

# IRI Field Guide

## (Areas of Localized Roughness – ALR)

\* Steps 1 to 8 are copied from the IRI Field Guide for Smoothness Pay

\*\* Steps 1-8 are to be performed by the contractor and the resulting ProVal ppf files shall be supplied to INDOT PE/PS for review and analysis. In addition, the original raw data files shall be available to INDOT for review in ProVal if requested during the life of the contract.

\*\*\* Steps 9 to 17 are to be performed by INDOT PE/PS to analyze the ProVal ppf files and download ALR data from ProVal in order to locate areas requiring corrective grinding work.

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ProVAL Applications can be downloaded from FHWA website:

<https://www.fhwa.dot.gov/pavement/proval/>

The screenshot shows a web browser window displaying the FHWA Pavements website. The page title is "Pavements" and the main heading is "Pavement Profile Viewer and Analyzer". The page content includes a description of the ProVAL software, its applications, and a list of events and contact information. The website header features the FHWA logo and navigation links. The browser address bar shows the URL "https://www.fhwa.dot.gov/pavement/proval/".

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### Pavement Profile Viewer and Analyzer

The Profile Viewer and Analyzer (ProVAL) is a software that was initially developed to provide a means to view and analyze pavement profiles efficiently and robustly, as part of the Federal Highway Administration (FHWA) smoothness initiative. ProVAL imports, displays, and analyzes the characteristics of pavement profiles from many different sources. ProVAL can analyze pavement profiles using several methods, including International Roughness Index (IRI), Ride Number, Profile Index, California profilograph, and rolling straightedge, and other more complex filters such as Butterworth band pass filters and power spectral density. Version 1.0 of the ProVAL software could import several popular profile data formats, such as ERD1, TxDOT2, and KJ Law3. A new standard profile format (PPF) was also created as a native ProVAL file specification, which proved to be stable, efficient, portable, and upgradeable. The PPF has since been recommended as the basis for the American Society for Testing and Materials (ASTM) draft profile data standard. Workshop material was also developed along with the ProVAL software to provide training in profiling fundamentals and the application of ProVAL.

### ProVAL Applications

ProVAL can help State highway engineers, contractors, and quality control managers improve the quality of pavement construction by analyzing a given profile quickly and providing results in a number of formats. In addition, researchers can use ProVAL to analyze large numbers of profiles of virtually any length, frequency of data collection, and number of longitudinal traces.

The following Focus article describes Ohio Department of Transportation (ODOT) application of ProVAL: <https://www.fhwa.dot.gov/publications/focus/07jul/02.cfm>

### Events

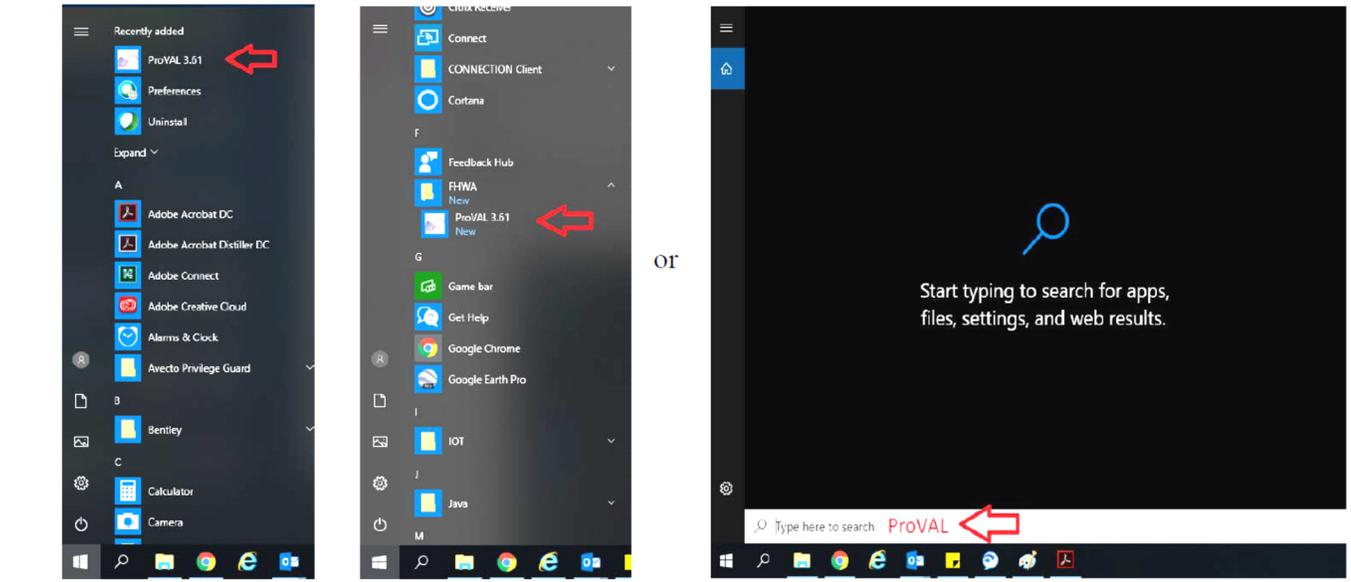
- [Sustainable Pavement Systems Webinar Series: LCCA Part II: Applications](#)  
Webinar  
March 19, 2020
- [View all Upcoming Pavement Events](#)

### Contact

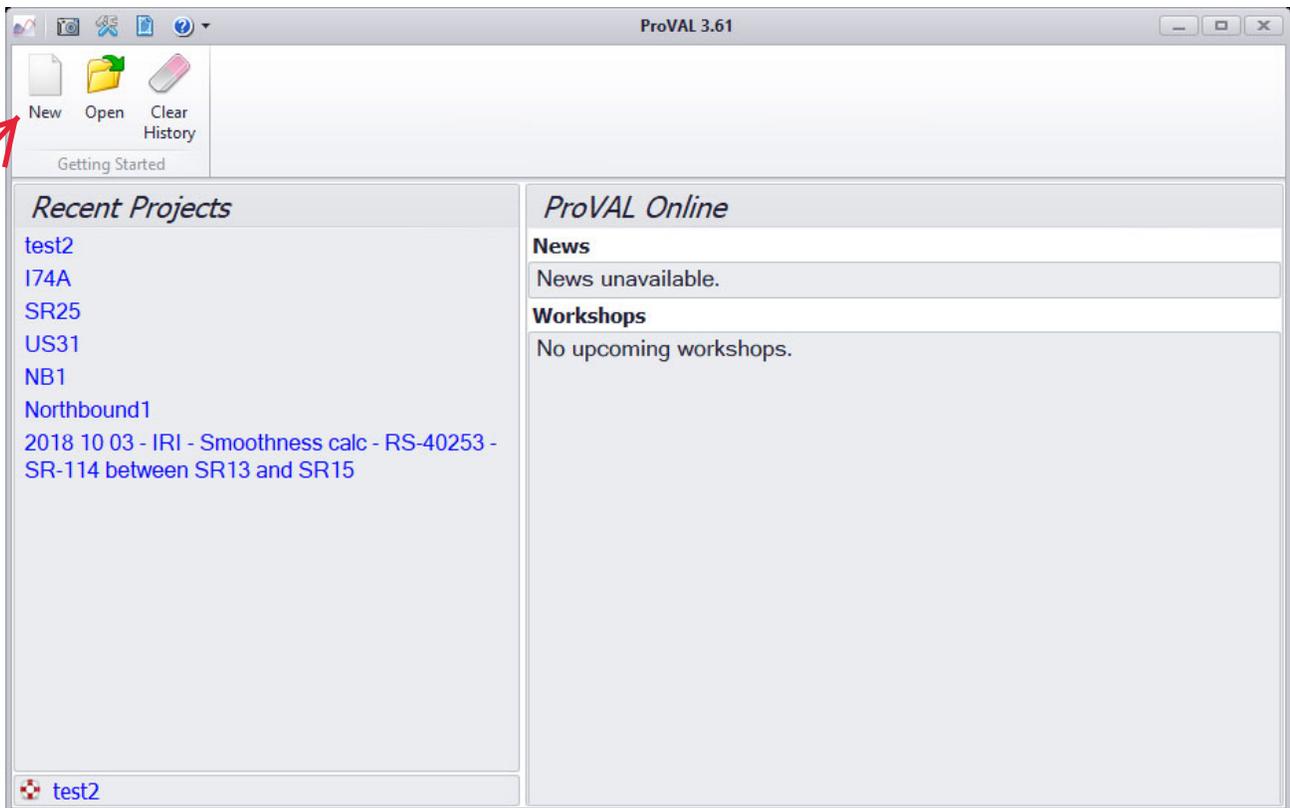
- Tom Yu**  
[Office of Preconstruction, Construction and Pavements](#)  
202-366-1198  
[E-mail Tom](#)

- 1) Open up ProVAL by either going to the Start button -> All Programs -> FHWA -> ProVAL or typing ProVAL into the search bar located in the Start menu

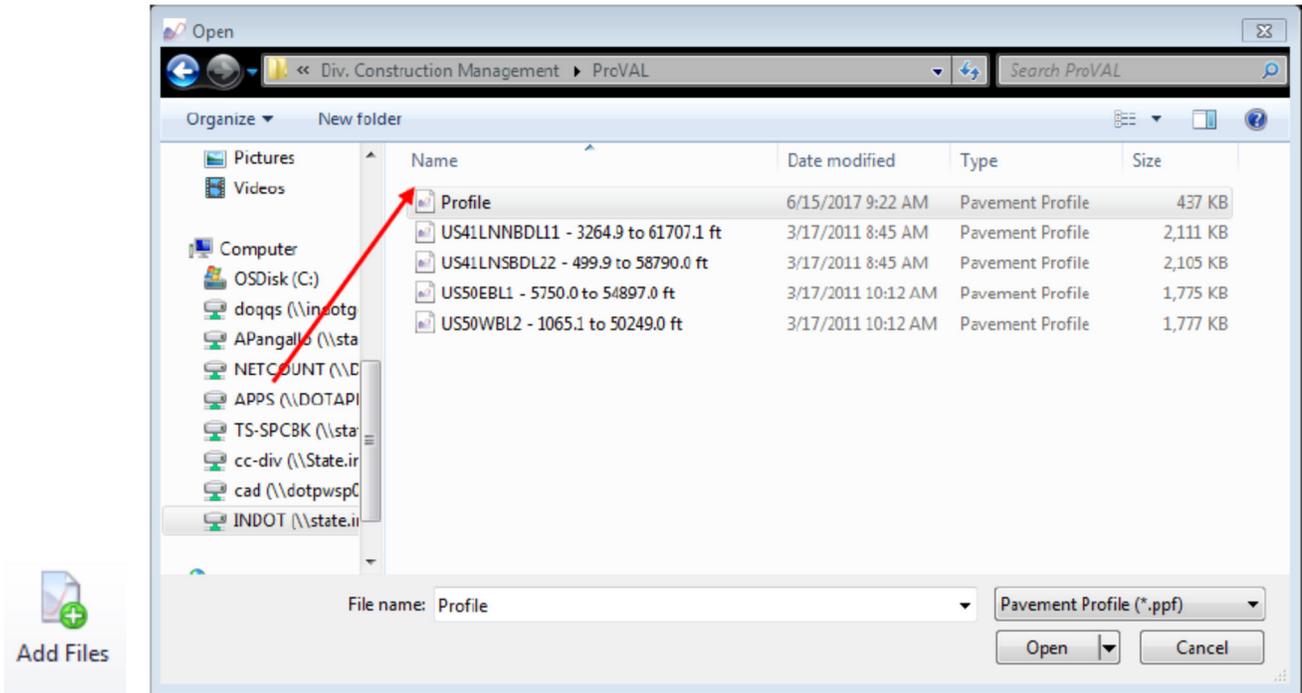
**(Windows 10)**



- 2) Select **New** to begin a new project file

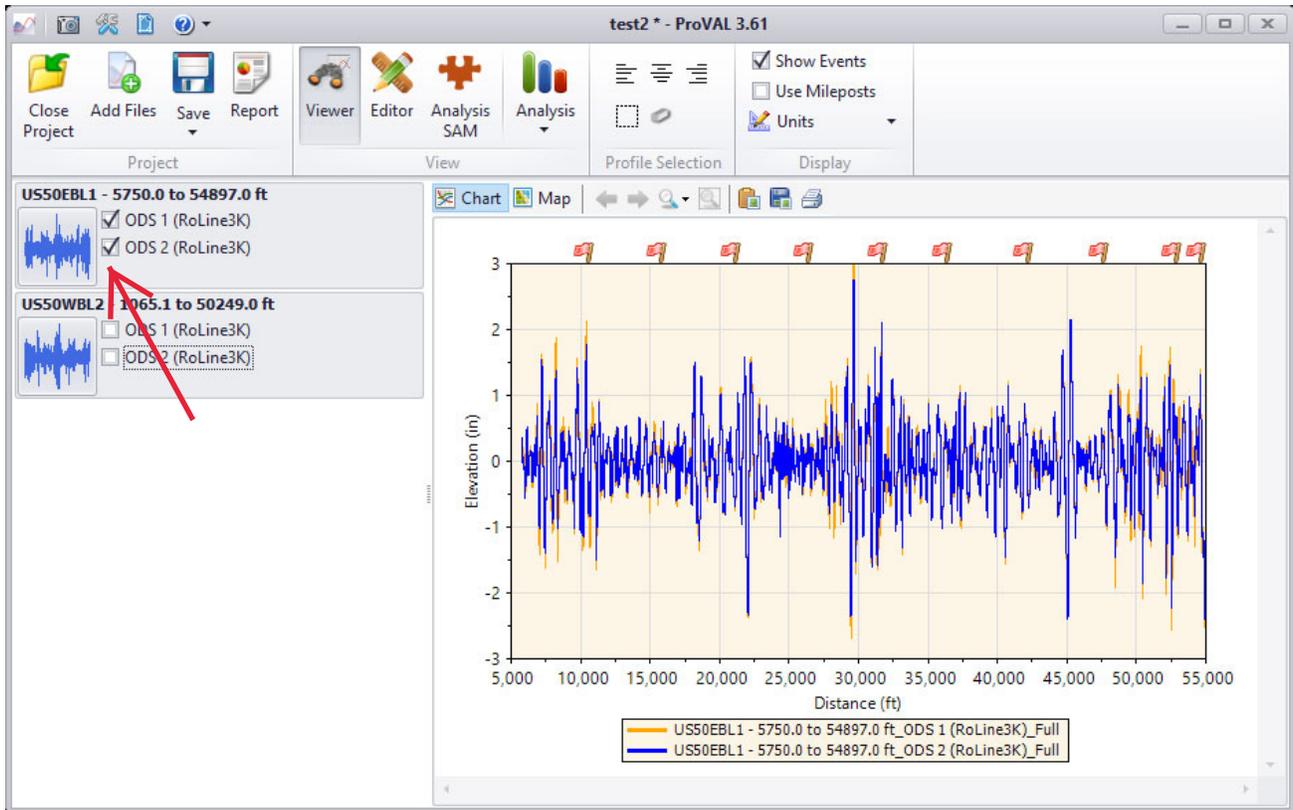


- 3) The data file the Contractor has sent needs to be downloaded onto this project file. Select **Add Files** and browse the folders where you placed the Contractor's data file (window below is only an example of a folder location) and open it.

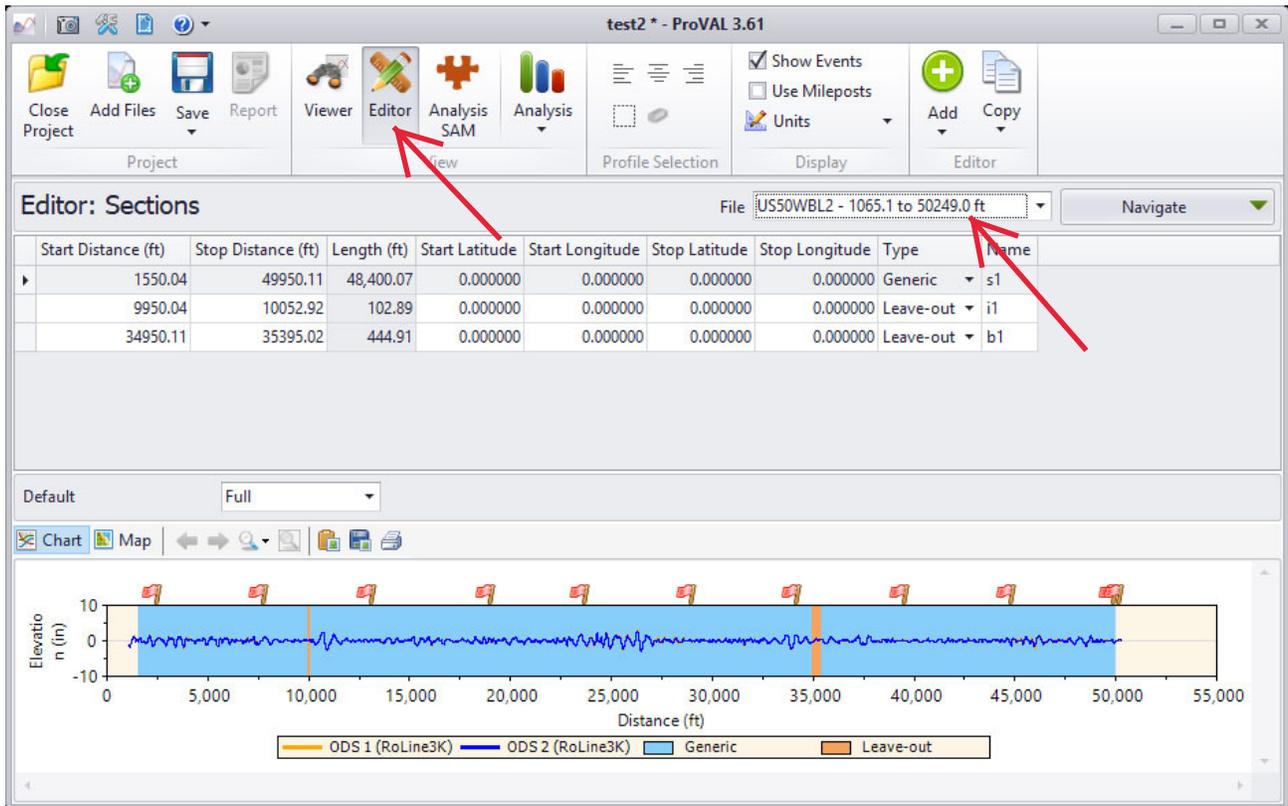


As more data is received, additional files should be added to this one project file to represent all the IRI testing for a contract.

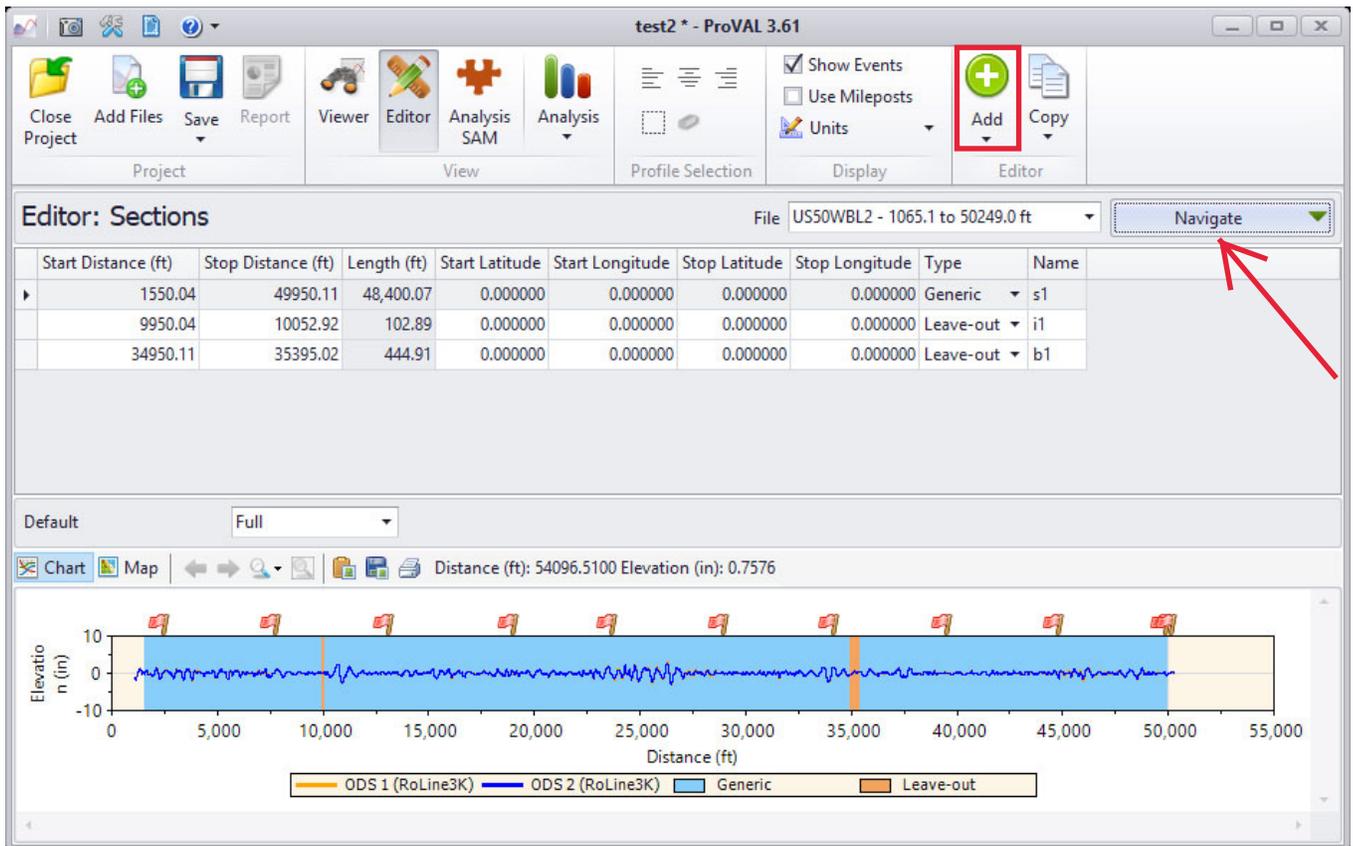
- 4) A data file will automatically begin in the Viewer pane. Each file will have two checkboxes for left and right wheel path readings. Clicking on these checkboxes will display the IRI readouts for the Section tested. The x-axis is listed in feet starting at 0 feet and up to the distance measured by the inertial profiler.



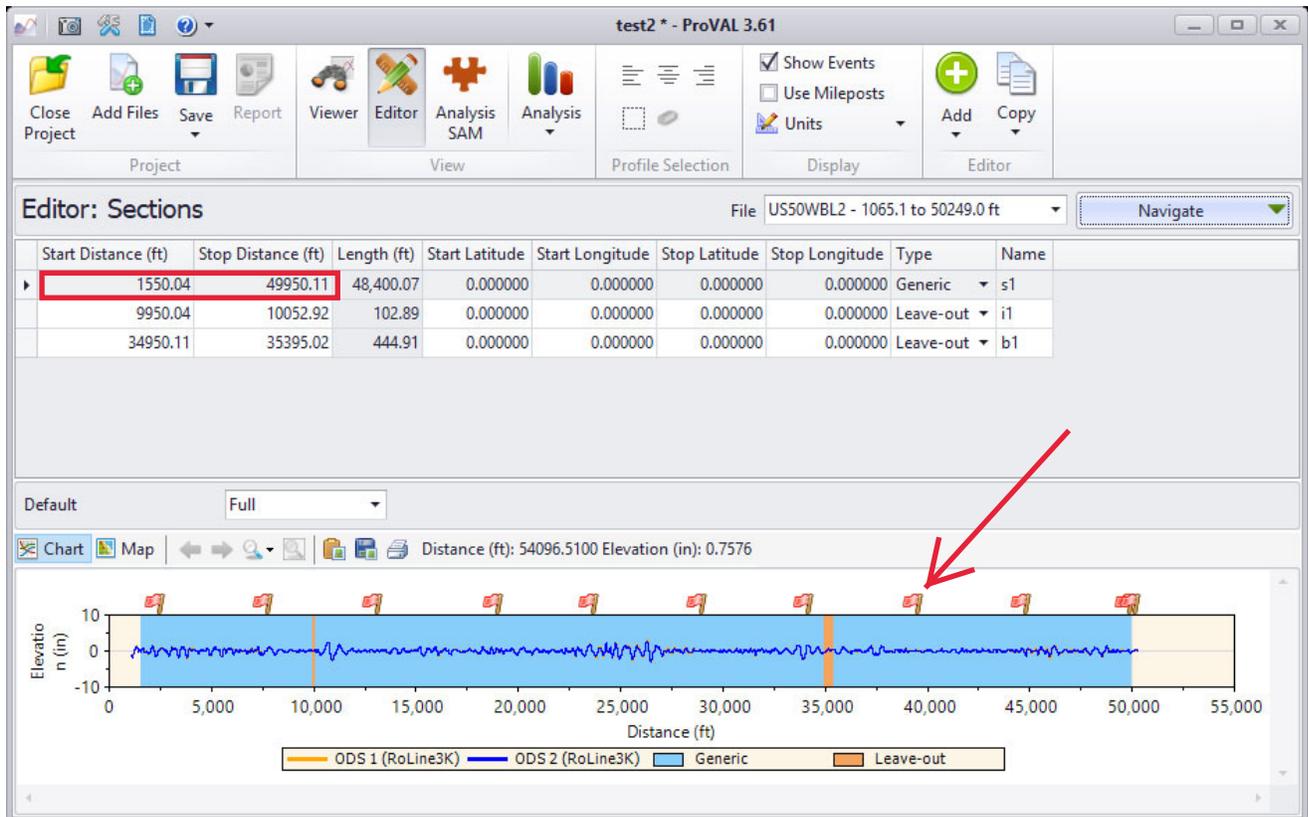
- 5) Next, the section needs to be identified for analysis. Not all sections start at 0 feet as can be seen above in the example. The starting feet on this graph needs to correspond with a station that represents the start of paving. To identify the section, select the Editor icon. Now select which file you want to use from the File dropdown.



- 6) Once the file is selected, you will notice the IRI results appear as they did on the Viewer pane. Click the Navigate dropdown to the right of File dropdown and select **Sections**. Next, click the **Add** button and provide a meaningful name that helps identify this exact section (Line/Direction/Lane/etc.).

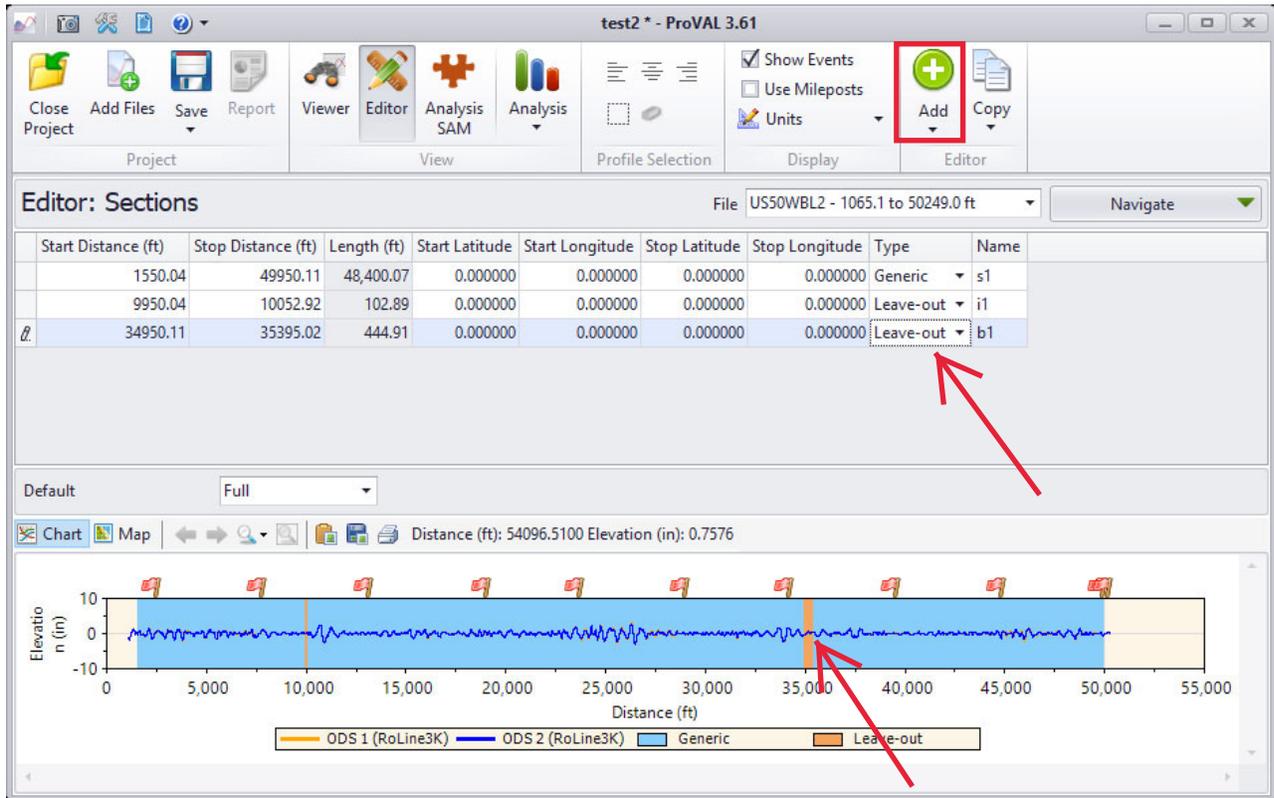


7) Provide the Start Distance and Stop Distance at which the Surface was measured for the contract. The distances will not always match up to your typical section stations. For example, the inertial profiler started taking measurements 500' before the construction limits and ended up 500' past the construction limits on the other side of the contract. The total distance measured was 4600'. The starting station for paving is 0+00. That means distance 500' would be station 0+00 since the inertial profiler started measuring 00' before the paving limits. One of the exceptions for the inertial profiler is the first and last 50' of paving. Therefore, the start Distance would be 550' and the Stop Distance would be 4050'. You will notice the blue shaded area will now shrink to the limits entered.



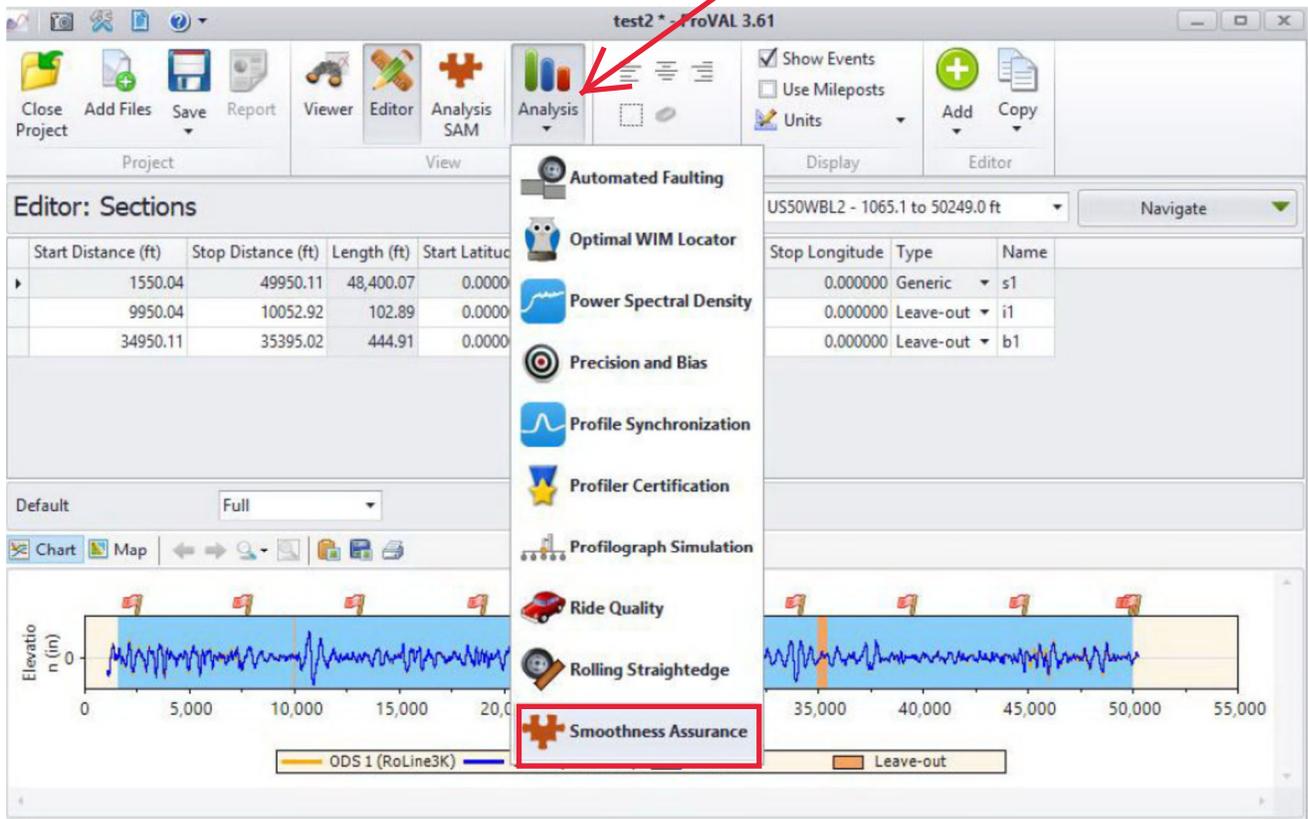
Red Flags can be seen right above the graph. These red flags represent **Events**. Events are usually accompanied by spikes in IRI because of a bridge, casting, railroad crossing or other feature that would cause a bump unrelated to the actual pavement. ITM 917 describes these and exempts 50' before through 50' after these features from measurement. The contractor should help identify these locations which should already be marked in the file before you receive it.

8) Once these exceptions are identified, these areas need to be excluded from measurement. Click Add button within Editor and provide a name that describes the exception such as STR 111 for a bridge. The Start Distance should be 50' before and then the Stop Distance should be 50' after the end of the feature. For example, there is a bridge that is 160' long with 20' approaches and the first approach begins at 3100'. The Start Distance should be entered as 3050' and the Stop Distance should be 3350'. The only difference between this section and the previous section is the selection for the dropdown under the Type column. Select **Leave-Out**.

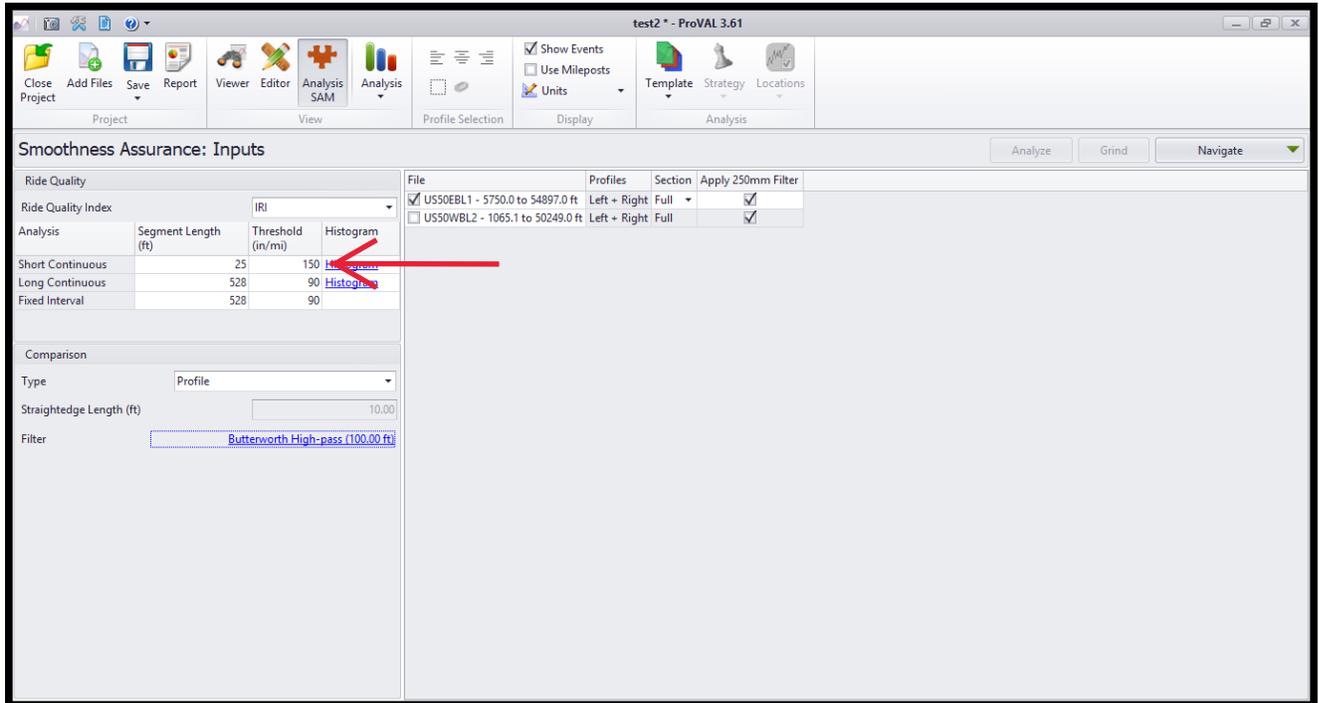


You will notice that the bridge can be seen as the orange shaded area. This area will now be excluded from IRI analysis. Repeat this process for all exceptions located within the section.

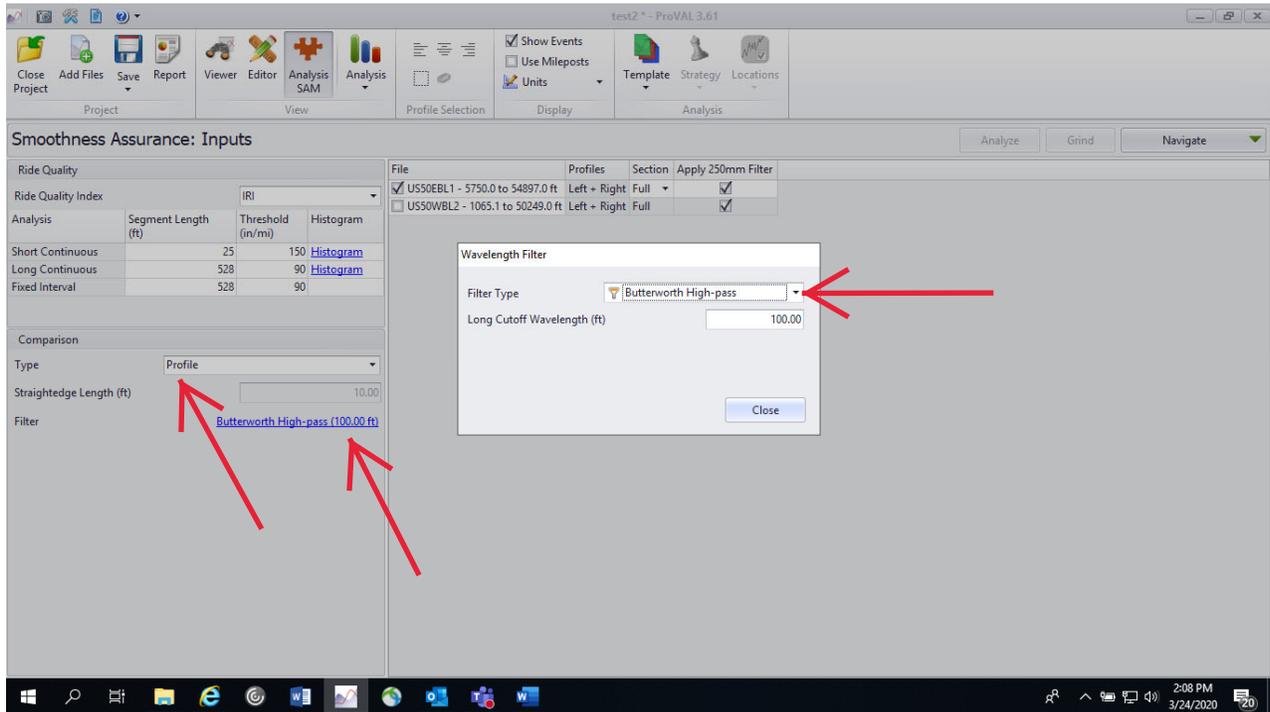
9) Now it is time to analyze the Section for Areas of Localized Roughness (ALR) and determine locations with roughness in excess of 150 in/mi that require corrective grinding work. Click the **Analysis** button and select **Smoothness Assurance** from the dropdown.



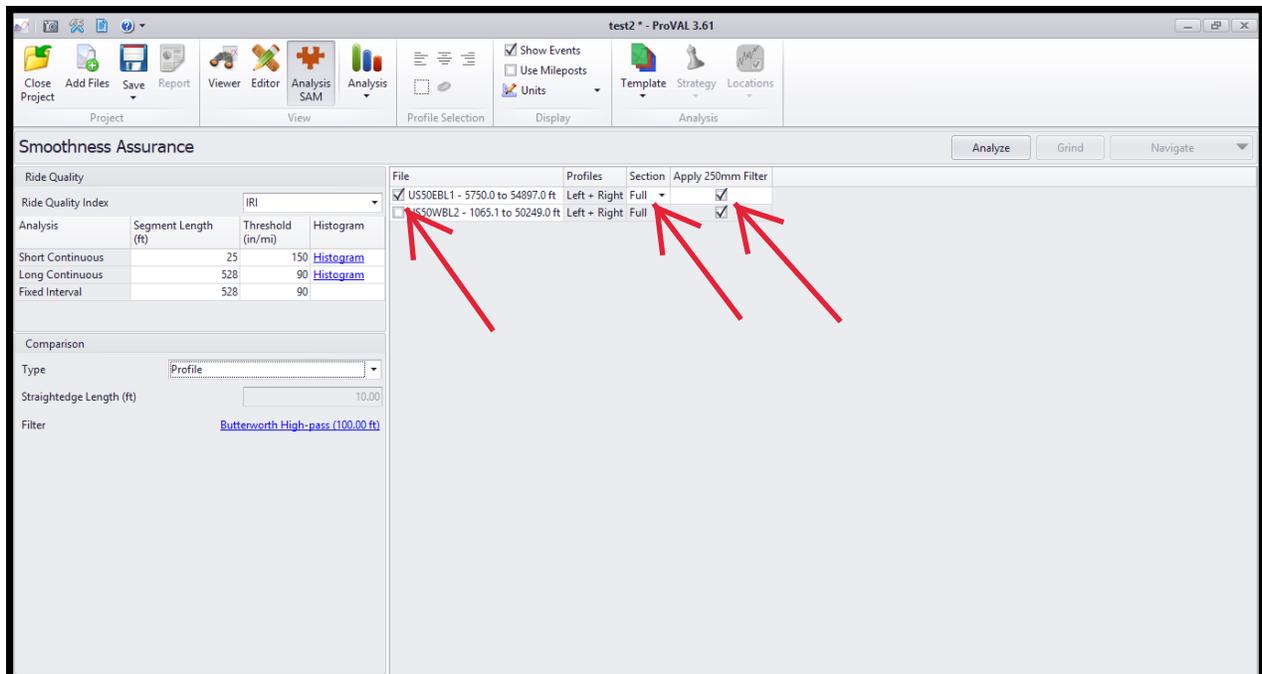
10) For (ALR) a continuous measurement with a 25 ft interval will be used for analysis with 150/in/mi being the threshold for correction action. To Set these parameters, you only need to be concerned with the Short Continuous row on the Ride Quality Table. The Segment Length is already set at 25 ft so no change is required there. Under the threshold column, **enter 150** for the value for **Short continuous**. **Histogram** on the Short continuous row can be left at default settings so no change is required there either.



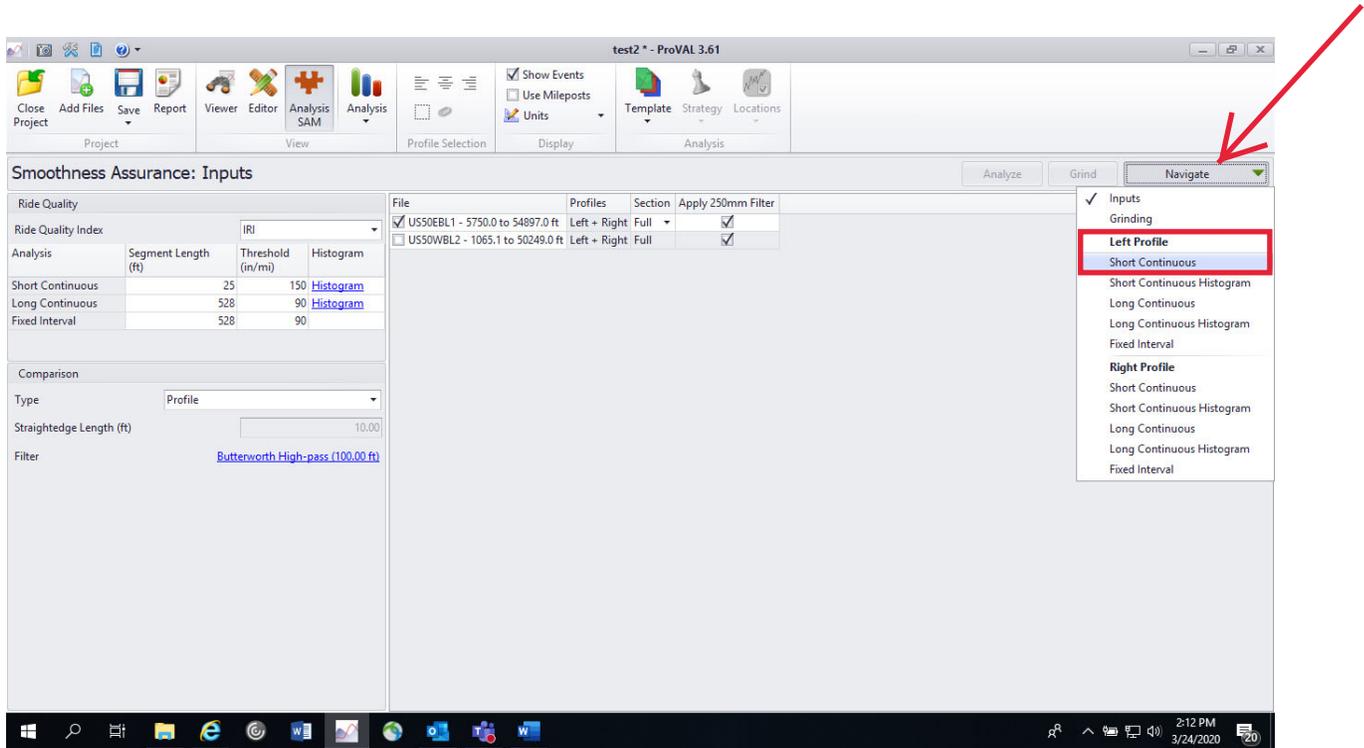
- 11) Notice just below the Ride Quality table is a Comparison. This tab will not change the IRI measurement but may help interpret the IRI data. Select **Profile** for the comparison type, then select the blue lettered filter type which will bring up the **Filter options**. Select **Butterworth High-pass** and input Wavelength(ft) of 100 ft as shown below.



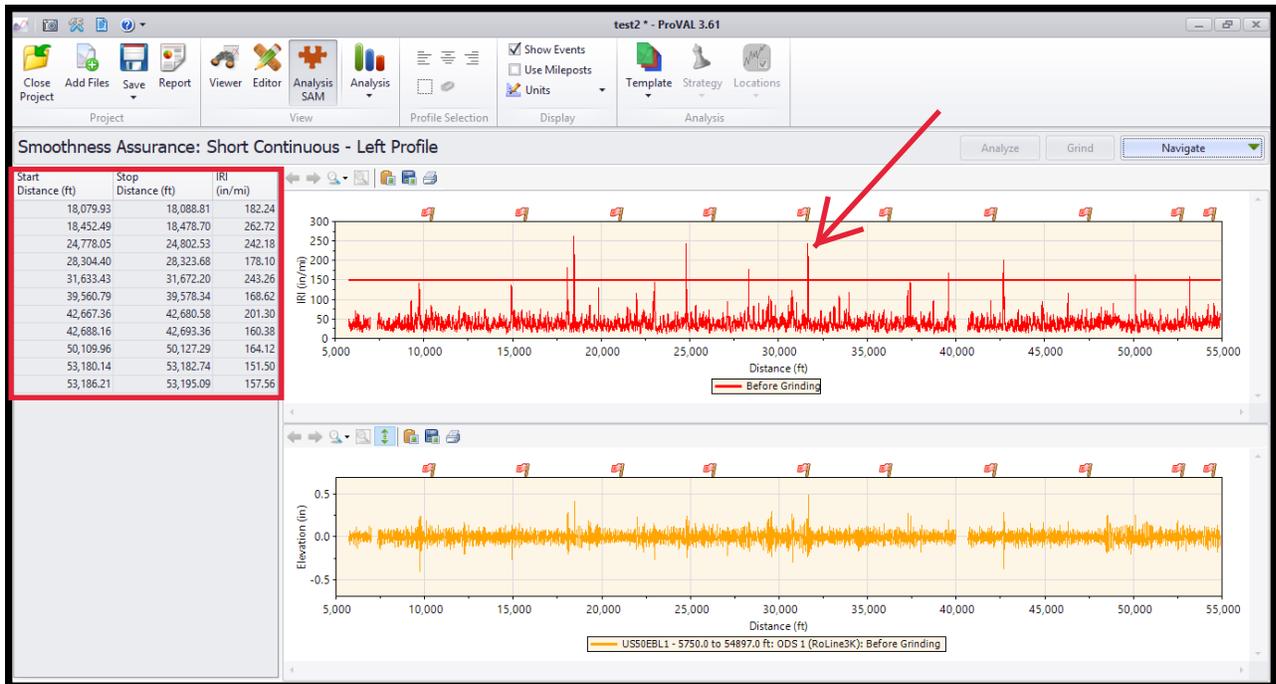
- 12) Now that the Short Continuous Analysis has been set to meet the specifications and the comparison type and filters have been selected, check the file and select the Section from the dropdown as seen in the screenshot. Also select to **Apply the 250 mm Filter** as shown. Click the **Analyze** button in the top right.



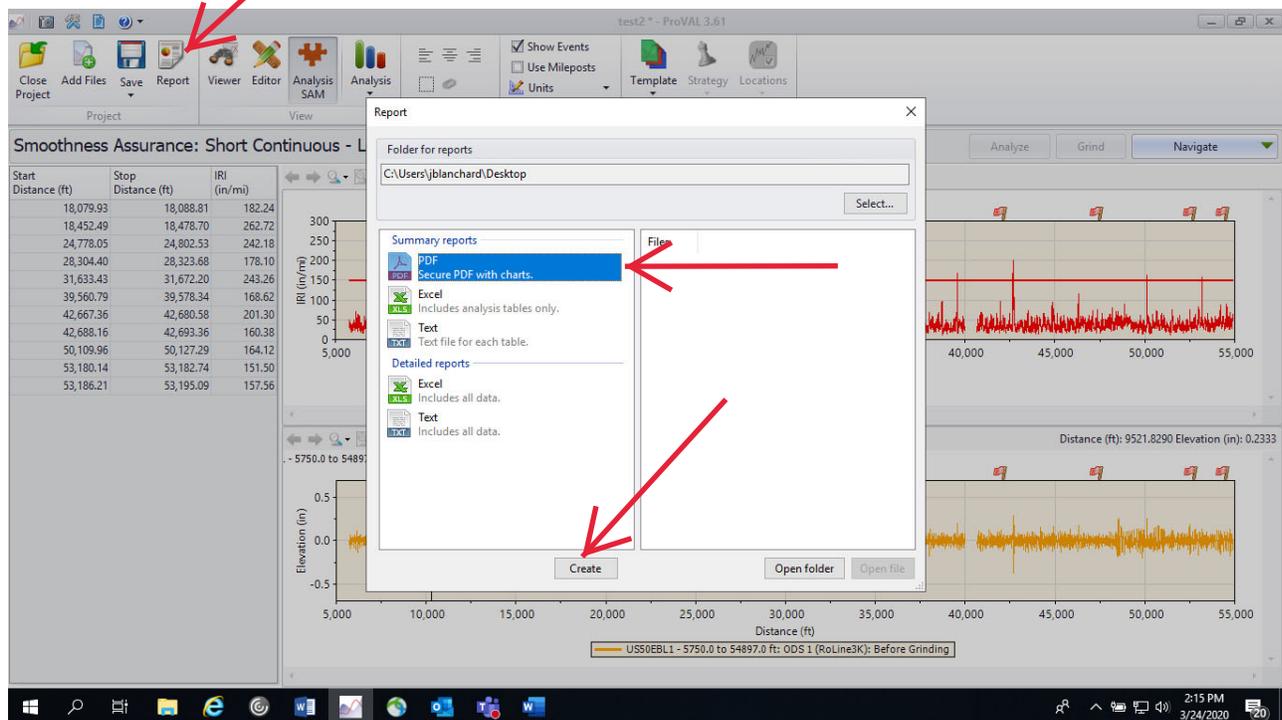
13) After the analysis is complete, select the **Navigate** button which will bring up a dropdown list then select **Left Profile -> Short Continuous** as shown below. Repeat for the **Right Profile -> Short Continuous** viewing as well in the same manner.



14) The **Smoothness Assurance: Short Continuous – Left Profile** should be visible as shown below. At this point the upper graph window of the IRI (in/mi) vs Distance (ft) on the left gives a visual indication of every location that requires grinding which exceeds the red solid line threshold located at 150 (in/mi). The chart to the left provides a numerical tabulation of the same information.



- 15) The final report of the results may be downloaded by selecting the **Report** button in the top right pane. A pdf of the report may be selected under Summary reports by clicking **PDF** or an excel version of the report may be selected by clicking **Excel**. Once PDF or Excel has been selected then click **Create** and the Report will be generated and may be saved to your computer. The engineer may need to correlate the distances shown to project stationing prior to providing the report to the contractor for grinding depending on the start station utilized during set up of the high speed profiler and ProVal editing of the files at the beginning.



16) Below examples are information that should be shown in the PDF report, which can be used to determine ALR grinding locations. The **Defects before grinding** table on the next page is the summary information that should be utilized to locate grind locations in excess of 150 in/mi. Other information in the report shown this page may be useful to the PE/PS for review purposes.

## Analysis: Smoothness Assurance

### Selections

File	Section	Apply 250mm Filter
US50EBL1 - 5750.0 to 54897.0 ft	Full	Yes

### Leave-outs

Start Distance (ft)	Stop Distance (ft)	Length (ft)	Name
7,000.072	7,349.892	349.819	b1
40,000.072	40,657.906	657.834	b2

### Left Profile Short Continuous

Segment Length (ft): 25.00

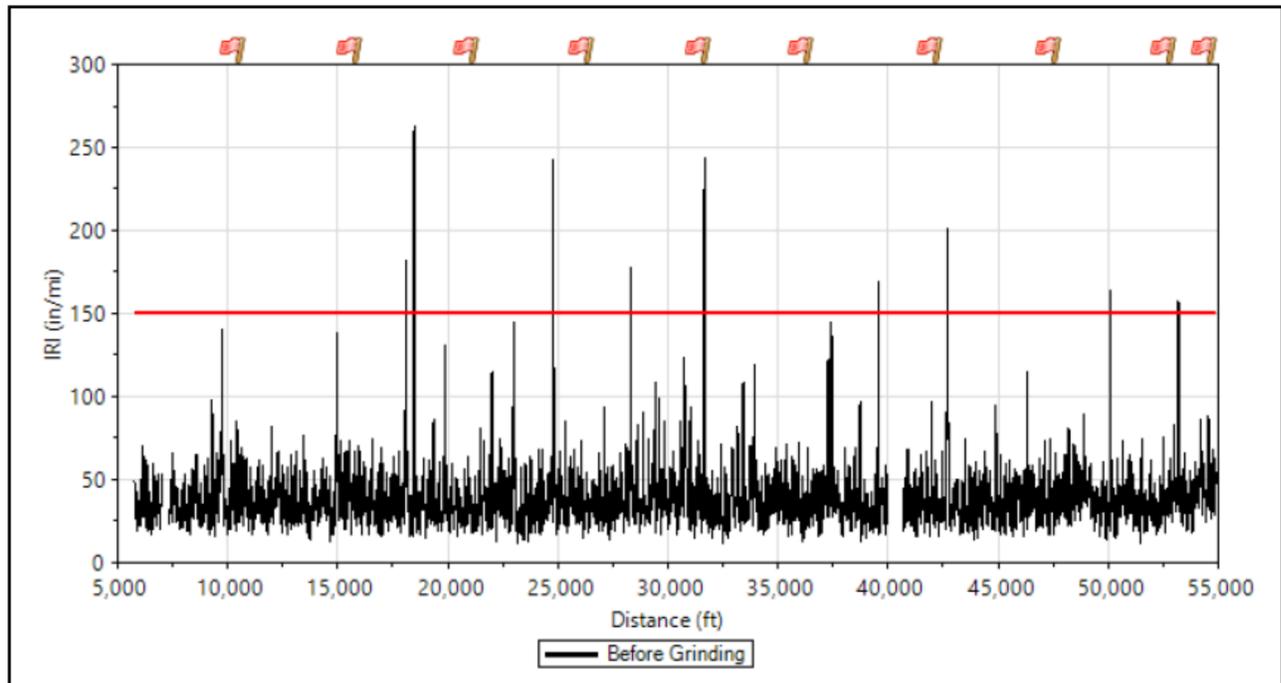
Threshold (in/mi): 150.00

#### Before Grinding

Total Percent Out of Spec (%): 0.38

Total Distance Out of Spec (ft): 182

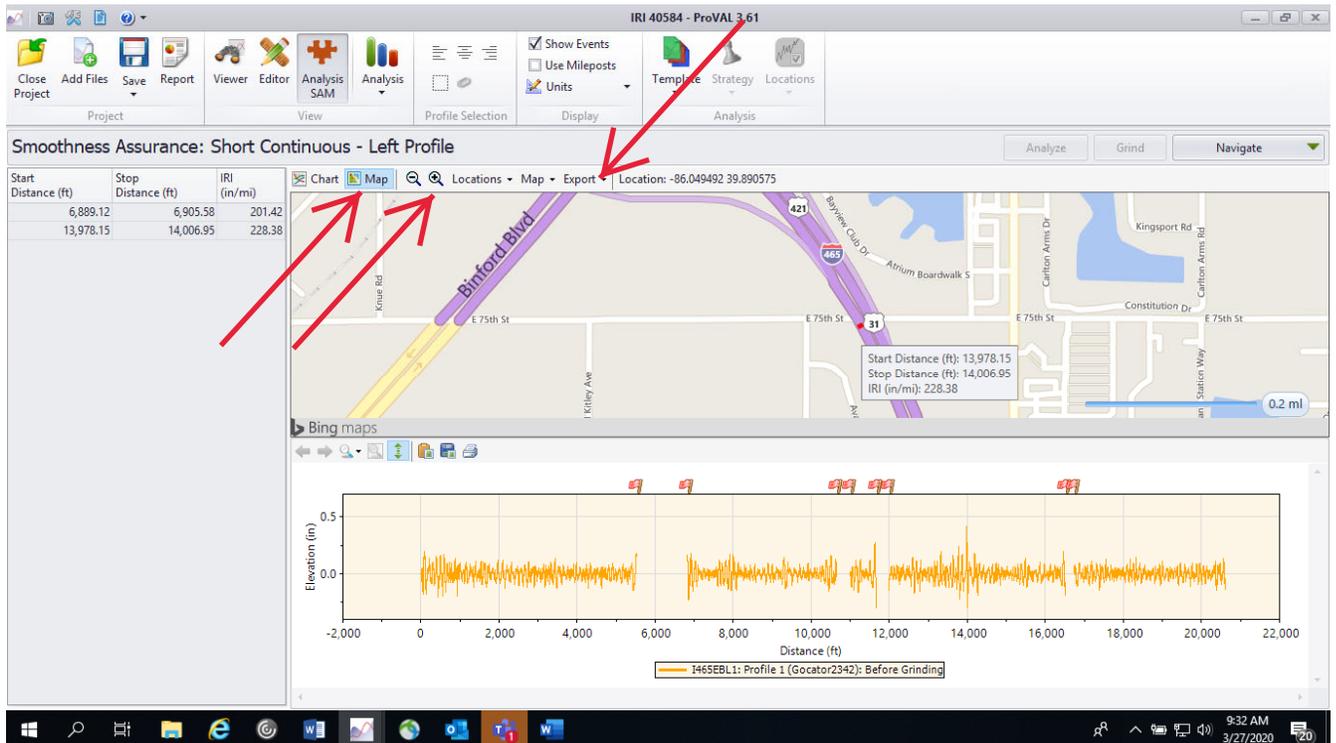
Max IRI (in/mi)	Min IRI (in/mi)	Before Grinding (%)	Before Grinding (ft)
∞	85.00	1.99	958
85.00	80.00	0.36	172
80.00	75.00	0.41	195
75.00	70.00	0.70	338
70.00	65.00	1.37	659
65.00	60.00	2.34	1,125
60.00	55.00	4.00	1,924
55.00	50.00	6.48	3,116
50.00	45.00	8.76	4,211
45.00	40.00	12.25	5,889
40.00	35.00	15.70	7,550
35.00	30.00	18.32	8,805
30.00	25.00	15.32	7,365
25.00	20.00	8.95	4,302
20.00	15.00	2.81	1,350
15.00	10.00	0.25	118
10.00	5.00	0.00	0
5.00	0.00	0.00	0



### Defects before grinding

Start Distance (ft)	Stop Distance (ft)	IRI (in/mi)
18,079.93	18,088.81	182.24
18,452.49	18,478.70	262.72
24,778.05	24,802.53	242.18
28,304.40	28,323.68	178.10
31,633.43	31,672.20	243.26
39,560.79	39,578.34	168.62
42,667.36	42,680.58	201.30
42,688.16	42,693.36	160.38
50,109.96	50,127.29	164.12
53,180.14	53,182.74	151.50
53,186.21	53,195.09	157.56

17) Locating ALR corrective areas in the field may be aided by the use of the map function within ProVal. To view the map of corrective areas, go back to step 14 of this document “Smoothness Assurance - Short Continuous Profile” and **click on the map button** on the tool bar just above the upper window as shown below. After you click on the map button, the chart view of the profile of IRI vs distance will be replaced by the map view shown below. On the same toolbar just above the map, **click on the zoom button** to zoom in on the ALR locations which will be shown in red. **Move the mouse over each location**, and as you do notice the box that opens up with start and stop location as well as IRI roughness data. You can continue to move from location to location by zooming in and out; and also by clicking and holding with the mouse while at the same time moving the mouse forward or backward. (Note: if the map button is not shown on your toolbar, it may be that the equipment the contractor used was not GPS enabled which means it is not meeting contract requirements)



Note: The map image shown in the window can be exported by **clicking the export button** on the same toolbar and **selecting save image**, the current zoomed view is what will be exported as an image. You could choose to zoom in on each location requiring ALR shown on the map in red and export an image file for each; then print each image to pdf and combine the pdf files into a single document for use in the field. Another option is to **select copy image** instead of save image, and then paste each image into a Microsoft Word document. Every Location could then be summarized in the Word document with start/stop distance and IRI data followed by a mapped location moving systematically from start of project to end of project. (There may be other ways to utilize the export data as well not explained here.) This information can then be printed and provided to inspectors and contractors involved in the locating and grinding corrective areas, or it could be utilized by sharing electronically only.