STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENT 1110

SUBMITTAL AND APPLICATION REQUIREMENTS FOR ProVAL PAVEMENT SMOOTHNESS SOFTWARE

April 18, 2014

1110.01 Scope. This supplement provides guidelines for use of ProVAL software for measuring and evaluating pavement smoothness.

1110.02 Acquiring software.

A. ProVAL software is a computer program initially developed by FHWA the Long Term Pavement Performance Program. The software provides users the ability to view and analyze roadway pavement profiles.

Acquire a copy of the software from

The Transtec Group, Inc.
6111 Balcones Drive
Austin, Texas 78731

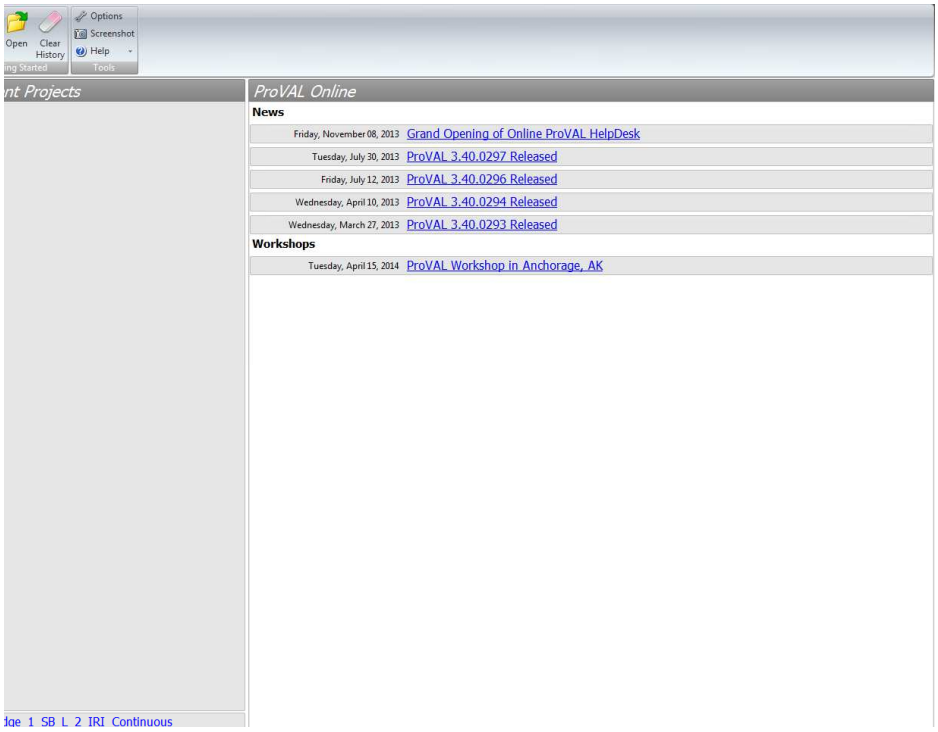
Web Page: http://www.roadprofile.com

There is no cost for the software.

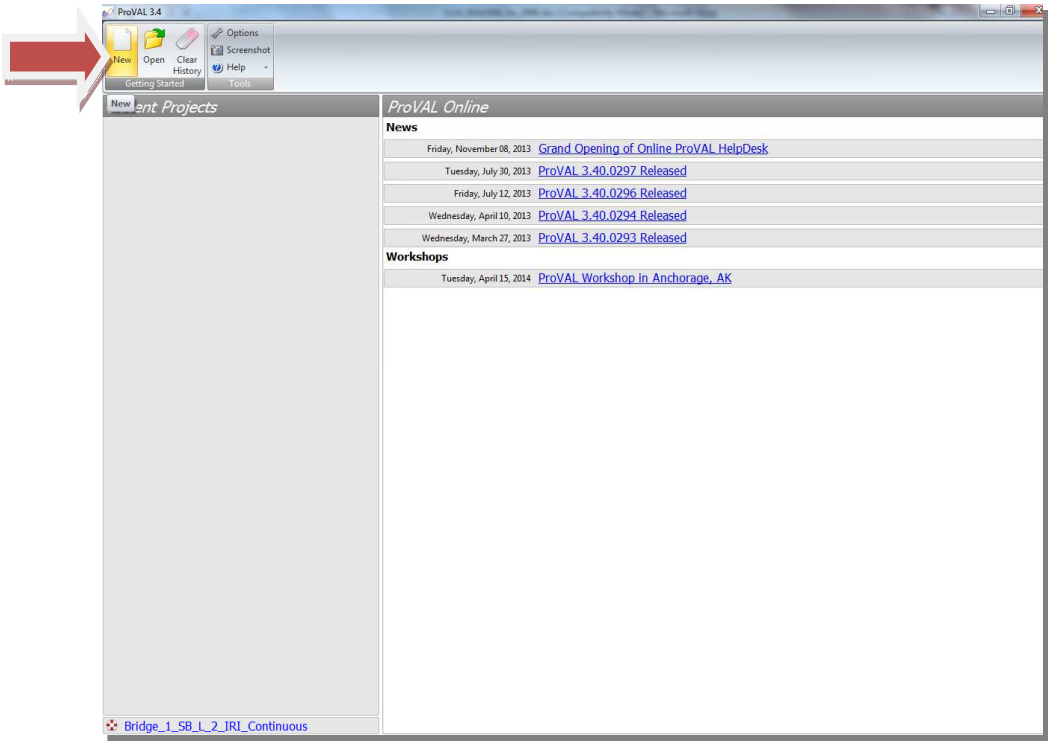
B. Microsoft Office software with Excel to be able to download data from ProVAL software in the form the Department wants the information submitted.

1110.03 Contractor requirements for identifying localized roughness with ProVAL

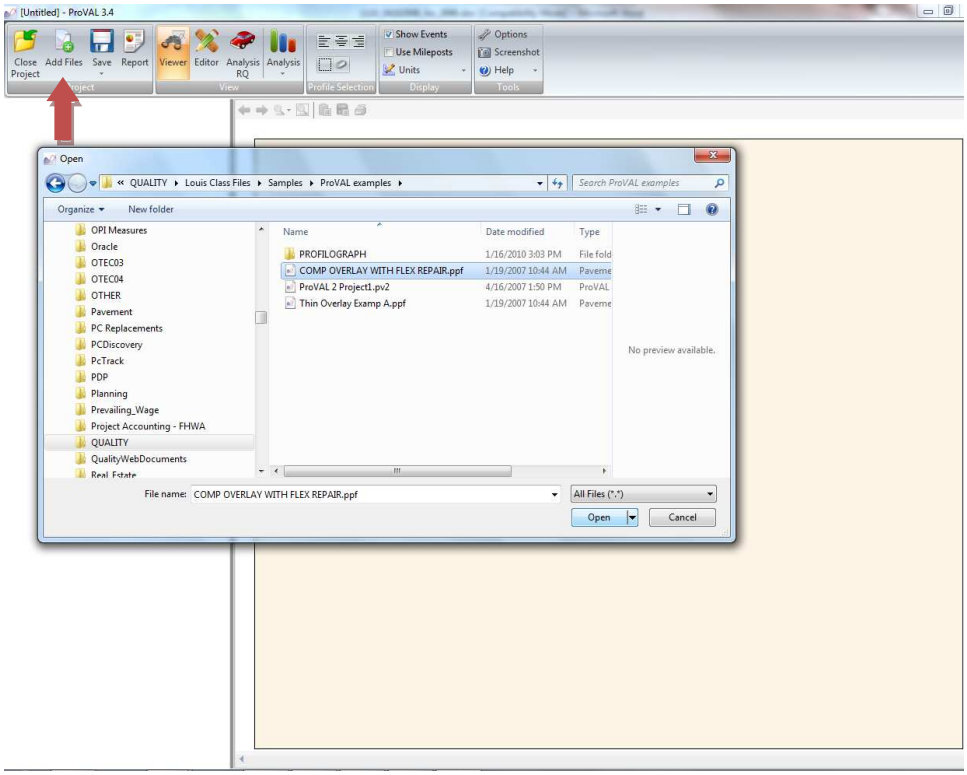
A. Install ProVAL version 3.4 or later and open.



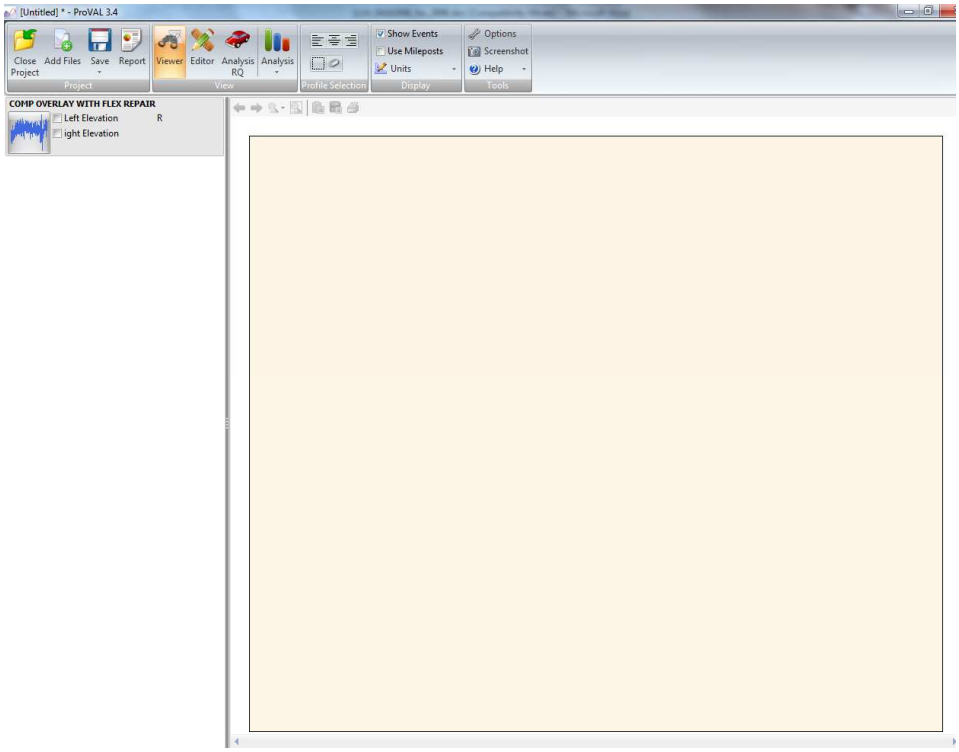
B. Open New ProVAL Project



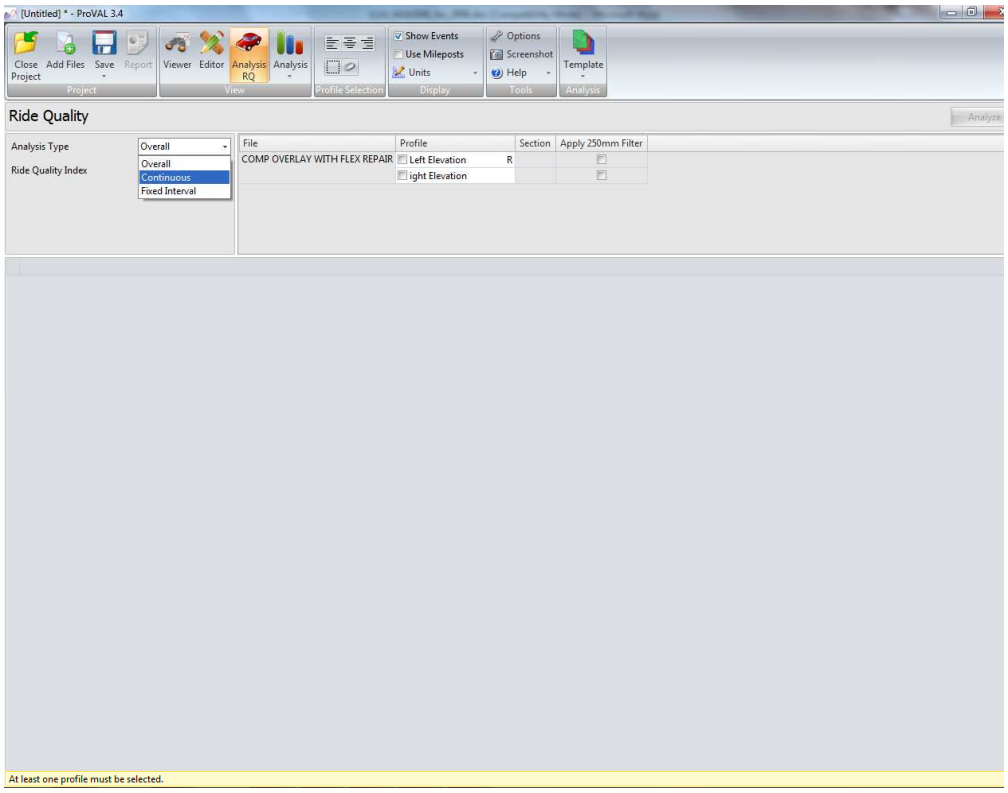
C. Add Files to your ProVAL project.



D. Select Analysis RQ



E. Go to the Analysis drop down box and select Ride Statistics Continuous

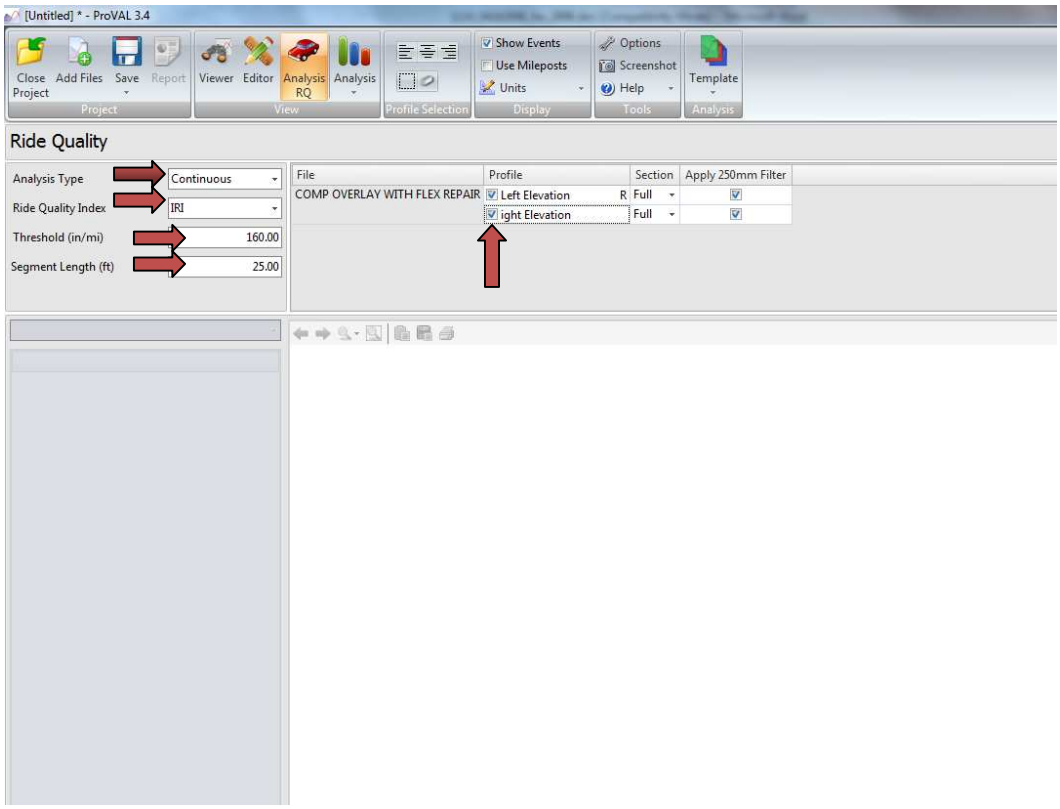


F. To find localized roughness (bumps in each wheelpath) measured in IRI look up the specification requirements (example 160 inches/mile in 25 feet) and do the following:]

a. Select both the left and right wheel path profiles
b. Make sure the sliding baselength is set to 25 feet
c. Set the IRI threshold to the specification limit (example 160 inches/mile)

The input should look like below before. Now

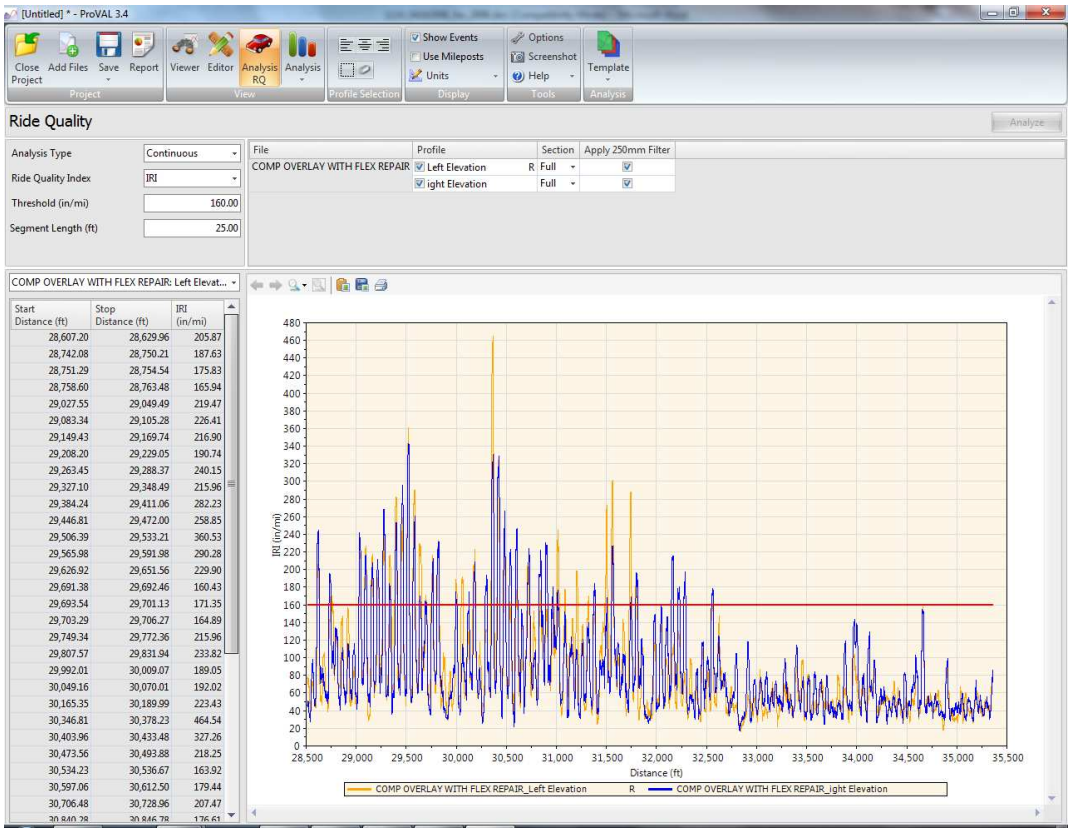
d. Click the analyze button.



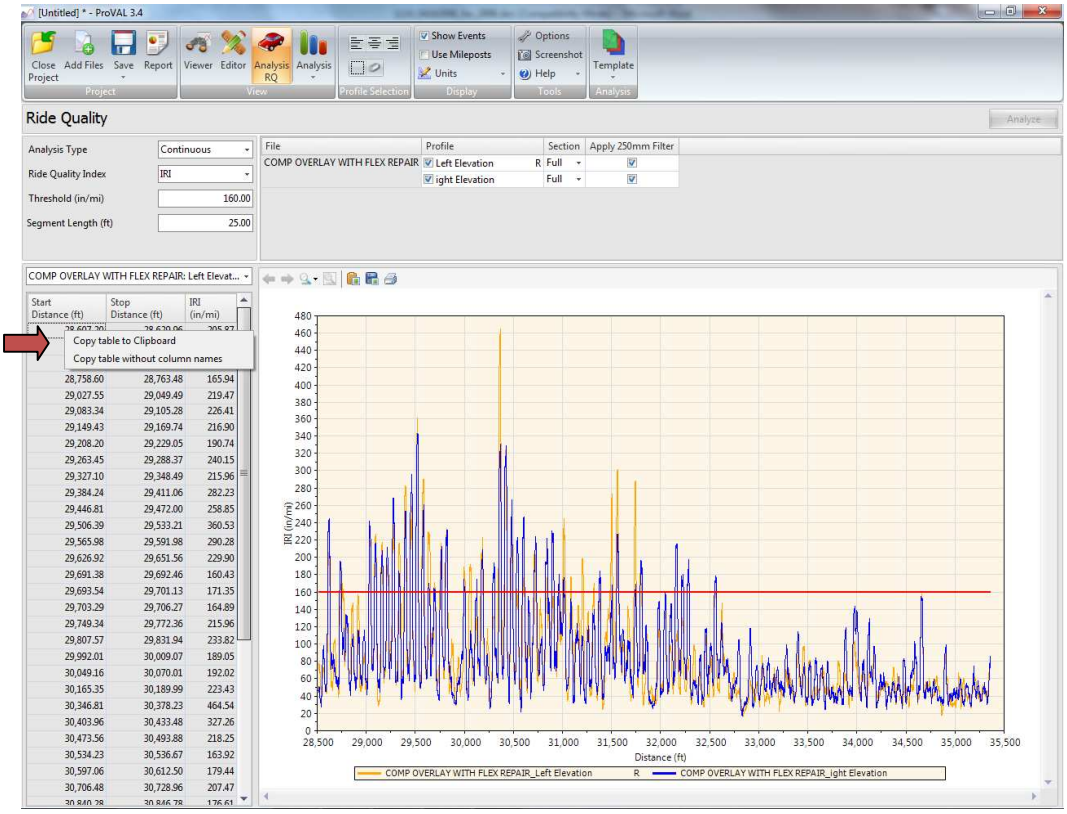
After the analysis is complete, a screen similar to the one below will appear**.**

The screen out shows in table and picture form where on the profile the localized roughness exceeds the limit (example 160)

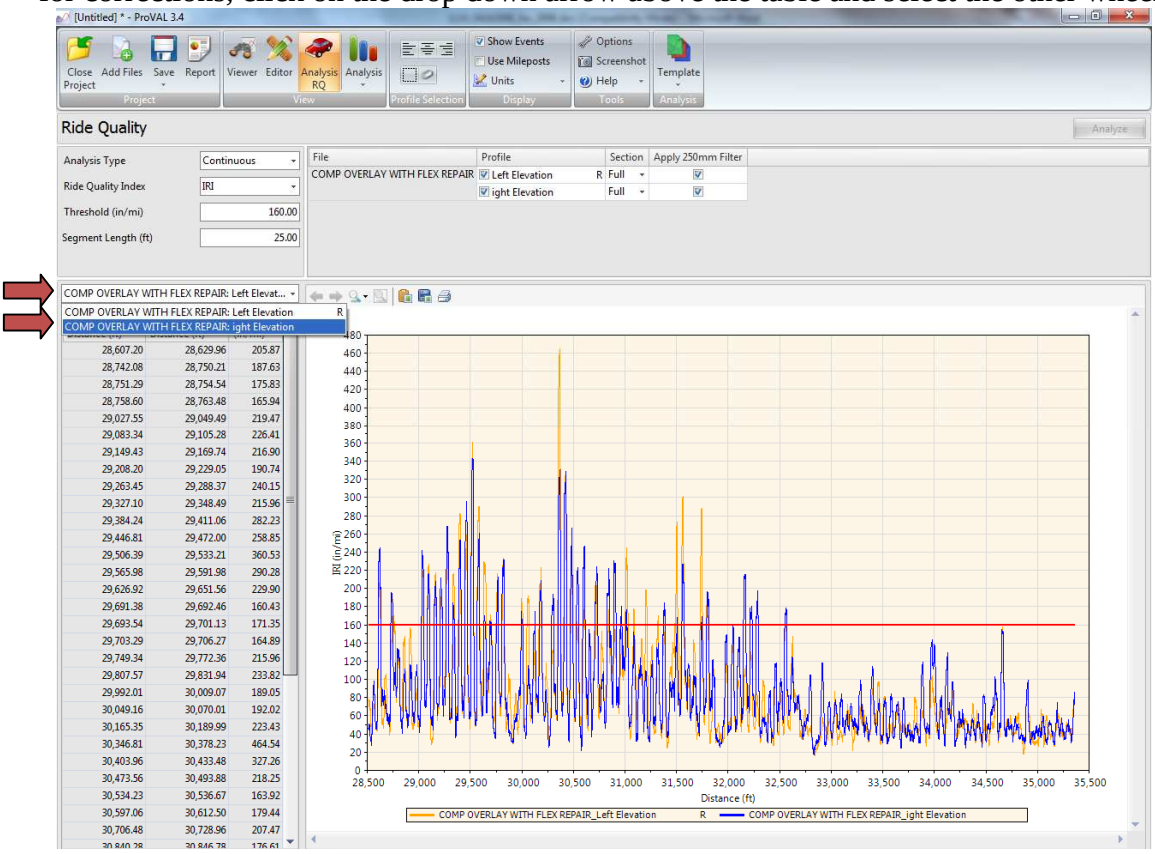
Place the cursor on any location on the trace to see the limit and location or just move scroll bar on the table to see the IRI and Location



To save the data to an Excel file left click in the top left cell of the table. Select copy table to clipboard and then open a blank Excel workbook. Left click your mouse in any cell and then click paste.



G. To view and copy the data for the other wheelpath and to get all the information needed for corrections, click on the drop down arrow above the table and select the other wheelpath.



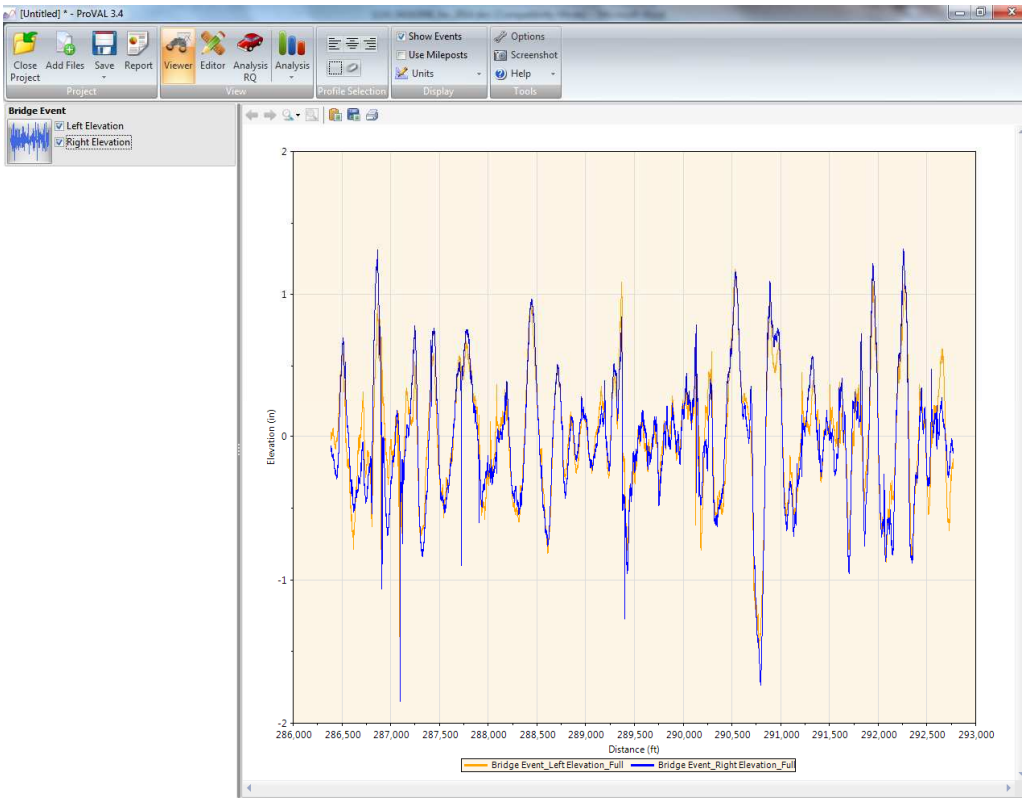
To save the data for the second wheelpath into your Excel spreadsheet repeat the process of left clicking your mouse in the upper left cell of the table and copy table to clipboard. Left click on an appropriate cell of your Excel spreadsheet and paste the data.

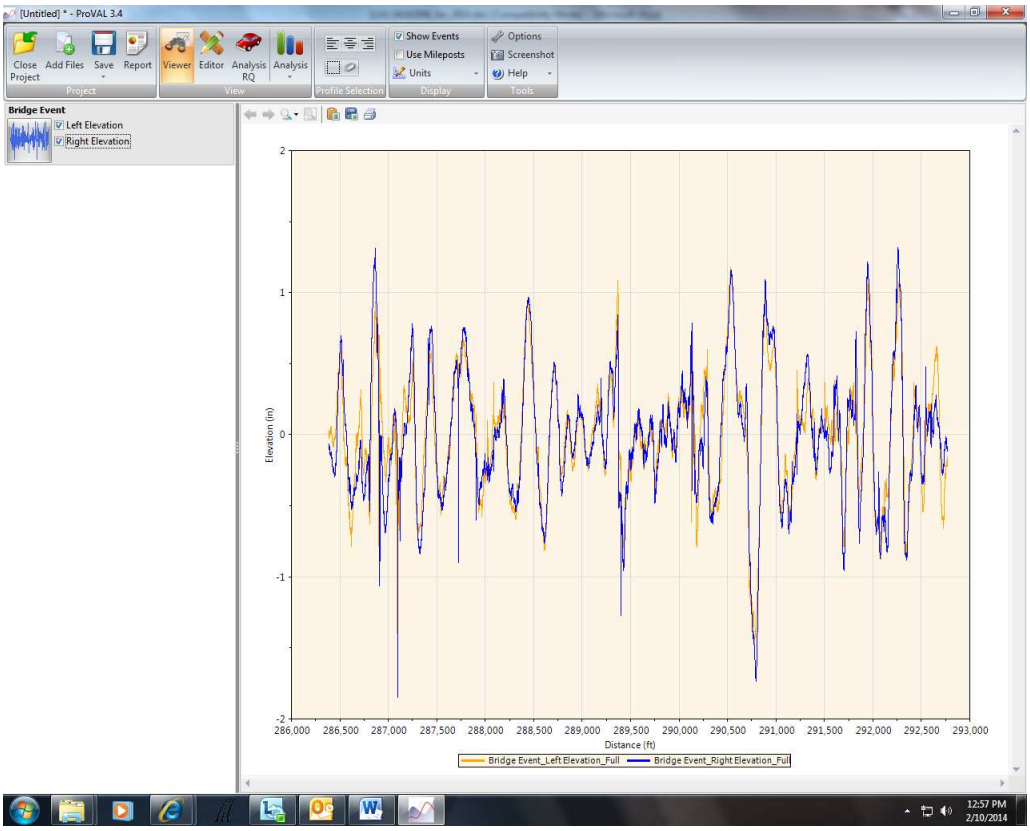
H. Use the Excel file output to identify the corrections in the field and make repairs. After corrections are made, you collect new profiles over the corrected section(s) and repeat the steps above to verify localized roughness has been eliminated from the originally identified section(s).

1110.04 Contractor requirements for cropping a road profile in ProVAL

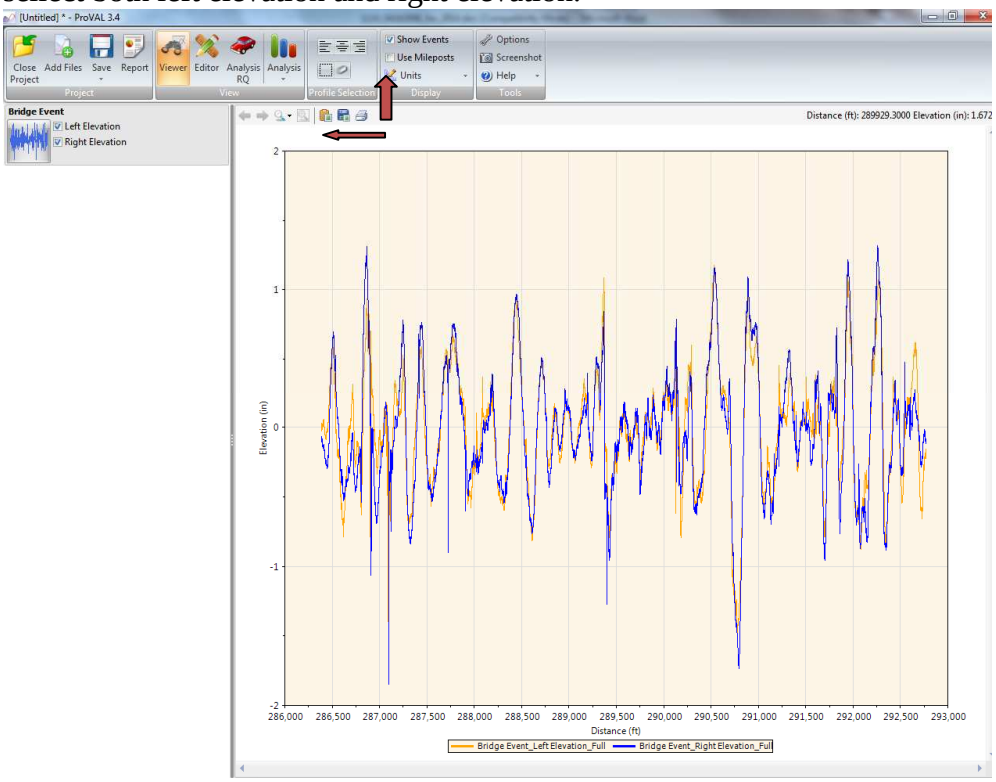
Smoothness specifications exempt certain areas of the pavement from the smoothness requirements. This section defines how you crop a road profile before analyzing the profile for IRI at 1/10 mile intervals.

A. Open road profile in ProVAL and select the Viewer button and select the Left Elevation and Right Elevation to view the profile and locate the event to be cropped.

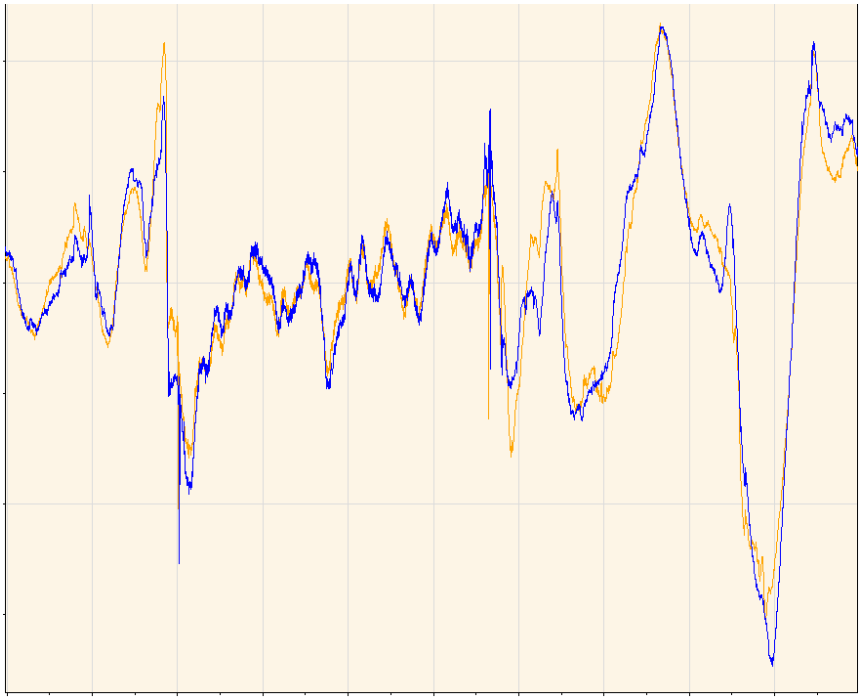




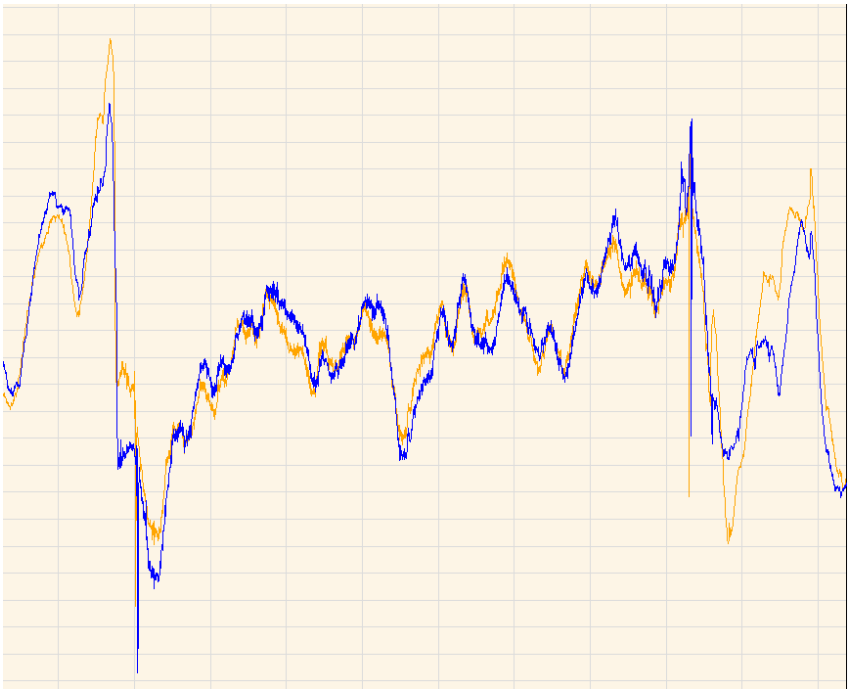
B. To locate your section for editing you will select “Viewer” from the top menu and then sellect both left elevation and right elevation.



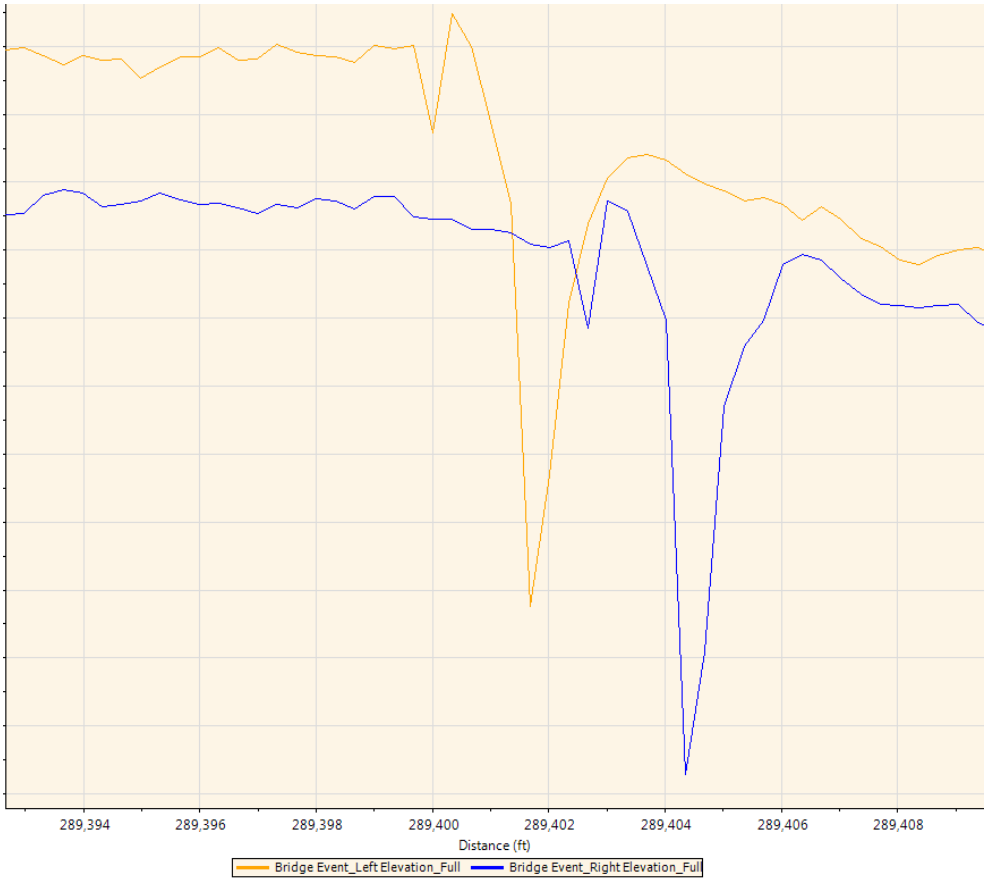
C. There is a bridge in the above profile trace. Zoom in to find the bridge. You should know the general distance location for the bridge already when you collected the profile. For this example it is between 289,000 and 291,000 (where the big bumps in the trace are).



You will need to zoom in until you can find the approach slabs for the bridge. See below zoom.



D. Zoom in until on the first bridge joint at 289,401 +/-. The trace shows the bottom of the bridge joint and the difference in the wheel paths is the skew. Determine the distance reading of the first wheel path dip at the bridge joint because this is when the profiler first made contact with the bridge joint. (Reading is 289,401.7)



E. Slide the bottom scroll button to find the other end of the bridge as seen below. The other bridge joint. The example below shows the bridge joint at the end of the bridge. Since this is the end joint, determine the distance reading for the last wheel that came off the bridge. That is the blue path in this trace and is 290,133 ft.

F. You now have the location of the two ends of the bridge. The specifications allow the elimination of the bridge length, the approach slab length and a length of pavement from the beginning and the end of the approach slab when determining the IRI value for 1/10 mile intervals.

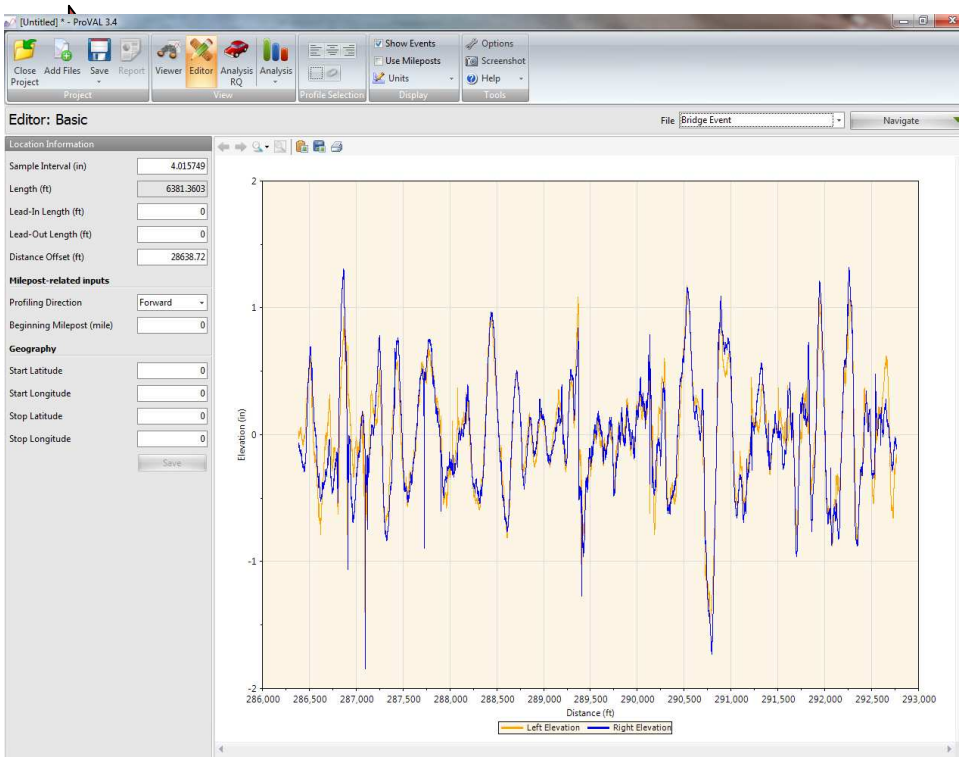
In this example the approach are 25 feet long and the specification excludes 40 feet of pavement. Therefore the distance that can be removed is

Beginning reading was C @ 289,401 – 25 ft approach and 40 ft of pavement = 289,336 ft.

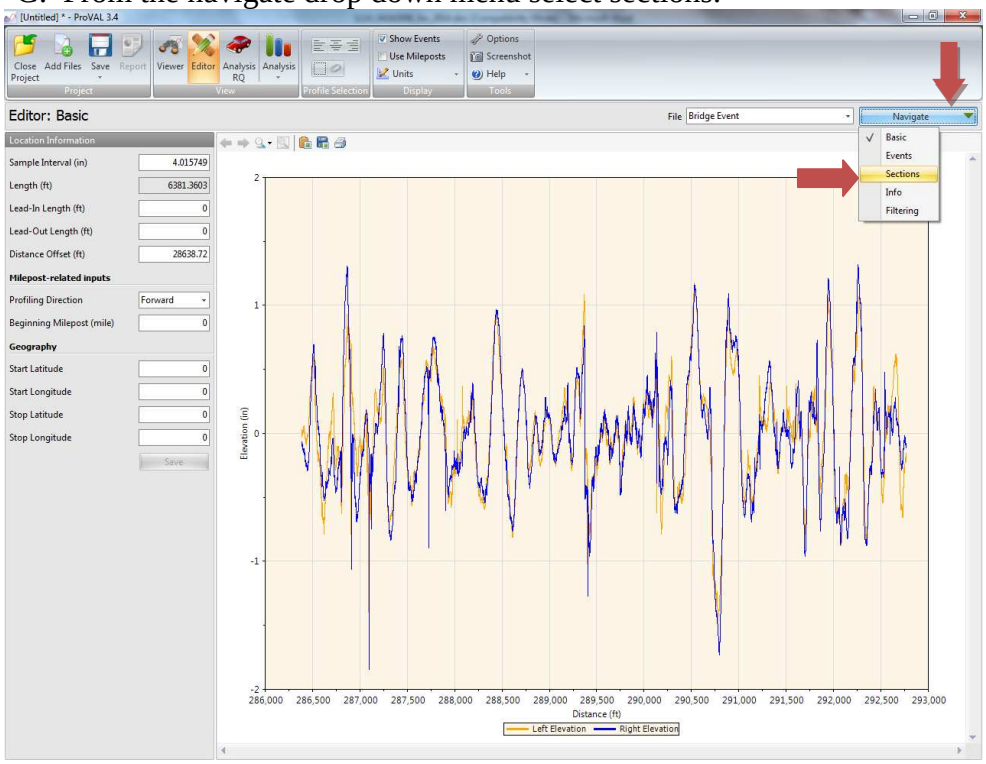
Ending reading was D @ 290,133 + 25 ft approach and 40 ft of pavement = 290,198 ft.

These two values are now your cropping points to be used.

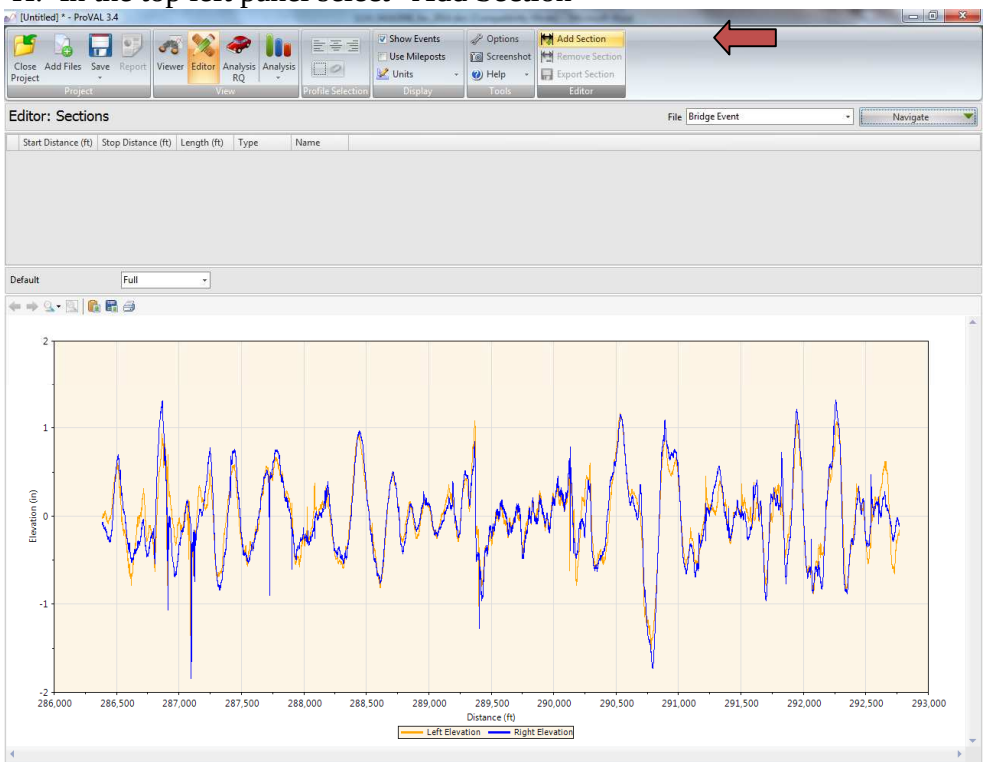
To create two new sections go to the Editor section and then from the menu select the file that you wish to section.



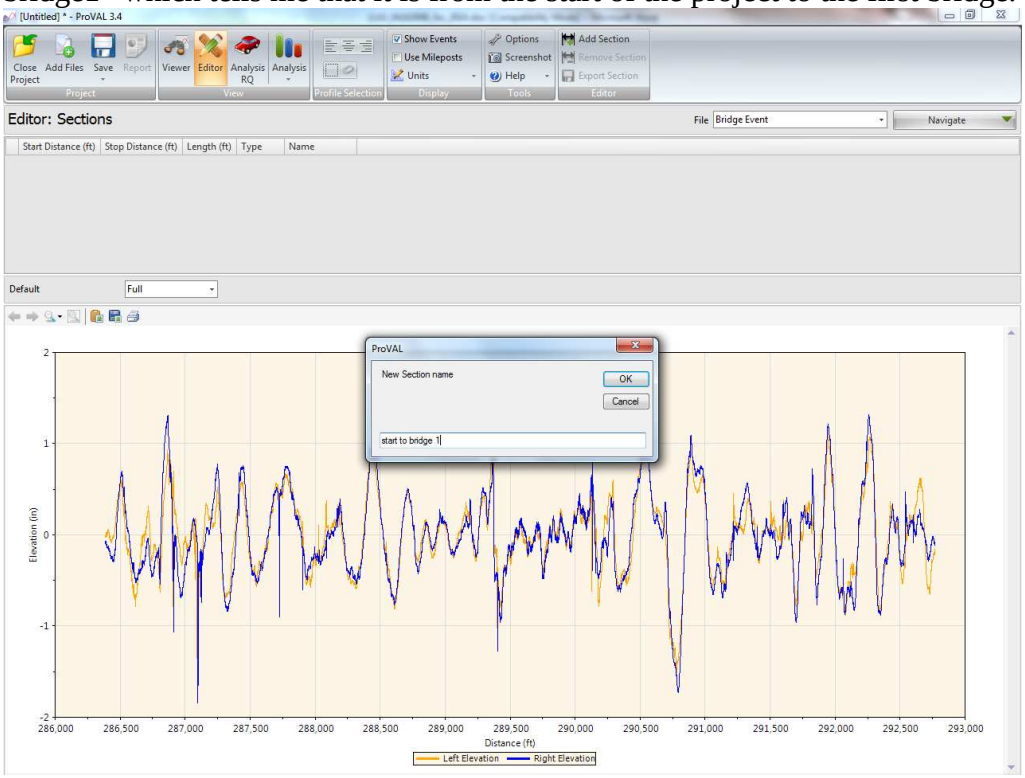
G. From the navigate drop down menu select sections.



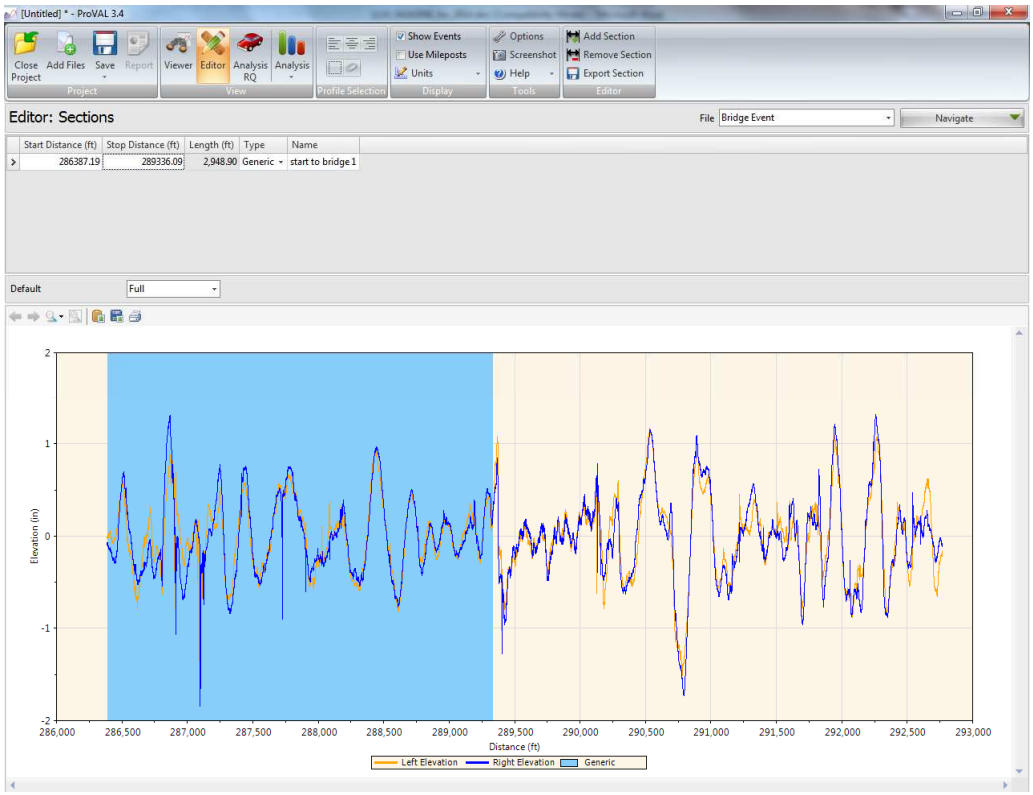
H. In the top left panel select “Add Section”



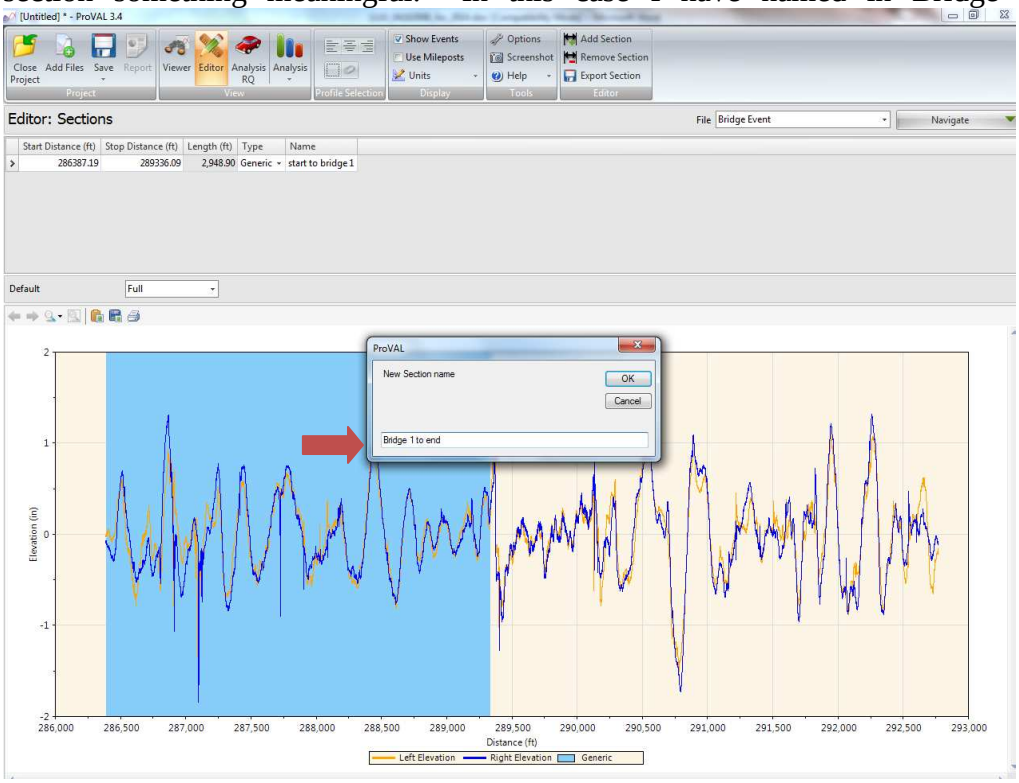
I. Name your road section something meaningful, in this case I have named it “start to bridge1” which tells me that it is from the start of the project to the first bridge.



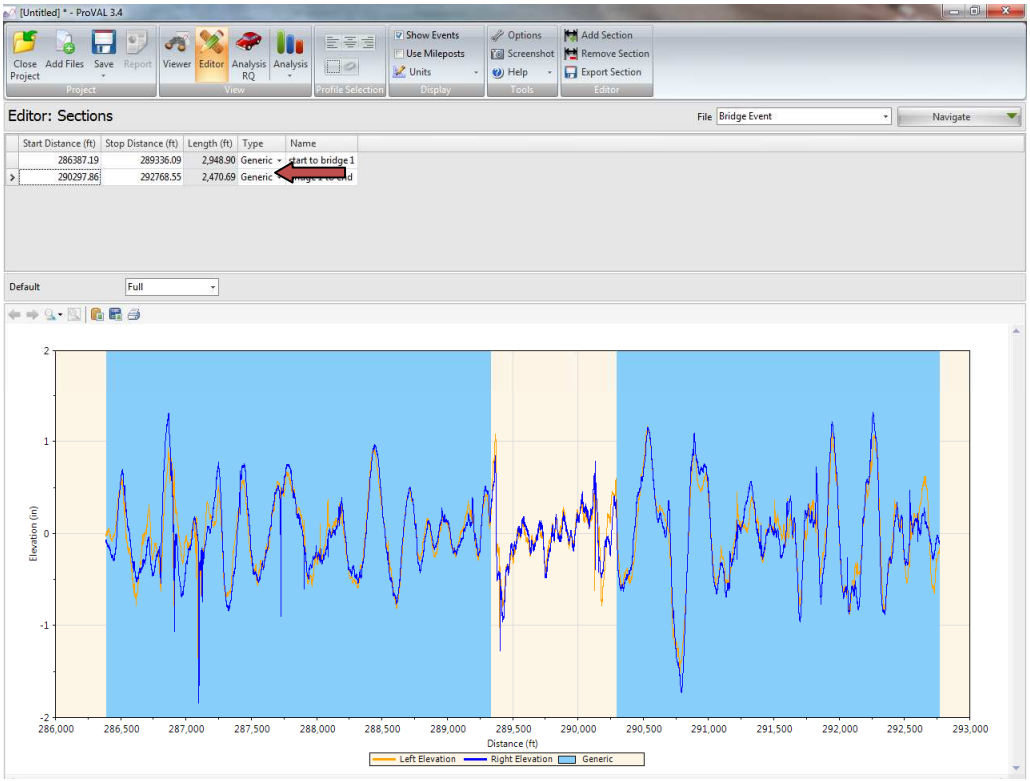
J. We know our starting point is not changing and we have determined that our new stopping point for the first section is 289,336 feet, we now enter that value into the “Stop Distance” block on the Editor window. Your newly created section is in the highlighted area.



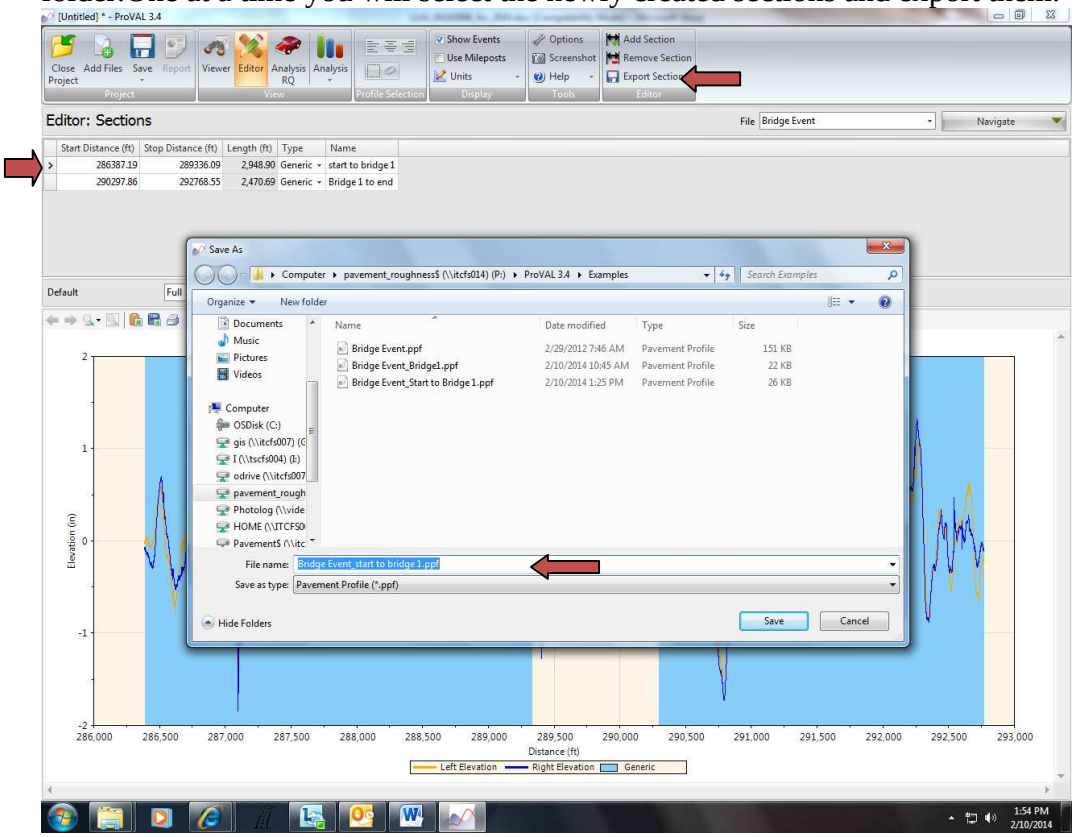
K. Go up to the Editor box and click on “Add Section” a second time. Again name your section something meaningful. In this case I have named in Bridge 1 to end.



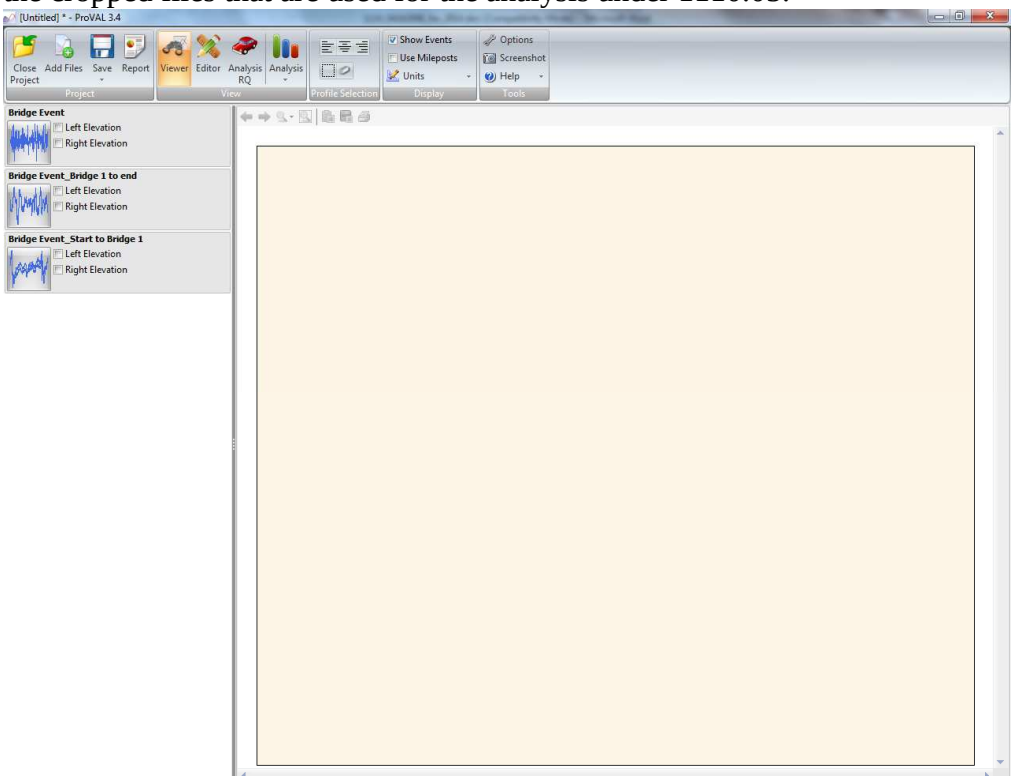
L. We know that the new starting distance for our section is 290,298, so in the “Start Distance” block for section 2 we will enter 290,298.



You will now see cropped sections. You are going to now export the sections into your work folder.One at a time you will select the newly created sections and export them.



M. The cropping is now complete. You now can go back to the view screen and add your newly created files to your active ProVAL project. Now you can look at the files and see the cropped files that are used for the analysis under 1110.05.

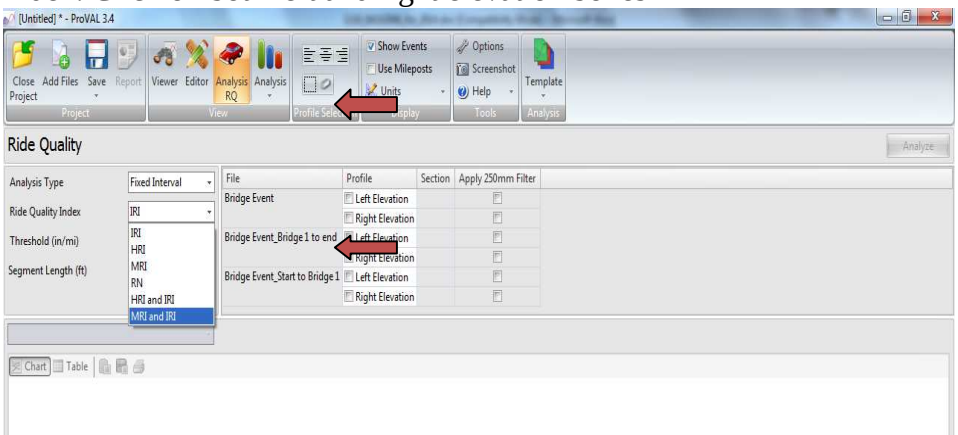


1110.05 Contractor requirements for IRI 0.1 mile interval calculation with ProVAL

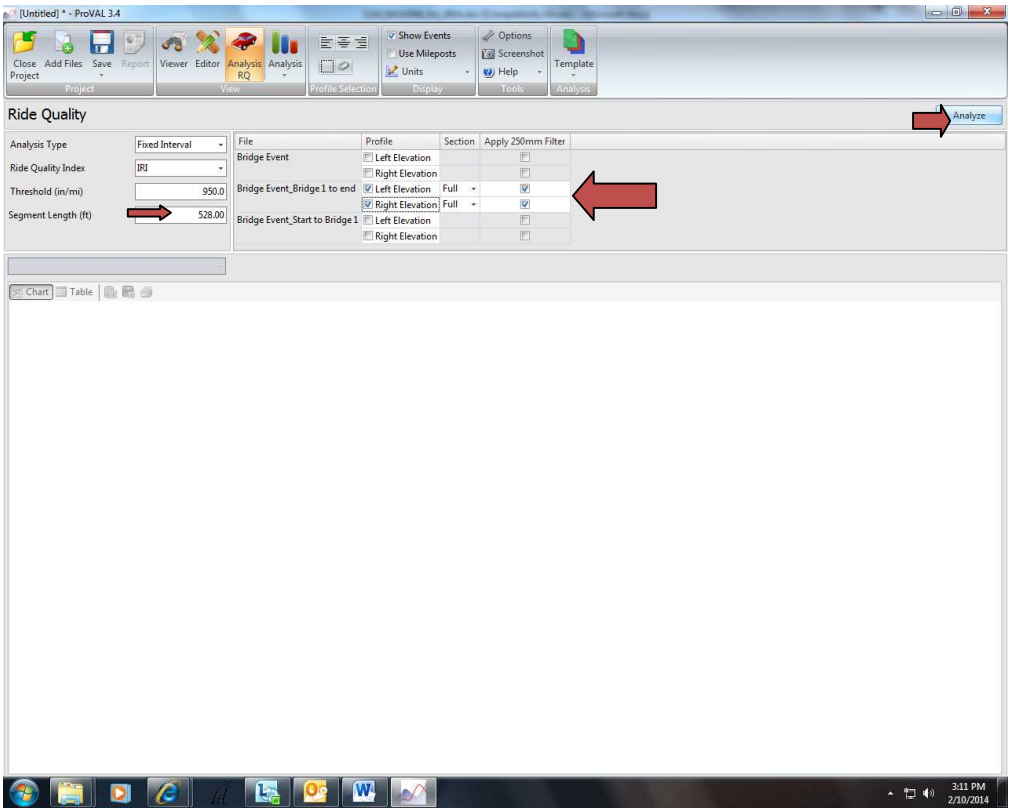
A. Open the originally collected profile(s) and the cropped files in ProVAL localized roughness (section 1110.03).

B. Select the **Analysis** tab and then select **Ride Quality.**

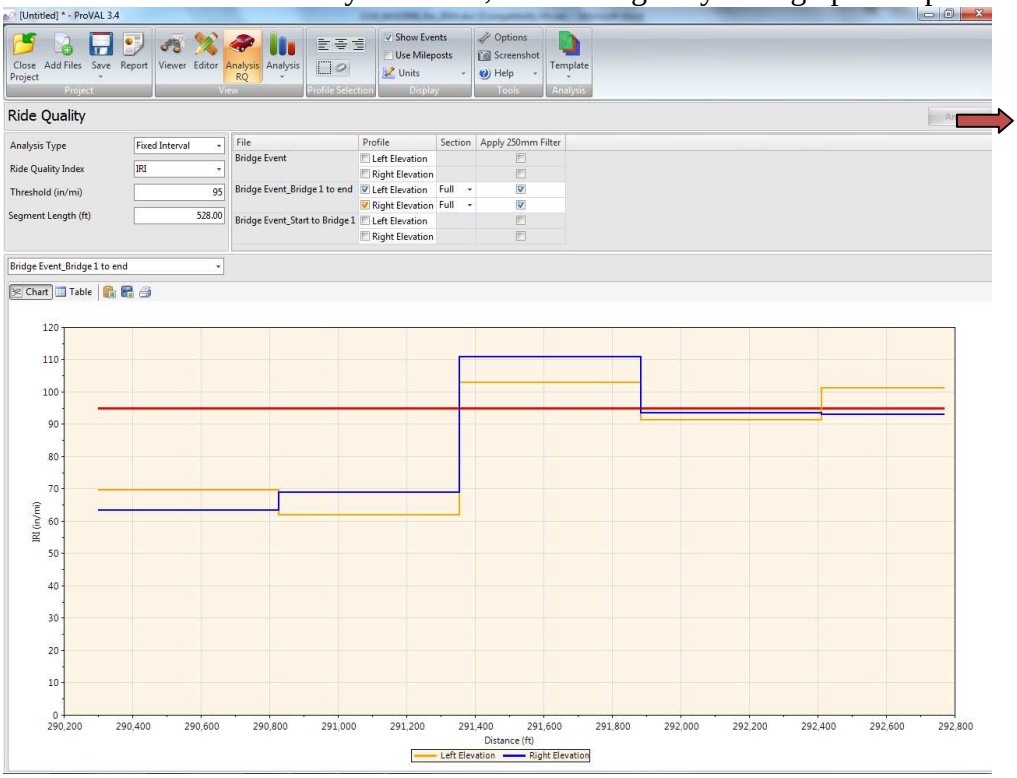
C. Select “Fixed Interval” as Analysis Type and select “MRI and IRI” as Ride Quality Index. Click on both left and right elevation boxes



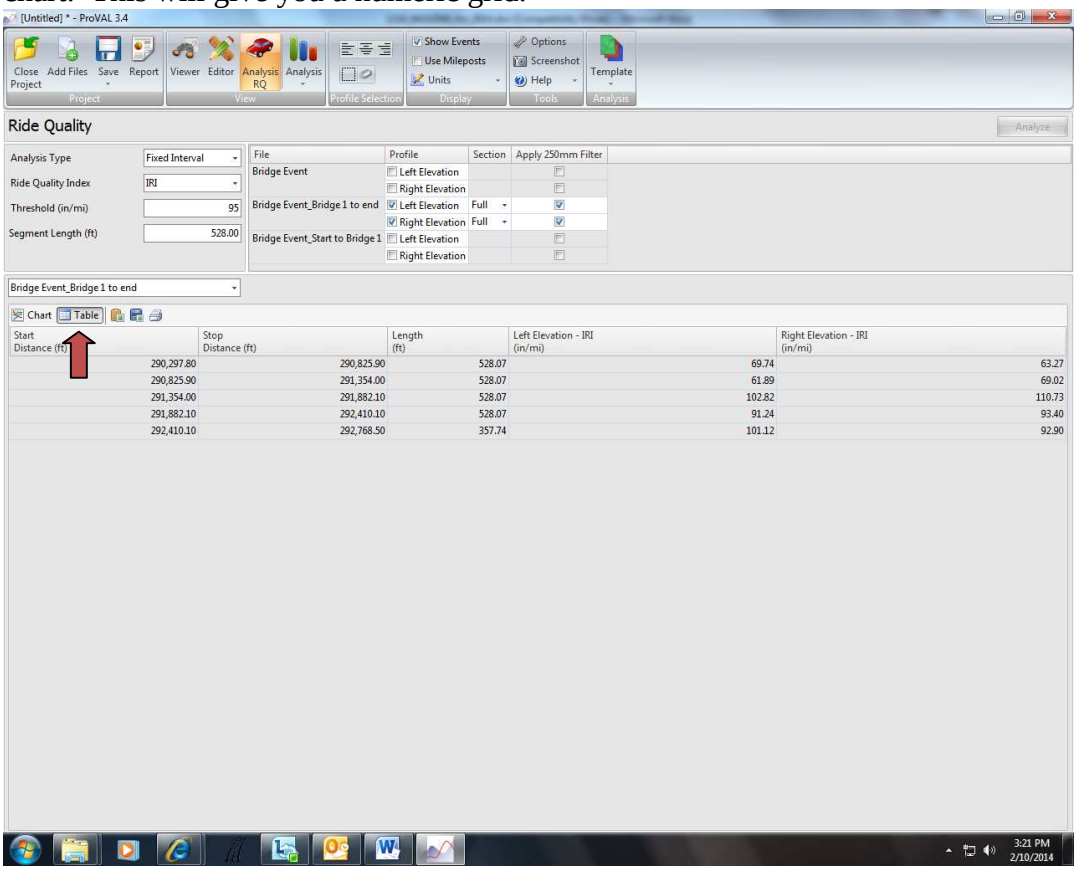
a. Make sure the Segment Length is set at 528 feet or 0.1 mile. (Under Viewer you can choose feet or miles. Use the same units you put in the viewer screen)
b. Check “Apply 250 mm filter”



D. Click on the Analyze button, this will give you a graphic representation of the data.

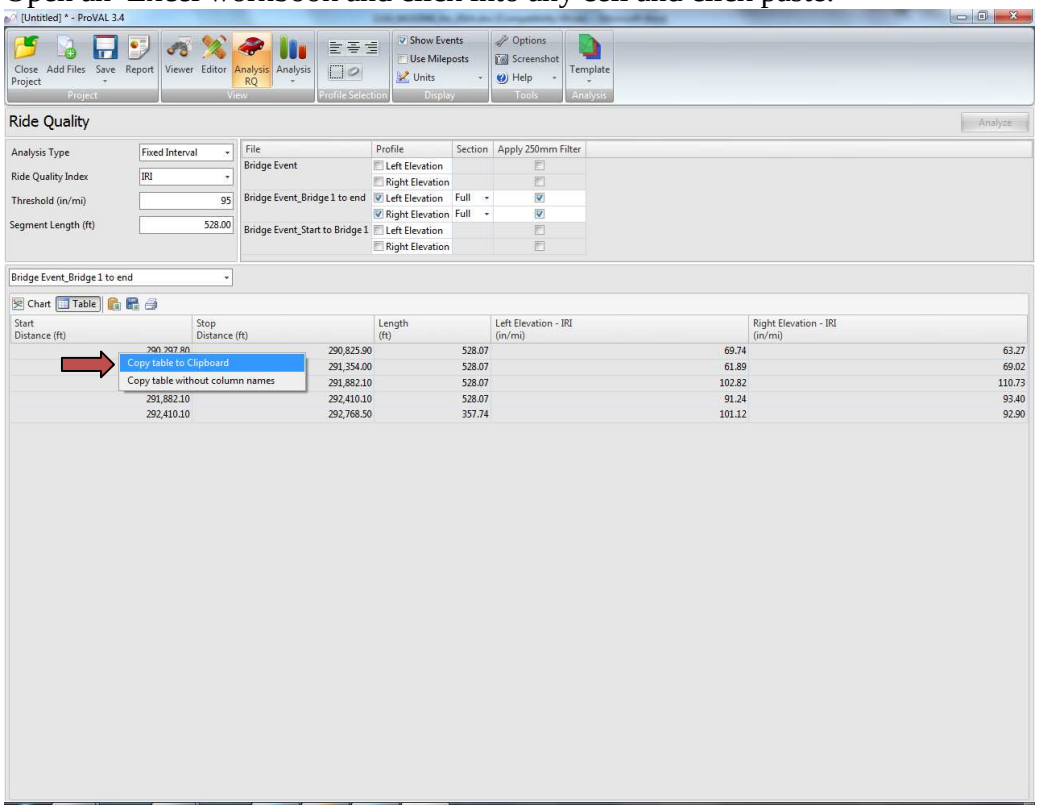


E. We want to see the chart, to do this go to the upper left hand corner of the graph and select chart. This will give you a numeric grid.

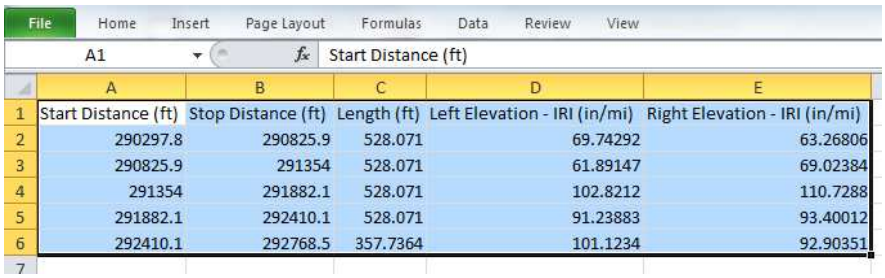


NOTE: Review the results of the MRI values and if any 0.1 mile sections have a value above 95 inches per mile, those 0.1 mile sections require correction. After section roughness corrections are made, collect new profiles over the corrected section(s) and repeat the steps in 1110.03 to check for localized roughness and repeat 1110.05 to verify no MRI values are greater than 95 inches per mile. (New profiles for section roughness corrections may be collected at the same time as new profiles for localized roughness corrections in 1110.03).

F. To calculate pay levels, export the **ride statistics at intervals** (1110.05.D) to Excel.
   1. Select right click in the upper left corner of the grid.
   2. select the Copy Grid to Clipboard
   3. Open an Excel workbook and click into any cell and click paste.



G. Data is displayed in Excel as shown below.



	A	B	C	D	E
1	Start Distance (ft)	Stop Distance (ft)	Length (ft)	Left Elevation - IRI (in/mi)	Right Elevation - IRI (in/mi)
2	290297.8	290825.9	528.071	69.74292	63.26806
3	290825.9	291354	528.071	61.89147	69.02384
4	291354	291882.1	528.071	102.8212	110.7288
5	291882.1	292410.1	528.071	91.23883	93.40012
6	292410.1	292768.5	357.7364	101.1234	92.90351

H. Save the Excel file with the same name as the root name of the profile (i.e. FRA071L1N.xls)

1110.06 Contractor submittals to ODOT from ProVAL

Provide a complete submittal to the Engineer and to the Office of Technical Services for each project. Include in the submittal:

A. A completed separate log sheet, Appendix A, for each day that you collect profiles on a given project prepared in accordance with the instructions in Appendix B.

B. A project CD including all electronic profiles, both pre- and post-correction, the analysis results of those profiles, and the pay adjustment summary sheets. Organize the CD as follows:
   1. A main folder with the project number as the name
   2. Sub folder(s) under the main folder with the dates the road profile were collected as the sub folder(s) name.
      a. Include in each subfolder:
         1. The road profile files collected for that date with the filenames matching the names on the completed log sheet.
         2. The analysis results of the profiles in Excel file format conforming to 1110.05. Name the Excel file the same name as the profile file but with the Excel file extension.
      b. A sub folder under the main folder named “Pay adjustment summary.” Include in this folder a pay adjustment Excel file with a separate sheet for each lane of the project and a summary sheet for the total project.

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Create the pay adjustment Excel file by pasting the analysis file Excel files from 1110.05 for each lane and including the specification’s pay adjustment table for each 0.1 mile lot. If a lot is less than 0.1 mile, the section will be prorated on the basis of length. (i.e. if a lot is 0.04 mile pay adjustment would be multiplied times 0.04/.1)

The Pay Adjustment Excel file(s) should look similar to the below example.

Using the applicable specification Pay Adjustment Table, modify the Excel file created and saved in 1110.05 to include:

a. The pay adjustment for each .1 mile lot
b. The total pay adjustment for the lane

You will need to do this for each **lane.**

					Table from current specification	
					IRI	PAY ADJUSTMENT
	Left Elevation	Right Elevation		Pay for 0.1 Lane Lot	**Inches per mile per 0.1 mile section (m/km per 0.16 km section)**	**Pavement Thickness less than 8 inches (200 mm)**
Interval (ft)	IRI (in/mi)	IRI (in/mi)	MRI (in/mi)		45 (0.71) or less	$375.00
0 to 528	67.8	70.8	69.3	$0.00	Over 45 to 50 (0.71 to 0.79)	$225.00
528 to 1,05	51.1	44.2	47.6	$225.00	Over 50 to 55 (0.79 to 0.87)	$150.00
1,056 to 1,	45.9	47.8	46.8	$225.00	Over 55 to 60 (0.87 to 0.95)	$75.00
1,584 to 2,	48.9	41.8	45.4	$225.00	Over 60 to 70 (0.95 to 1.10)	$0.00
2,112 to 2,	51.9	51.7	51.8	$150.00	Over 70 to 75 (1.10 to 1.18)	($150.00)
2,640 to 3,	54.5	54.4	54.5	$150.00	Over 75 to 80 (1.18 to 1.26)	($300.00)
3,168 to 3,	51.7	57.4	54.5	$150.00	Over 80 to 85 (1.26 to 1.34)	($450.00)
3,696 to 4,	88.6	94.5	91.5	-$750.00	Over 85 to 90 (1.34 to 1.42)	($600.00)
4,224 to 4,	77.2	73.5	75.4	-$150.00	Over 90 to 95 (1.42 to 1.50)	($750.00)
4,752 to 5,	49.9	58.5	54.2	$150.00	Over 95 (1.50)	-1
		TOTAL PAY ADJUSTMENT		$375.00		

Either provide hard copies of Project Road Profile Log Sheet(s) [Appendix A] with the CD of the road profile files and pay adjustment excel file or provide electronic copies of the log sheets stored in the same subfolders as their road profile files. Name any electronic log sheets with both project number and date to match the subfolder it is stored in.

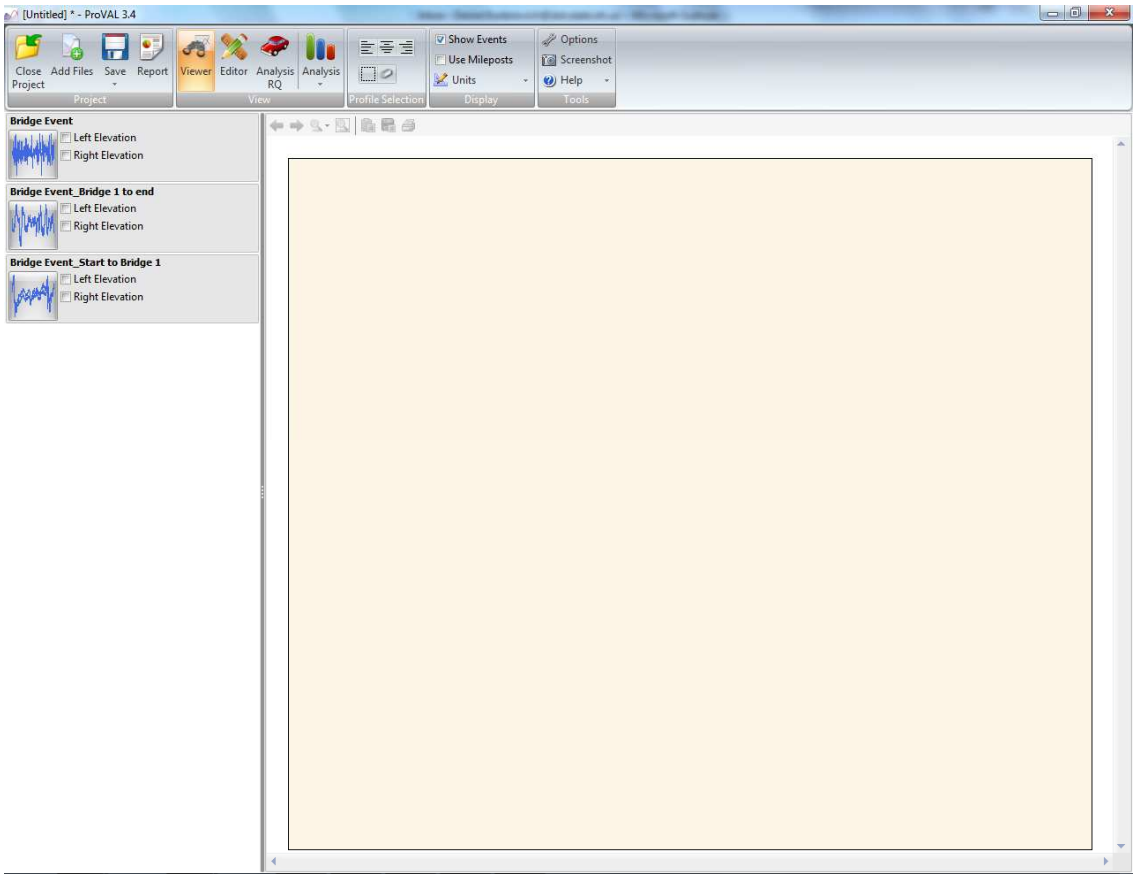
Project engineers may require hard copies of the pay adjustment Excel file for 0.1 mile lots, complete with incentive/disincentive calculations, along with the electronic copies stored on the electronic storage media.

Project engineers may also require access to all smoothness information for any portions of a project for payment, verification or information.

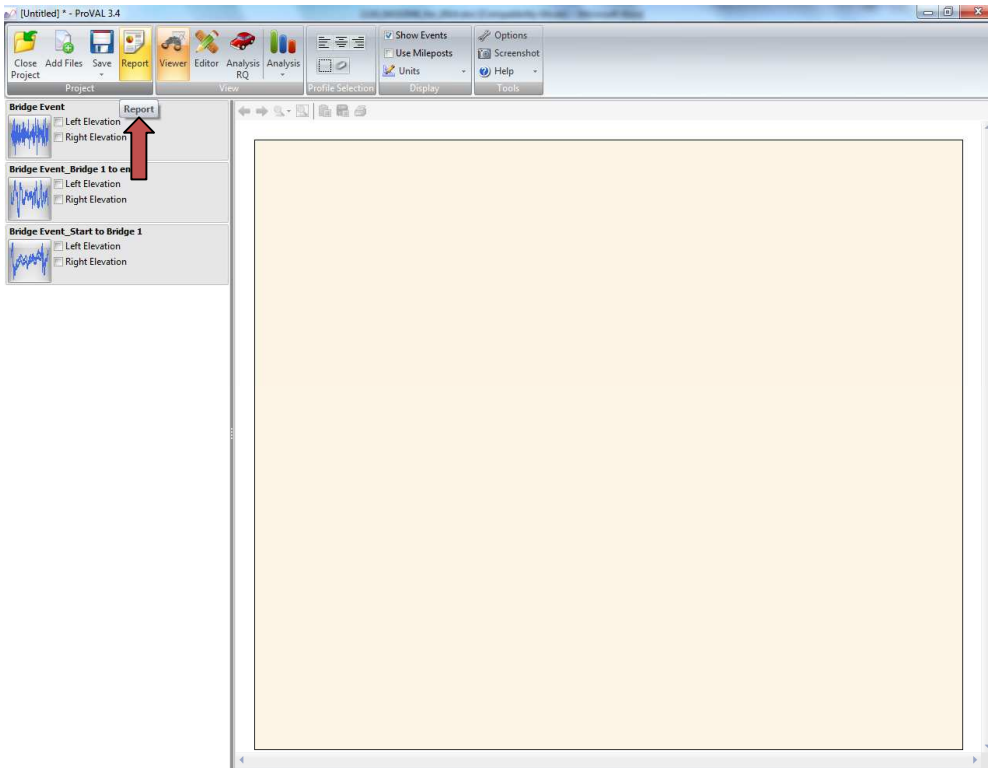
1110.07 Engineer verification of the smoothness data

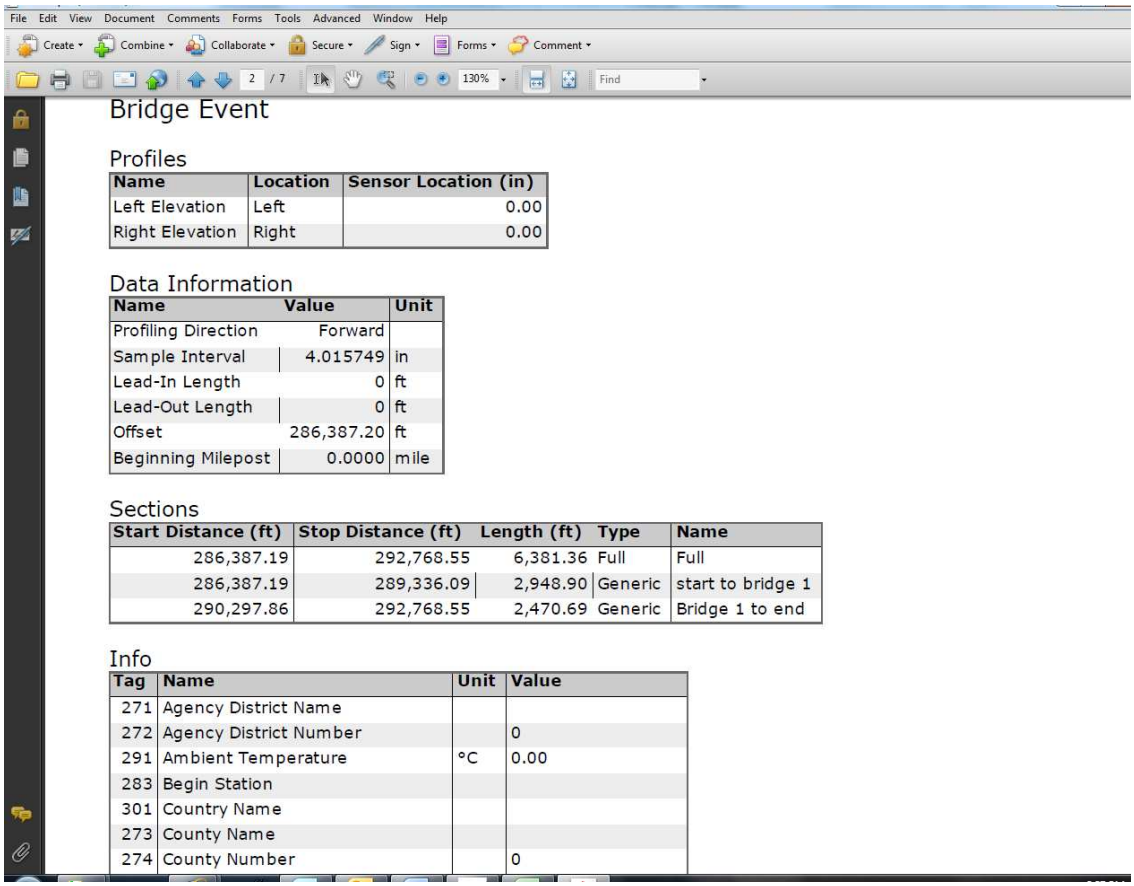
The Engineer will randomly select one of the road profile files as follows:

A. Open ProVAL and load the selected road profile file



B. Select the Report button
    1. Select “Files to Print”
    2. Click the Create button
    3. A Report will be shown on the screen similar to the report on the next page





Bridge Event

Profiles

Name	Location	Sensor Location (in)
Left Elevation	Left	0.00
Right Elevation	Right	0.00

Data Information

Name	Value	Unit
Profiling Direction	Forward	
Sample Interval	4.015749	in
Lead-In Length	0	ft
Lead-Out Length	0	ft
Offset	286,387.20	ft
Beginning Milepost	0.0000	mile

Sections

Start Distance (ft)	Stop Distance (ft)	Length (ft)	Type	Name
286,387.19	292,768.55	6,381.36	Full	Full
286,387.19	289,336.09	2,948.90	Generic	start to bridge 1
290,297.86	292,768.55	2,470.69	Generic	Bridge 1 to end

Info

Tag	Name	Unit	Value
271	Agency District Name		
272	Agency District Number		0
291	Ambient Temperature	°C	0.00
283	Begin Station		
301	Country Name		
273	County Name		
274	County Number		0

The Engineer should check that the History of the report shows no use of filters. If it does, reject all data and require the contractor to reanalyze all profiles with no filters.

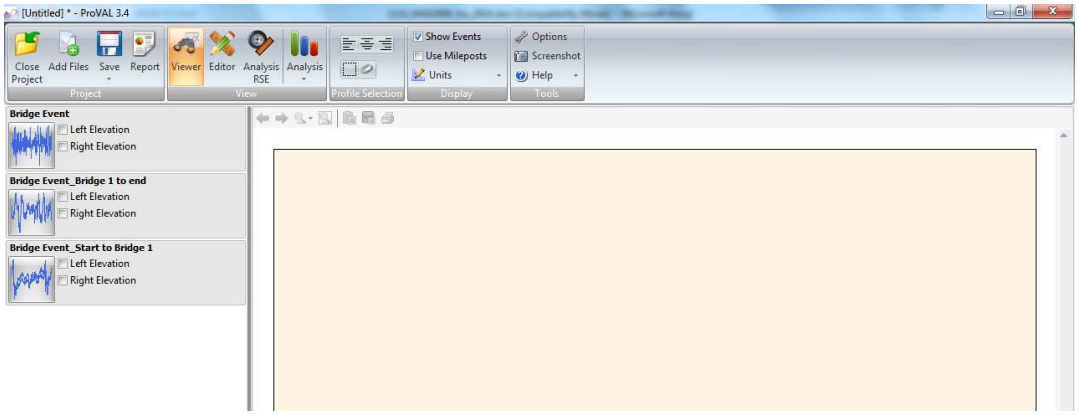
If no filters are shown, the Engineer should verify the MRI + IRI table created through ProVAL for the profile file loaded matches the MRI-IRI table in the "Pay Adjustment file".

Follow the procedures listed under 1110.05 and recreate the MRI + IRI table in ProVAL. Check the table against the Excel pay adjustment file information submitted to see if the IRI for the 0.1 mile Lots are the same. If they are, accept the data submitted in the electronic media.

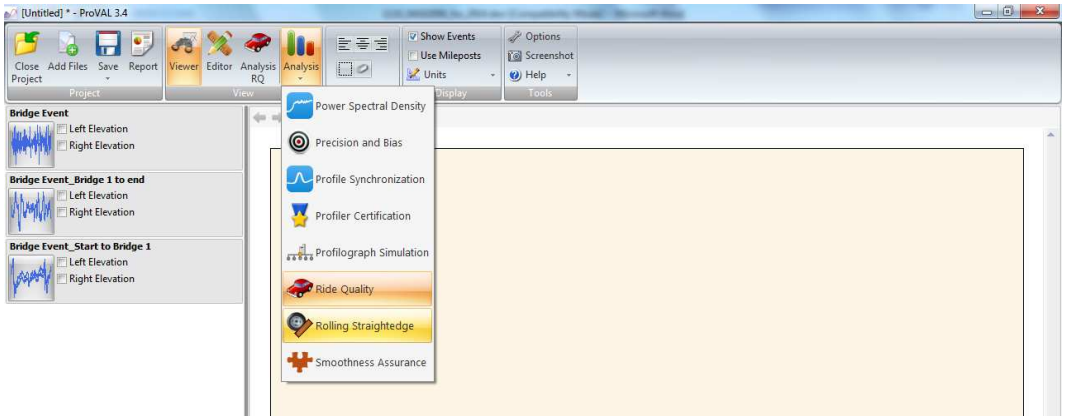
If not, reject all the submitted data and require the contractor to reanalyze all profiles with no filters.

1110.08 Contractor requirements for 10 foot rolling straightedge 401.19

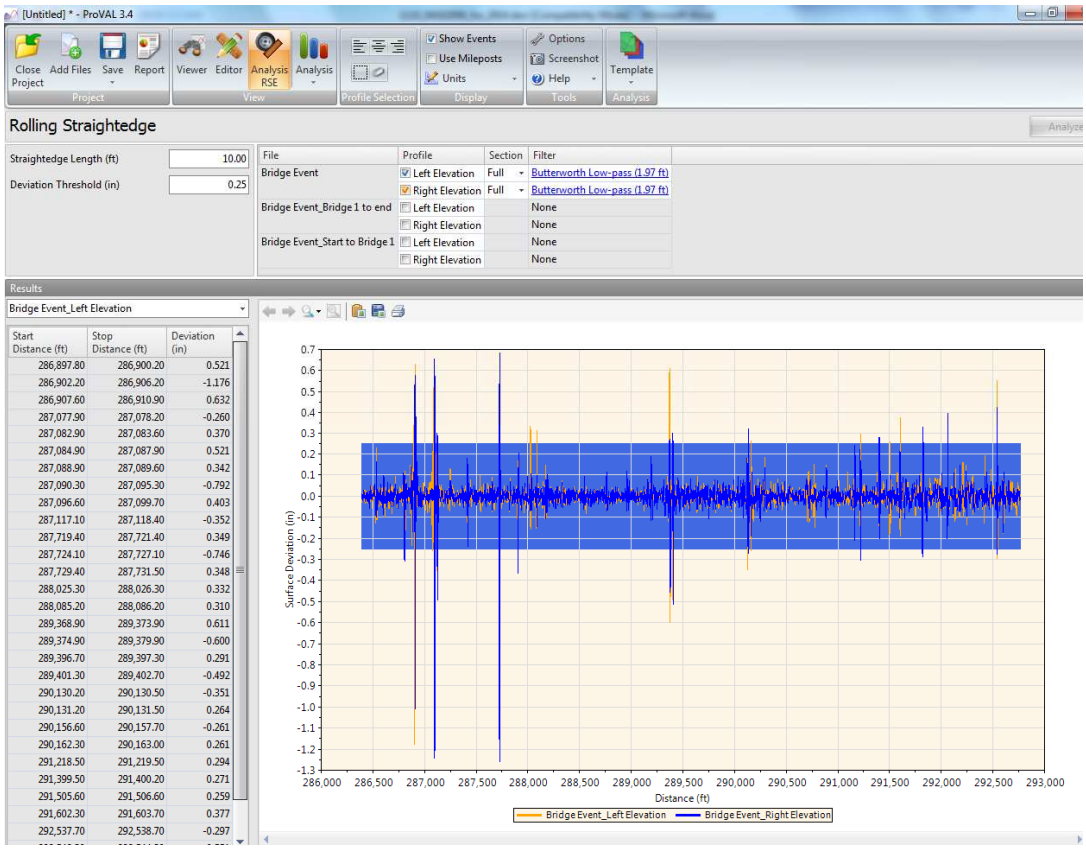
A. Open ProVAL 3.4 and select a ProVAL compatible profile file to open.



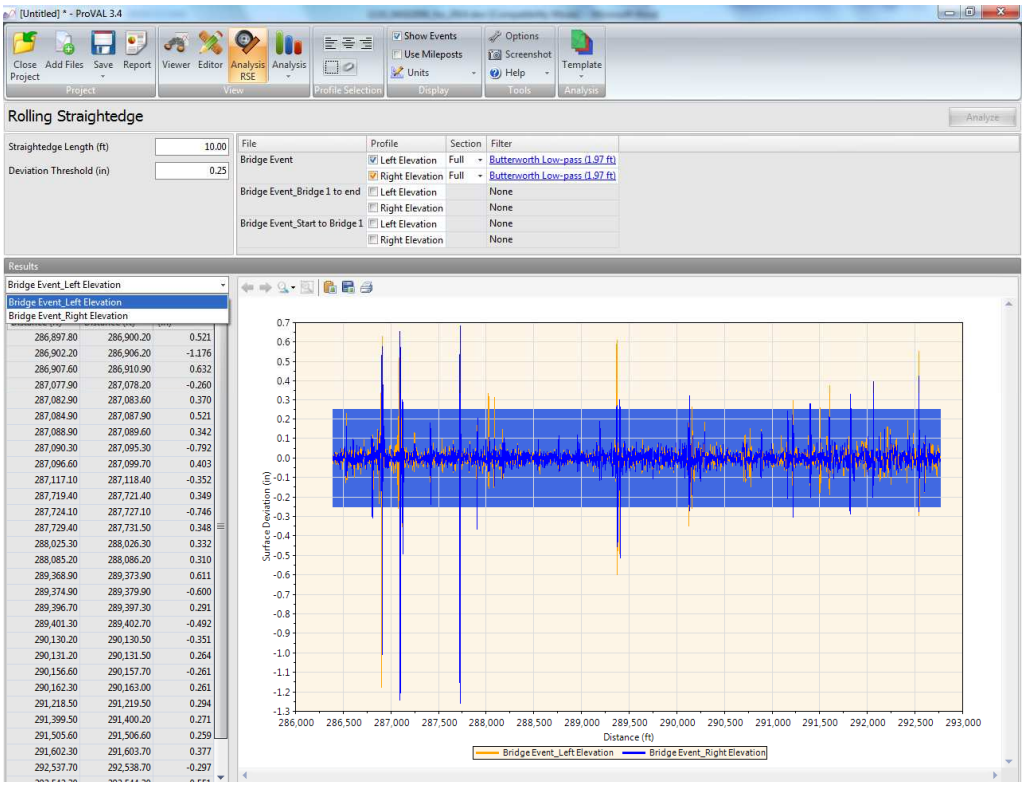
B. Select under the ”Analysis” menu select “rolling straightedge”



C. Select the Left and Right wheel paths (Left and Right elevation); check that the straightedge length is 10 feet; and the “Input Set” is “Original”. Click the Analyze button. The profile is evaluated to show the “Surface Deviation” along the profile based on the 10 foot straightedge.



D. To look at where in the profile exceeds the 1/4” in 10 feet tolerance, create a zoomed area with the top and bottom limits +/- 0.25 in. Profile wheelpath points going above or below the zoom area exceed +/- 0.25 inch. Those points need to be corrected. The areas needing corrective action are also listed in the chart to the left. To switch wheelpaths select the dropdown menu at the top of the grid.



Appendix A

Ohio Department of Transportation

Project Road Profile Log Sheet

Contractor / Company Name _____ Profile Operator Name _____

Profile Make _____ ODOT Cert. Device # _____ Date _____

Project Number _____ County _____ Route Number _____

Bounce Test Performed (Y/N) _____ Block Check Performed (Y/N) _____ Check Long. Distance (Y/N) _____

File Name	Dir	Lane	Beginning Mile Point	Ending Mile Point	Beginning GPS Coordinate	Ending GPS Coordinate	Beginning Station	Ending Station	Beginning Physical Feature	Ending Physical Feature

Notes: _____

Appendix B

Instructions for Completing ODOT's, "Project Road Profile Log Sheet"

This log sheet may be printed and completed by hand so long as it is legible or it may be completed electronically. This form is available on the ODOT Pavement Engineering website. A separate log sheet will be completed for each different day profiles are collected on any given project.

Contractor/Company Name – self explanatory

Profiler Operator Name – First and Last

Profiler Make – Ex Ames, Dynatest, KJLaw, SSI

ODOT Certification Device Number – number assigned by ODOT during certification

Date – Date you collected the profiles PROVIDE A PROJECT ROAD PROFILE LOG SHEET FOR EACH DATE PROFILES ARE COLLECTED.

Project Number – self explanatory

County – County or Counties where the project is located

Route Number – Route Number(s) of completed work, Ex. US 33, SR 128, I 271

Bounce Test Performed – Required at the beginning of the project and also recommend performing daily. If equipment fails a bounce test you should not collect profiles until remedied.

Block Check Performed – Required at the beginning of the project and also recommend performing daily. If equipment fails a block test you should not collect profiles until remedied

Check Longitudinal Distance – Required at the beginning of the project. If equipment fails the longitudinal distance test you should not collect profiles until remedied

File Name – This is at the contractor's discretion. It must exactly match the name of the electronic profiles given to ODOT including extensions.

Direction – This will be either U for Up or D for Down according to ascending or descending direction of mile markers. Routes are either signed Up for predominately Northbound or Eastbound and Down for predominately Southbound and Westbound travel directions.

Lane – Lane Number, Lanes will be numbered from the outside to the inside by direction. [Example: A 6 lane divided section of I-71 will have the outside driving lane in each direction labeled lane number 1, the center lane in each direction will be labeled lane number 2, and the inside lanes in each direction will be labeled lane number 3.

For beginning and ending descriptions, at a minimum one pair of the following four sets must be completed. Please complete all that you are able.

Beginning Milepoint – The beginning of data collection to the nearest 0.01 mile if known.

Ending Milepoint – The ending of data collection to the nearest 0.01 mile if known.

Beginning GPS – The GPS coordinates at the beginning of a data collection run if known.

Ending GPS – The GPS coordinates at the end of a data collection run if known.

Beginning Station – Station location at the beginning of a data collection run if known.

Ending Station – Station location at the end of a data collection run if known.

Beginning Feature – Description of the point where the data collection run began. Examples may include: Began at structure over County Road 110; Began at bridge over Wolfe Creek, Began 250 feet west of Junction SR 607, etc. Do your best to describe where you began.

Ending Feature – Similar to beginning features.

Notes – Any additional notes to help describe profile file names with location information will be appreciated. Feel free to turn the paper over and draw maps if that helps describe the data that you collect.