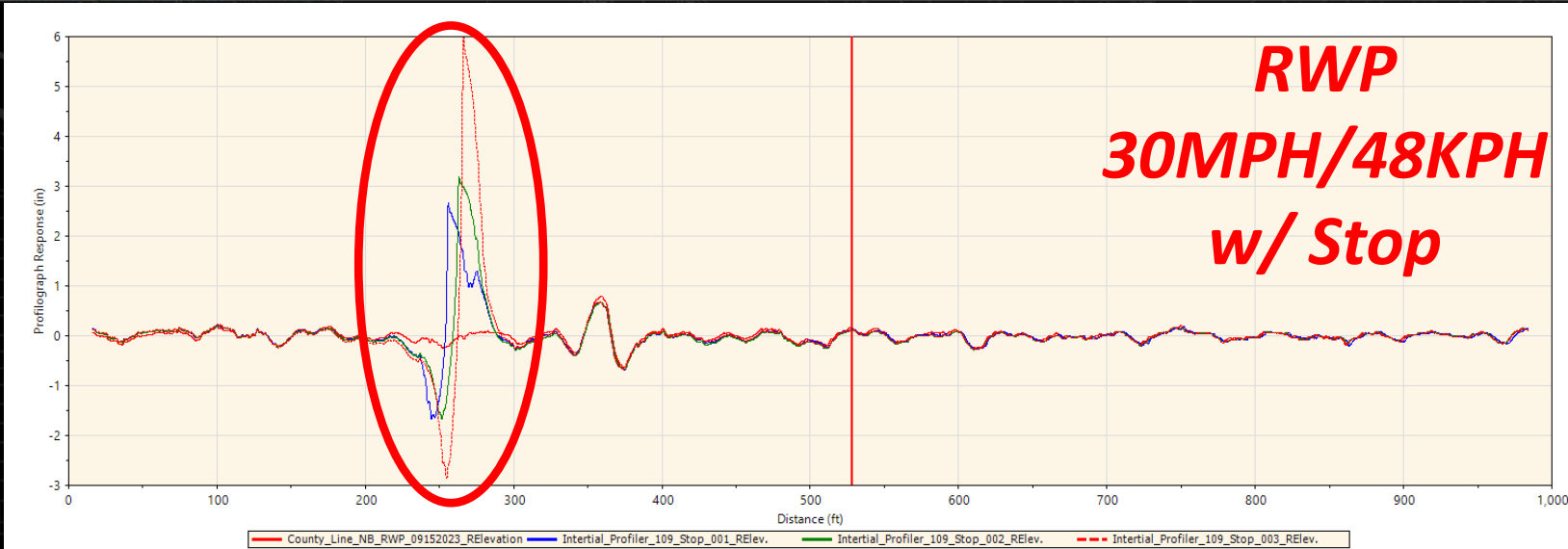
**Enter site at 30MPH/48.5KPH, stop abruptly, then accel., 1000Ft/305M**



**Stop for 60 Seconds...**



# Profilograph Simulation and Profiler Certification Results (ProVAL)



Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	0.00	0.00	0.00	0.00
Mean	44.04	39.25	6.26	9.60
Minimum	17.46	15.70	5.18	3.99
Maximum	69.81	52.98	7.96	14.73
Standard Deviation	26.2	20.5	1.5	5.4
Grade	Failed	Failed	Failed	Failed

Accuracy	Repeatability - Left Correlations (%)			Repeatability - Left Offsets (ft)			Repeatability - Right Correlations (%)			Repeatability - Right Offsets (ft)				
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3	Run	2	3
1	5.18	10.09	1	44.84	17.46	1	-5.0	-2.9	1	49.06	15.70	1	-5.0	-2.9
2	7.96	14.73	2		69.81	2		-2.9	2		52.98	2		-3.0
3	5.64	3.99												

Inertial profiler (x3 runs) 1000 Ft



# Profilograph Simulation and Profiler Certification Results (ProVAL)



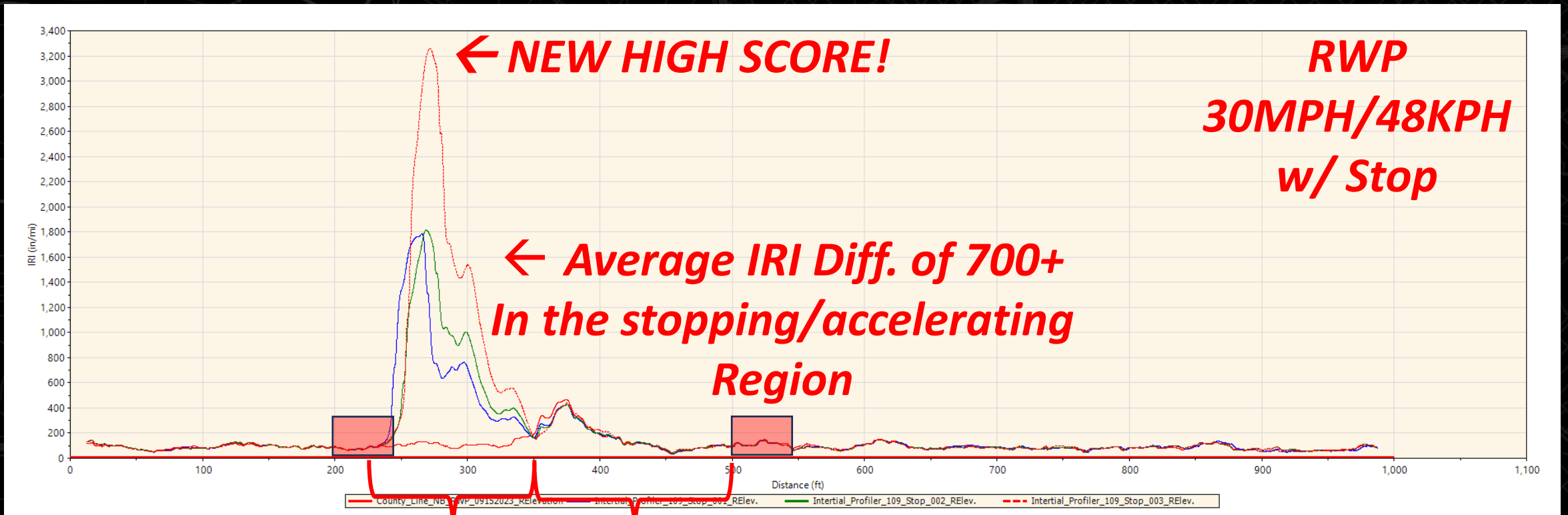
Statistic	Repeatability - Left	Repeatability - Right	Accuracy - Left	Accuracy - Right
Comparison Count	3	3	3	3
% Passing	100.00	100.00	0.00	0.00
Mean	93.19	96.27	77.13	83.95
Minimum	92.62	95.09	73.98	81.81
Maximum	93.70	97.75	78.78	85.54
Standard Deviation	0.5	1.4	2.7	1.9
Grade	Passed	Passed	Failed	Failed

Accuracy			Repeatability - Left Correlations (%)			Repeatability - Left Offsets (ft)			Repeatability - Right Correlations (%)			Repeatability - Right Offsets (ft)		
Run	Left	Right	Run	2	3	Run	2	3	Run	2	3	Run	2	3
1	78.78	81.81	1	93.70	92.62	1	-0.2	-0.2	1	95.97	95.09	1	-0.2	-0.2
2	78.62	85.54	2		93.26	2		0.0	2		97.75	2		0.0
3	73.98	84.51												

**ASP (x3 runs) 1000 Ft**



# Ride Quality Analysis (Continuous, 25ft Interval)(ProVAL)

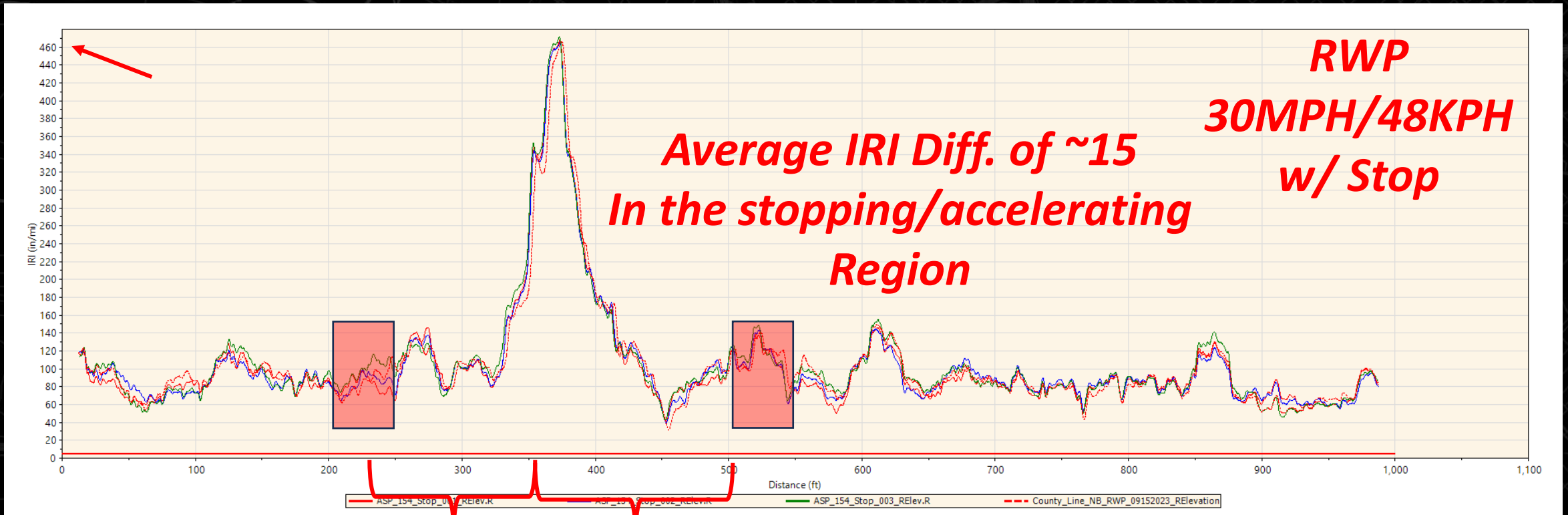


**Stopping Accelerating**

**Inertial profiler (x3 runs) 1000 Ft**



# Ride Quality Analysis (Continuous, 25ft Interval)(ProVAL)



**Average IRI Diff. of ~15  
In the stopping/accelerating  
Region**

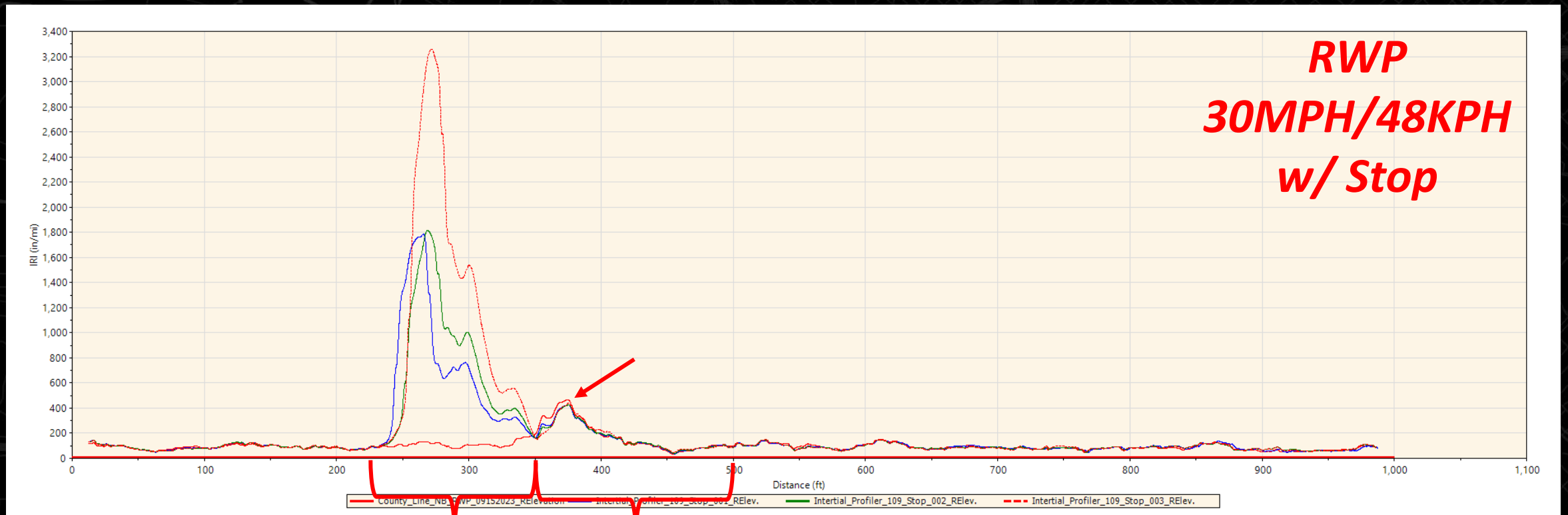
**RWP  
30MPH/48KPH  
w/ Stop**

**Stopping Accelerating**

**ASP (x3 runs) 1000 Ft**



# Ride Quality Analysis (Continuous, 25ft Interval)(ProVAL)



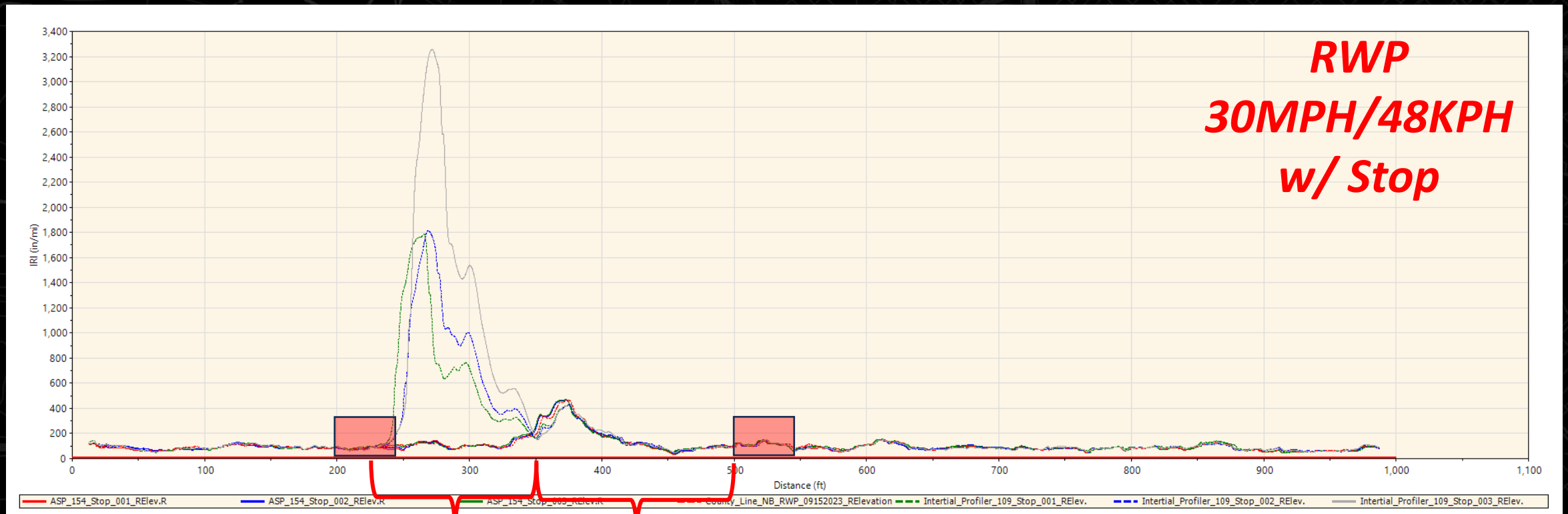
**RWP**  
**30MPH/48KPH**  
**w/ Stop**

**Stopping Accelerating**

**Inertial profiler (x3 runs) 1000 Ft**



# Ride Quality Analysis (Continuous, 25ft Interval)(ProVAL)



**RWP**  
**30MPH/48KPH**  
**w/ Stop**

**Stopping Accelerating**

**ASP and Inertial Profiler (x6 runs) 1000 Ft,  
30mph w/ abrupt stop (100 ft)**



*Thank you!*

## *Points of interest...*

- Procuring a test site: Currently 3 facilities in the US*
- Facilitating the tests— knowledgeable staff*
- Time consuming— A necessary evil?*
- Interpreting the results— Manual analysis (ProVal)*





**RPUG 2024**  
Road Profile Users' Group

April 29 - May 2



**ST. AUGUSTINE**  
FLORIDA

*New Technology For An Old World*

QUESTIONS?

COME BY THE PATHWAY  
SERVICES INC. BOOTH  
TO DISCUSS MORE...



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