2020 WEBINAR SERIES

RPUG Road Profile Users' Group

ProVAL: Upcoming Improved and New Features

By

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The Transtec Group

THE TRANSTEC GROUP

RPUG Road Profile Users' Group

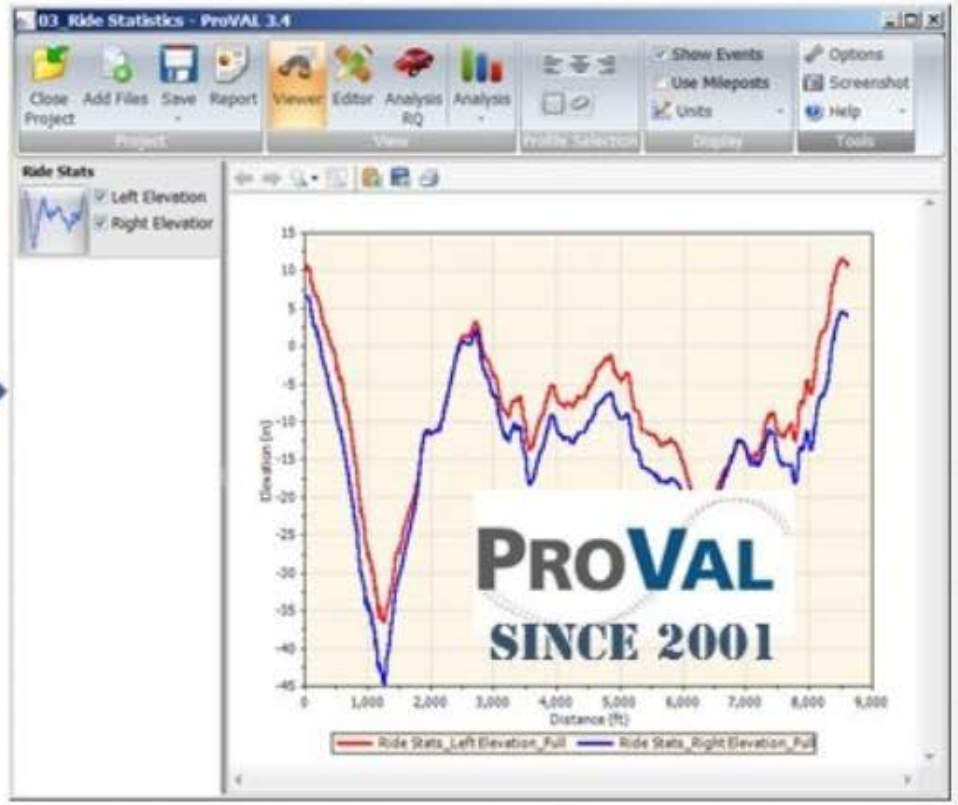
PROVAL *View and analyze pavement profiles*

SOFTWARE | WORKSHOPS | LIBRARY | FAQ | NEWS | SUPPORT

www.RoadProfile.com

Many Different Profilers...

One Standard Software



TPF-5(354) TPF ProVAL Support

- SDDOT Contract #614565
- 2017 – 2020

Task 1: TPF-5(354) Meeting

Task 2: ProVAL Software Maintenance

Task 3: ProVAL Website Maintenance

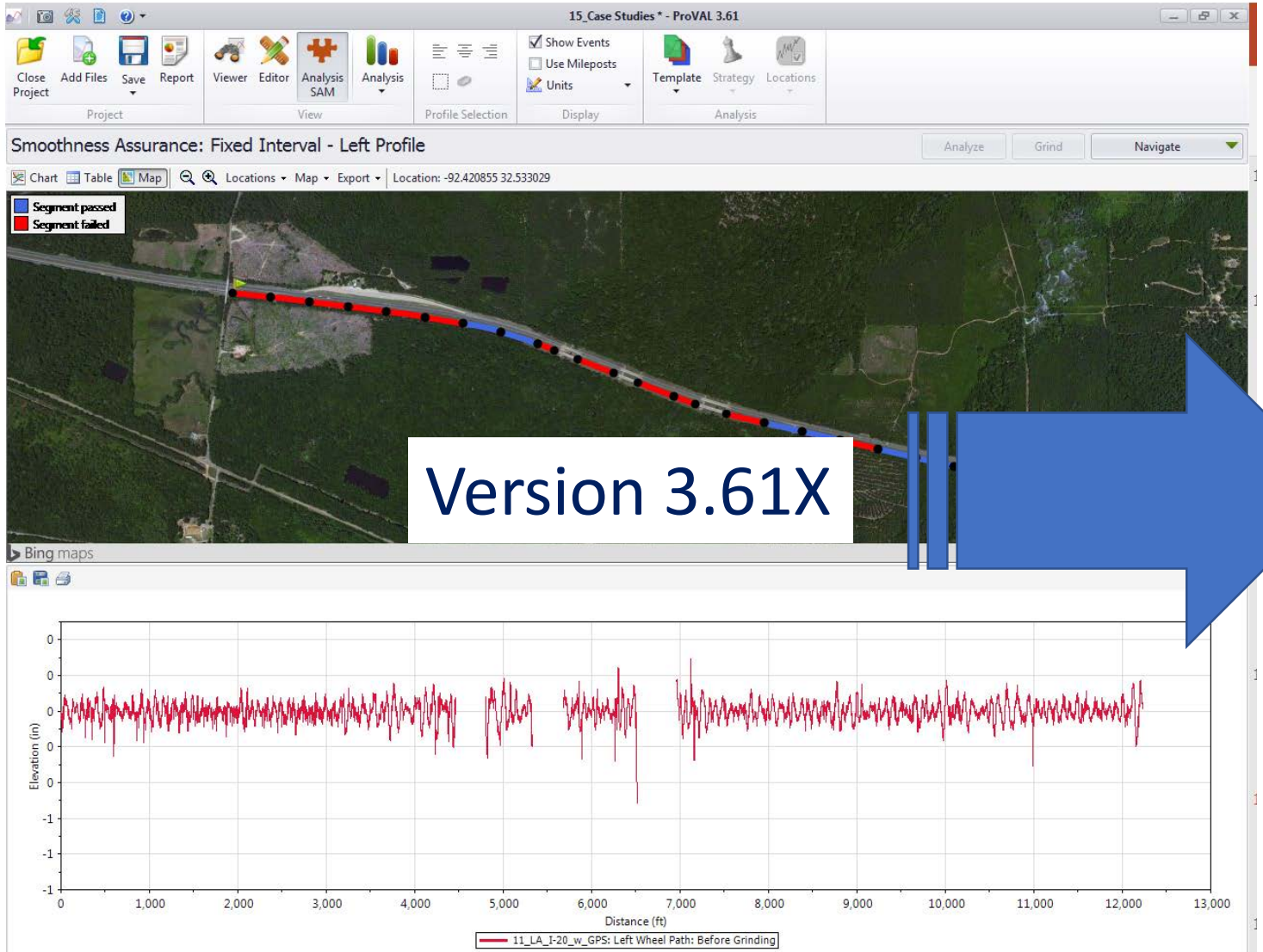
Task 4: ProVAL Support

Task 5: ProVAL Training Workshops

Task 6: ProVAL Enhancements

Task 7: Update ProVAL Users Manual

ProVAL Enhancements



Version 3.61X

PROVAL

Continuous Improvement

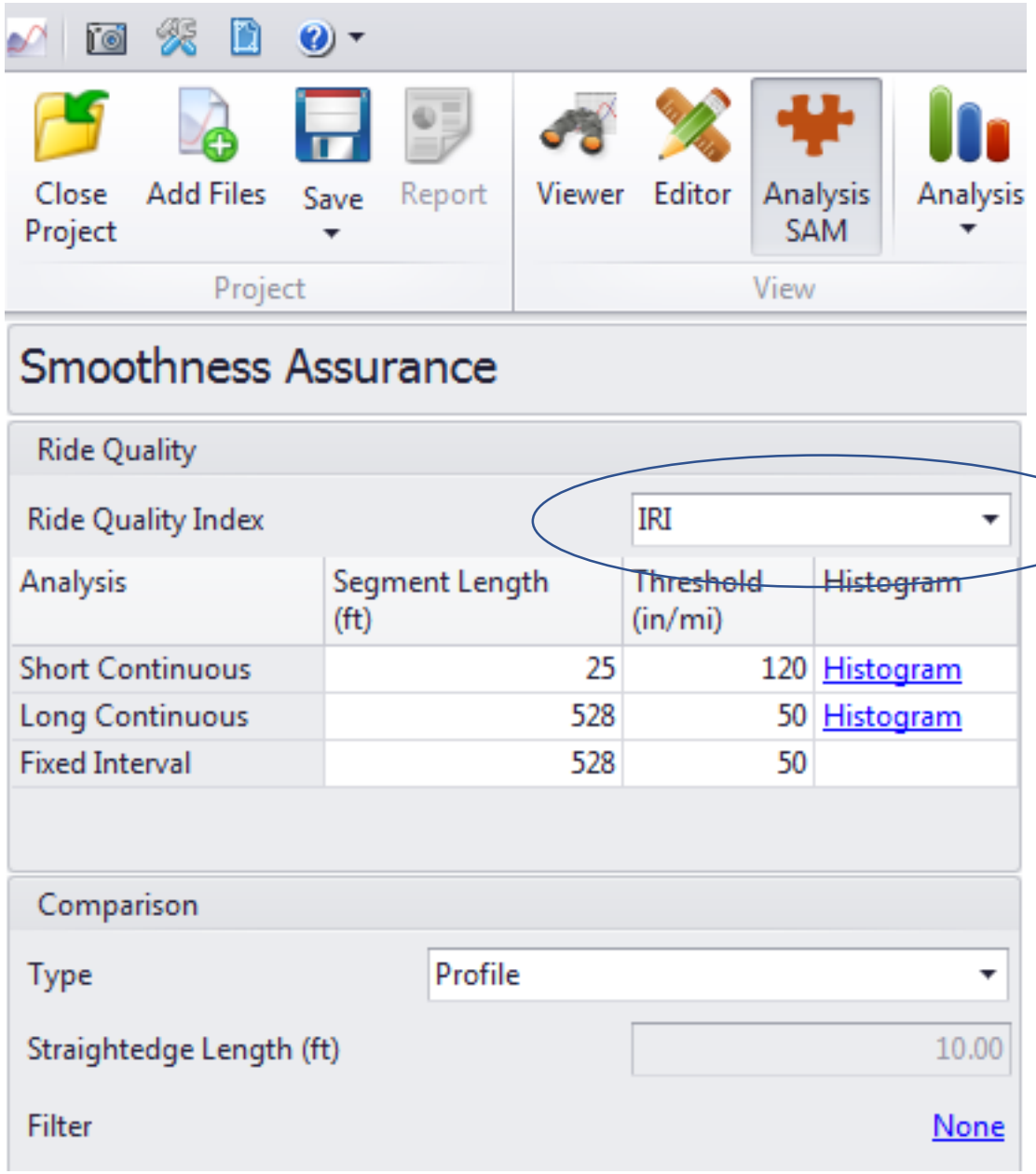
Version 4.0

TPF Survey (Feb. 13, 2020)

#	Topic	Score
7	Profile Measurement Screening Tool	4.28
10	Enhanced Cross Correlation	3.84
1	Smoothness Assurance Module Enhancements	3.82
2	Optimization of Grinding Simulation	3.5
5	Bing Maps for Improved Route Creation	3.44
[illegible]	Support for Stationing	3.28
[illegible]	Import Route GPS Information for New Alignment Projects	3.22
6	GPS Verification and Tampering Prevention	3.22
3	Jointed Concrete Pavement Curl and Warp Analysis	3.16
11	Miscellaneous ProVAL Enhancements	3.11
9	Reporting Conveniences	3.06

Final TPF Approved List (Feb. 13, 2020)

No.	Titles
1	Smoothness Assurance Enhancements
2	Optimization of Grinding Simulation
3	JCP Curl and Warp Module
4	Replace MapQuest with Bing Map
5	GPS Data Management to Prevent Tampering
6	Profile Measurement Screening Tool
7	Reporting Convenience
8	Enhanced Cross Correlation
9	Miscellaneous Enhancements



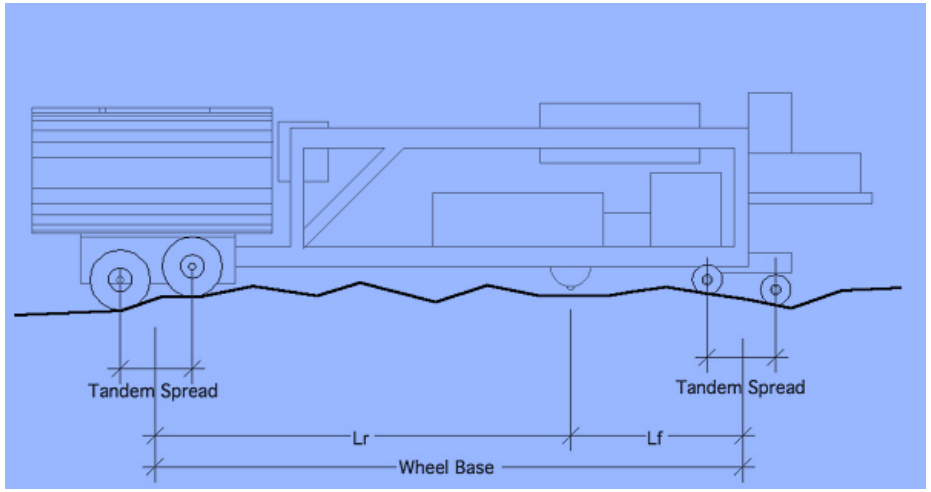
Same Index for all analyses

1 - Smoothness Assurance Module Enhancements

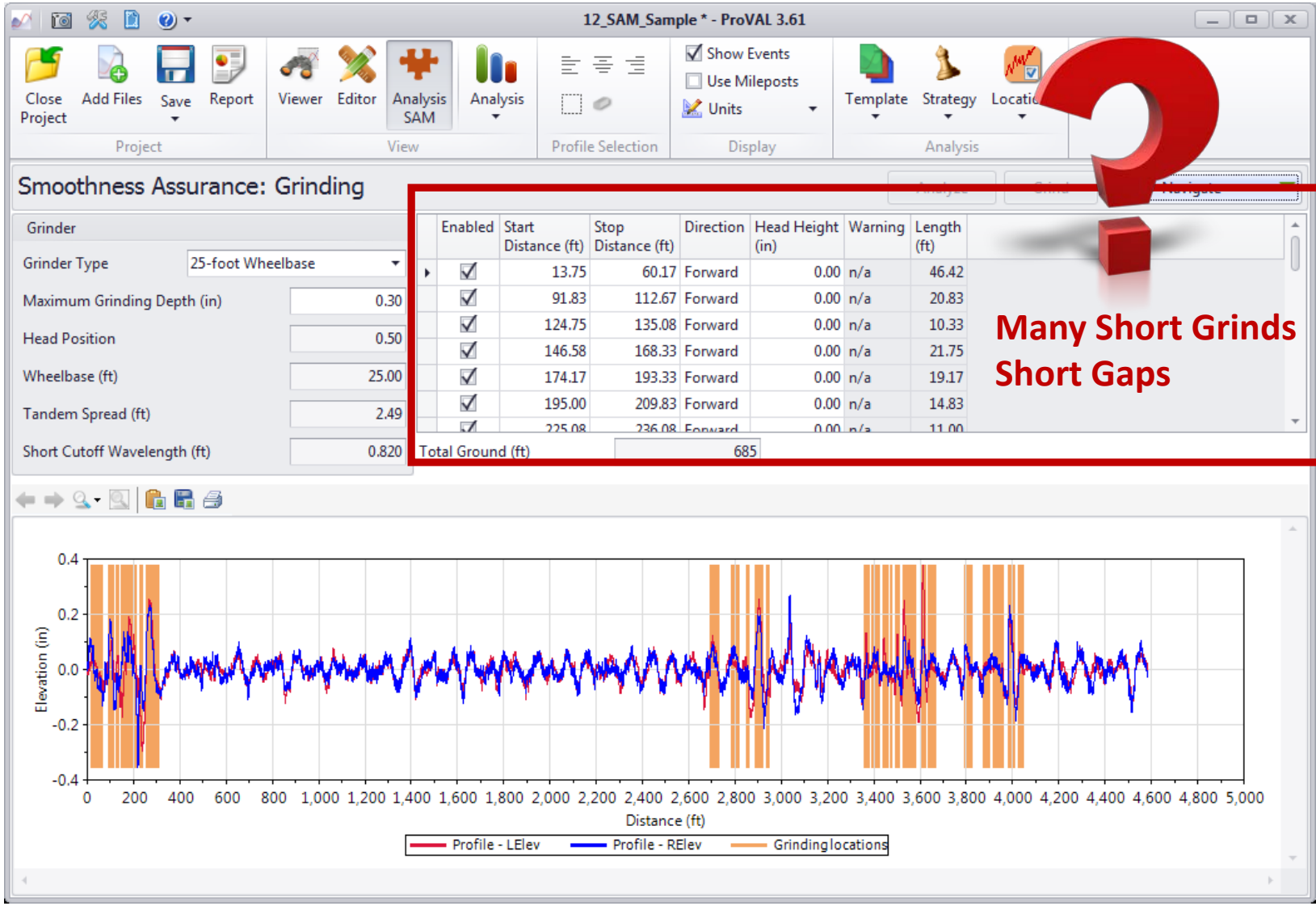
- Allow users to select **different ride indexes** for short continuous roughness analysis, long continuous roughness analysis, and fixed interval analysis as well as enable/disable the analyses.
- For example, a user may select **IRI** for short continuous roughness analysis, disable long continuous roughness analysis, and select **MRI** for the fixed interval analysis. The report will reflect these users' choices.

SAM - Grinding Simulation

Core Algorithm Since 2005



Mainly
Minimizing ALR
Only



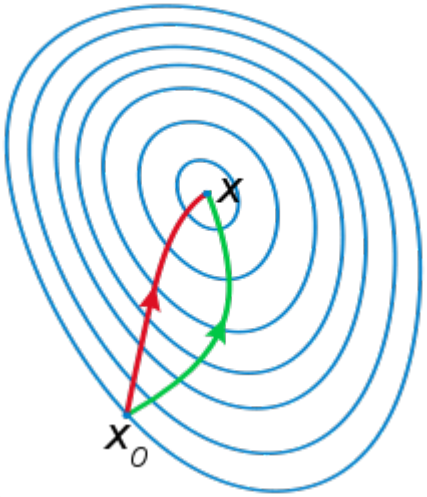
2 - Optimization of Grinding Simulation 1/2

- Eliminate as many of the **short-interval defective segments** as possible, or
- Eliminate as many of the **long-interval (continuous report) defective lengths** as possible, or
- Get as many **fixed-interval lots** under a desired threshold as possible
- Consider the grinding locations for both **left and right** wheel tracks,

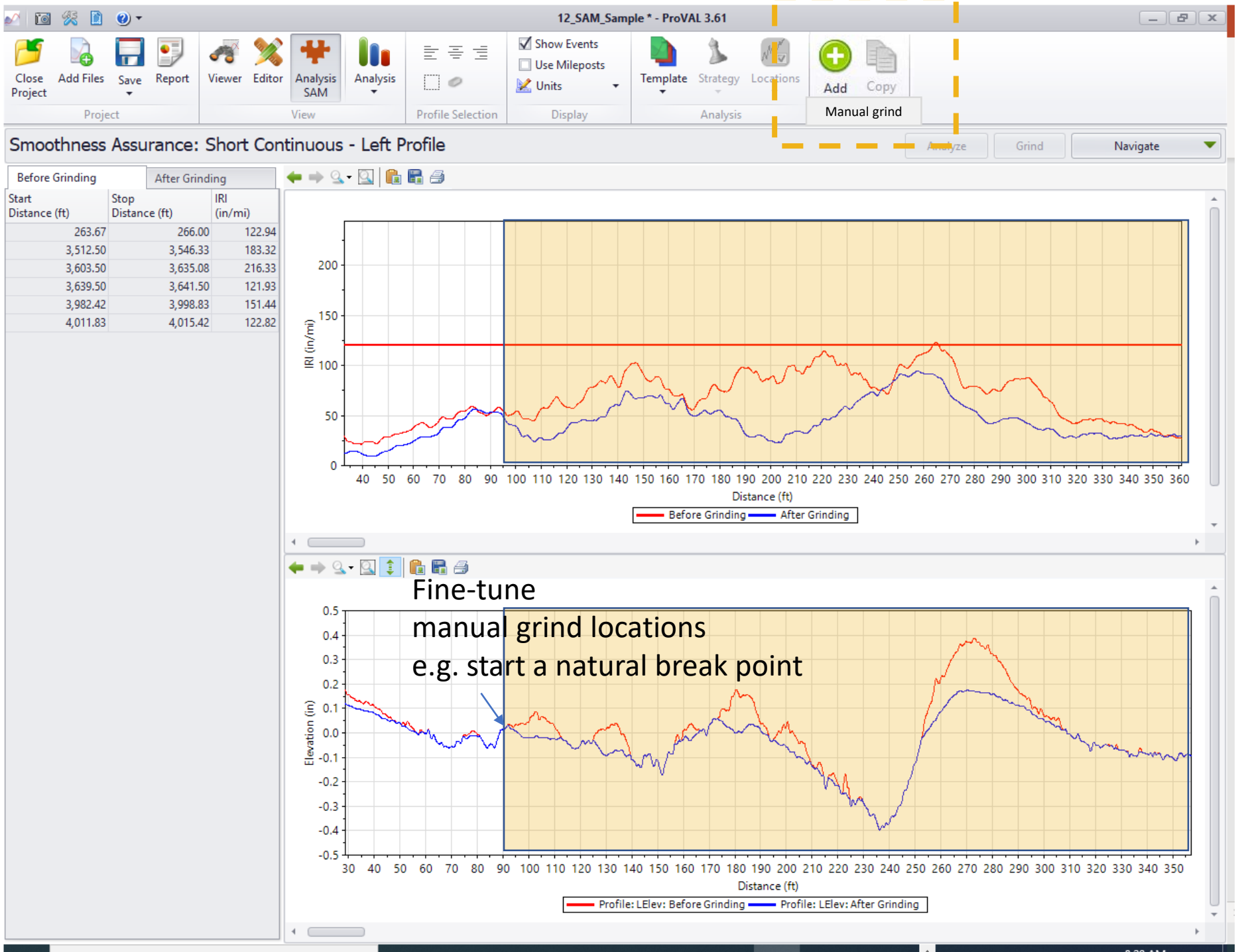
Source: Safety Grooving & Grinding

2 - Optimization of Grinding Simulation 2/2 (cont'd)

- Eliminate spurious ground areas that are too **short** (e.g., users provide minimum ground length of 3 ft),
- Combine ground locations where the gap is between is too short (e.g., users provide minimum **ground gap** of 5 ft),
- Add and delete ground locations,
- Sort and select ground locations based on **grinding depths**,
- Save **customized** grinder setup.




12_SAM_Sample * - ProVAL 3.61
Close Project
Add Files
Save
Report
Viewer
Editor
Analysis SAM
Analysis
Project
View
Profile Selection
Show Events
Use Mileposts
Units
Display
Template
Strategy
Locations
Add
Copy
Analysis
Manual grind
Smoothness Assurance: Short Continuous - Left Profile
Analyze
Grind
Navigate
Before Grinding
After Grinding
Start Distance (ft)
Stop Distance (ft)
IRI (in/mi)
263.67 266.00 122.94
3,512.50 3,546.33 183.32
3,603.50 3,635.08 216.33
3,639.50 3,641.50 121.93
3,982.42 3,998.83 151.44
4,011.83 4,015.42 122.82
Preserve one-grind results to aid users to determine manual grind locations
IRI (in/mi)
Distance (ft)
Before Grinding
After Grinding
Elevation (in)
Distance (ft)
Profile: LElev: Before Grinding
Profile: LElev: After Grinding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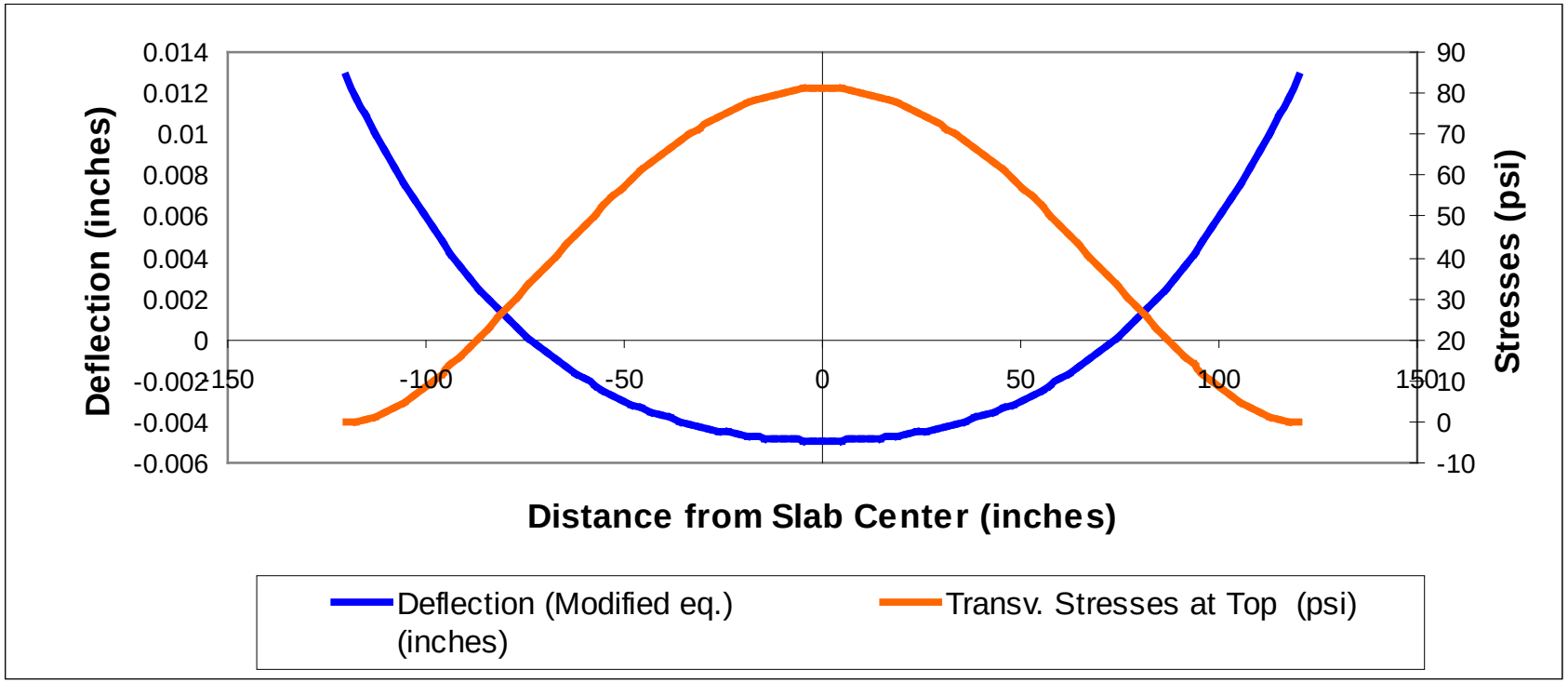
4,011.83 4,015.42 122.82
IRI (in/mi)
Distance (ft)
Before Grinding
After Grinding
Fine-tune
manual grind locations
e.g. start a natural break point
Elevation (in)
Distance (ft)
Profile: LElev: Before Grinding
Profile: LElev: After Grinding

JCP Curl and Warp

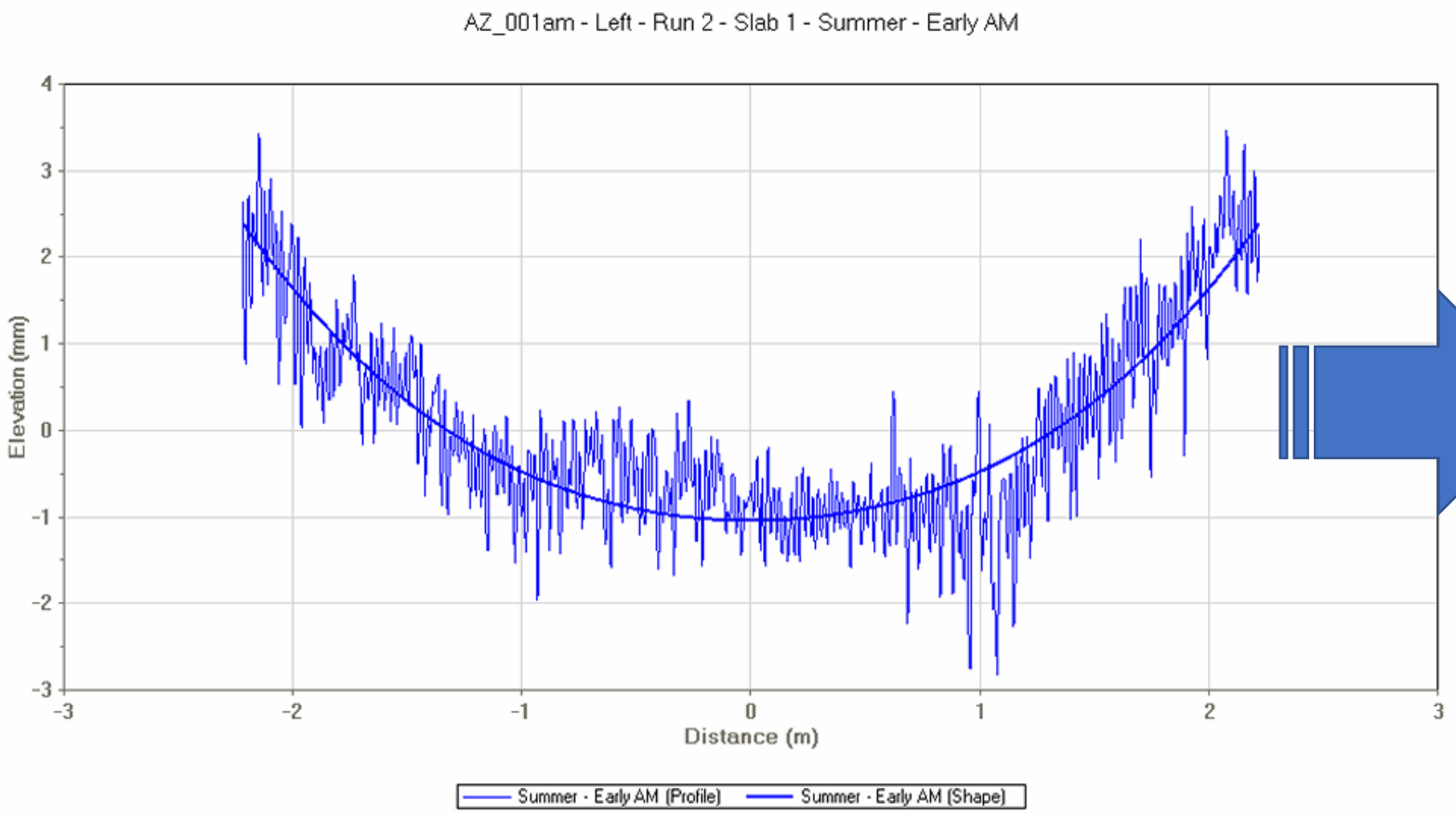


$$z = -z_o \frac{2\cos\lambda\cosh\lambda}{\sin 2\lambda - \sinh 2\lambda}\left[(-\tan\lambda + \tanh\lambda)\cos\frac{x}{l\sqrt{2}}\cosh\frac{x}{l\sqrt{2}} + (\tan\lambda + \tanh\lambda)\sin\frac{x}{l\sqrt{2}}\sinh\frac{x}{l\sqrt{2}}\right]$$

Westergaard curling function

Source: Chang et al (2008)

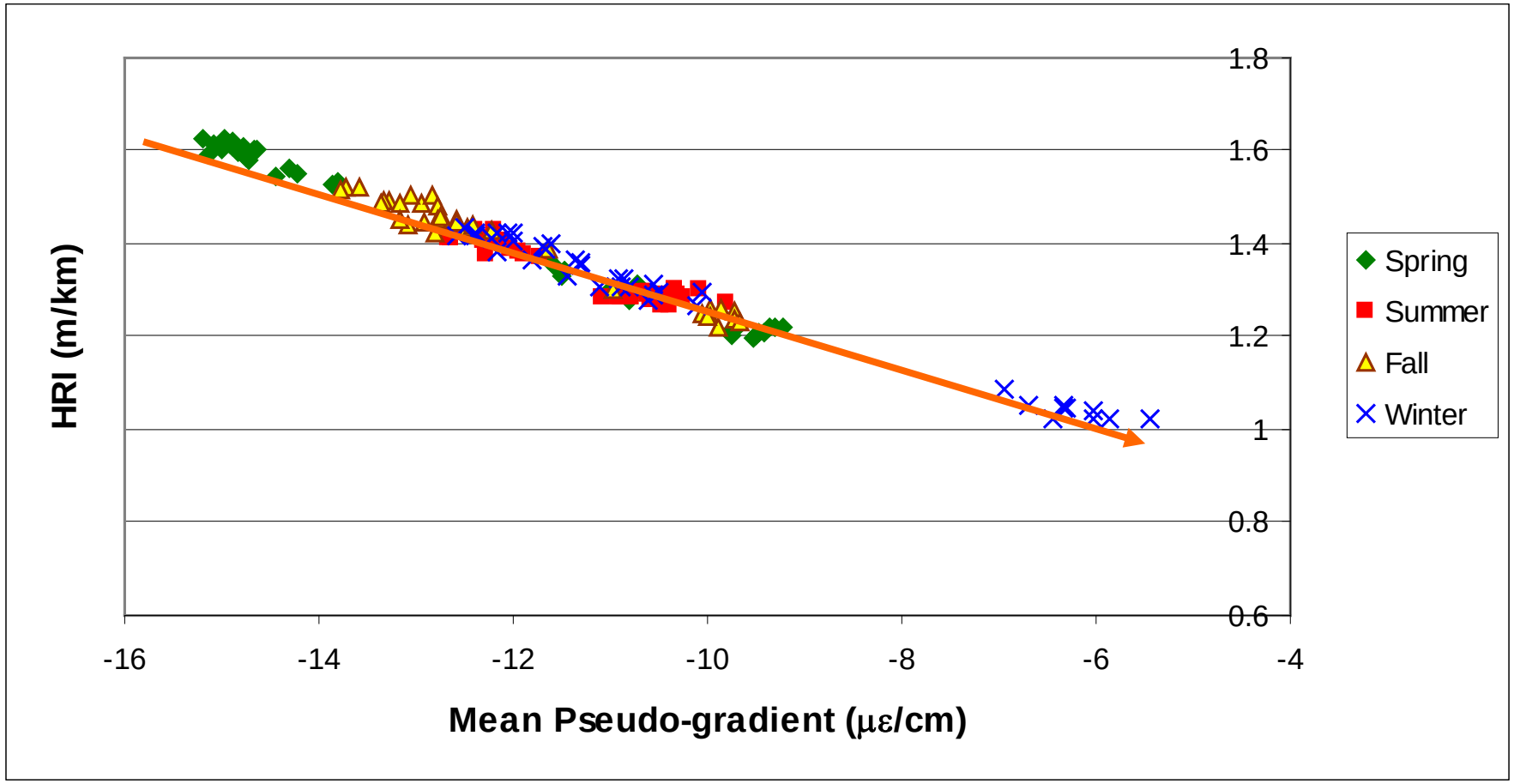
Fit Profiles to Westergaard Curl Equation



2GCI

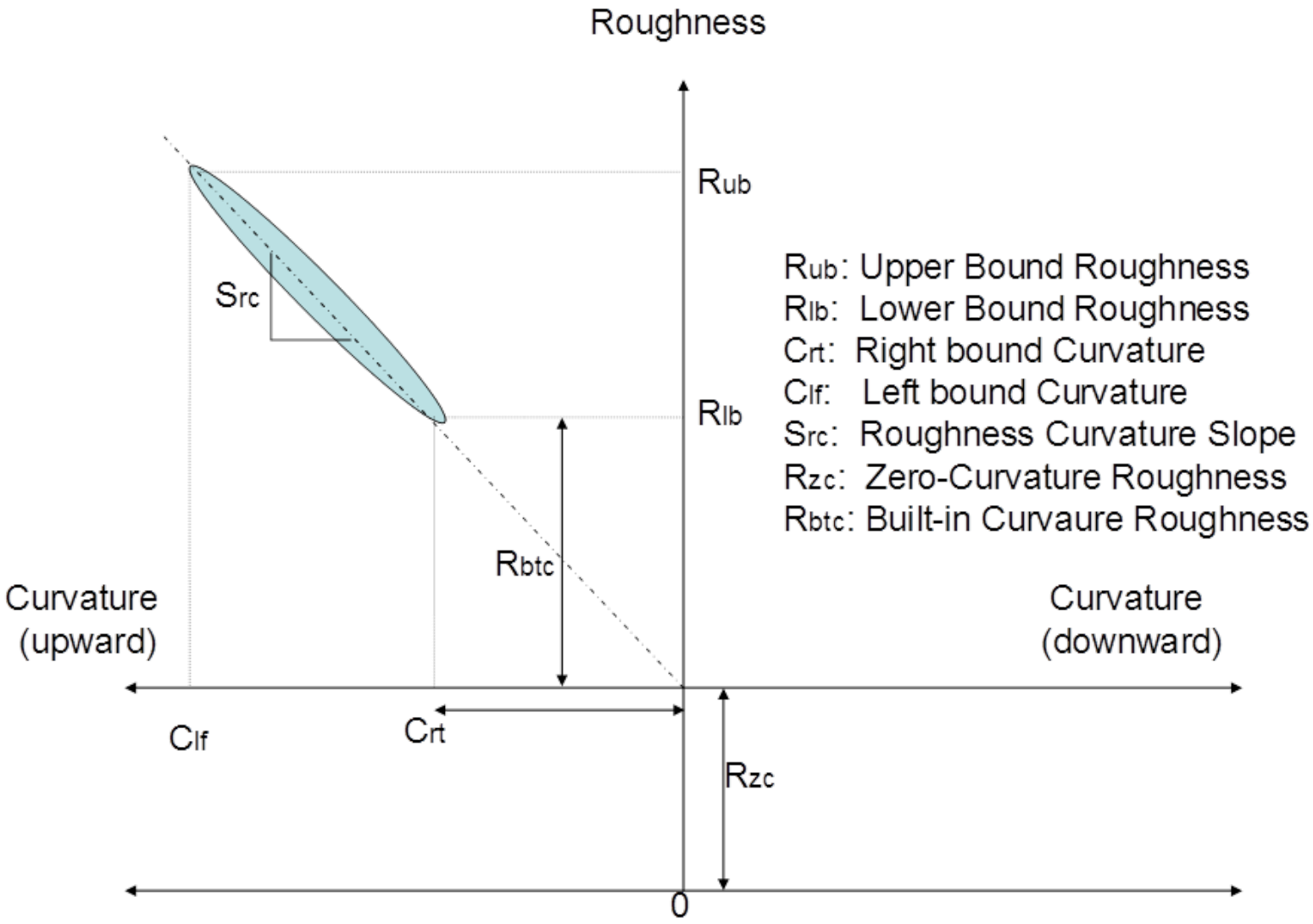
Correlation between Roughness and Curvatures

AZ_001m



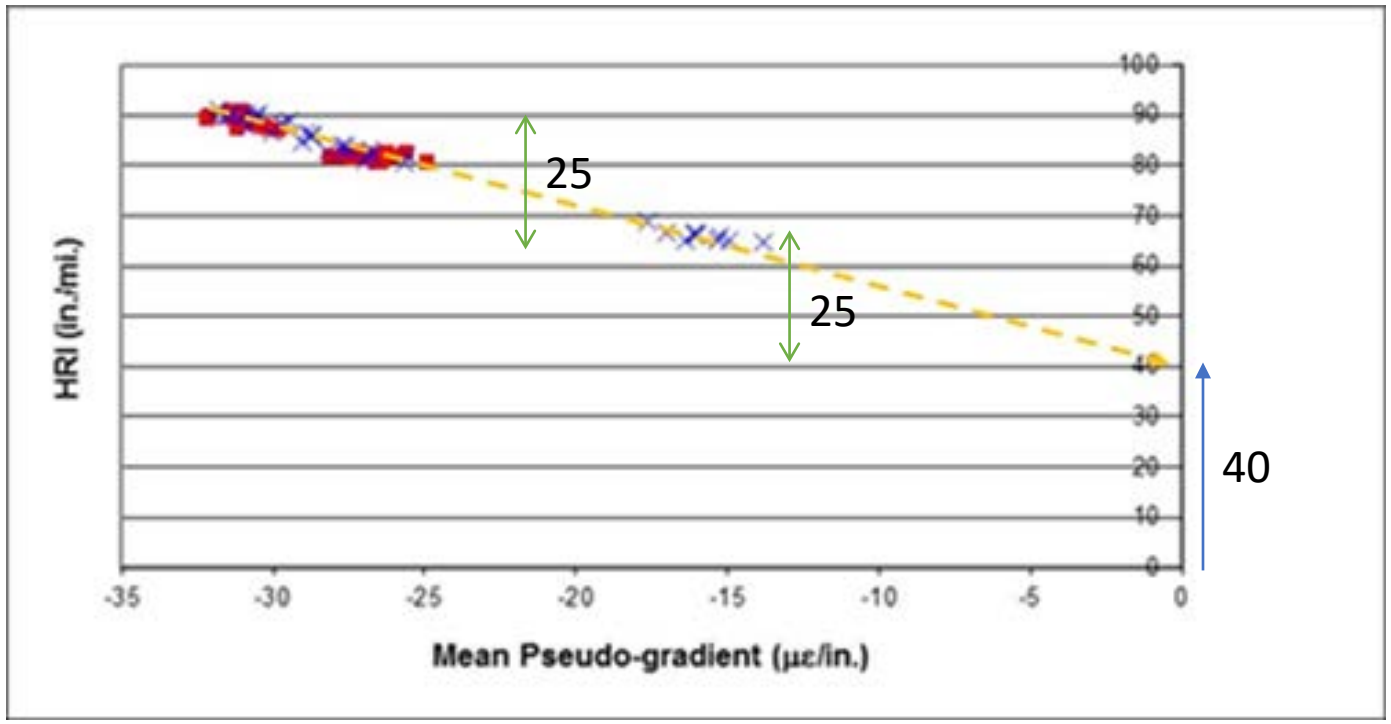
Source: Chang et al (2008)

RoCK Curl and Warp Model



Source: Chang et al (2008)

Impact of Curling on Roughness



Negative CVI >> Curled Up

ΔHRI = 25 in./mile

Built-in Curl Roughness = 25

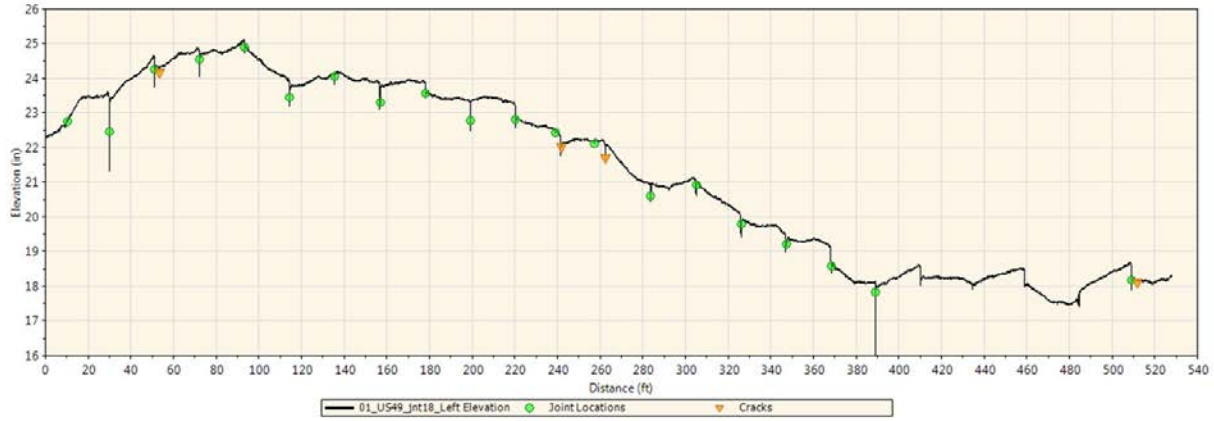
Zero-Curvature Roughness = 40

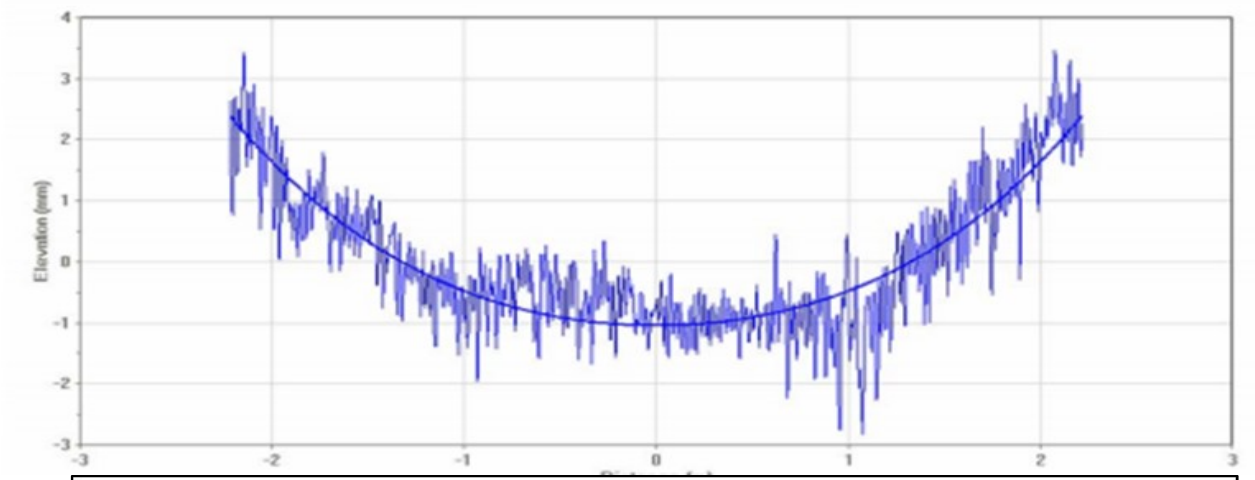
Source: Chang et al (2008)

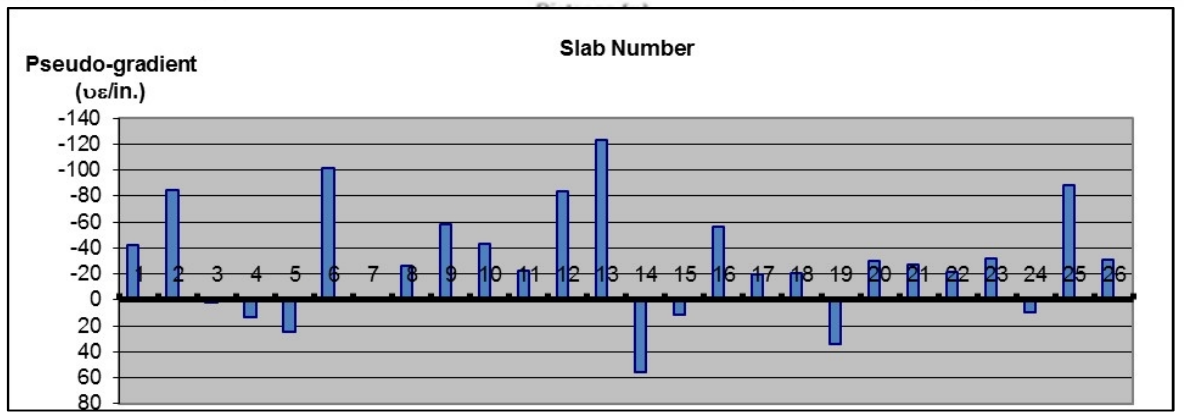
3 - JCP Curl and Warp Analysis

- Fixed **pseudo-radius** will be used. Additional user inputs will include: **PCC Poisson's ratio**, **PCC Modulus**, **PCC thickness**, and **support K-value**.
- Identify the joint locations (excluding cracks) in the profile data,
- Isolate profile slices within each JCP slab (after the above identification of joint locations is completed),
- Perform non-linear fitting of the slab profile data with the Westergaard curling function to produce **CVI**,
- Report CVI for all slabs,
- Report the relationship between CVI and roughness (HRI or MRI).

Similar to AFM





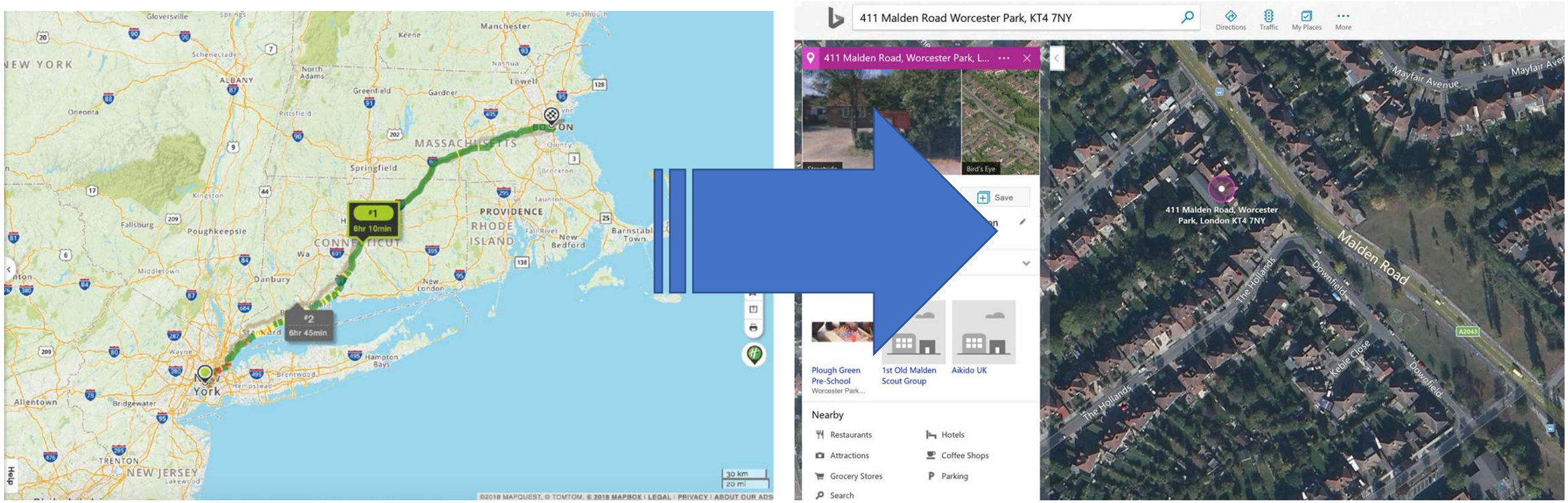


Slab Isolation

2GCI Fitting
for each slab

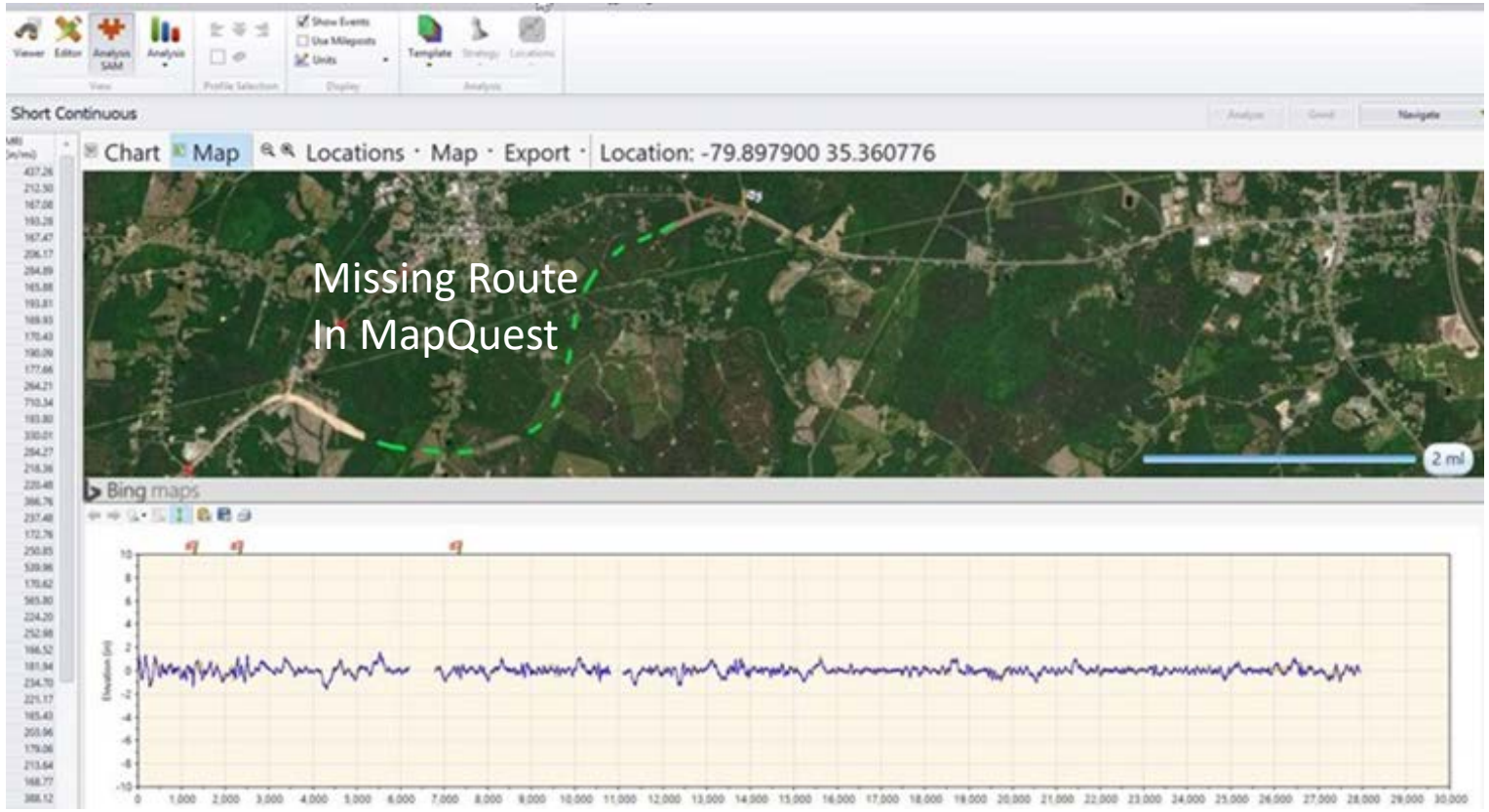
Curvature Reports

4 - Replace MapQuest with Bing Map



Benefits of Using Bing Map

- More **Updated** Maps and Routes
- **Higher Limit** for Route Creation Requests



5 - GPS Data Management to Prevent Tampering

- Remove **start and stop** coordinates the Editor/Basic.
- **Read-only versions** added to the Editor/Info.
- Provide Option to use the **GPS route data** collected with the profile data.
- If online route creation is not available, inaccurate, undesired, or not allowed, this will still allow the profile data to be mapped in ProVAL.

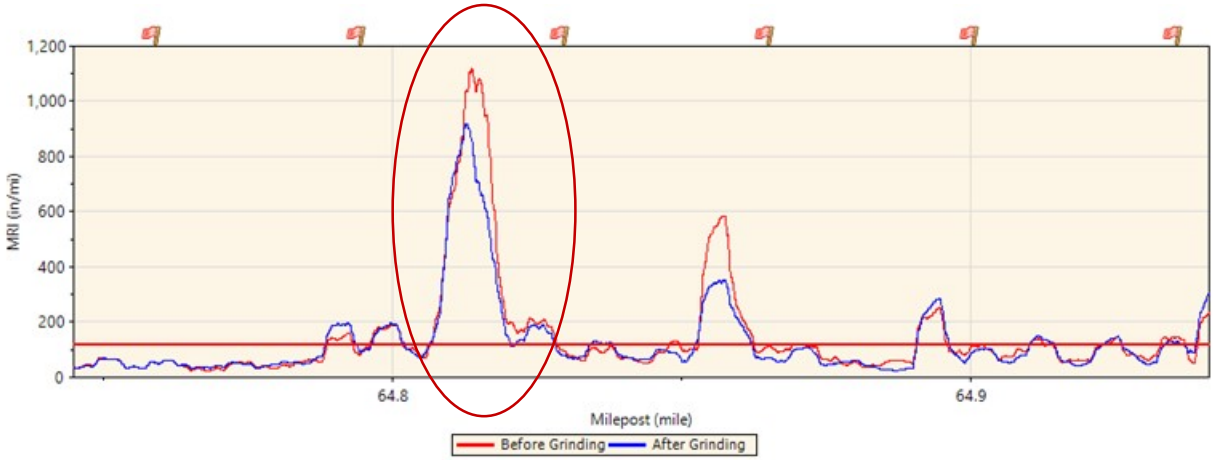
6 - Profile Measurement Screening Tool

- Check if the profile data was **smoothed or low-pass filtered**. Issue warning if the low-pass filter has removed too much profile content that matters to IRI.
- Issue a warning for a **recording interval** that is too large, or excessive quantization.
- Check if **high-pass filtered** - if so, provide users the estimated cutoff wavelength for the high-pass filtering.

Profile Sniffer!

6 - Profile Measurement Screening Tool

- Check if any **abnormalities** exist in the data and highlight the locations “unrealistic disturbance”
- Check **unusually low roughness** as a sign of trouble and highlight the locations.
- Check **skewed spectral content** (either too wavy or too choppy) that suggests a major malfunction in one of the sensors.

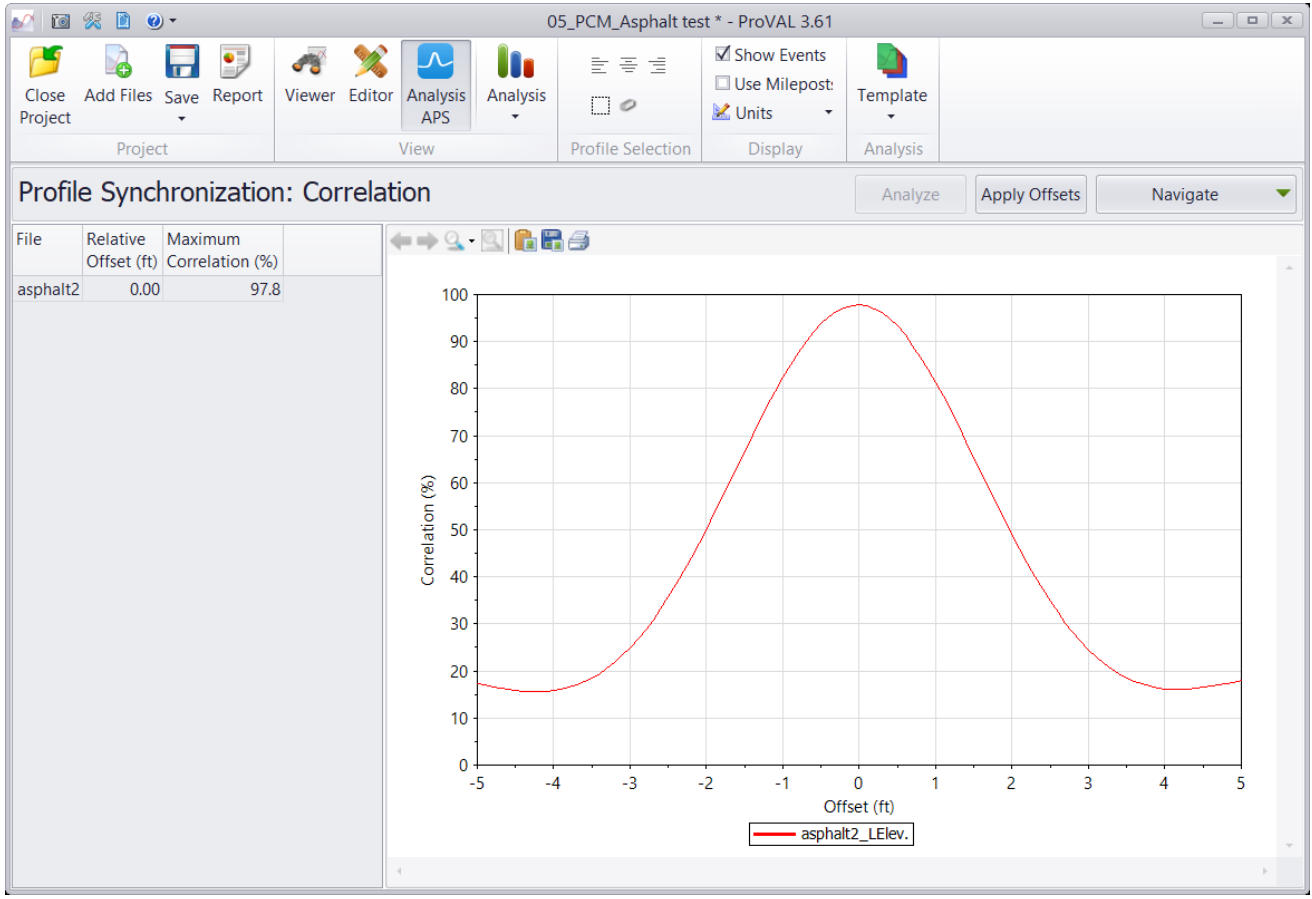


7 - Reporting Convenience

- Include **page breaks** for titles separating Short Continuous, Long Continuous, and Fixed Interval reports from the SAM analysis,
- Include an option to print a **chart** to over multiple pages.

8 - Enhanced Cross Correlation

- Decimation
  - Save Time
- Adjustment of Sampling Interval
  - Avoid Influence of DMI Error
- Preprocessors
  - Padding (insufficient lead-in)
  - Up-Sampling (increase sampling)

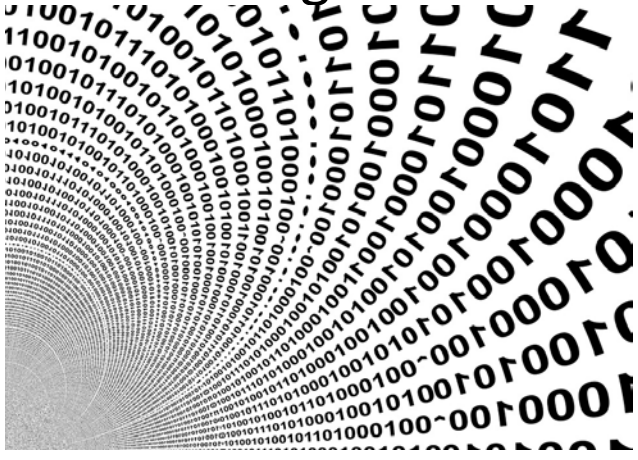


9 - Miscellaneous Enhancements

- **Smoothness Assurance Module (SAM)**
  - Display the profile lengths for each bin of histogram.
  - Include the lengths of all localized roughness “hot spots” in the analysis results and reports
  - Allow options for enabling only desired analyses in SAM. Will be reflected in Template.
- **Fixed Interval Reports**
  - Allow fixed interval reports for profile segment less than the segment length for cases such as a very short profile, or profile sections between two close adjacent exclusions. This changes will apply to the Ride Quality and SAM modules.
- **Template**
  - Make the import feature intuitive, so that users can simply click the OK button after the import.

9 - Miscellaneous Enhancements

- Rolling Straightedge (**RSE**)
  - Indicate percentage of defective length.
- General
  - Import files using less memory.
  - Add **64-bit version** to allow for handling **larger files** which cannot be handled by the current 32-bit version of ProVAL.
  - Improve **performance** of event marker drawing on chart to prevent freezing.



Questions and New Ideas for Future ProVAL Enhancements?

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Thank You!

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