

IRI Field Guide

ProVAL Applications can be downloaded from FHWA website:

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

Home / Programs / Pavements

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>

Current Status

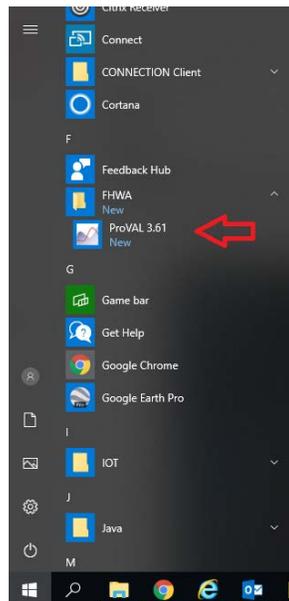
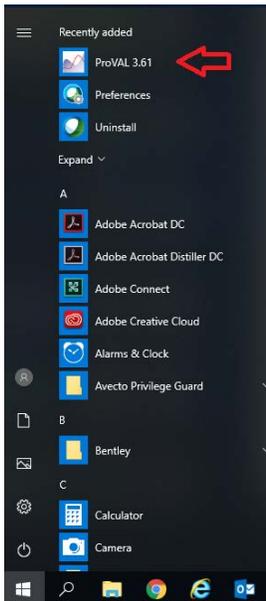
ProVAL is kept current under a Transportation Pooled Fund Project [TPF-5\(354\) Improving the Quality of Highway Profile Measurement](#).

Download the current version of ProVAL from the following web site: <http://www.roadprofile.com/proval-software/current-version/>

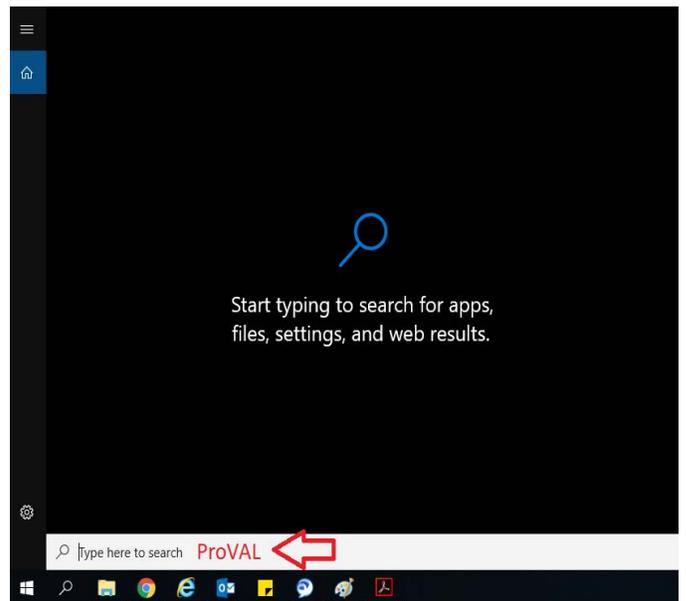
Updated: 09/25/2018

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.

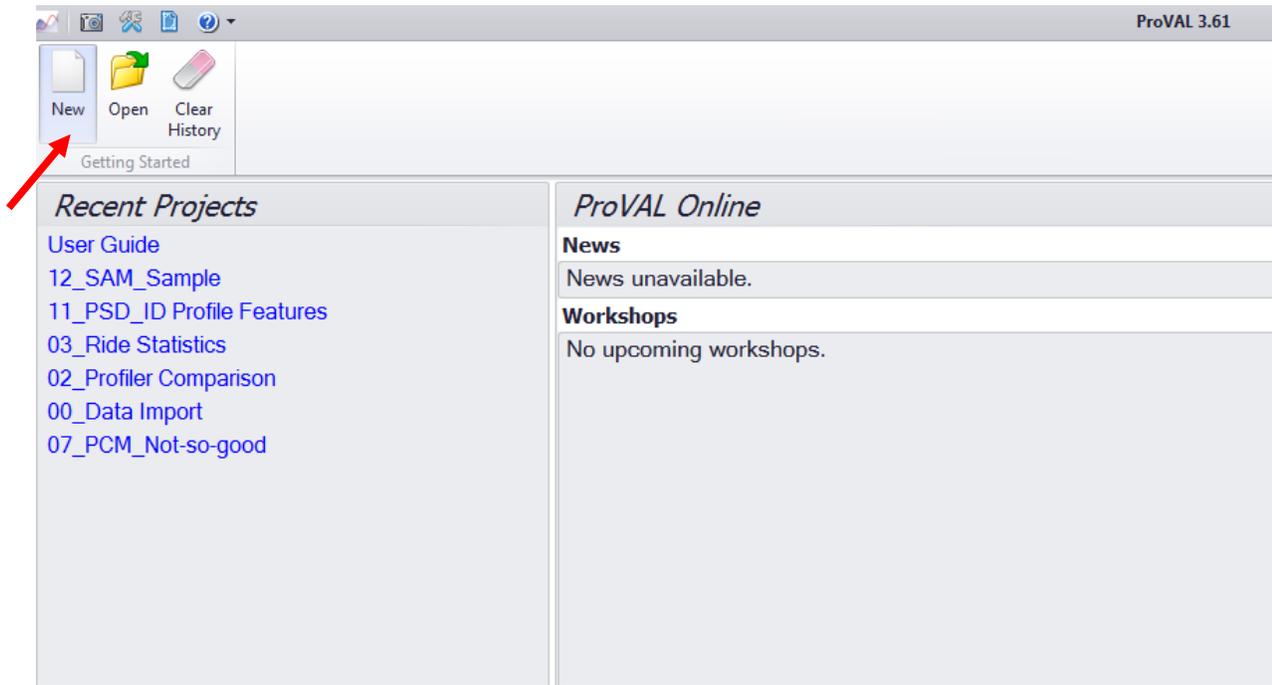
(Windows 10)



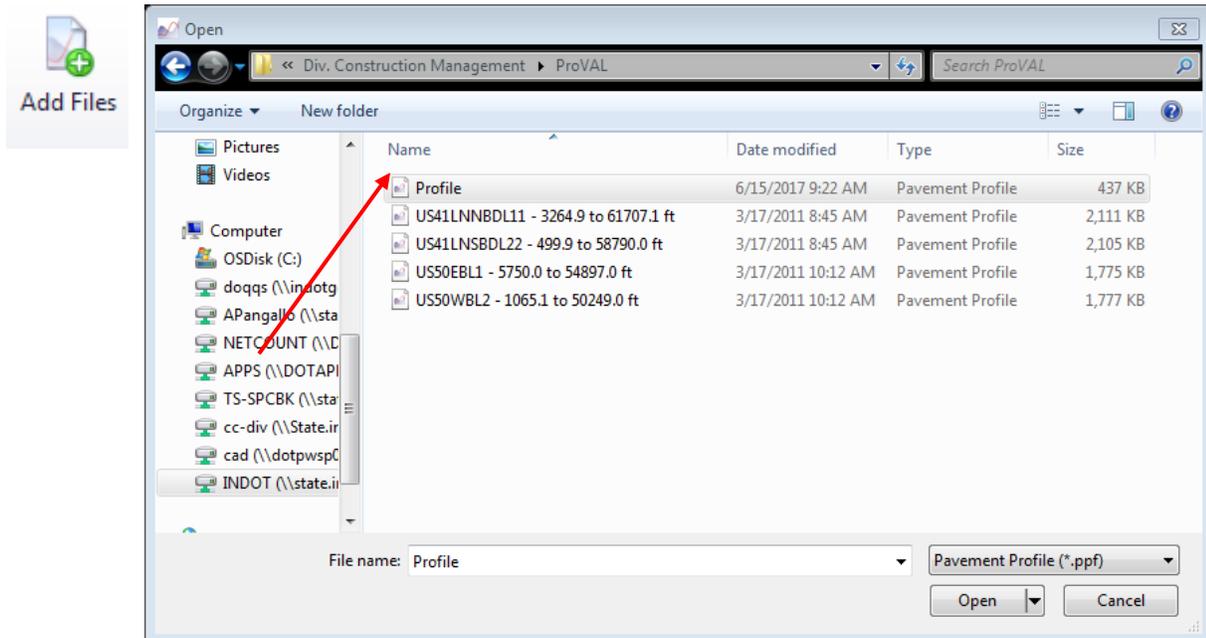
OR



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

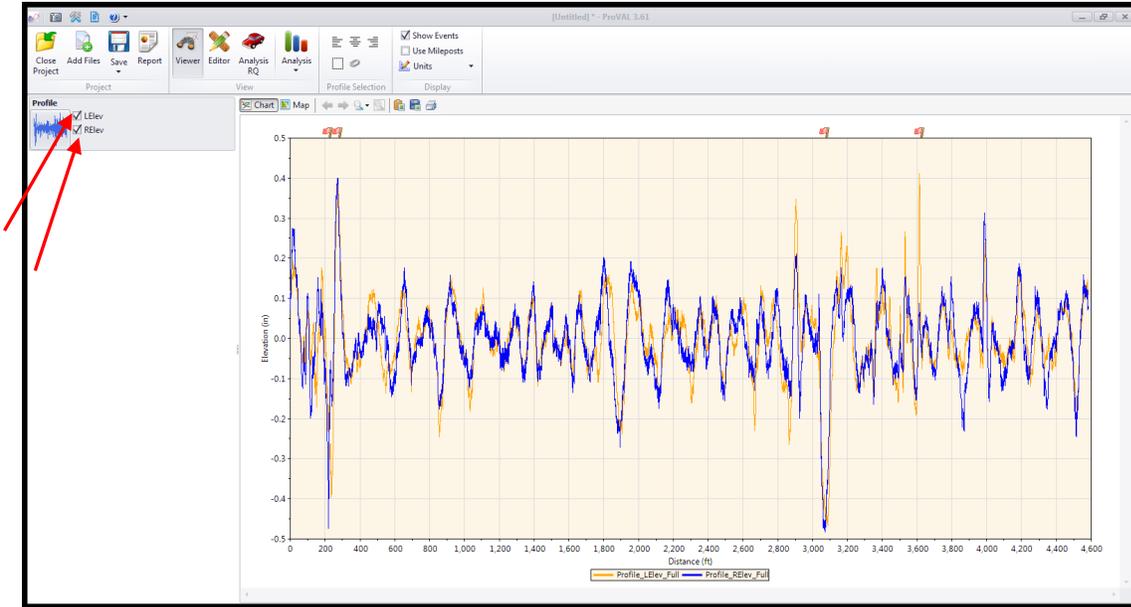


3) The data file the Contractor has sent needs to be downloaded onto this project file. Select **Add Files** and browse the folders where you placed the Contractor's data file (window below is only an example of a folder location) and open it.

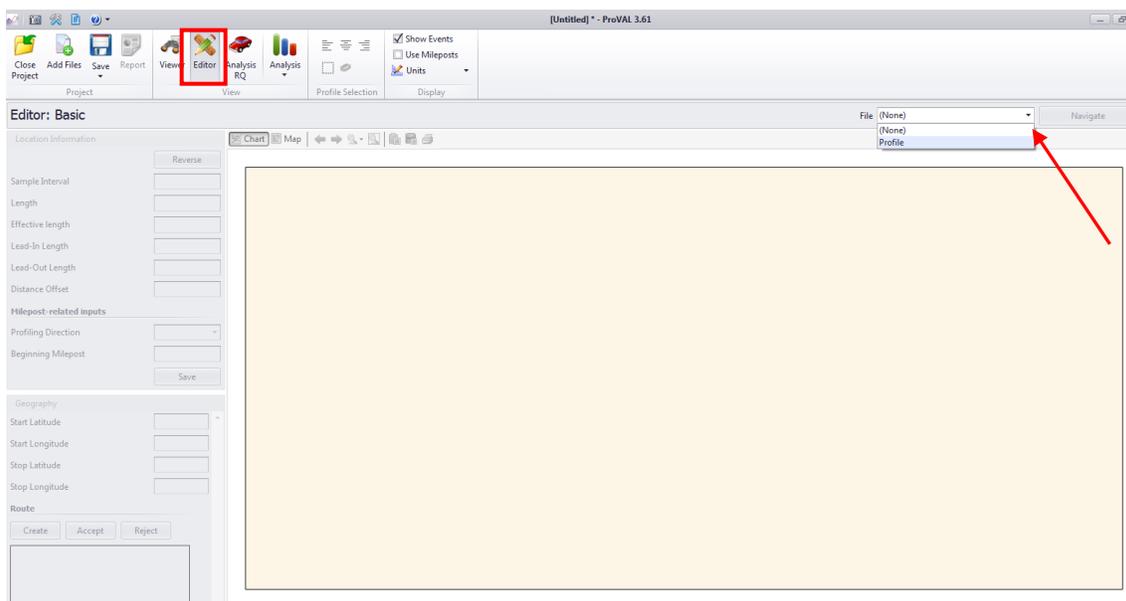


As more data is received, additional files should be added to this one project file to represent all the IRI testing for a contract.

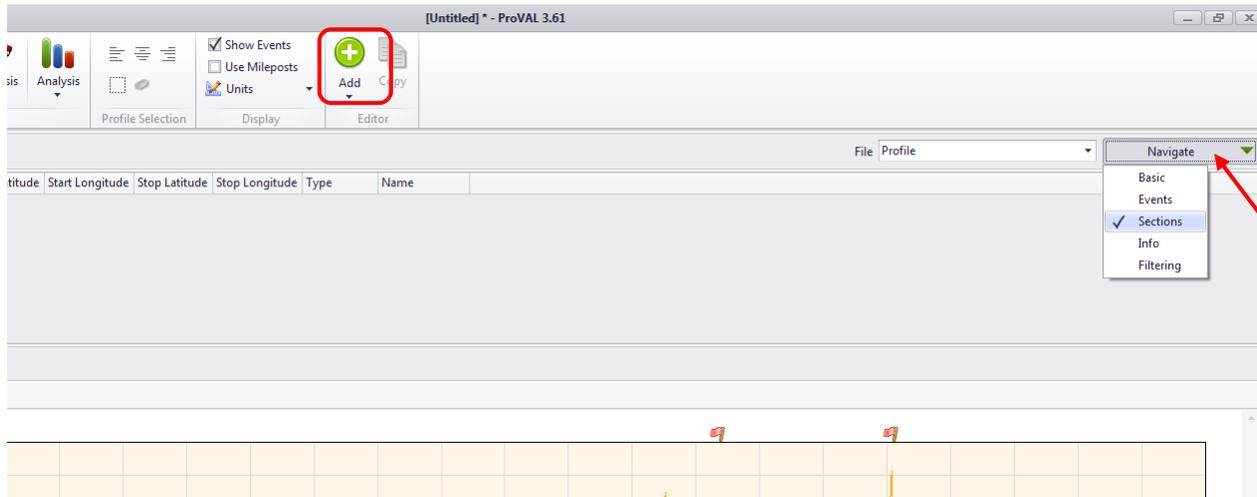
4) A data file will automatically begin in the Viewer pane. Each file will have two checkboxes for left and right wheel path readings. Clicking on these checkboxes will display the IRI readouts for the Section tested. The x-axis is listed in feet starting at 0 feet and up to the distance measured by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



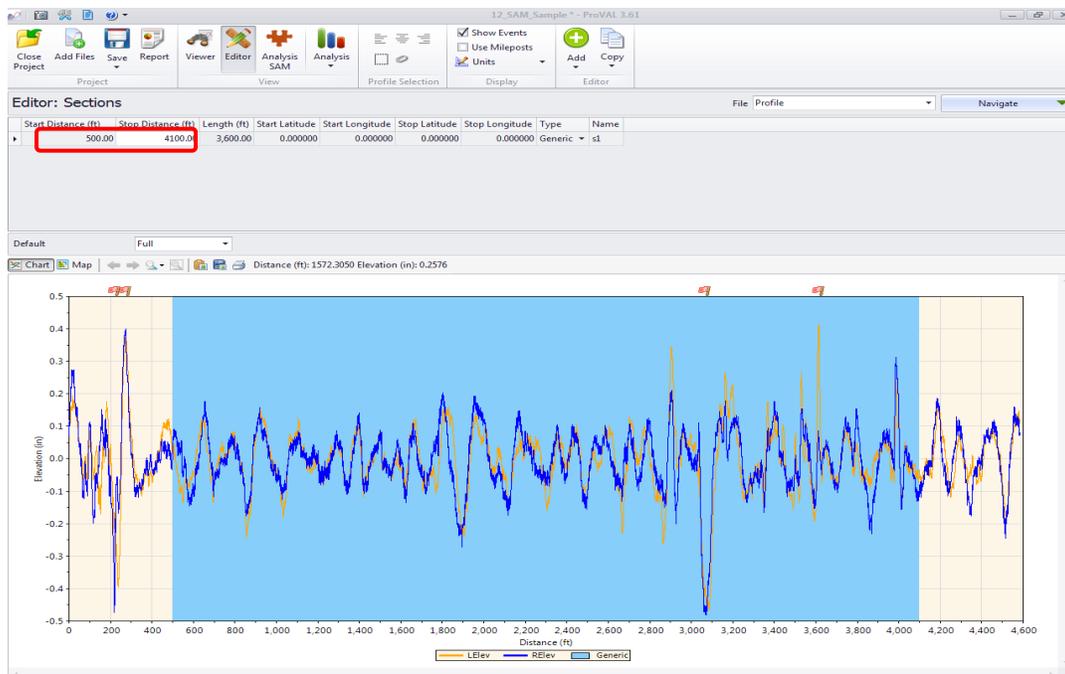
5) Next, the section needs to be identified for analysis. Not all sections start at 0 feet as can be seen above in the example. The starting feet on this graph needs to correspond with a station that represents the start of paving. To identify the section, select the Editor icon. Now select which file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

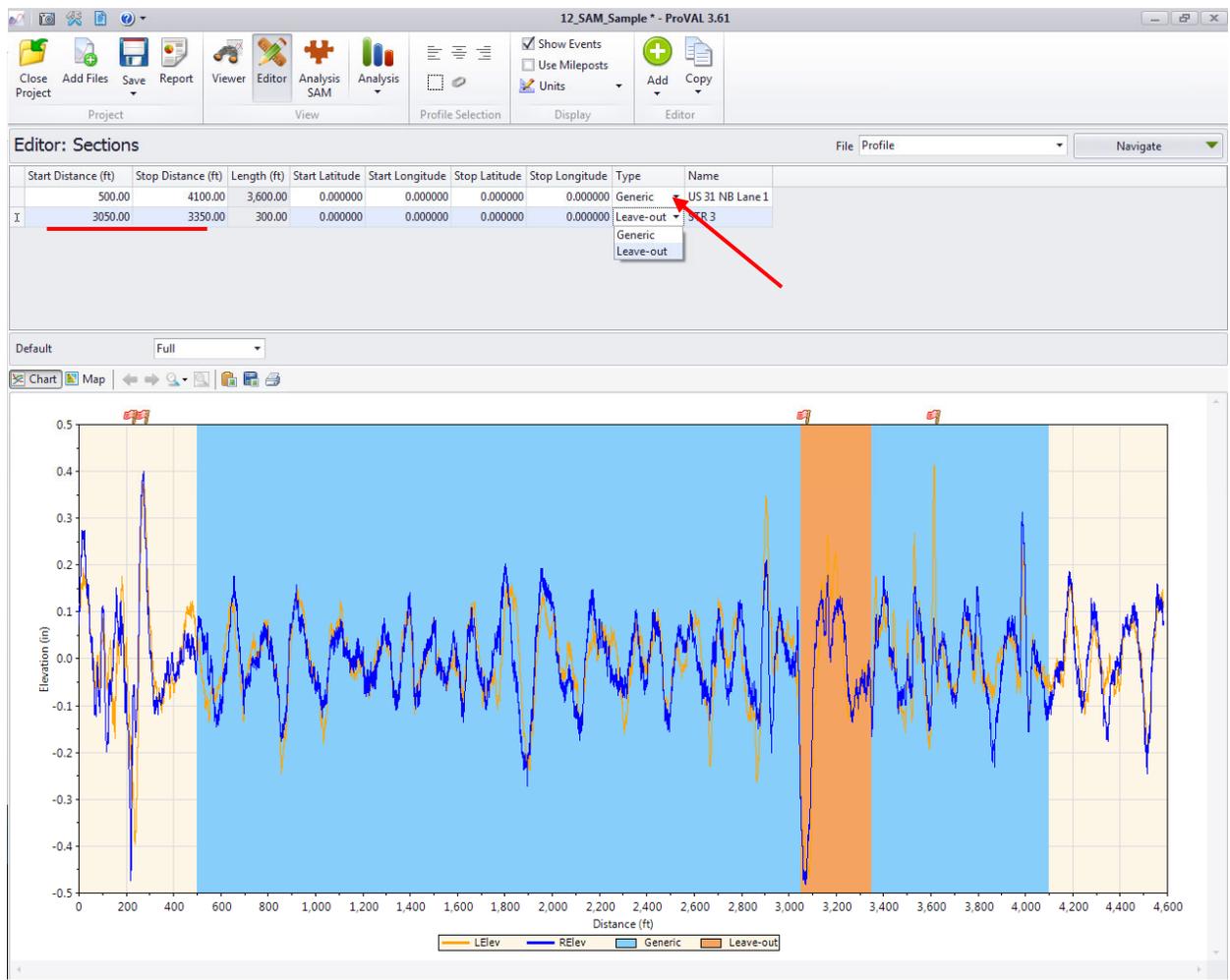


7) Provide the Start Distance and Stop Distance at which the Surface was measured for the contract. The distances will not always match up to your typical section stations. For example, the inertial profiler started taking measurements 500' before the construction limits and ended 500' past the construction 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 500' 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.



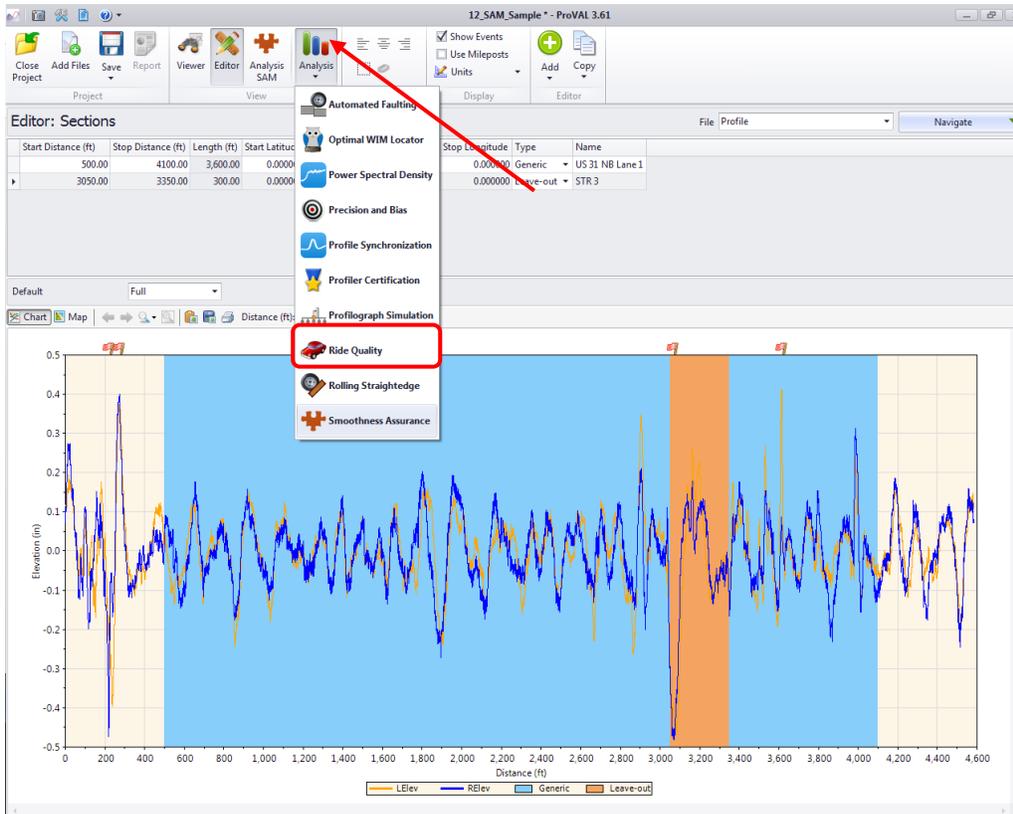
Red Flags can be seen right above the graph. These red flags represent **Events**. Events are usually accompanied by spikes in IRI because of a bridge, casting, railroad crossing or other feature that would cause a bump unrelated to the actual pavement. ITM 917 describes these and exempts 50' before 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 added to the list. Click Add button within Editor and provide a name that describes the exception such as STR 3 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 IRI and eventually output to obtain pay factors (PF) for smoothness quality adjustments. Click the Analysis button and select Ride Quality from the dropdown.



10) The Inertial Profiler specification explains that a fixed interval measurement with a 528 ft interval will be used for analysis with 90 in/mi being the threshold for corrective action. To set these parameters, you only need to select "fixed interval" for Analysis Type on the Analysis RQ table. Select "MRI" for Ride Quality Index. The Segment Length is already set at 528 ft. so no change is required there. Under the threshold column, enter 90 for the value for correction Threshold. Next, select the data files you would want to analyze and check "Apply 250 mm Filter" for all the selected files.

The screenshot shows the 'Ride Quality' configuration window in ProVAL 3.61. The 'Analysis RQ' button is highlighted. The configuration table is as follows:

Analysis Type	Ride Quality Index	Threshold (in/mi)	Segment Length (ft)	File	Profiles	Section	Apply 250mm Filter
Fixed Interval	MRI	90.00	528.00	<input type="checkbox"/> US41LNNBDL11 - 3264.9 to 61707.1 ft	Left + Right		<input type="checkbox"/>
				<input type="checkbox"/> US41LNSBDL22 - 499.9 to 58790.0 ft	Left + Right		<input type="checkbox"/>
				<input checked="" type="checkbox"/> US50EBL1 - 5750.0 to 54897.0 ft	Left + Right	s1	<input checked="" type="checkbox"/>
				<input checked="" type="checkbox"/> US50WBL2 - 1065.1 to 50249.0 ft	Left + Right	Full	<input checked="" type="checkbox"/>

Below the table, there are tabs for 'Chart' and 'Table'. At the bottom, there is a summary table with columns for 'Start Distance (ft)', 'Stop Distance (ft)', 'Length (ft)', and 'ODS 1 (RoLine3K) - IRI (in/mi)'.

11) Now that the Fixed Interval Analysis has been set to meet the specifications, select the checkbox for the file and select the Section from the dropdown box. Click the Analyze button in the top right.

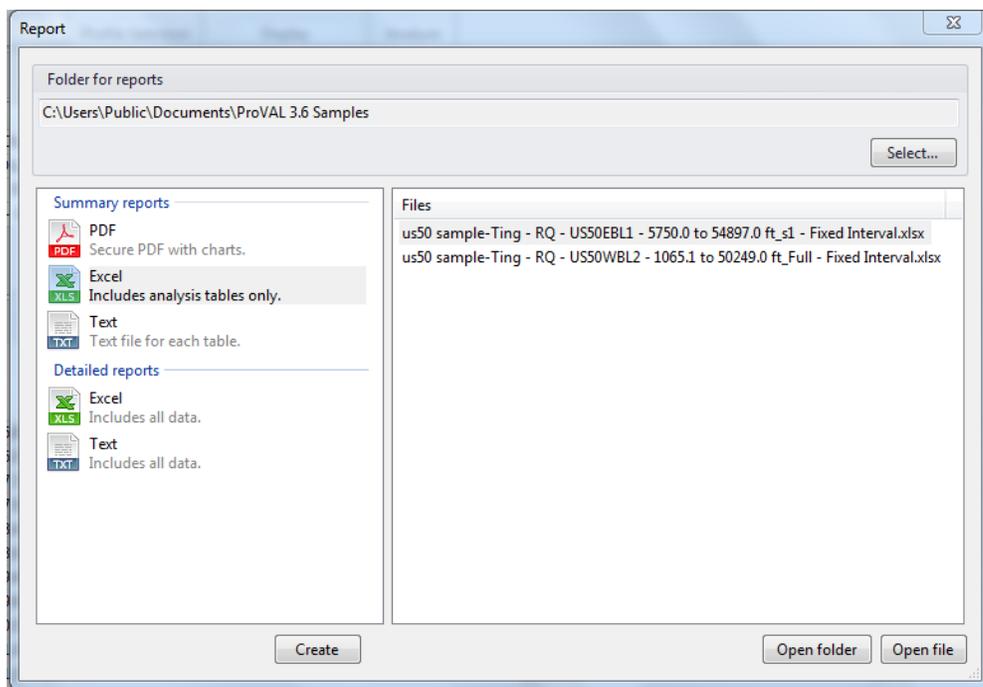
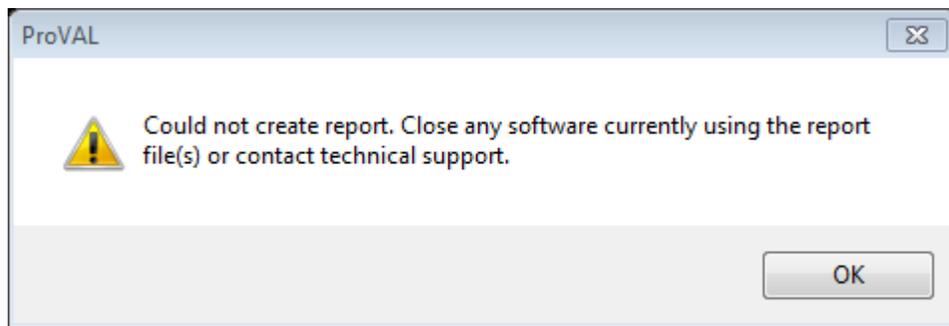
The screenshot shows the 'Ride Quality' software interface. The 'Report' button in the top toolbar is circled in red. The 'Analyze' button in the top right corner is also circled in red with an arrow pointing to it. The 'Ride Quality' panel shows analysis settings for 'Fixed Interval' with a 'MRI' index and a '90.00' threshold. A table of analysis results is displayed below, with a red box around it.

Start Distance (ft)	Stop Distance (ft)	Length (ft)	MRI (in/mi)	
6,000.00	6,528.09	528.09	528.09	36.43
6,528.09	7,000.07	471.99	471.99	34.45
7,350.11	7,878.20	528.09	528.09	36.74
7,878.20	8,406.28	528.09	528.09	34.70
8,406.28	8,934.37	528.09	528.09	38.51
8,934.37	9,462.46	528.09	528.09	33.94
9,462.46	9,990.54	528.09	528.09	43.97
9,990.54	10,518.63	528.09	528.09	39.32
10,518.63	11,046.71	528.09	528.09	38.22
11,046.71	11,574.80	528.09	528.09	34.55
11,574.80	12,102.89	528.09	528.09	35.56
12,102.89	12,630.97	528.09	528.09	39.50
12,630.97	13,159.06	528.09	528.09	34.11
13,159.06	13,687.15	528.09	528.09	36.38
13,687.15	14,215.23	528.09	528.09	31.73

12) After that, select the **Report** button. You can click Select to browse folders for the destination of the report. Once a folder is selected, choose the Excel includes analysis tables only option on the left and click Create.

The screenshot shows the 'Report' dialog box. The 'Folder for reports' field is set to 'C:\Users\Public\Documents\ProVAL 3.6 Samples\Data import'. The 'Excel' option under 'Summary reports' is selected. The 'Create' button is visible at the bottom.

***If you get this screen below, you may have a spreadsheet with the same exact name but by a different user. Either select a different folder or delete the old spreadsheets. ***



13) You are now ready to compute smoothness adjustments with the Excel Spreadsheet. Open the IRI Inertial Profiler Quality Adjustments spreadsheet wherever it is stored on your computer. Open the spreadsheet you created from ProVAL. The spreadsheet should have the project file's name with columns of start distance, stop distance, length and MRI.

14) Now you can go to INDOT website: <https://www.in.gov/indot/div/construction.htm> and select:

"2020 Fixed Interval IRI Payment Adjustment Spreadsheet - HMA (MRI)" or

"2020 Fixed Interval IRI Payment Adjustment Spreadsheet - PCCP (MRI)".

Once you have this spreadsheet open, go back to the spreadsheet generated by ProVAL and copy/paste the columns of start distance, stop distance, length and then MRI from the spreadsheet generated by ProVAL into the respective columns on the Adjustments spreadsheet as shown below.

ProVAL Starting Distance (feet)	ProVAL Ending Distance (feet)	ProVAL Output Length (feet)	START STATION	END STATION	MRI (in. /mile)	Comments	PAY FACTOR FOR SMOOTHNESS, PFs	CALCULATED CONTRACT VALUE OF HMA MATERIAL PLACED					Qs
								BASE 2	OG LAYER	BASE 1	INTERMED.	SURFACE	
6050.036	6578.123	528.0866	61+00	66+28	35.05999		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
6578.123	7000.072	421.9494	66+28	70+50	35.682655		1.06			\$7,426.31	\$5,569.73	\$4,641.44	\$1,058.25
7350.108	7878.195	528.0866	74+00	79+28	36.744301		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
7878.195	8406.281	528.0866	79+28	84+56	34.701023		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
8406.281	8934.368	528.0866	84+56	89+84	38.506725		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
8934.368	9462.455	528.0866	89+84	95+12	33.939323		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
9462.455	9990.542	528.0866	95+12	100+41	43.967827		1.04			\$9,294.32	\$6,970.74	\$5,808.95	\$882.96
9990.542	10518.63	528.0866	100+41	105+69	39.321716		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
10518.63	11046.71	528.0866	105+69	110+97	38.218372		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
11046.71	11574.8	528.0866	110+97	116+25	34.545944		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
11574.8	12102.89	528.0866	116+25	121+53	35.560387		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
12102.89	12630.97	528.0866	121+53	126+81	39.499119		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
12630.97	13159.06	528.0866	126+81	132+09	34.110924		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
13159.06	13687.15	528.0866	132+09	137+37	36.37541		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44
13687.15	14215.23	528.0866	137+37	142+65	31.579967		1.06			\$9,294.32	\$6,970.74	\$5,808.95	\$1,324.44

15) Fill in all of the Section Data in the spreadsheet such as Profile starting station and Profile ending station, lane width, all Planned spread rates (if HMA), and Unit price per pay items. Once all this information is entered, you will notice the highlighted cell for variable Qs will show the dollar amount for the quality adjustment.

When the next Section has been measured for MRI, simply click the New Section button right next to the Qs cell. This action will save the current section spreadsheet results and will appear at the end of the spreadsheet tab shown at the bottom of the spreadsheet but maintain the profile stations, lane width, planned spread rates, and unit prices per pay item shown at the top of the spreadsheet and clear out the ProVAL spreadsheet data so the next ProVAL section spreadsheet data can be copied to the Adjustment spreadsheet to calculate adjustments for the next section.

16) Once all Sections are completed, return to the first worksheet tab called "Qsc". Simply press the **Calc Qsc** button to get the final quality adjustment for smoothness.

	A	B	C	D	E	F	G	H
1								
2		Calc Qsc	\$ 129,150.22	TOTAL				
3		US 50 EB s1	\$ 32,659.02					
4		US50 WB	\$ 77,350.53					
5		US 50 EB S2	\$ 19,140.67					
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Worksheet tabs: Qsc | US 50 EB s1 | US50 WB | US 50 EB S2 | (+)