

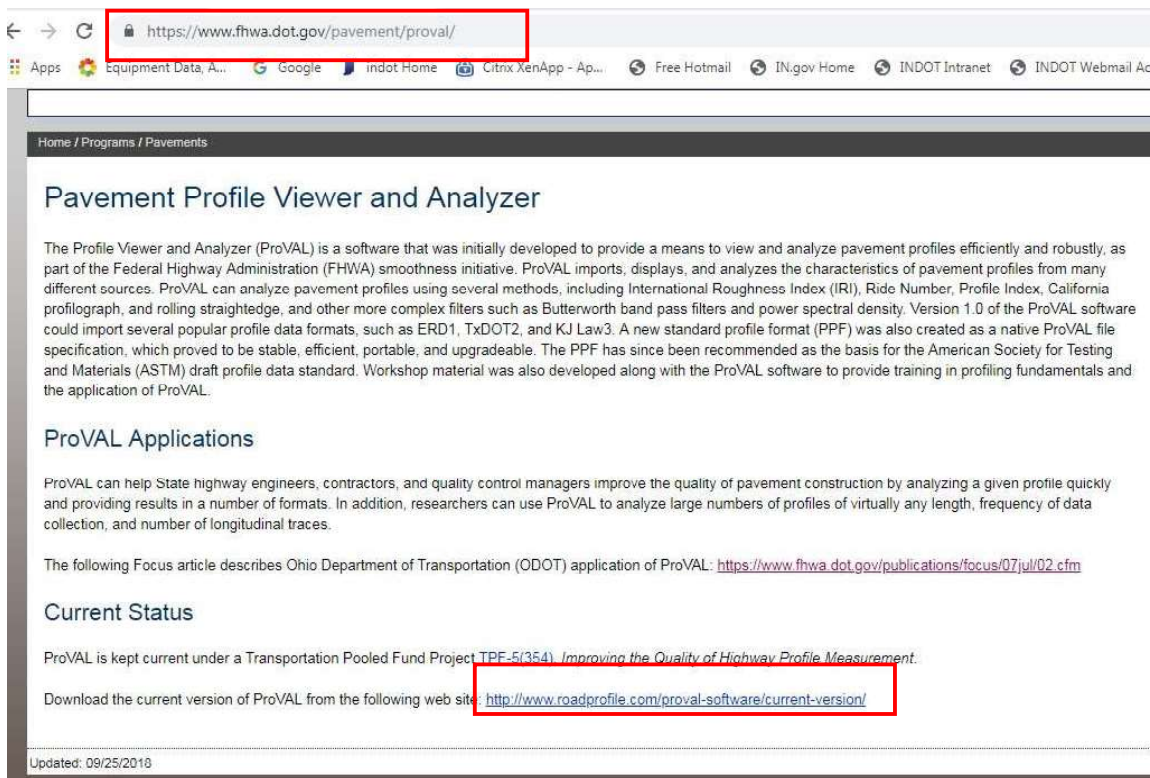
Profilograph Simulation Field Guide

***The steps in this Field Guide are intended to be completed by the contractor performing the high speed profile data collection. After preparing the files, analyzing the data, and generating reports in ProVal, all files are to be submitted to the PE/S for review. The PE/S will review the ProVal files and utilize the smoothness information to generate smoothness payment utilizing the Dept spreadsheets as shown at the end of this guide. Any corrective action required for smoothness sections exceeding the contract thresholds will be performed in accordance with the contract documents.**

(Profilograms in pdf format that are generated by the high-speed profiler software and meet the requirements SS 401.18 may be accepted in place of data files. The profilograms provided will be analyzed, reviewed, and utilized for payment in the same manner as profilograms generated by current profilograph equipment and in accordance with SS 401.18.)

ProVAL Applications can be downloaded from FHWA website:

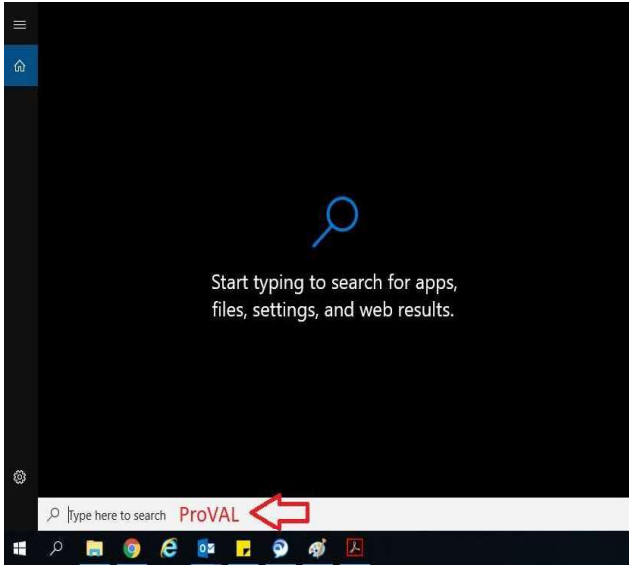
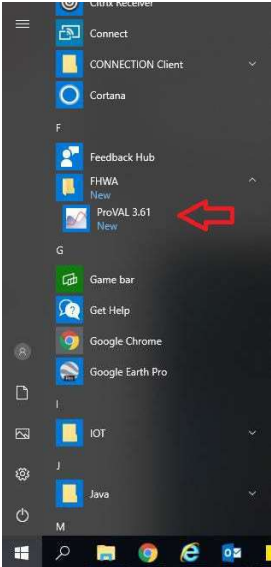
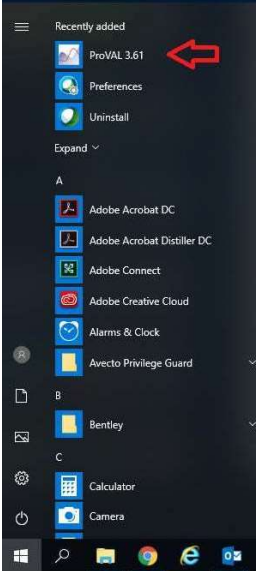
<https://www.fhwa.dot.gov/pavement/proval/>



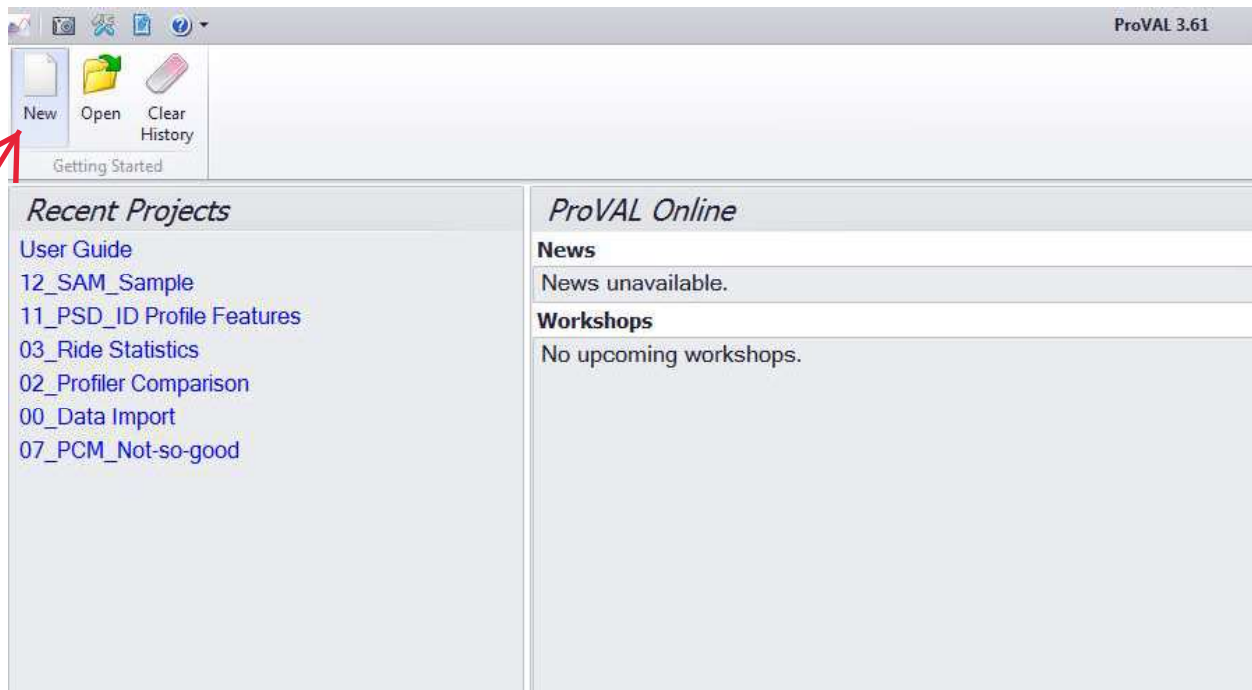
The screenshot shows a web browser window with the address bar containing the URL <https://www.fhwa.dot.gov/pavement/proval/>. The browser's taskbar shows several open applications including 'Equipment Data, A...', 'Google', 'indot Home', 'Citrix XenApp - Ap...', 'Free Hotmail', 'IN.gov Home', 'INDOT Intranet', and 'INDOT Webmail Ac'. The website content includes a breadcrumb trail 'Home / Programs / Pavements', a title 'Pavement Profile Viewer and Analyzer', and a detailed description of the software. Below this, there are sections for 'ProVAL Applications' and 'Current Status'. The 'Current Status' section mentions that ProVAL is kept current under a Transportation Pooled Fund Project TPF-5(354) and provides a link to download the current version: <http://www.roadprofile.com/proval-software/current-version/>. The footer of the page indicates it was updated on 09/25/2010.

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.

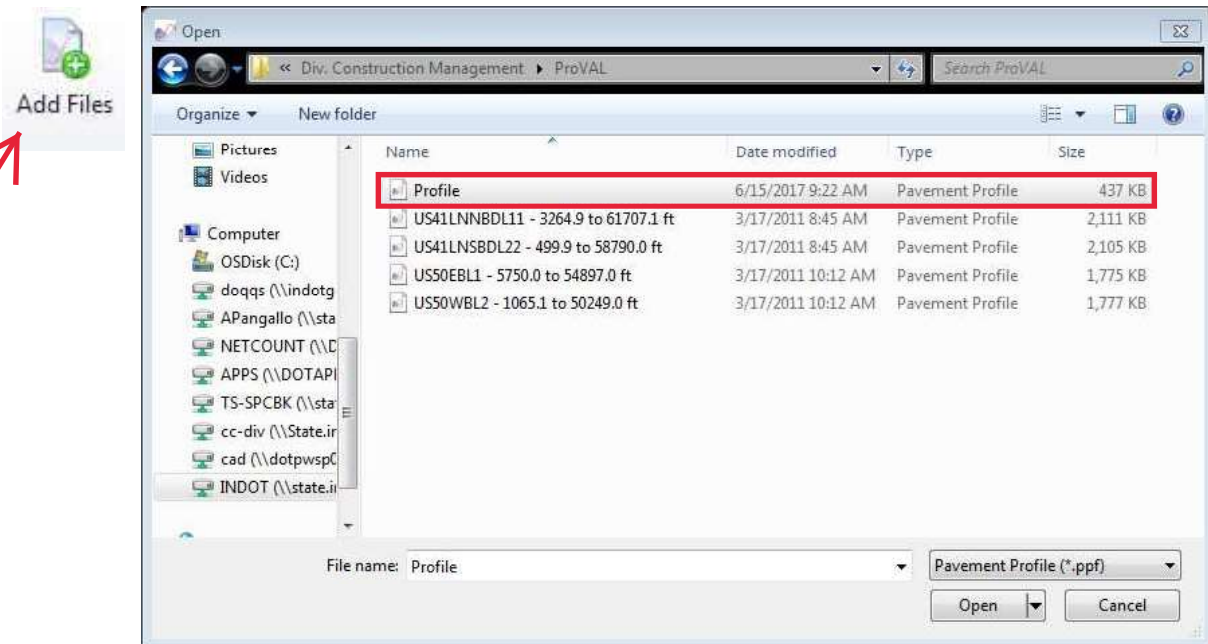
(Windows 10)



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

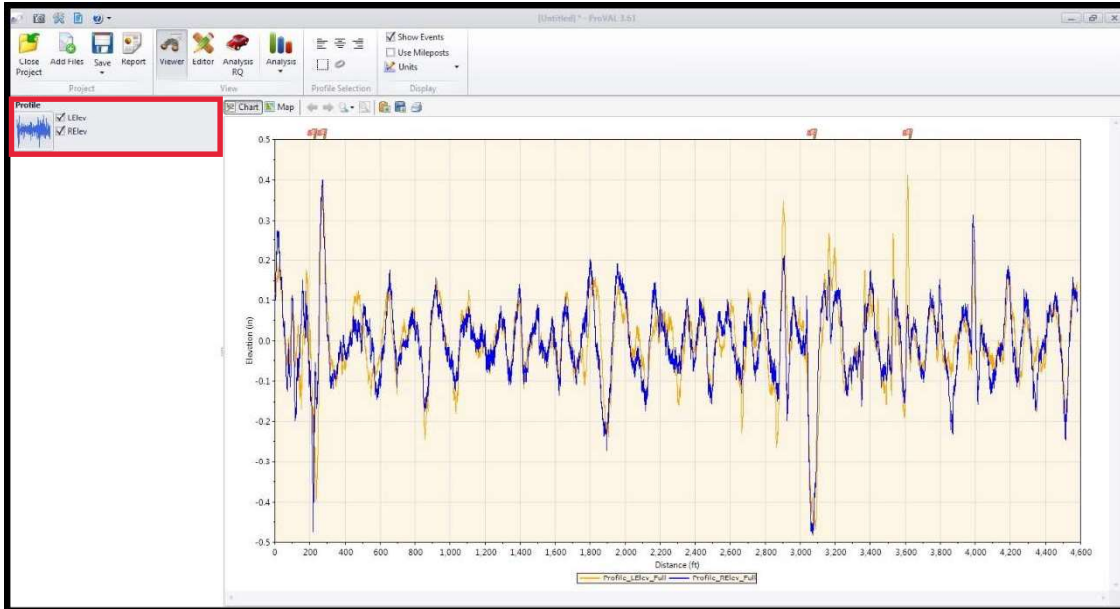


3) The data file the Contractor has sent needs to be downloaded onto this project file. Select **Add Files** and browse the folders where you placed the Contractor's data file (window below is only an example of a folder location) and open it.

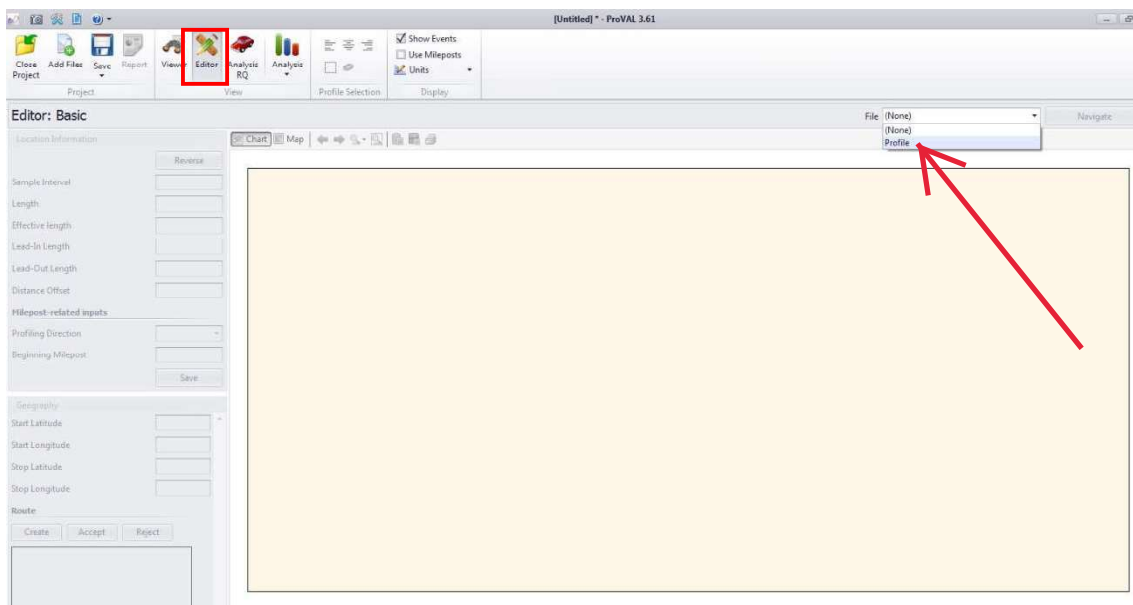


As more data is received, additional files should be added to this one project file to represent all the testing for a contract.

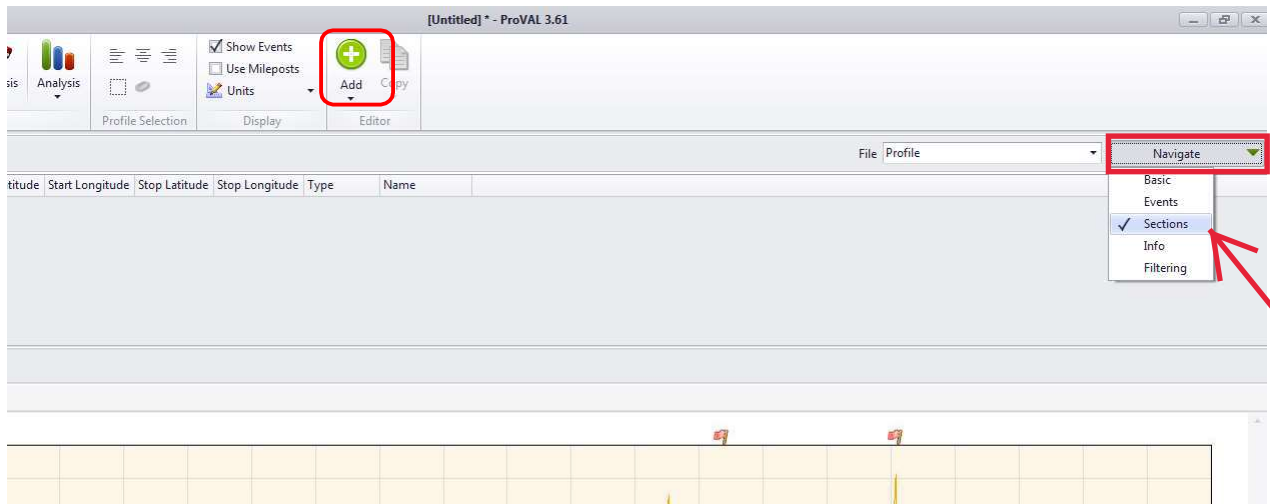
4) A data file will automatically begin in the Viewer pane. Each file will have two checkboxes for left and right wheel path readings. Clicking on these checkboxes will display the profile data readouts for the Section tested. The x-axis is listed in feet starting at 0 feet and up to the distance measured by the inertial profiler. (In accordance with the 401 section of the spec, for profilograph measurement only the right wheel path will be utilized in a profilograph simulation analysis and smoothness payment.)



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 profile data 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.).

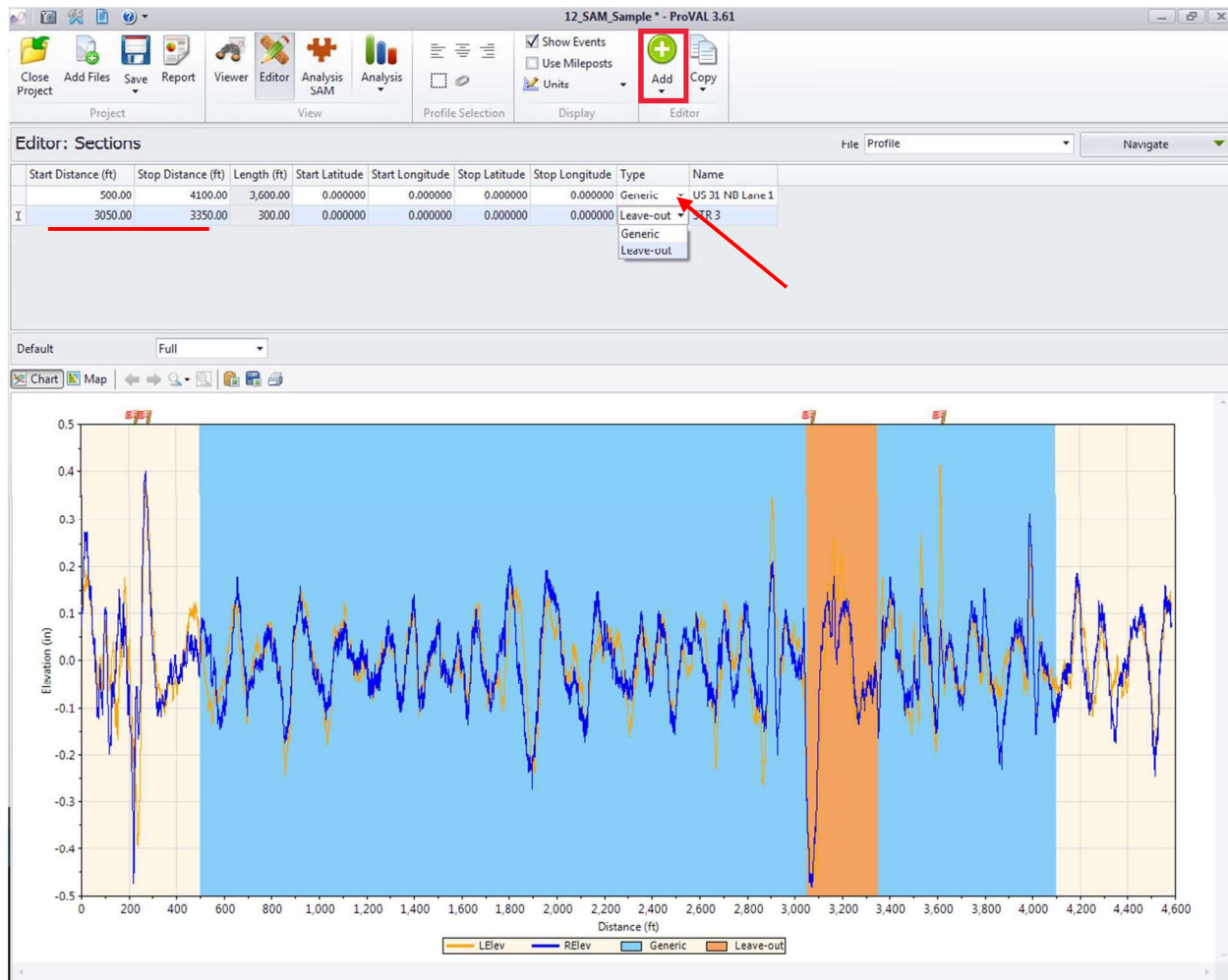


7) Provide the Start Distance and Stop Distance at which the Surface was measured for the contract. The distances will not always match up to your typical section stations. For example, the inertial profiler started taking measurements 500' before the construction limits and ended 500' past the construction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



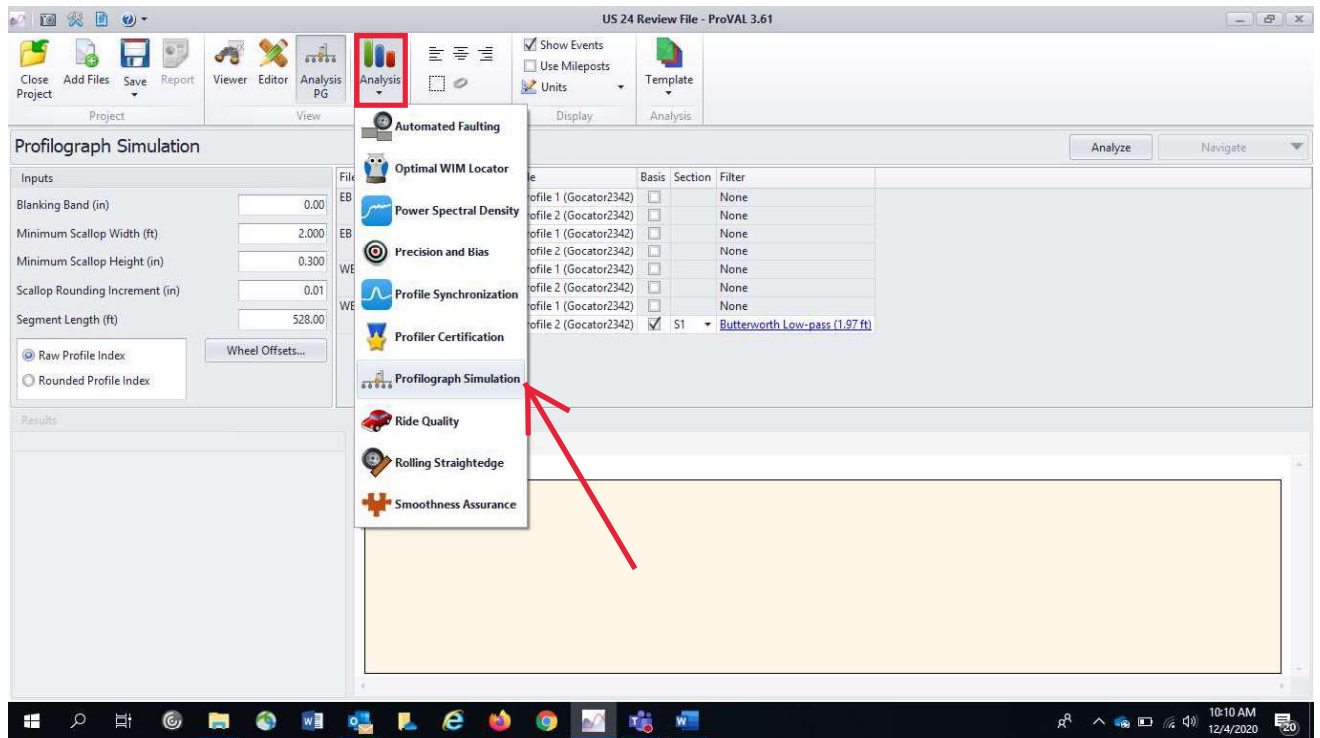
Red Flags can be seen right above the graph. These red flags represent **Events**. Events are usually accompanied by spikes in profile data because of a bridge, casting, railroad crossing or other feature that would cause a bump unrelated to the actual pavement. ITM 917 describes these and exempts 50' 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 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**. (Note: ProVAL software does not “leave out” these areas when utilizing the Profilograph Simulation Module for analysis, the leave outs are useful however when using the other analysis modules in ProVAL.)

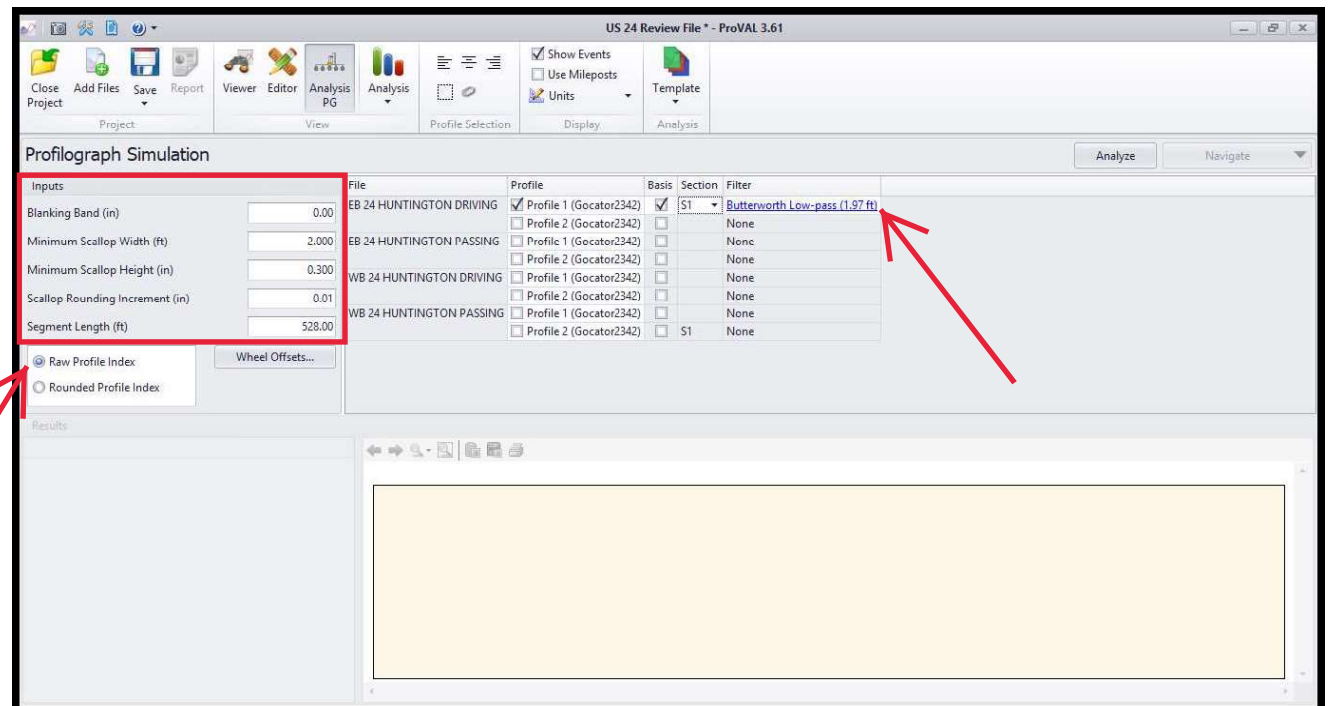


You will notice that the bridge can be seen as the orange shaded area. This area will now be excluded from analysis. Repeat this process for all exceptions located within the section.

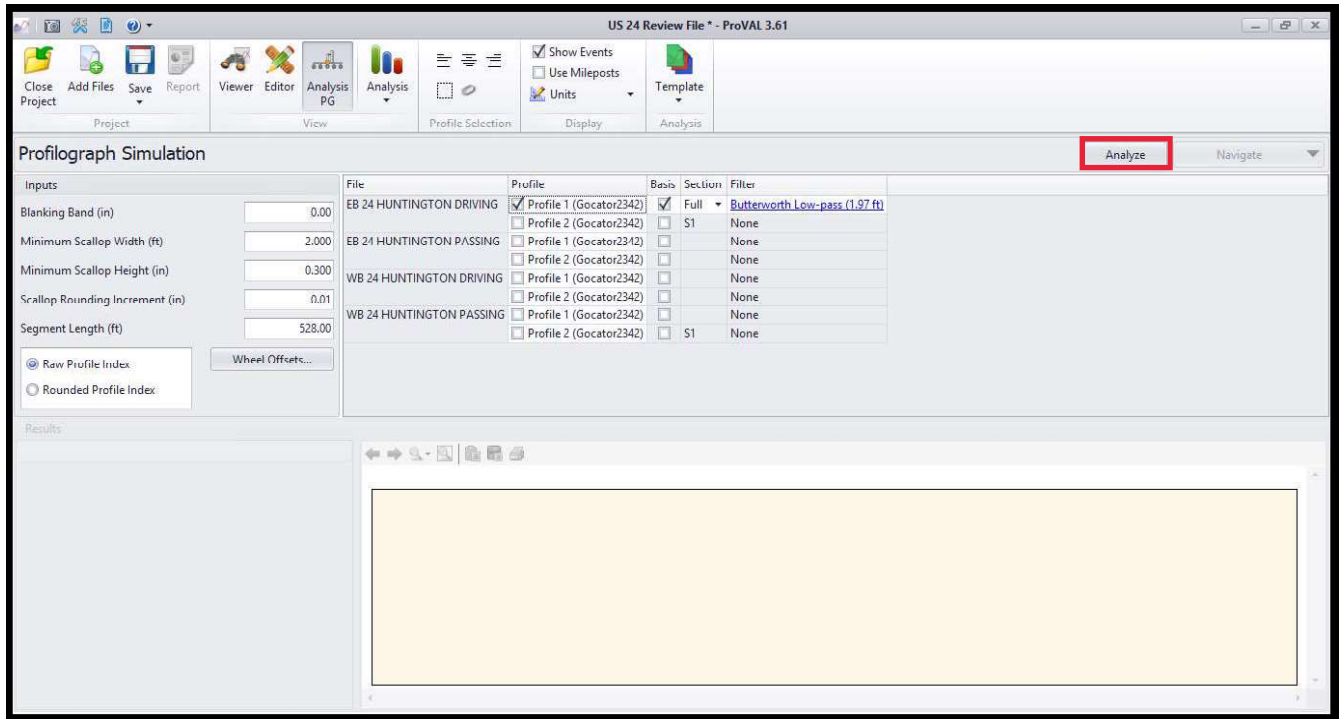
9) Now it is time to analyze the Section in Profilograph Simulation Mode and eventually output data to obtain pay factors (PF) for smoothness quality adjustments and locate areas in need of corrective action. Click the **Analysis** button and select **Profilograph Simulation** from the dropdown.



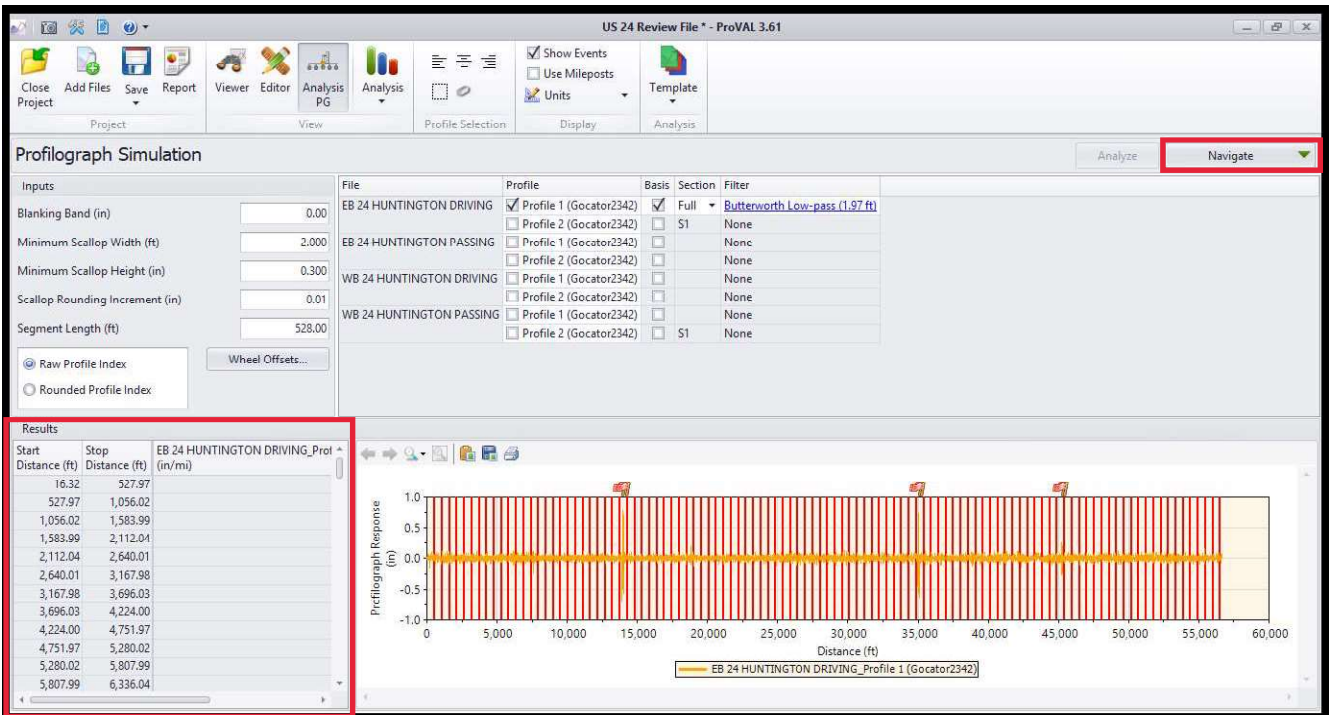
10) The standard specification explains that a 0.3 inch deviation is the threshold for corrective action and that smoothness measurement for payment is based on 0.1 miles or 528 ft. Set the parameters for analysis as: Blanking Band set to 0.00 in, Min Scallop Width to remain at default 2.00 ft, Min. Scallop Height set to 0.3 in, Scallop Rounding Increment set to 0.01 in, Segment Length to remain at default 528 ft, and finally click on the Raw Profile Index. Next, select the data file you want to analyze and select basis for the same file, then select S1 for Section and Butterworth Low Pass 1.97 ft for the filter. (Note: For Profilograph Simulation the file selected should represent the right wheel path to meet spec.)



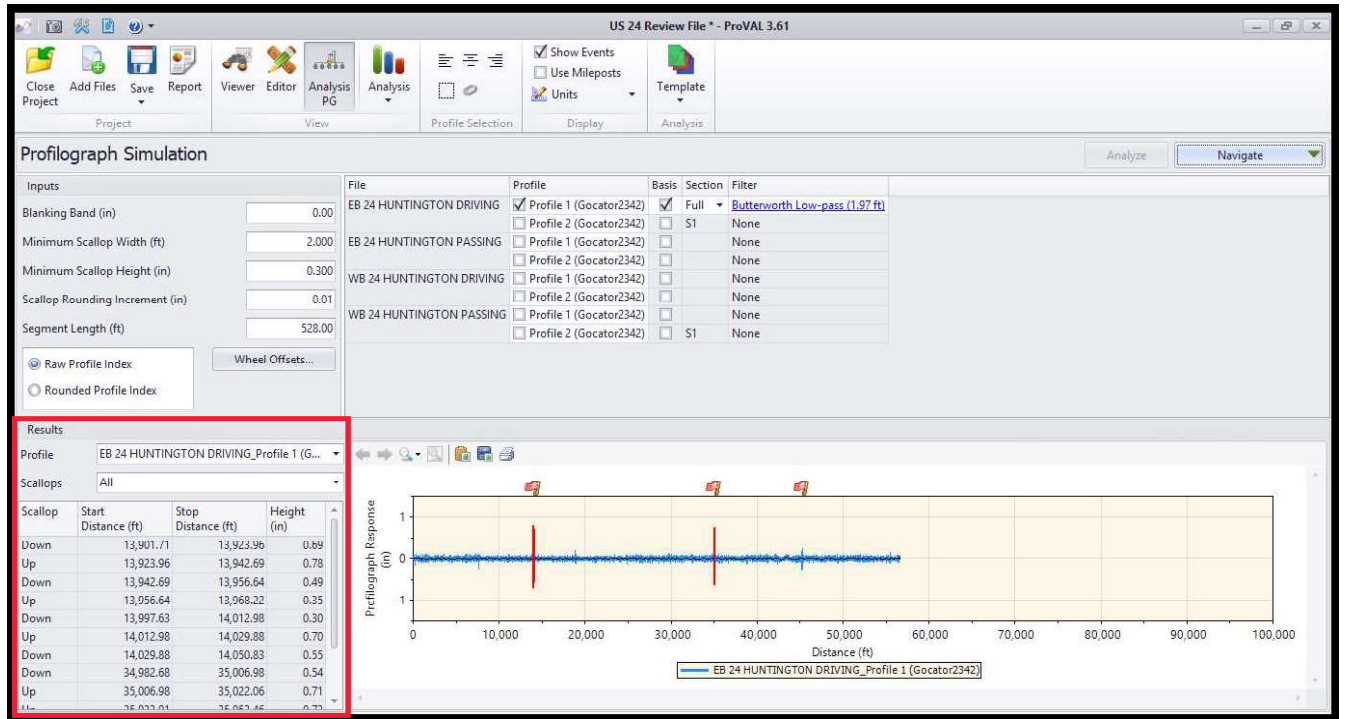
11) Now that the Profilograph Simulation has been set to meet the specifications, and the file to be analyzed has been selected and filtering is set. Click the **Analyze** button in the top right corner.



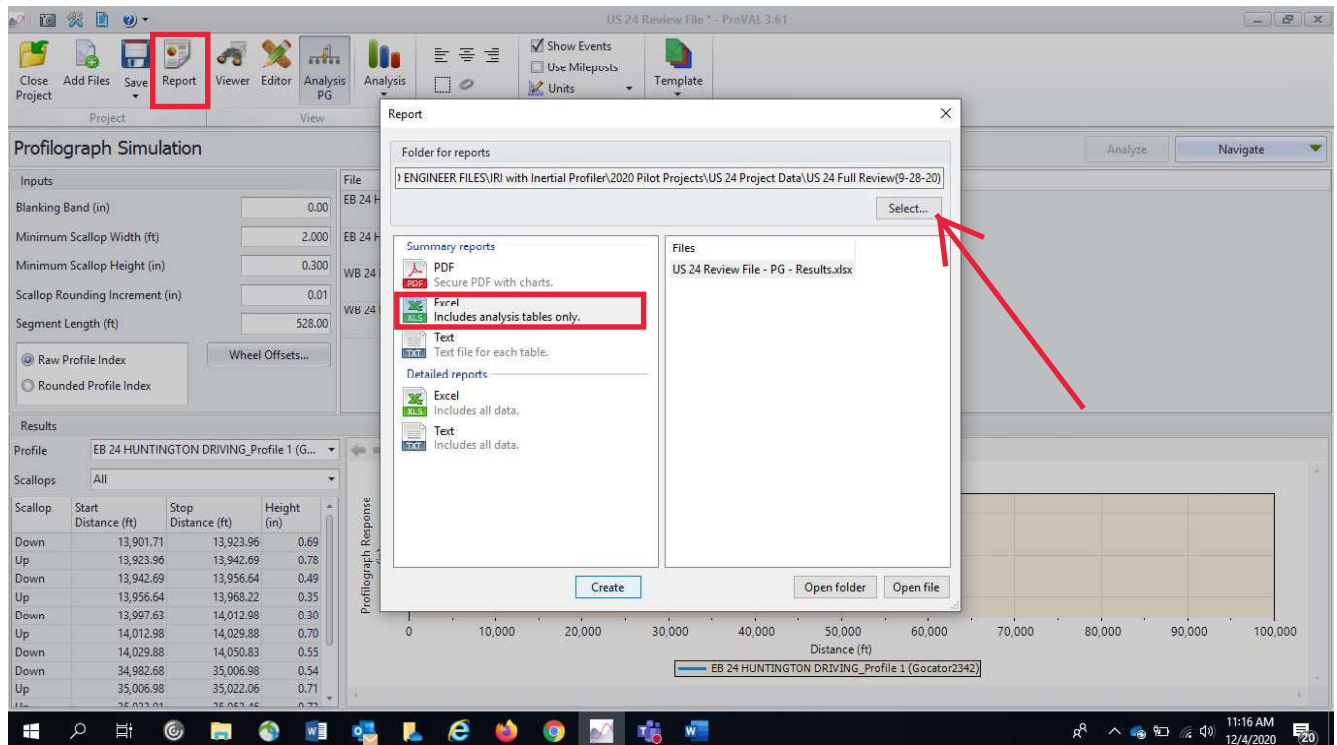
12) Once the analysis is complete, the profilograph simulation results will be available as a chart and in table form as shown below. There are scrolls both vertical and horizontal to allow viewing of the results. Next, select **Navigate** in the upper right corner and click on **Scallops** for the remaining portion of the analysis.



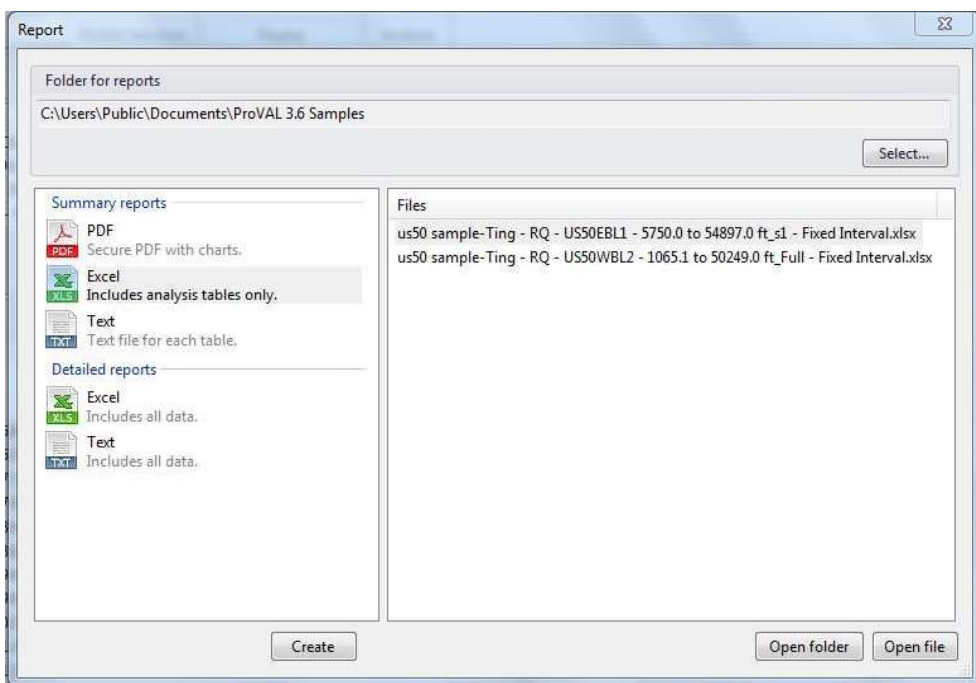
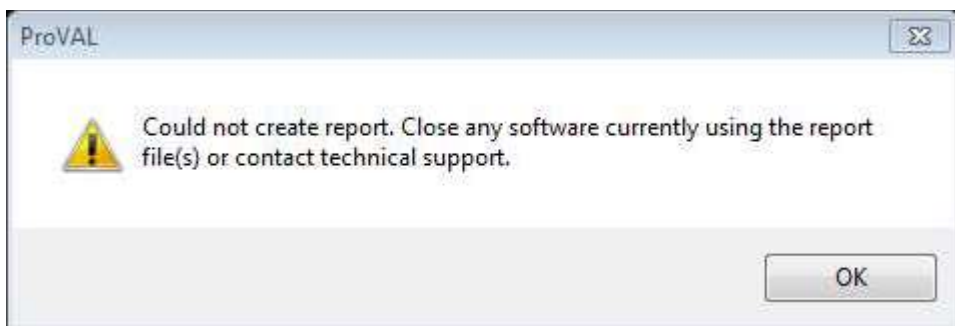
13) Once the 2nd portion of the analysis is complete, the profilograph scallop results will be available as a chart and in table form as shown below. There is a scroll to allow viewing of the results which will indicate each location where the 0.3 inch deviation threshold was exceeded.



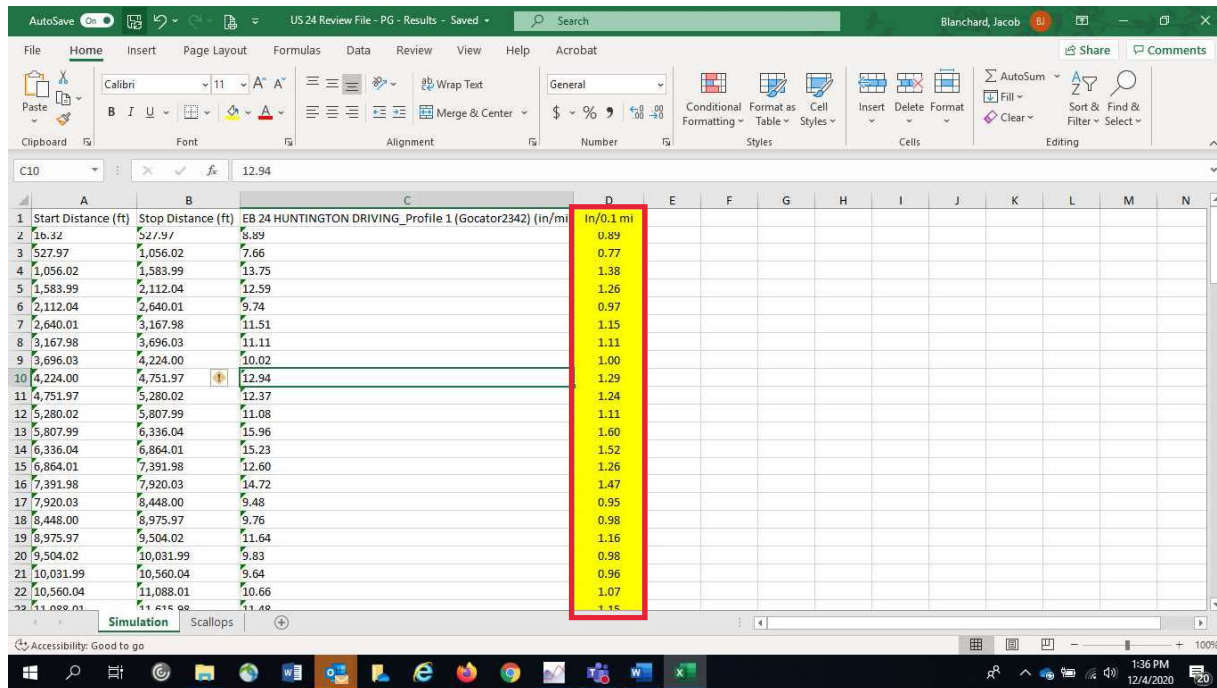
14) After that, select the **Report** button. You can click Select to browse folders for the destination of the report. Once a folder is selected, choose the Excel includes analysis tables only option on the left and click create.



***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. ***



15) Open the spreadsheet you created from ProVAL. The spreadsheet should have the project file's name with columns of start distance, stop distance, and profile in inches/mile. Add a new column with heading (inches/0.1 mile) and divide the inches per mile column (column C below) by 10 for this conversion (Yellow Column below is the new column). (Note: If you selected only the right wheel path profile in step #10, you will correctly see only right profile results in column C. If you selected both the right and left profiles by accident, the left profile data will not be used for profilograph simulation smoothness payment.)

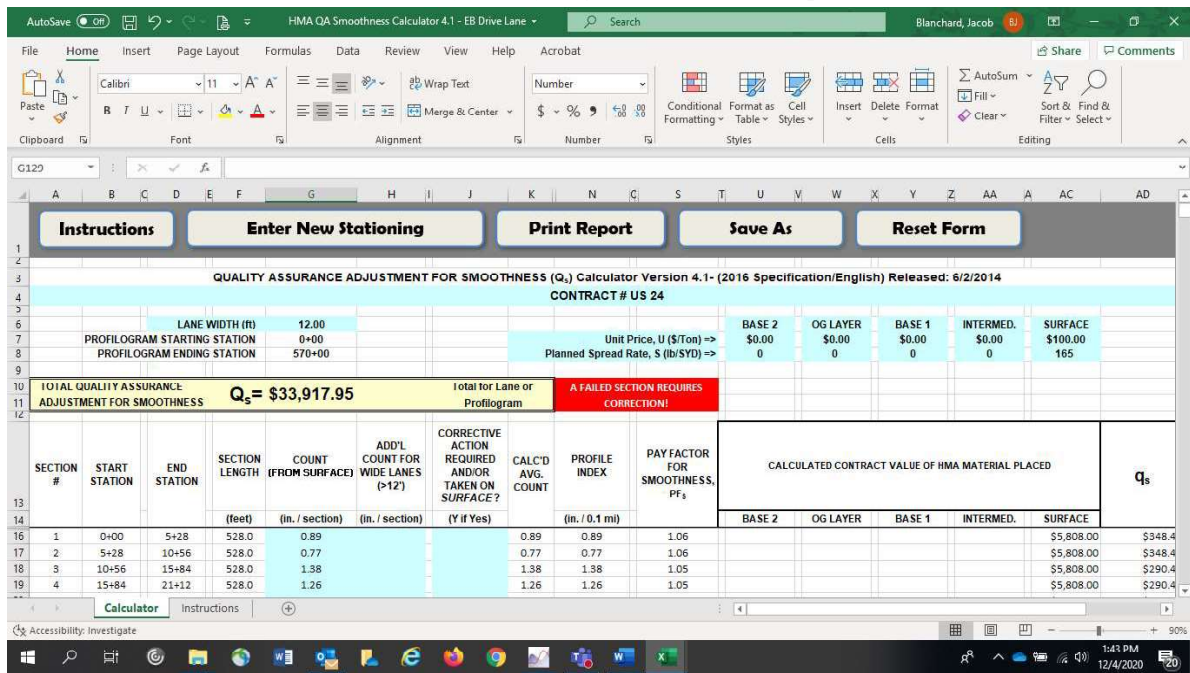


16) As noted in step 8, when using the Profilograph Simulation Module (and only this module) exceptions such as bridges, railroad tracks, castings, and locations under 45 mph are not appropriately removed from the smoothness calculation by the ProVAL software. The exceptions will need to be removed by one of the following methods.

The first method is to enter each exception in the Dept's spreadsheet - HMA QA Smoothness Calculator 4.1; follow the sixth step on the instructions tab of this spreadsheet. You will need to know the number of exceptions and each start and stop location in order to enter them accurately.

The second method is to manually delete the exceptions from the ProVal generated excel spreadsheet. To do this, you'll first need to note each "start" "stop" distance for each exception input in step 8. Then, find the corresponding "start" and "stop" distances in the spreadsheet of results generated from ProVAL and delete the rows of data. For example, if the "start" of a bridge exception that was a "leave out" was 500.00 ft and the "stop" of the bridge was 1200.00 ft, the corresponding rows 1, 2, and 3 shown above would be deleted since they included smoothness data for a bridge that was intended to be left out. This may create some partial sections, where a portion of the 0.1 mile section is included and a portion is excepted. For this scenario, ITM 912 section 7.14 provides direction on how to prorate these sections appropriately.

17) You are now ready to compute smoothness adjustments with the Excel Spreadsheet. Open the departments **HMA QA Smoothness Calculator 4.1** spreadsheet utilized for profilograph smoothness data analysis for payment. Copy and past columns A, B, and D into the appropriate columns in the analysis spreadsheet as you would with profilograph data. The spreadsheet will calculate the smoothness incentives/disincentives and will notify of any segments that will require corrective action as normal.



18) The ProVal spreadsheet created will also have a tab showing all of the scallops which may be used to locate bumps and dips in the field greater than 0.3 inch deviations which require corrective action. The distances shown will not necessarily line up with project stationing, the starting point of the high speed profiler run should be noted as an anchor point and any other known features such as bridges along the route may be utilized as anchor points and reviewed in ProVal editor tab under sections as to the exact distance of the bridge anchor point. The bump locations can then be measured from the anchor points and found more accurately in the field. There is also a map function with aerial views of the project high speed profiler route that may be used for locating anchor points visually.

