Version

1.0

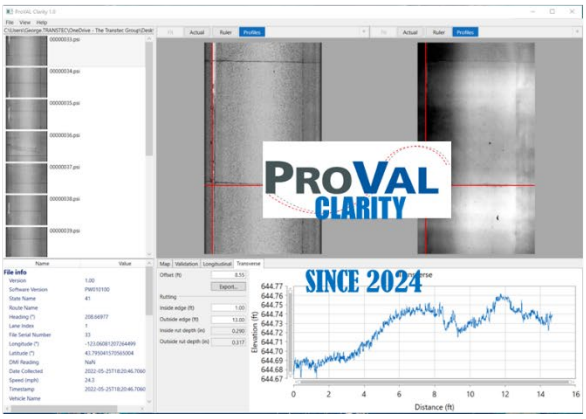
THE TRANSTEC GROUP

ProVAL Clarity User's Guide

PROVAL CLARITY

Different Transverse Profilers...

One Standard Software



Transverse Pavement Profile Analysis

ProVAL Clarity User's Guide

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Chapter 1

INTRODUCTION

ProVAL Clarity is an engineering software application that allows you to view and analyze transverse pavement profiles in many ways. Version 1.0 focuses on the import/export, viewing, and verification of 2D/3D pavement image files in the AASHTO MP 47 format.

AASHTO (2024), Standard Specification for File Format of Two-Dimensional and Three-Dimensional (2D/3D) Pavement Image Data, AASHTO Designation: MP 47-24, American Association of State and Highway Transportation Officials.

The current and future ProVAL Clarity is expected to enable state agencies, industry, and academics to view, validate, analyze, and share pavement images stored in the standard data format. The software tools would allow states to verify image quality and improve their data quality management plans and practices.

Access to image sets is expected to improve the pavement evaluation community's ability to analyze images for non-cracking features like macrotexture, potholes, and edge conditions. Pavement performance research may be enhanced by comparing images collected by various equipment over long periods.

Experience gained from more extensive 2D/3D imagery use would improve the AASHTO MP 47 standard.

The purpose of this document is to describe all software operations and software/hardware requirements for ProVAL Clarity.

From the ProVAL Development Team

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Quick Links:

- Technical Support: https://www.roadprofile.com/proval-support/
- Disclaimer: https://www.roadprofile.com/disclaimer/
- Privacy Policy: https://www.roadprofile.com/privacy-policy/

Chapter 2

SOFTWARE INSTALLATION

Download

ProVAL Clarity can be downloaded from the link provided by the ProVAL team or on the RoadProfile.com website.

Requirement

While ProVAL Clarity should run on any system from the past several years, we recommend at least the following for the most pleasant experience:

- 2 GHz processor,
- 4 GB RAM,
- 1920x1080 display resolution.

The installation itself does not require administrative privileges, but it is possible that a computer's security policy is configured to not allow the installation. If this happens, please contact the person(s) responsible for the managing your computer.

Microsoft .NET 6 Desktop Runtime is required. The ProVAL Clarity installation will not check for this requirement. Installing .NET 6 does require administrative privileges.

https://dotnet.microsoft.com/en-us/download/dotnet/6.0

Installation

Run the installation kit and follow the on-screen instructions.

Chapter 3

GETTING STARTED

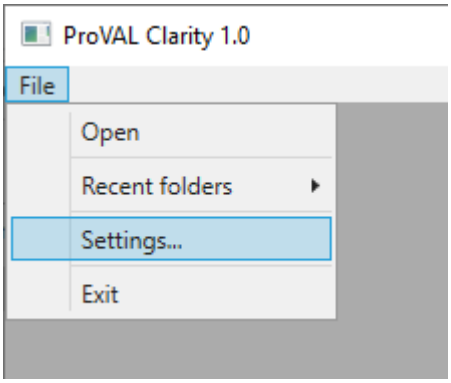
Launching the program

Launch ProVAL Clarity by locating **All Programs** » **ProVAL Clarity 1.0**.

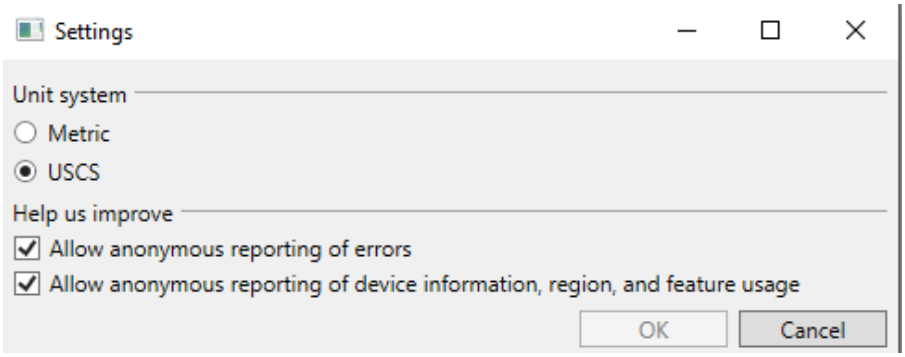
The opening screen is simple.

Settings

Click the File from the menu and select Settings.



The Settings screen allows you to select unit system and provide reporting of errors, etc.

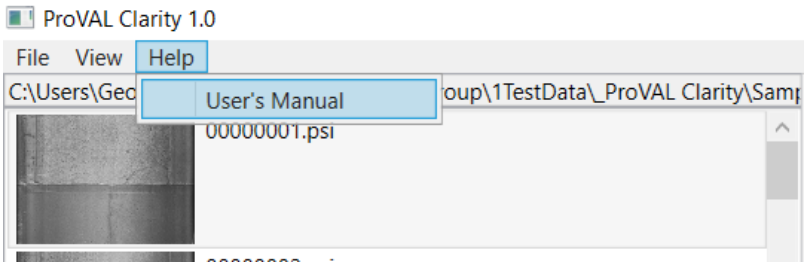


This gives you a convenient way to specify preferences. The Welcome Wizard only shows once after each installation. You can also modify those settings later by using the Options dialog box.

Help

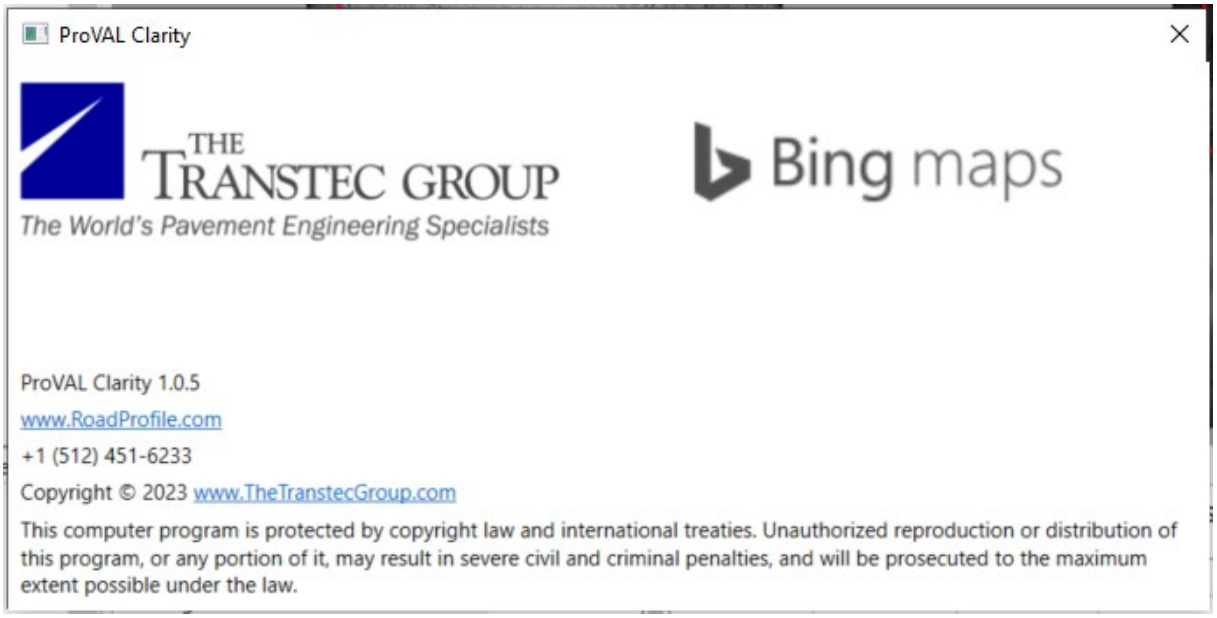
User's Manual

The User's Manual (this document) can be accessed using the Menu/Help/User's Manual.



About

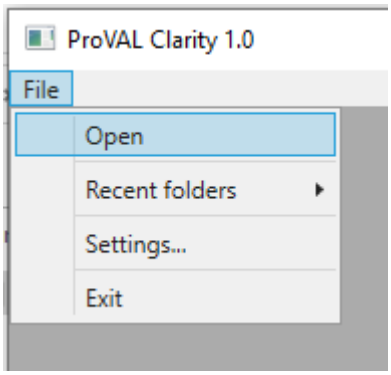
Click the Menu/Help/About, and the About dialogue will appear.



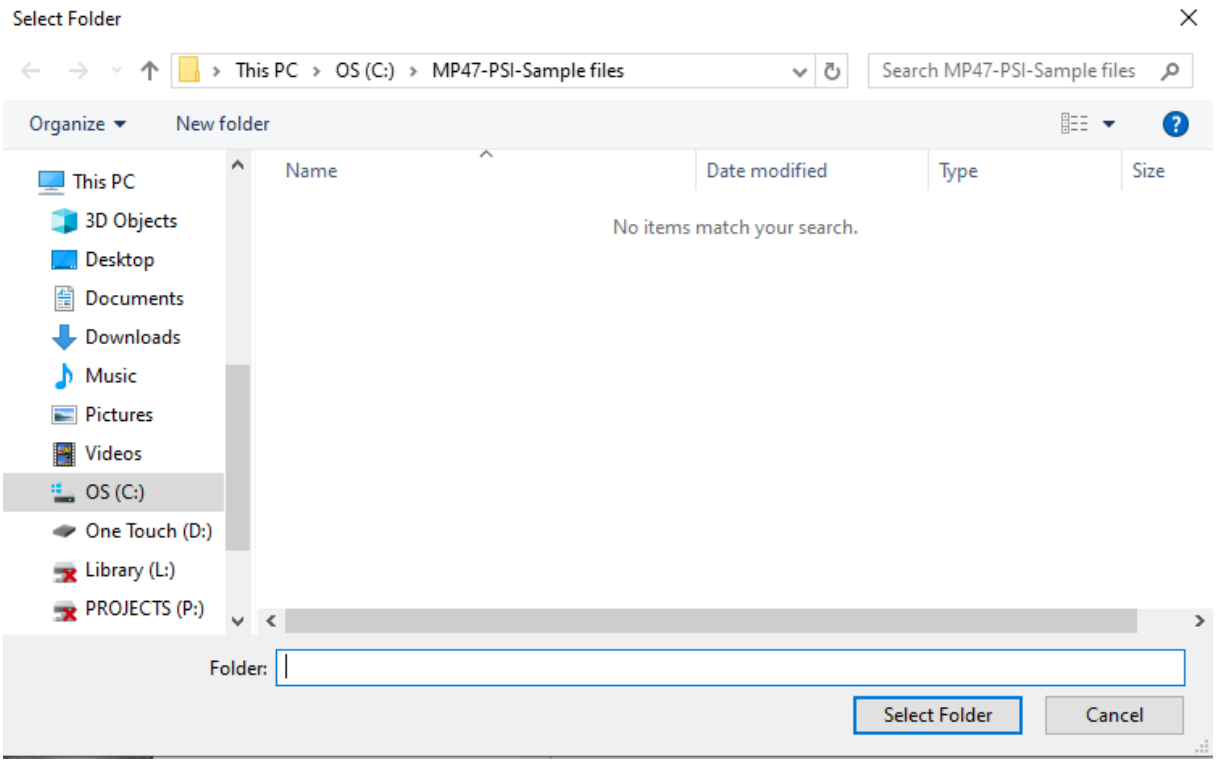
OPEN FILES

Use Open Menu

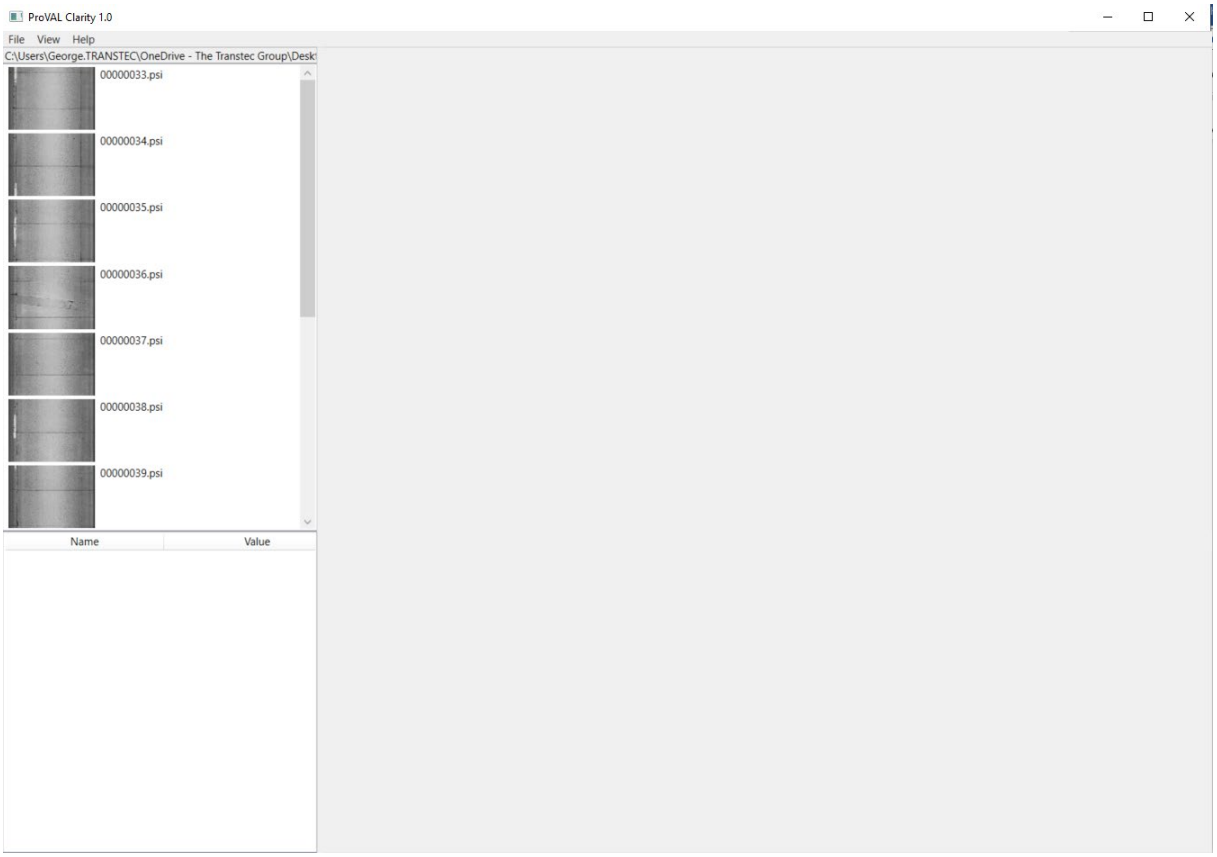
Use File/Open to launch a dialogue to select a file folder that consists of 2D/3D pavement image files in the AASHTO MP 47-24 PSI format.



Click Select Folder for the data file folder.

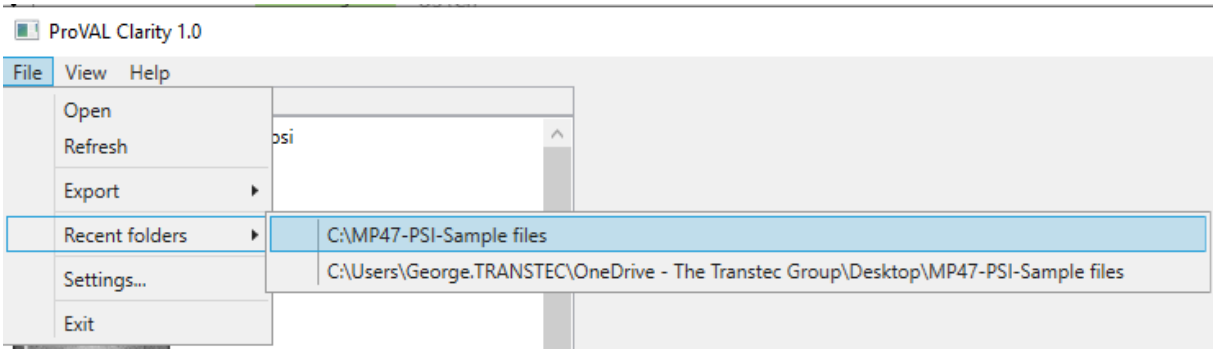


The thumbnails of data files will be shown on the upper left panel. You can then select any of the thumbnails for further viewing and analysis.



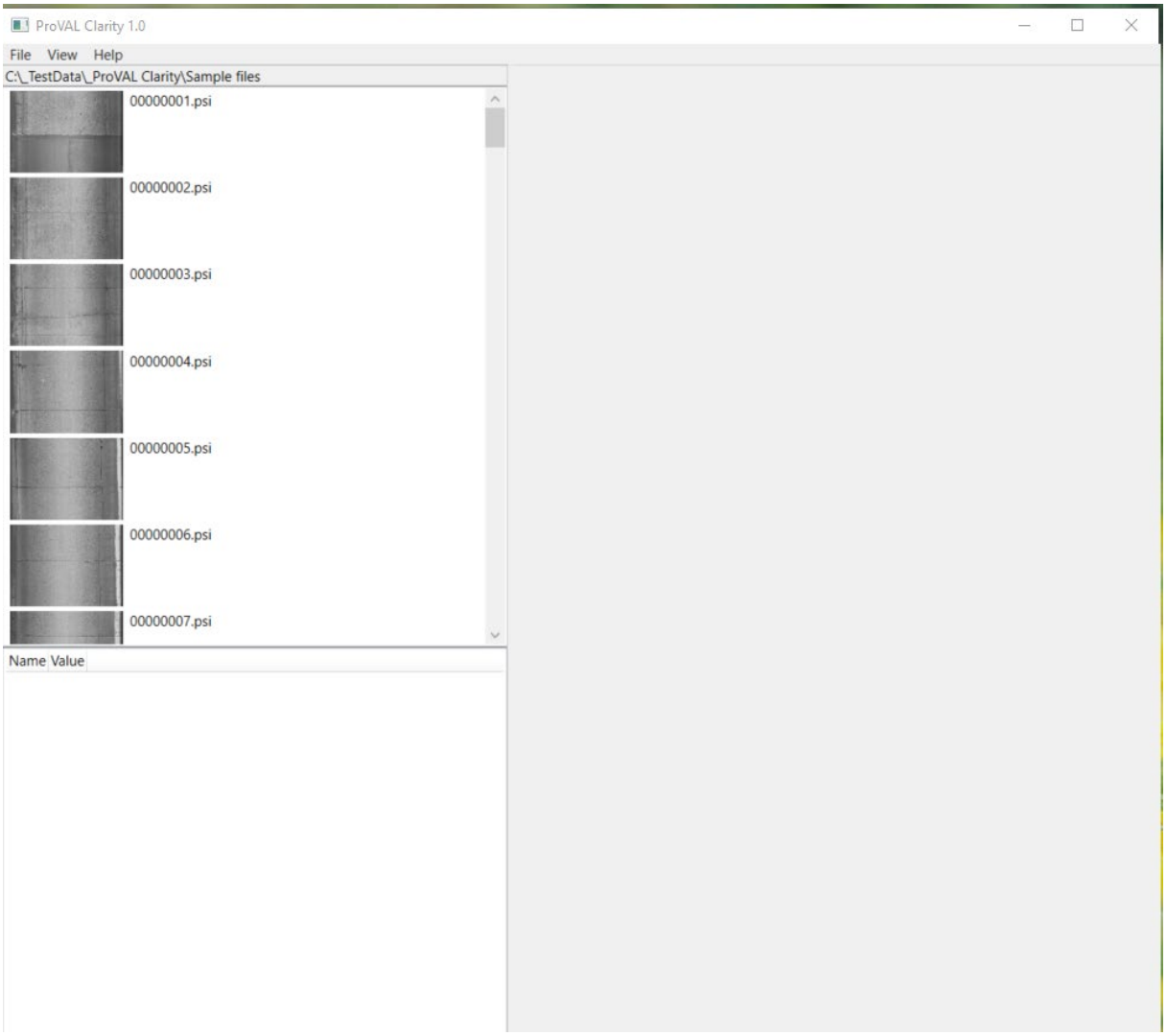
Use Recent Folders

A convenient way to open files is to use the Recent folders.

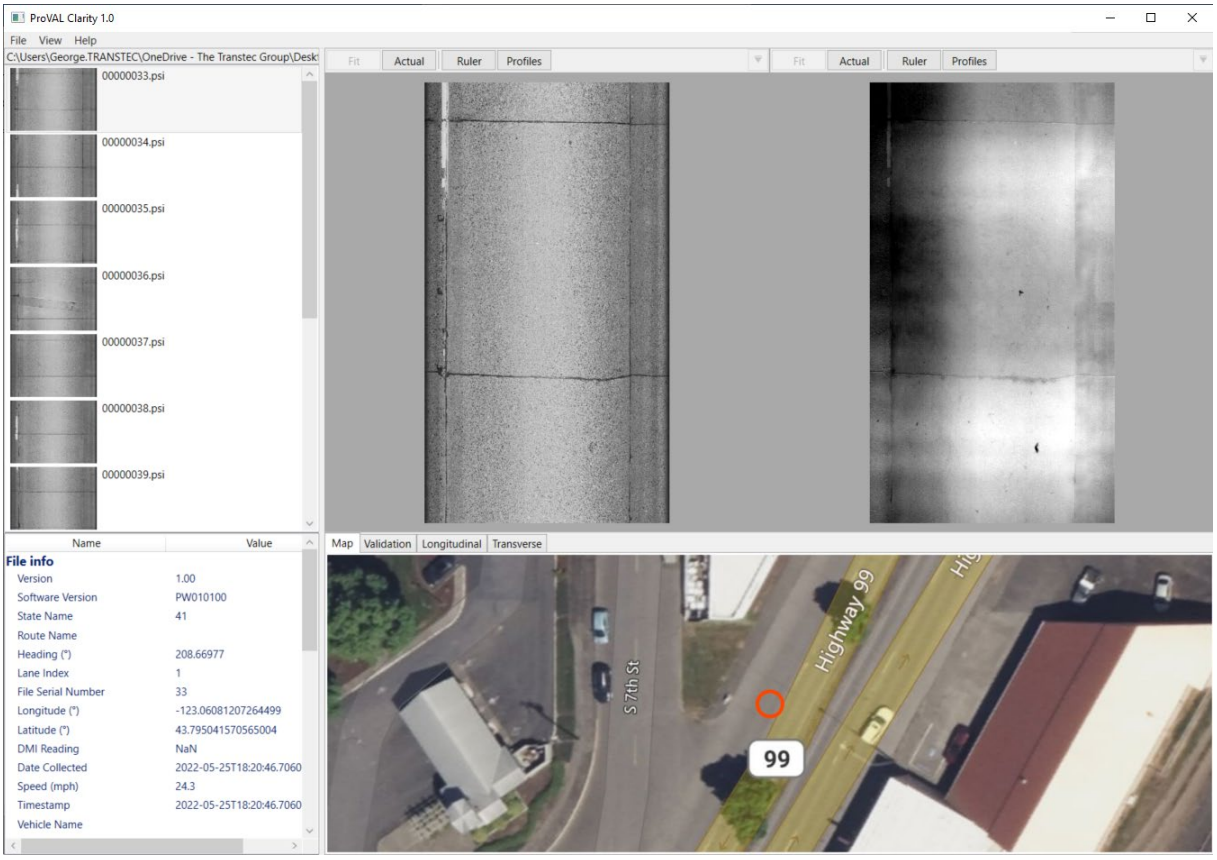


VIEW FILES

After opening a file folder, the thumbnails of the file images would appear on the left panel.



Click a thumbnail to view the image.



The screens include:

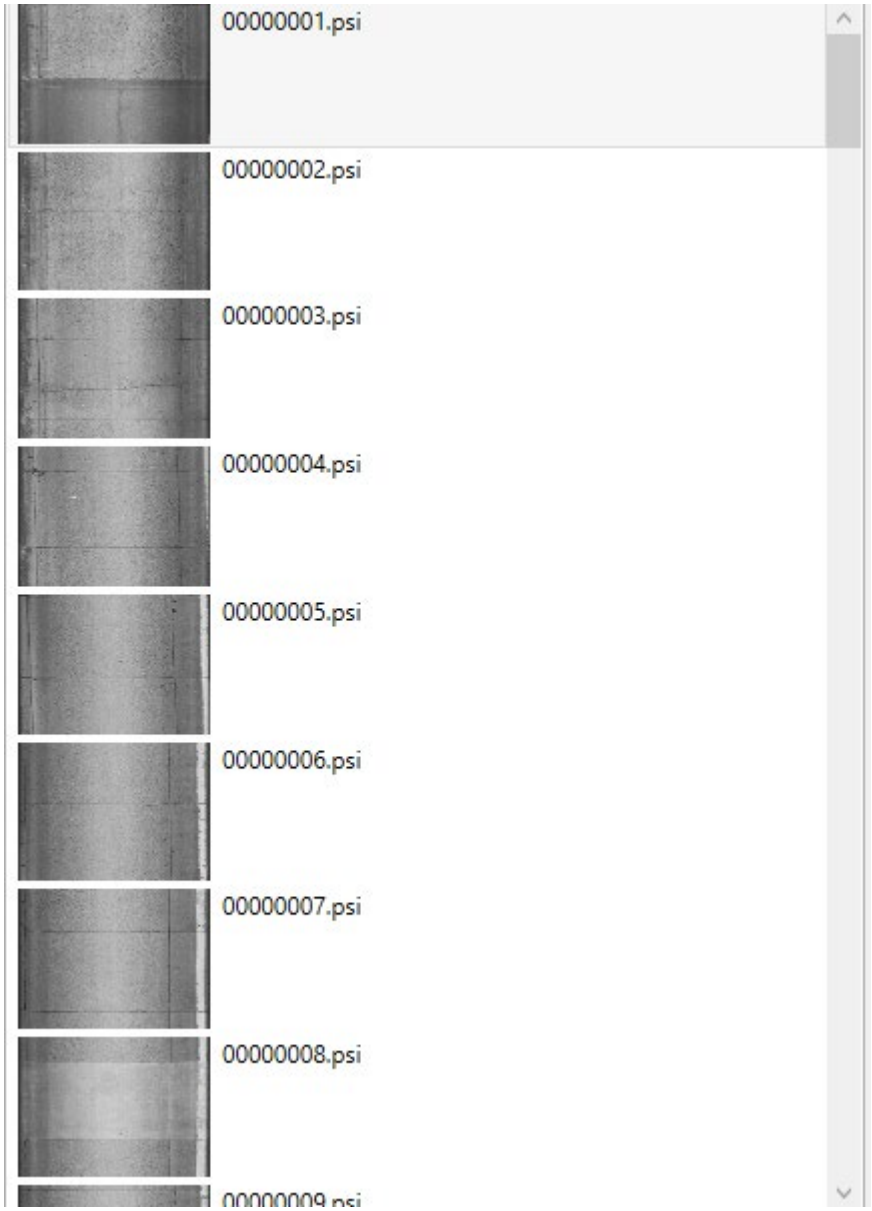
- Thumbnails: for image selection
- File information: File information of the selected image.
- Intensity/Range images: Display the 2D intensity and 3D Range images side-by-side.
- Map/Validation/ Longitudinal/ Transverse: display:
  - The map: A satellite map that indicates the image location.
  - Validation: Validation results of the selected image.
  - Longitudinal: Extracted longitudinal profile of selected cross sections.
  - Transverse: Extracted transverse profile of selected cross sections.

Thumbnails

Select an Image

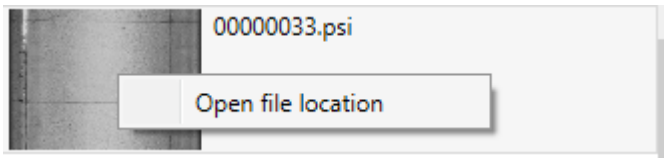
The Thumbnails panel allows the user to select an image by clicking the desired image. Note that the thumbnail images are not scaled.

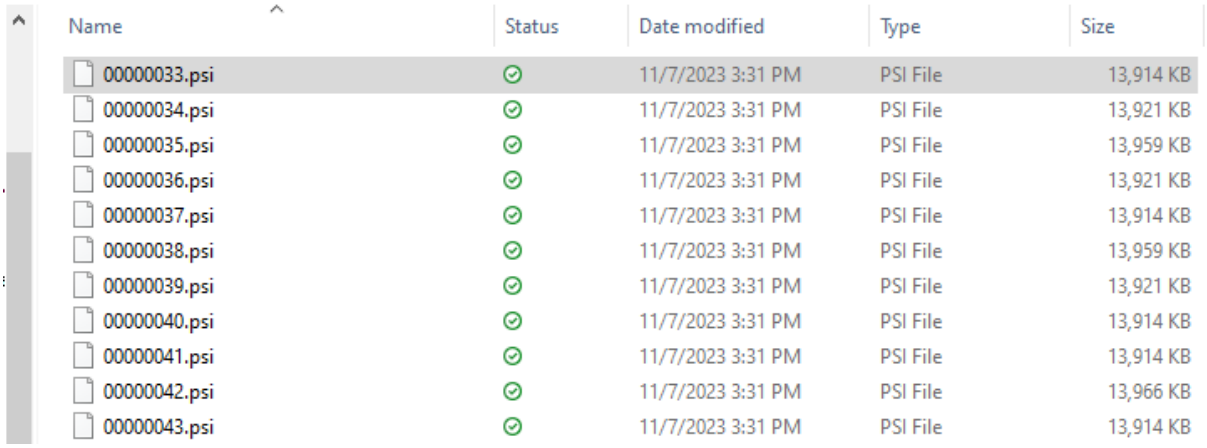
Files are displayed alphabetically in ascending order, as is common. The images are typically acquired in the reverse direction (i.e., traffic direction).



Open File Location

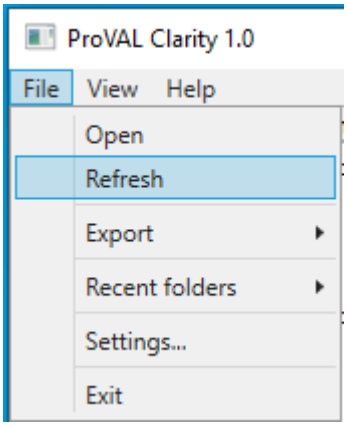
By right clicking a thumbnail image, users can select Open file location to view the selected file in Windows Explorer.





Refresh

Users can refresh the thumbnail view by selecting the menu File/Refresh.



File information

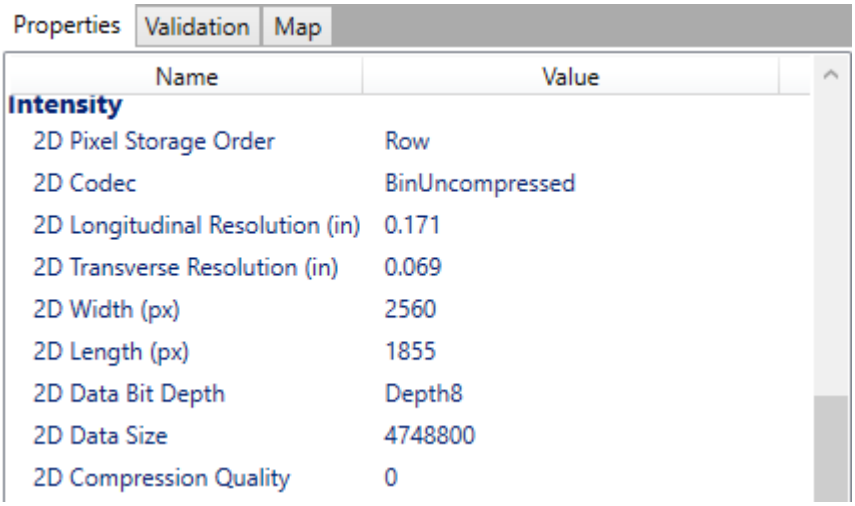
The File Info panel displays the detailed file information and intensity/range image properties.

File Info

Name	Value
File info	
Version	1.00
Software Version	PW010100
State Name	41
Route Name	
Heading (°)	208.66977
Lane Index	1
File Serial Number	33
Longitude (°)	-123.06081207264499
Latitude (°)	43.795041570565004
DMI Reading	NaN
Date Collected	2022-05-25T18:20:46.7060
Speed (mph)	24.3
Timestamp	2022-05-25T18:20:46.7060
Vehicle Name	
Operator Name	
Contractor Name	

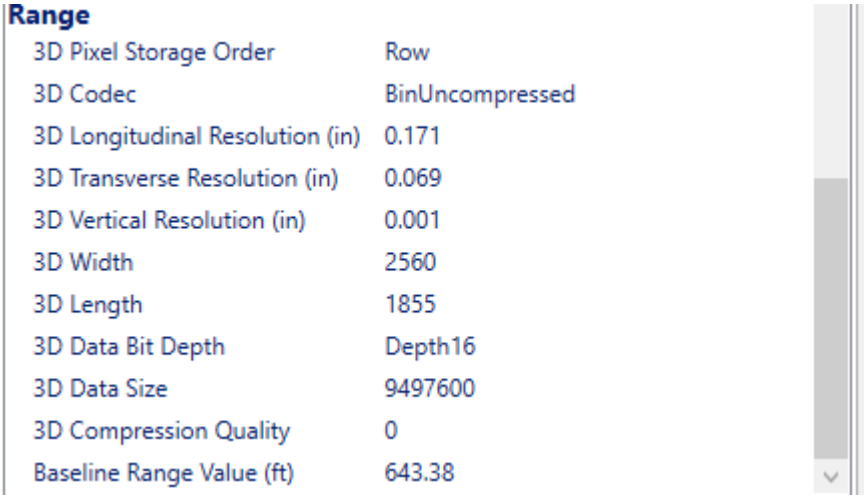
Intensity

Note the difference between the 2D Longitudinal Resolution and 2D Transverse Resolution.



Range

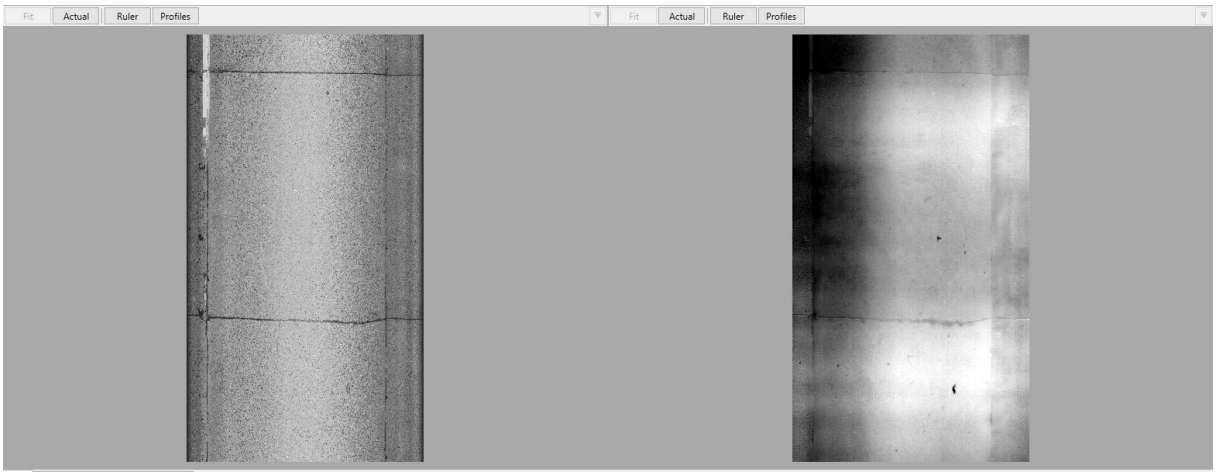
Note the difference between the 3D Longitudinal Resolution and 3D Transverse Resolution.



Intensity and Range Images

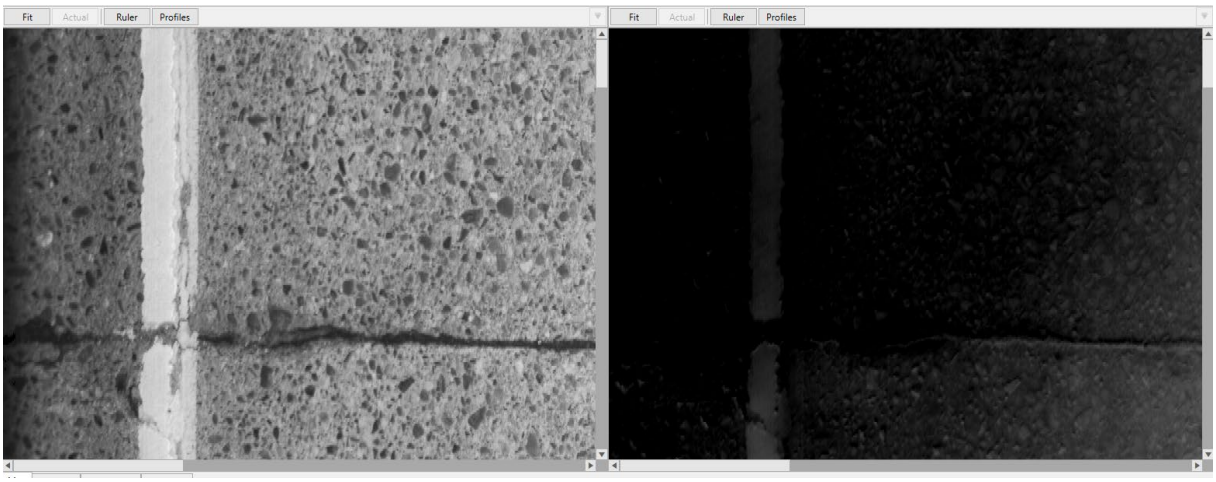
Fit

Display the scaled image that fits into the screen's panel.



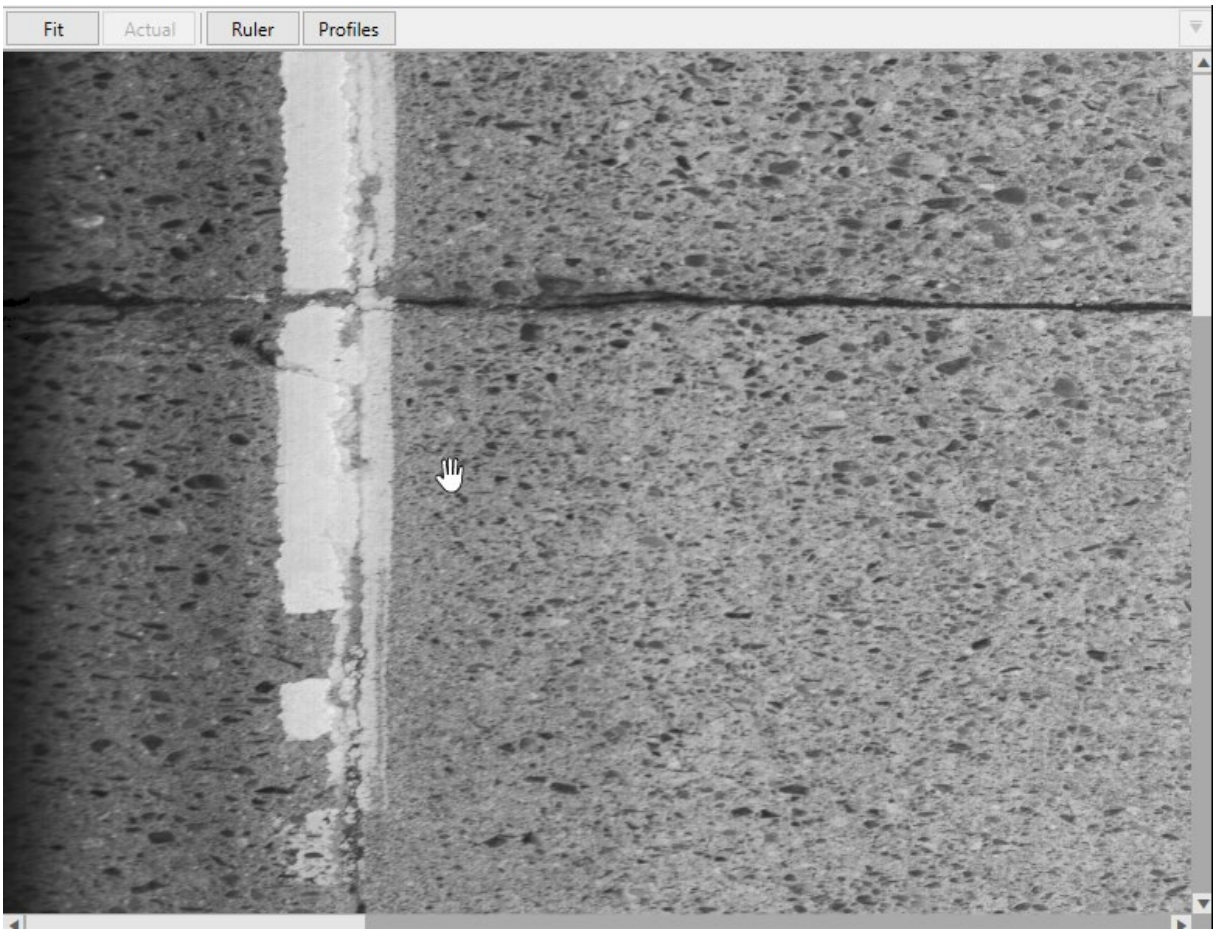
Actual

Display the actual, unscaled image.



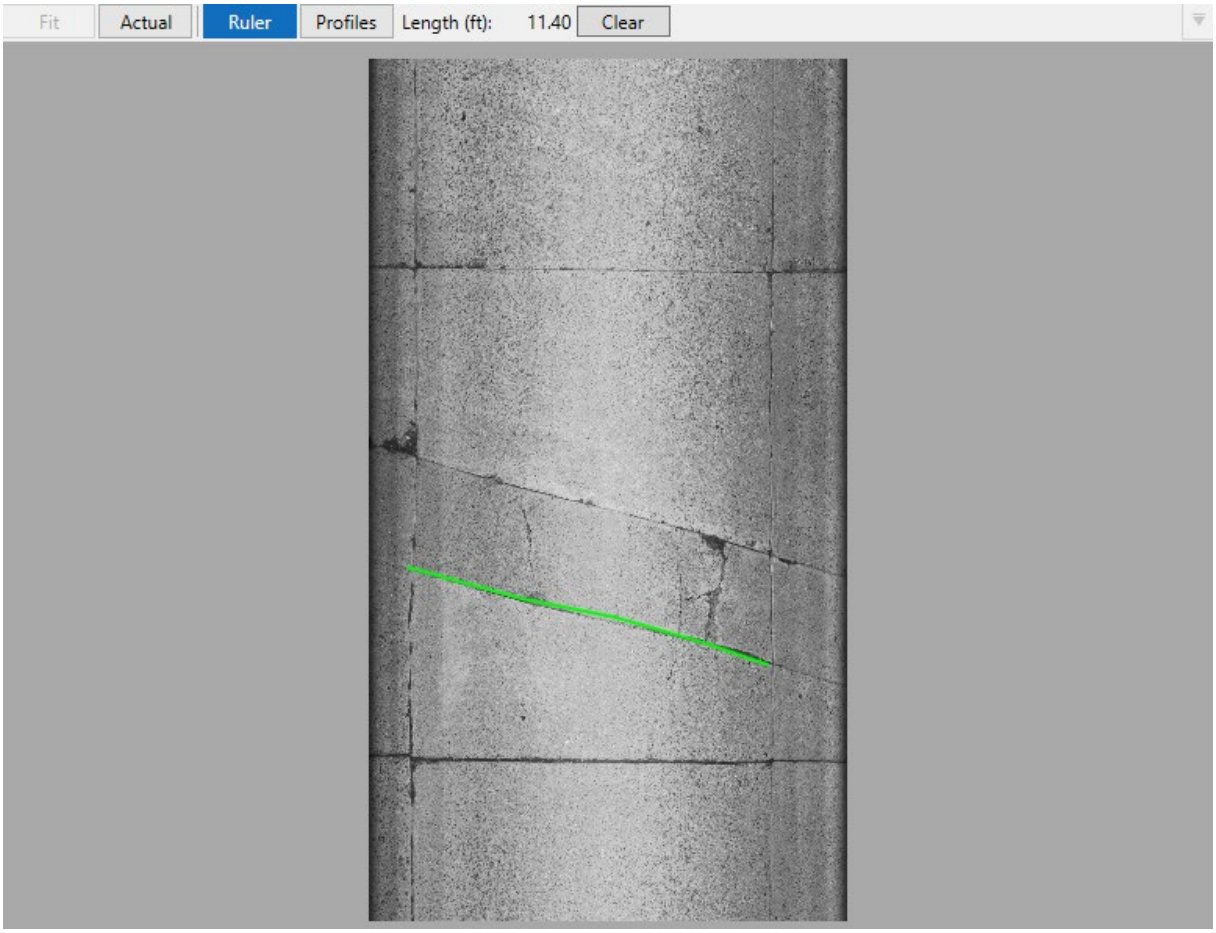
Pan

Users can pan/move the image by holding the left mouse button and turning the pointer to a hand icon.



Ruler

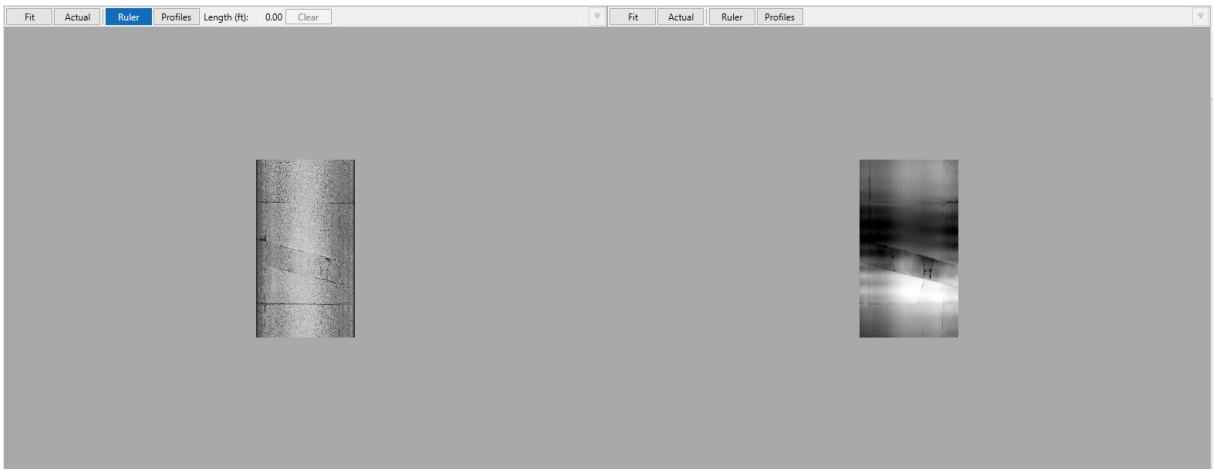
Users can use the ruler to select the locations on the image, and the total lengths between selected locations will be displayed. Users can use the Clear button to reset and select the locations again.



Zoom

Users can zoom in or zoom out of the selected image (synchronized for intensity and range) by using the mouse's wheel.

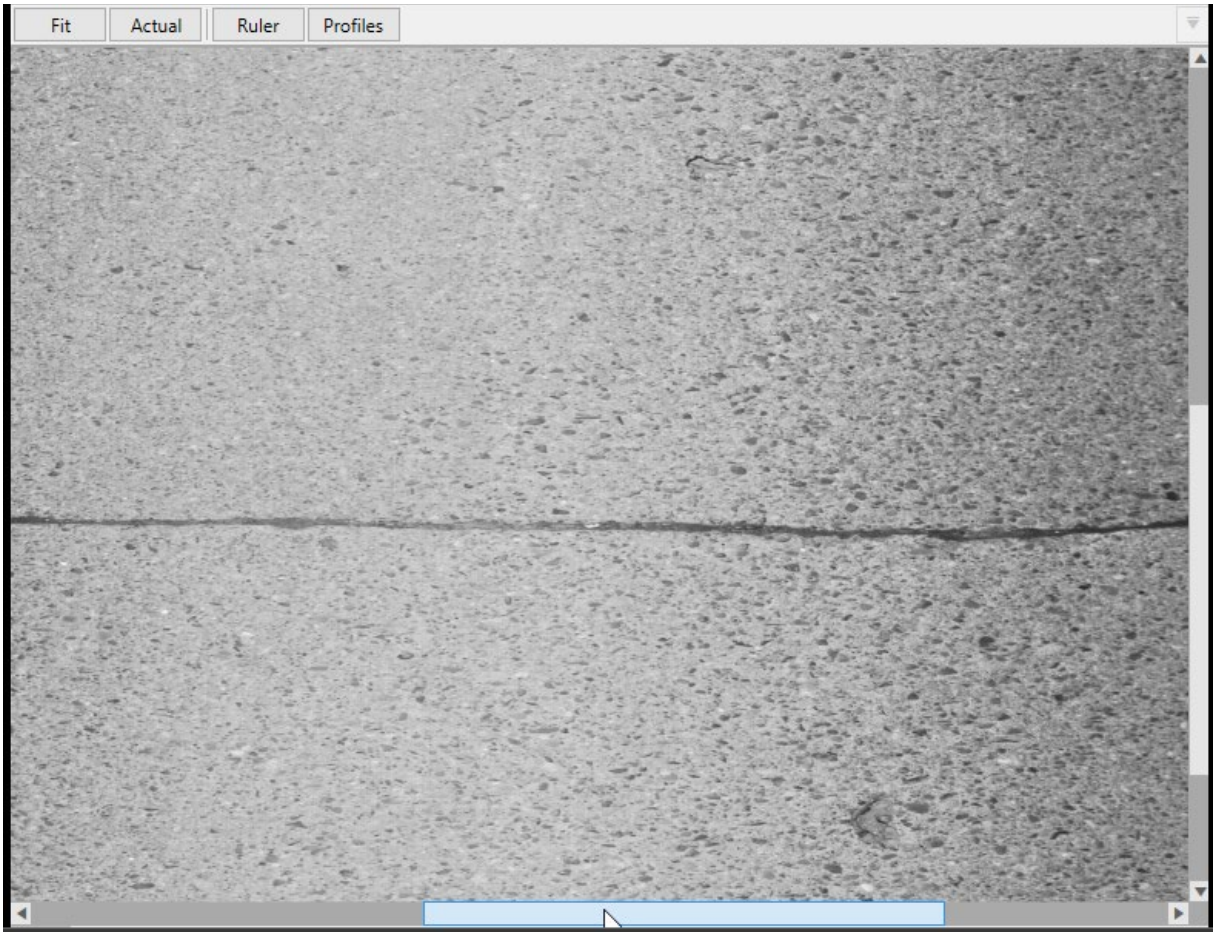
Zoom out -



Zoom in –

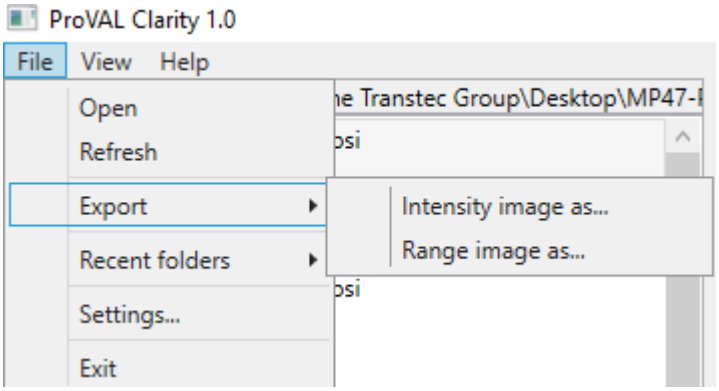
Scroll

Users can use the scroll bars or the keyboard arrows to scroll the selected images.

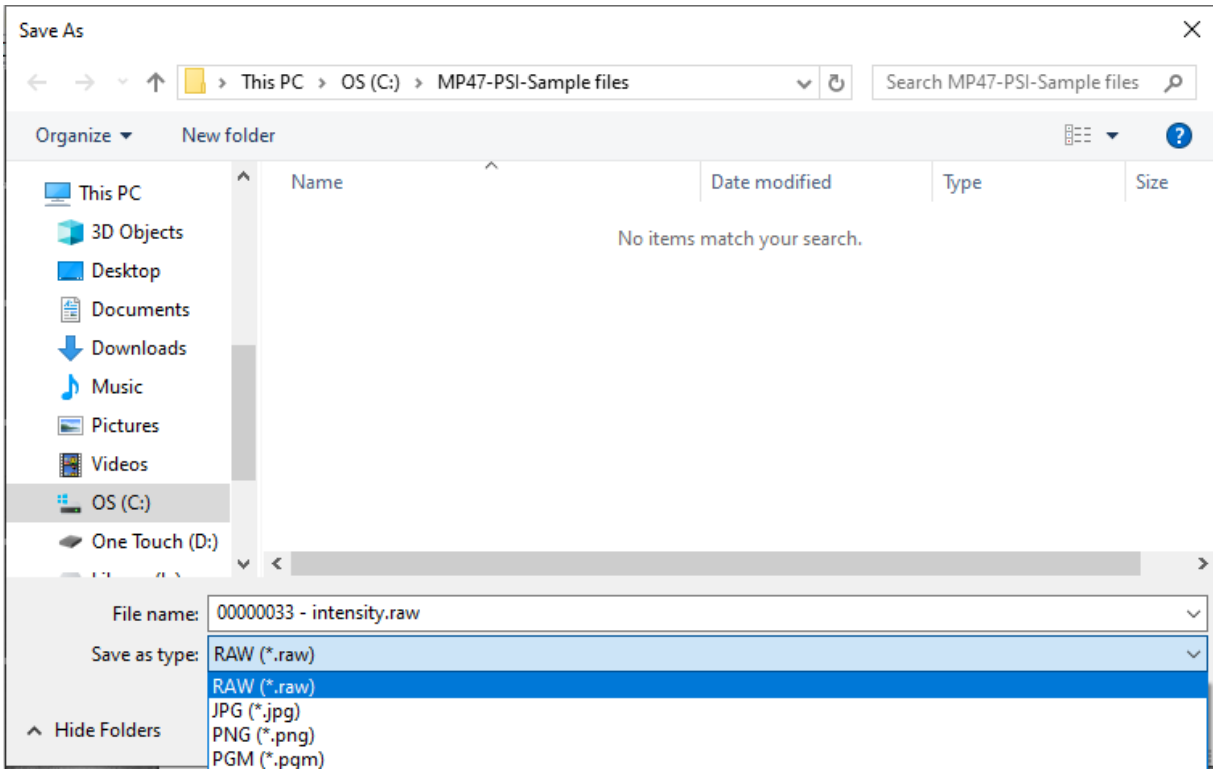


Export

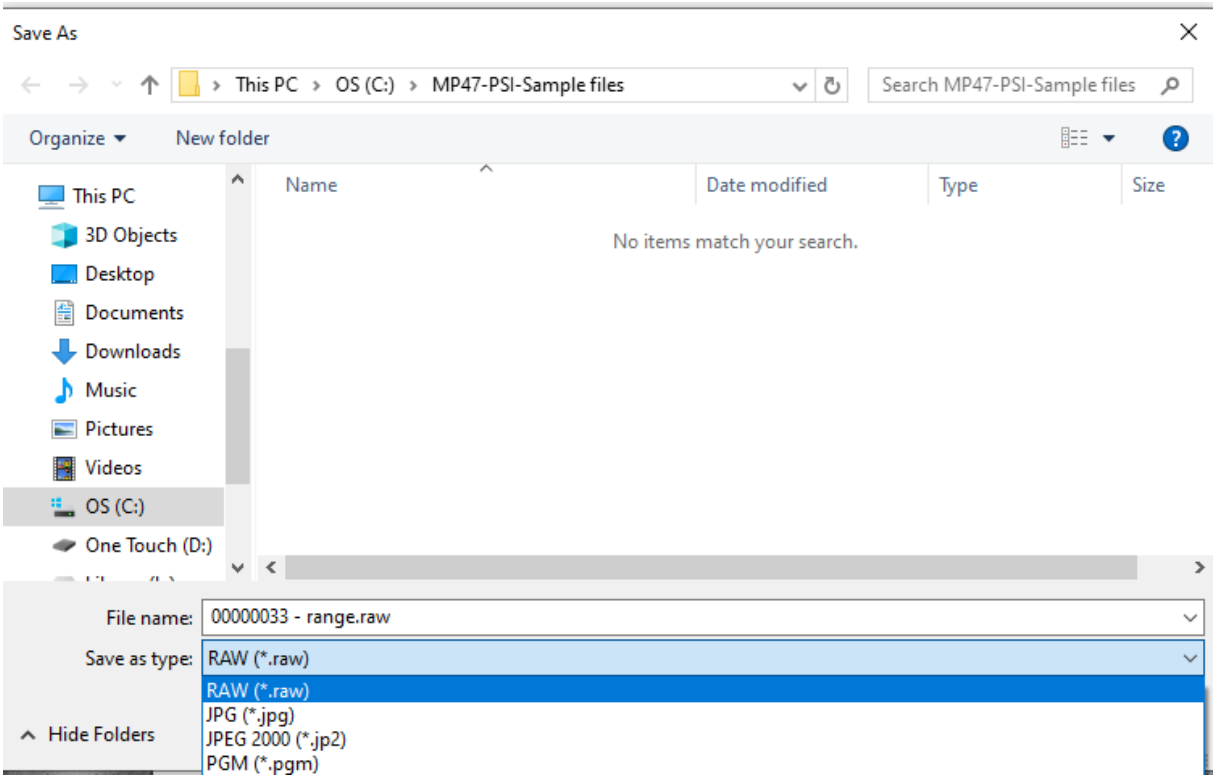
While viewing a set of intensity and range images, users can export them to files by selecting the menu File/Export/Intensity image as… or File/Export/Range image as…:



For the intensity image, users can select the export file option and determine the exported file name in a dialogue.



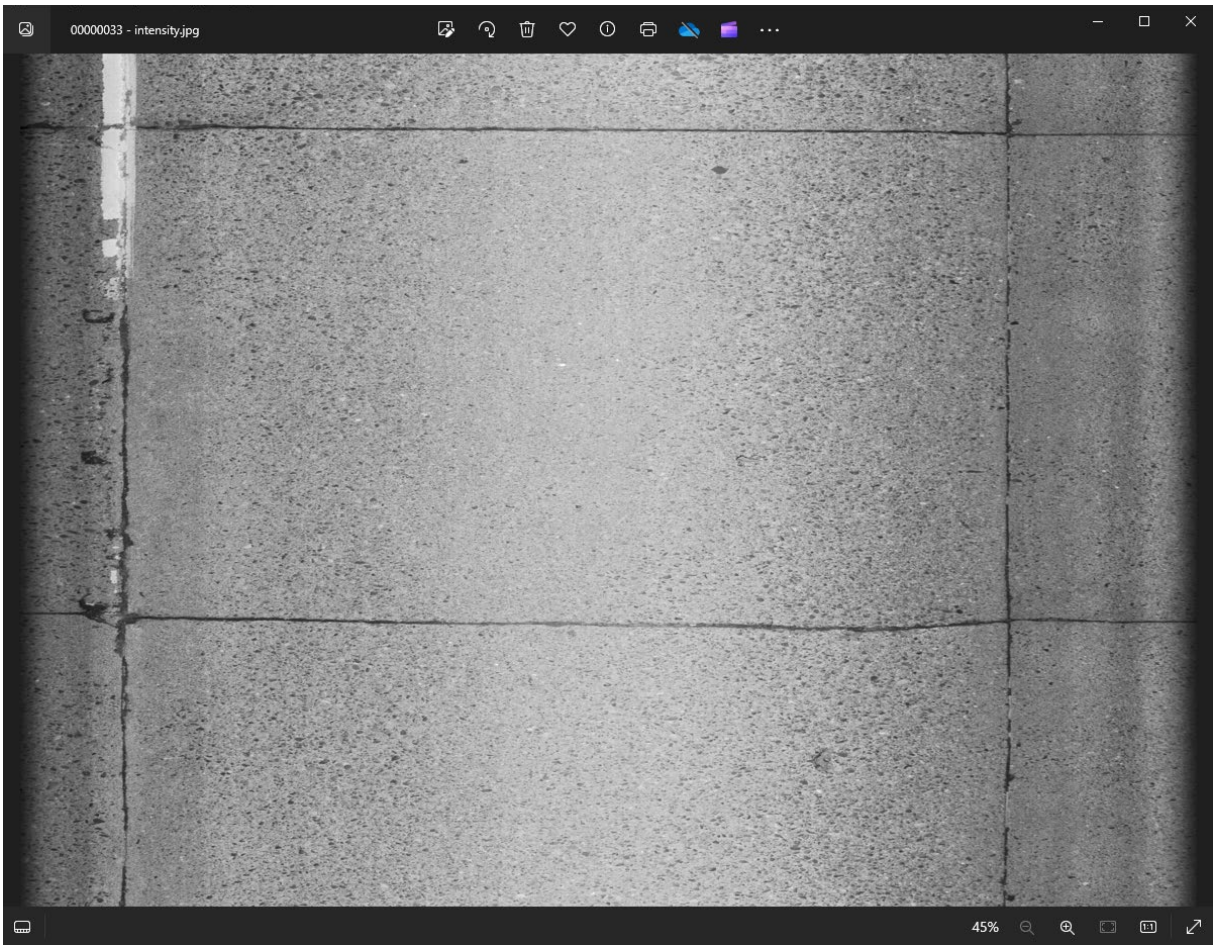
For the range image, users can select the export file option and determine the exported file name in a dialogue.



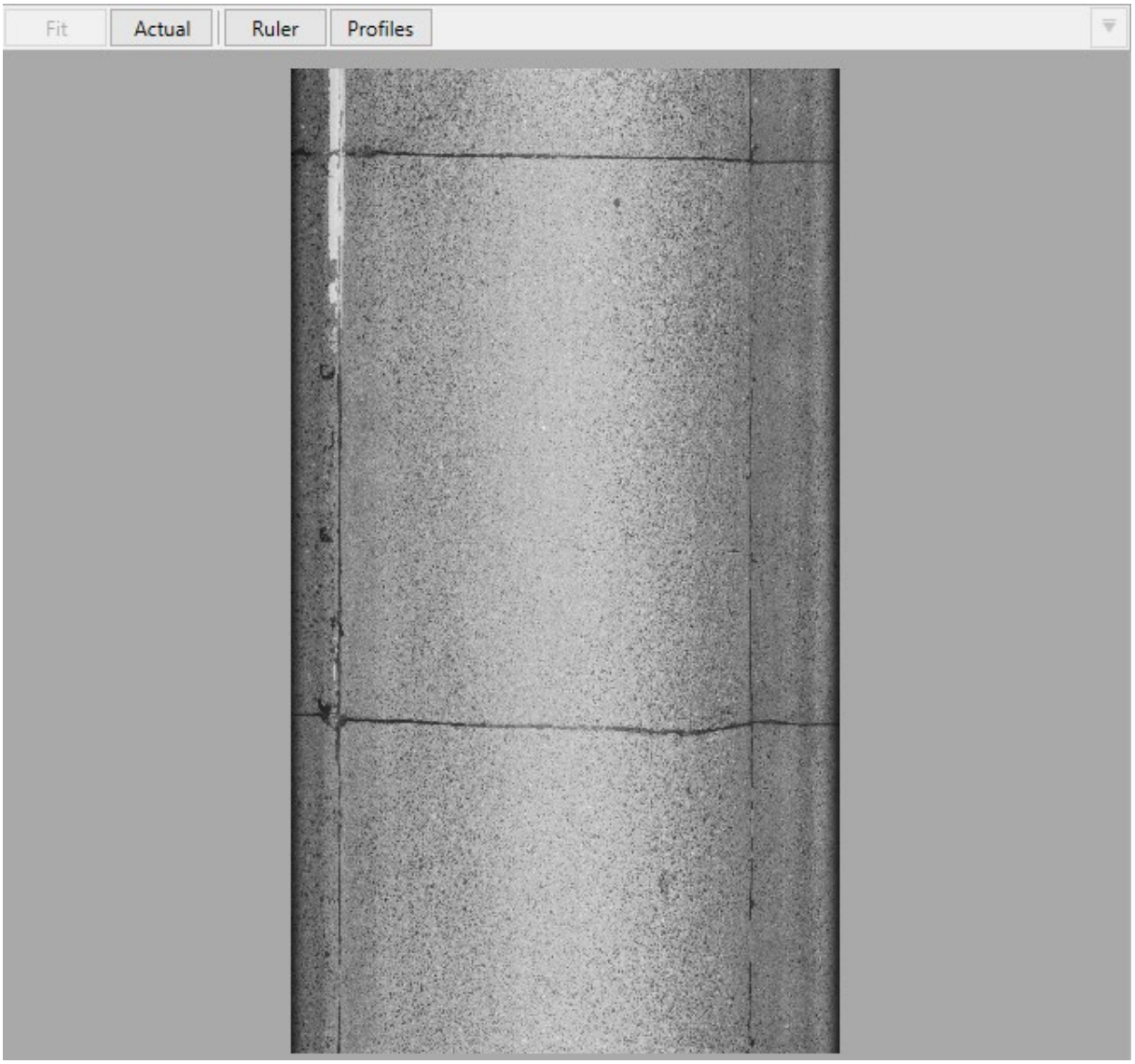
The options for exported file formats are:

- RAW (*.raw): A RAW file is a binary data file that contains raw pixel data. Not to be confused with the RAW files from digital cameras. Because RAW files only contain pixel data, additional information must be provided to view the image, such as width and height. IrfanView is an example of software that can display raw files. (https://en.wikipedia.org/wiki/Raw_image_format#Raw_bitmap_files)
- PNG (*.png): A PNG file (Portable Network Graphic) is a versatile raster image format commonly used for web graphics, digital photographs, and images with transparent or semi-transparent backgrounds. PNG files can be viewed with Windows Default Viewer, web browsers, or other image viewer programs (e.g., Microsoft Paint, Adobe Photoshop, IrfanView, FastStone Image Viewer, XnView.)
- JPG (*.jpg): JPEG or JPG (Joint Photographic Experts Group) is a widely used method of lossy compression for digital images. It's particularly popular for images produced by digital photography. JPG files can be viewed by almost all viewer programs.
- JPEG 2000 (*.jp2): JPEG 2000 (JP2) is an image compression standard and file format developed by The Joint Photographic Experts Group (JPEG) in the year 2000. Its main objective was to improve upon the original lossy JPEG standard by introducing enhanced encoding algorithms, better scalability, and more efficient coding tools. JPEG 2000 files can be read with various viewer programs (e.g., Adobe Photoshop, IrfanView, FastStone Image Viewer, XnView).
- PGM (*.pgm): A PGM file (Portable Gray Map) stores grayscale 2D images. A PGM file can be read with various image viewers (e.g., GIMP, Corel PaintShop Pro, Apple Preview). (This is probably the closest thing to an "official" spec:
- https://netpbm.sourceforge.net/doc/pgm.html)

Note that the graphic viewer program would display the images in a non-scaled manner, i.e., the difference in the longitudinal and transverse resolutions is ignored, such as the one below.

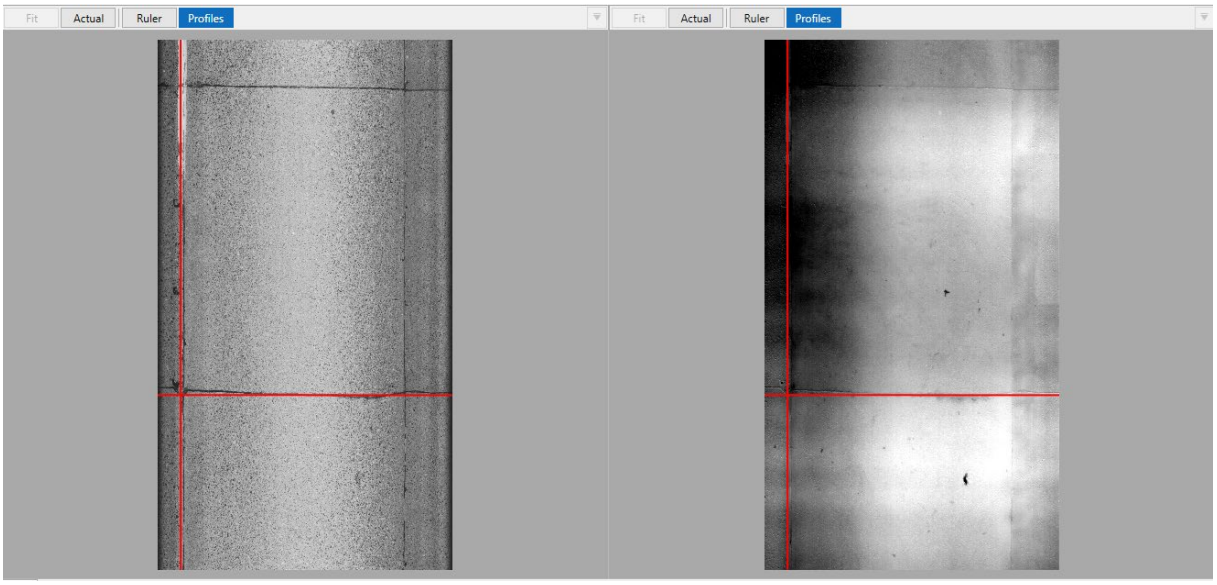


Compared with the correctly scaled version in ProVAL Clarity below:



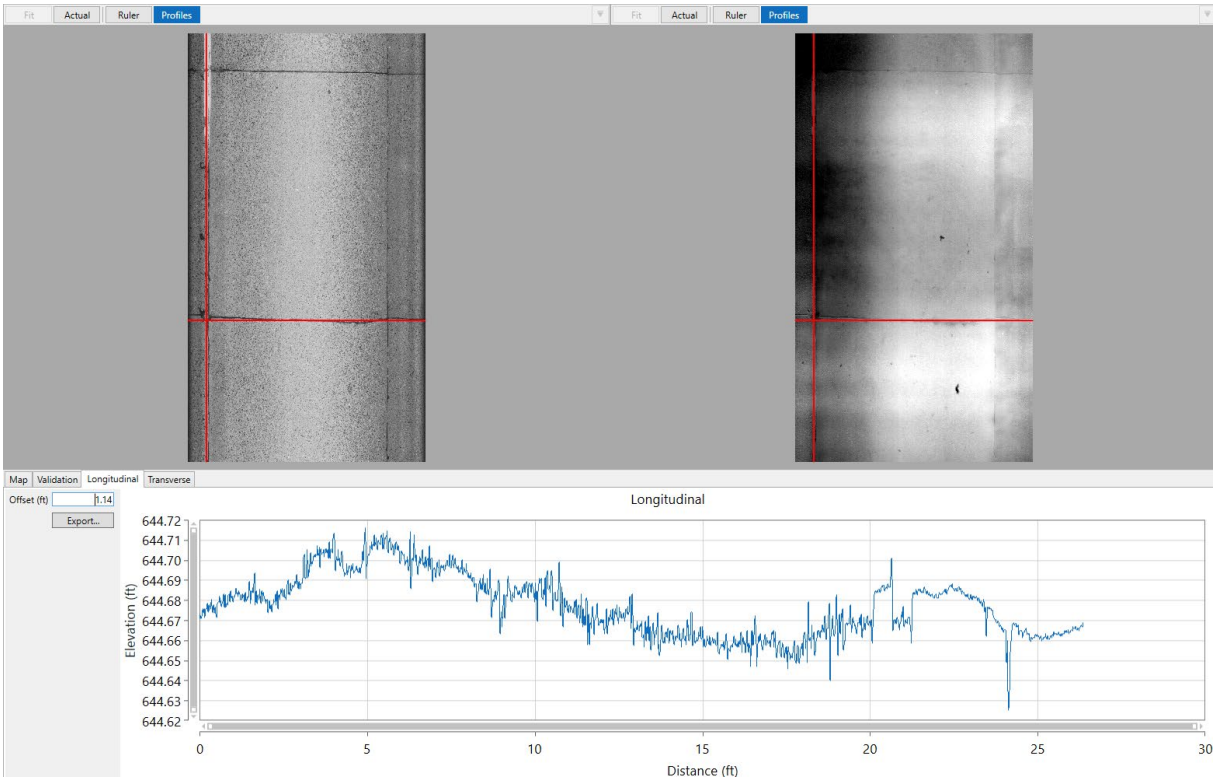
Profiles

Users can use the mouse to select the location of the cross hairs to display the extracted longitudinal (bottom to top) and transverse (left to right) profiles from the range image.



Though the cross-hairs are synchronized between the intensity and range images, it may be more intuitive to select the cross-hair position on the intensity image.

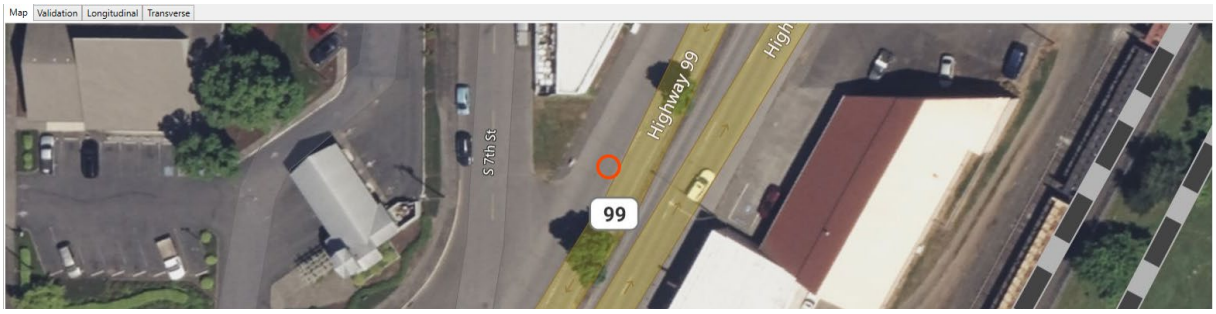
After selecting the cross-hair location in the image, users can click the Longitudinal tab of the bottom panel to display the extracted profile. The longitudinal profile elevation of the selected cross-section is displayed from the offset of the bottom edge to the top edge of the range image.



See the following sections for details of the extracted longitudinal and transverse profiles.

Map

A satellite map is shown around the selected image location, which is indicated with a red circle.



Validation

The Validation shows the validation results based on the following checklist:

The checklist on the psi standard was recommended by Tsai et al. in 2019 and further refined in a personal communication on 12/7/2020, as follows.

File Integrity

- The file signature is present. Check if the first 3 bytes of the file is "psi".
- The file trailer is present. Check if the last four bytes of the file is "@@@@".
- The file's checksum equals the given one. If a checksum is given, calculate the checksum based on the file content and check if it equals the given checksum.

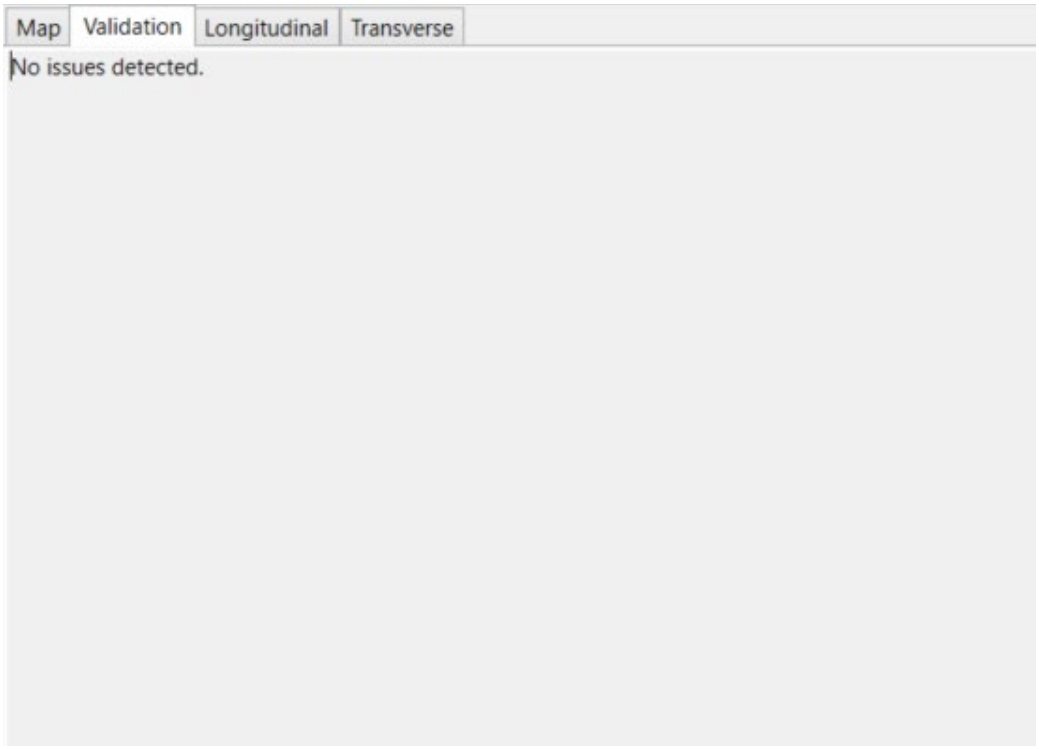
Header Correctness

- The values in the required header fields are valid. For each value in required fields, if the field takes only the assigned value, check if the value is in the "assigned values list". For example, the version must follow the format "X.YY" where X and YY are the numbers.
- The size of the 2D/3D data is correct. If the data are not compressed, check if the following condition holds: "datasize = biddepth / 8 * width * length

Data Correctness

- The data in the 2D and 3D sections can be extracted using header information. Extract and decode the 2D and 3D data using header-provided information. Check if the extracted data can fit into a width * length data matrix of that given data type.

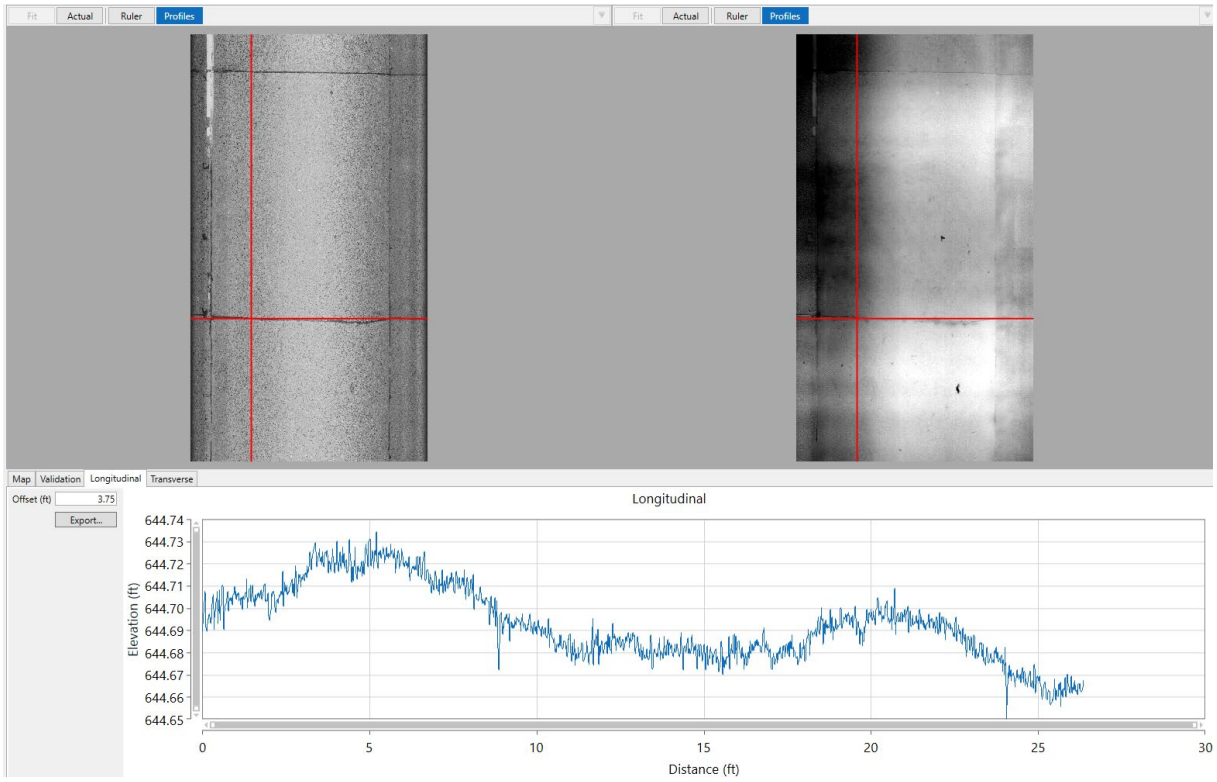
The example below shows no issues detected.



Longitudinal Profile

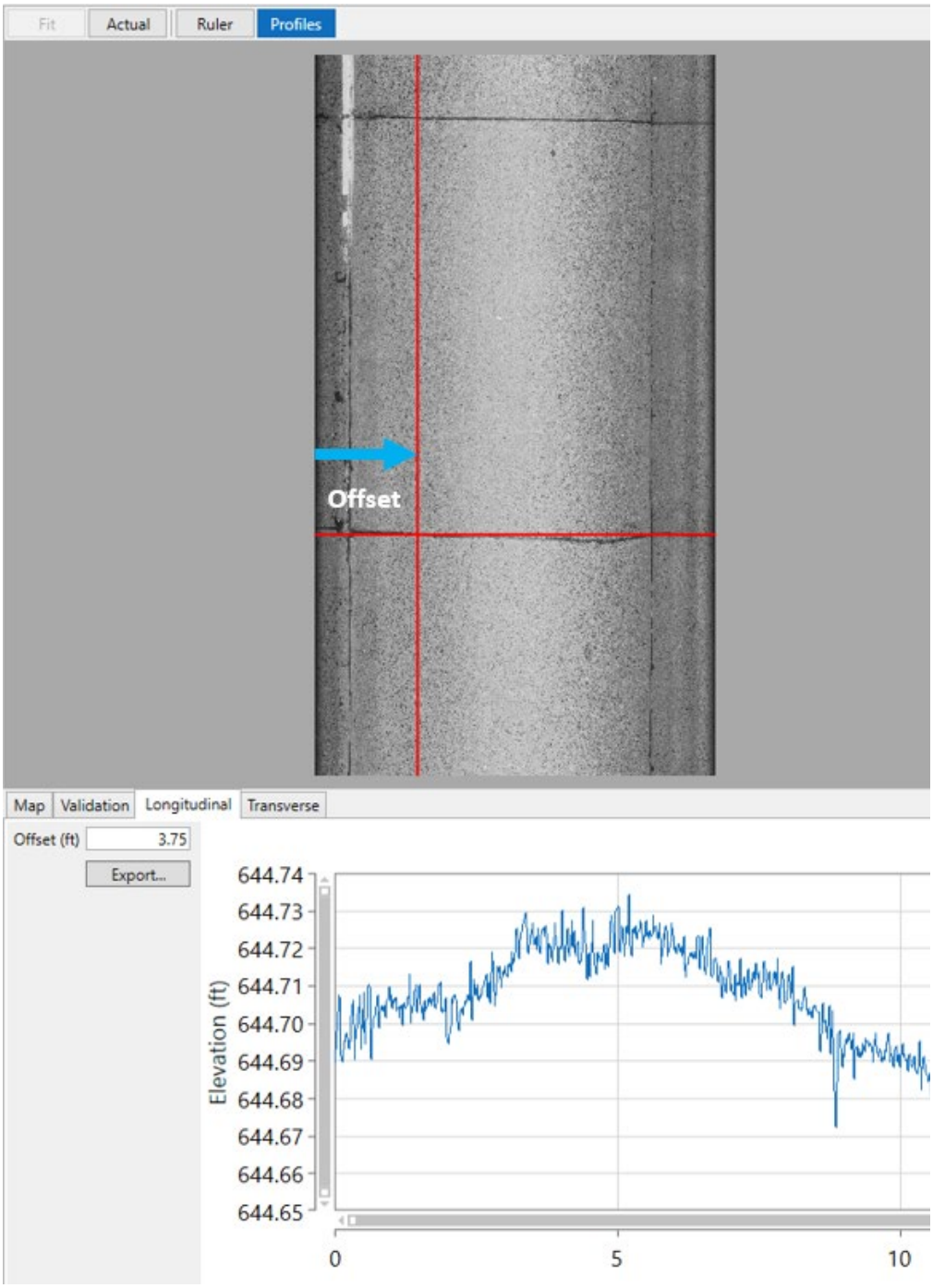
Profile

The longitudinal profile elevation of the selected cross-section is displayed from the offset of the bottom edge to the top edge of the range image.



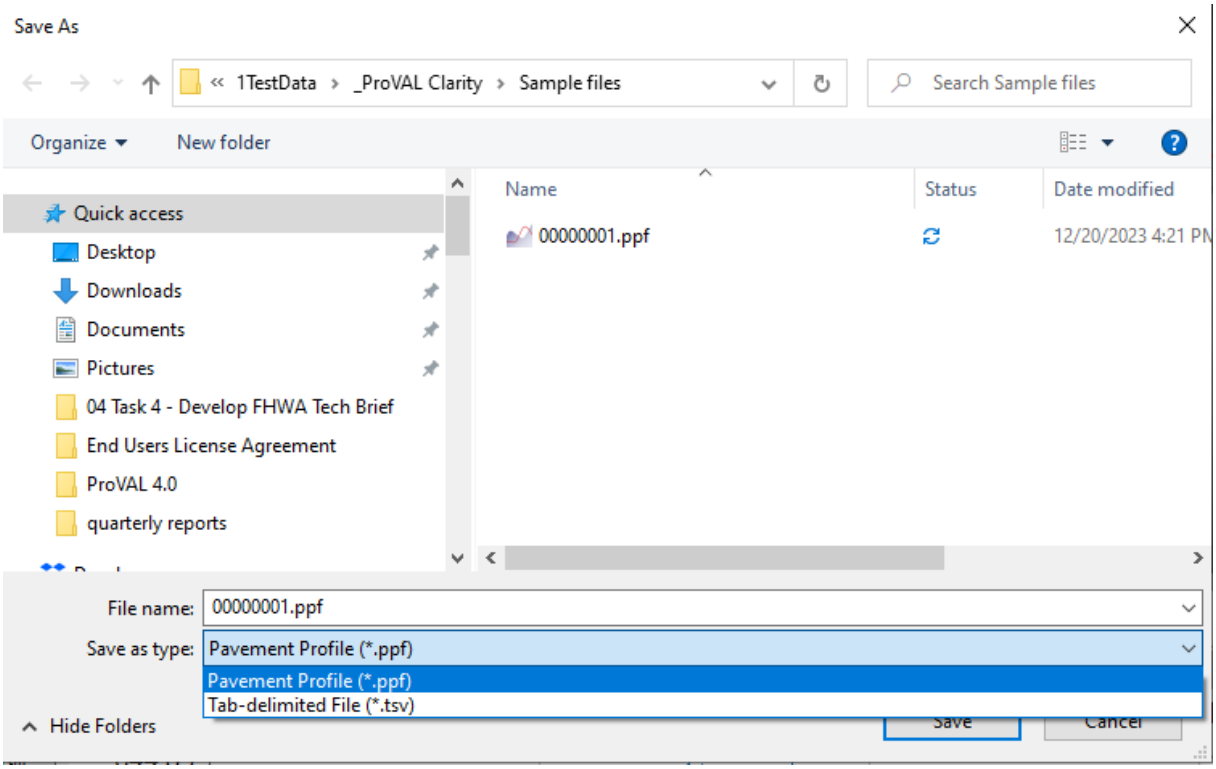
Offset

For the longitudinal profile, the offset is the distance from the left edge of the range image to the selected cross-hair.



Export

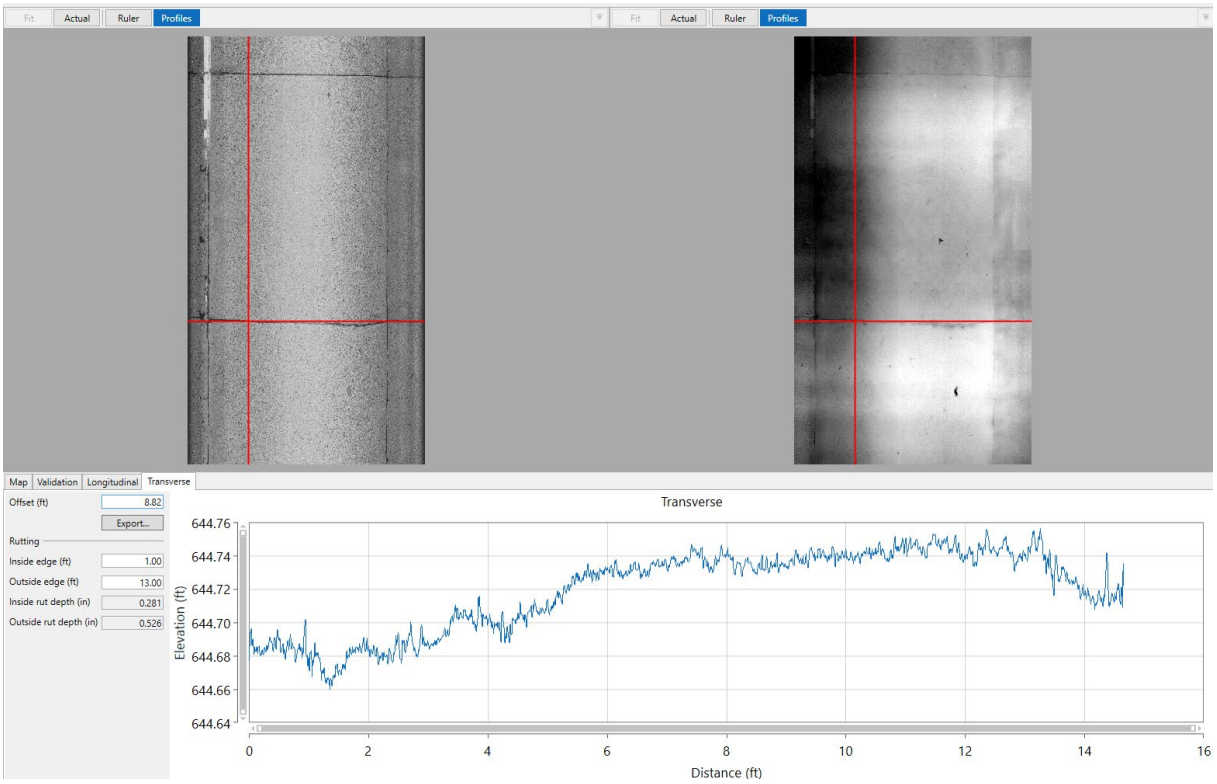
Users can click the Export button to export the profile in the ASTM E2560 pavement profile (*.ppf) format or tab-delimited file (*.tsv) format. The longitudinal ppf file can be imported to ProVAL.



Transverse Profile

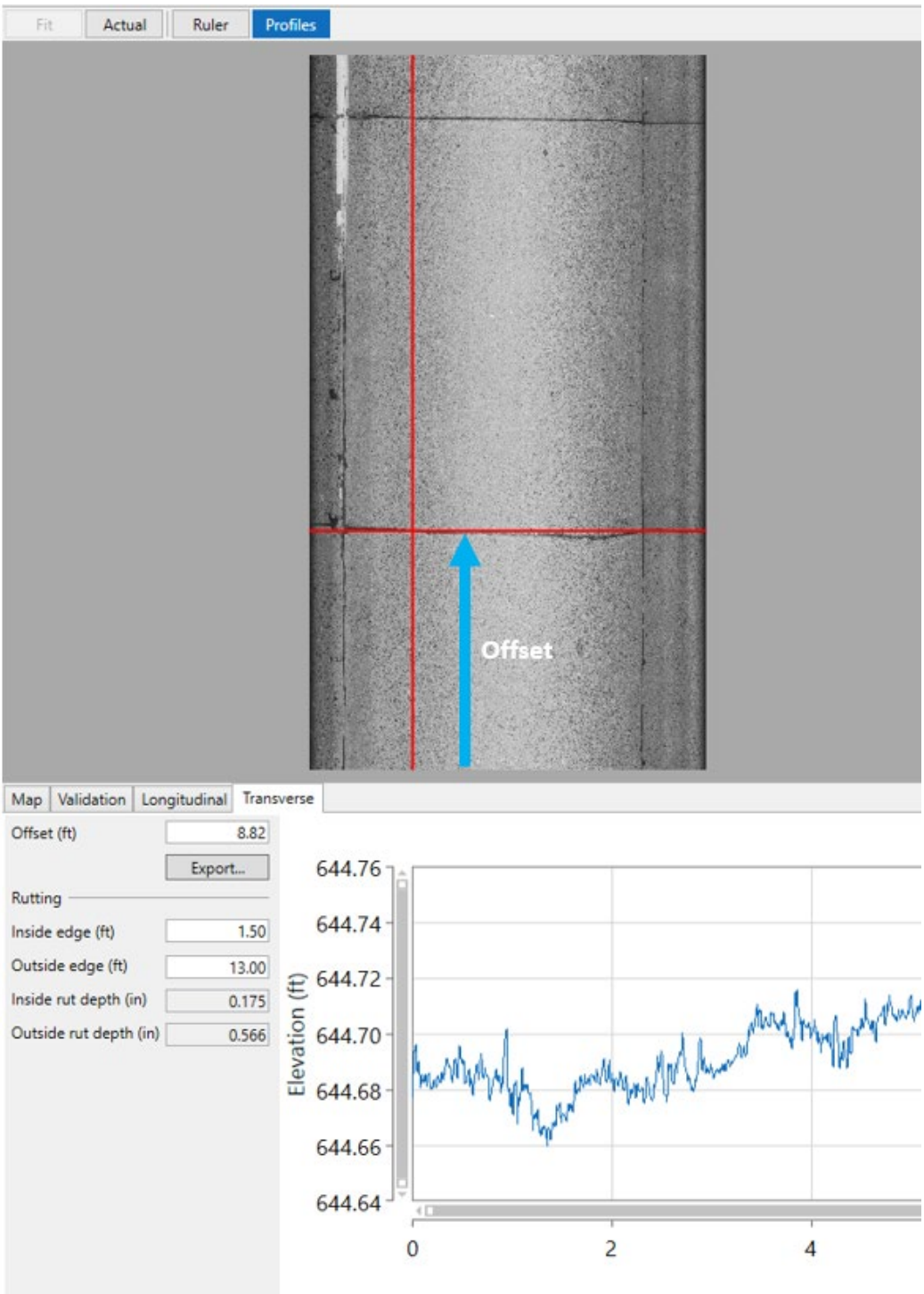
Profile

The transverse profile elevation of the selected cross-section is displayed from the offset from the left edge to the right edge of the range image.



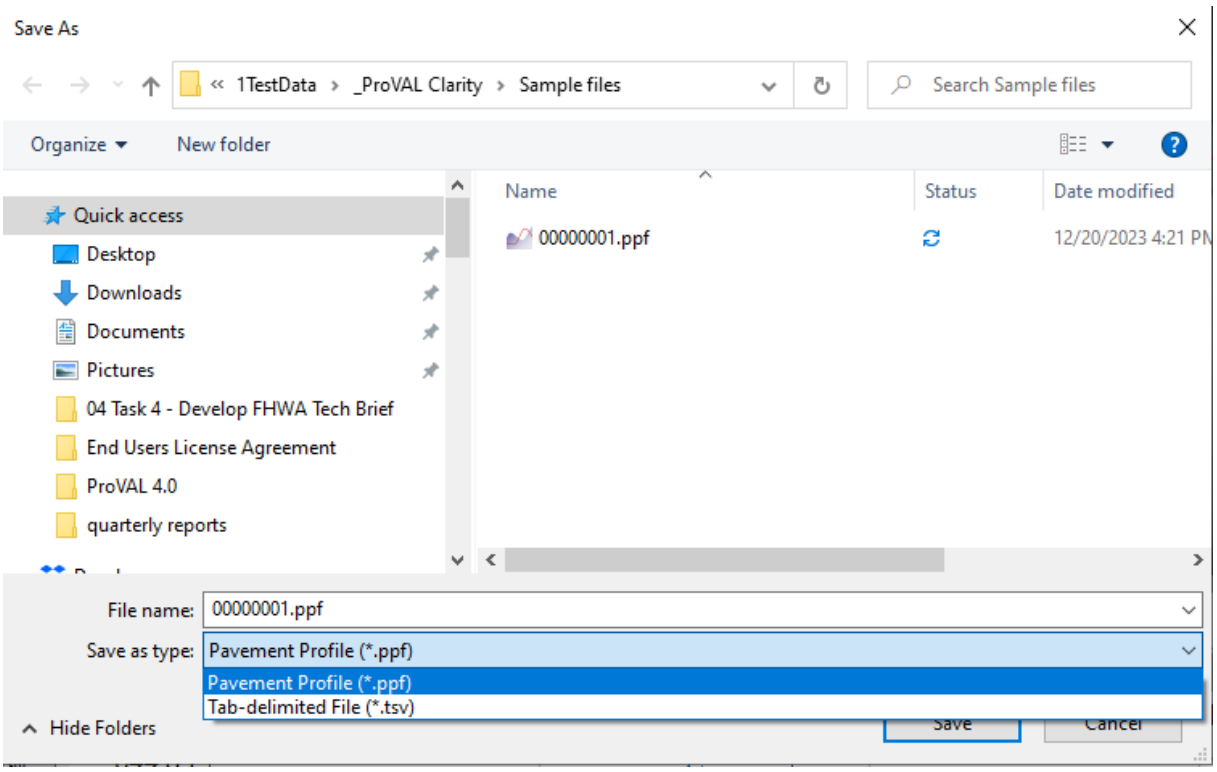
Offset

For the transverse profile, the offset is the distance from the bottom edge of the range image to the selected cross-hair.



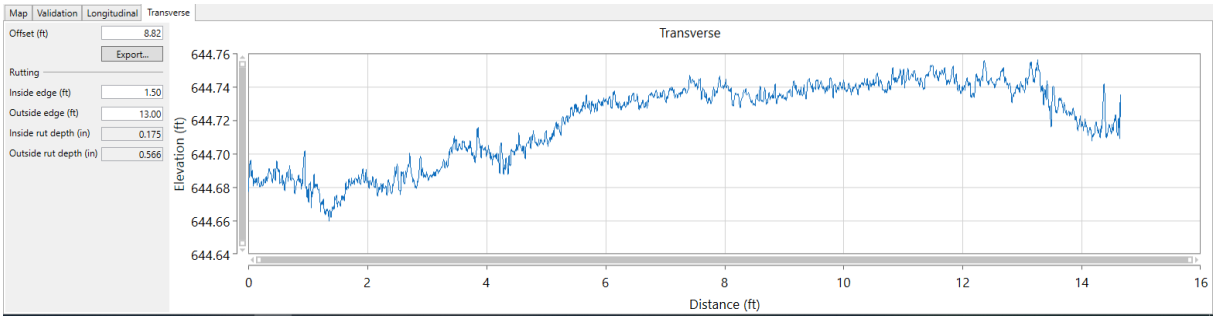
Export

Users can click the Export button to export the profile in the ASTM E2560 pavement profile (*.ppf) format or tab-delimited file (*.tsv) format. The transverse ppf file has not yet been imported to ProVAL.



Rutting

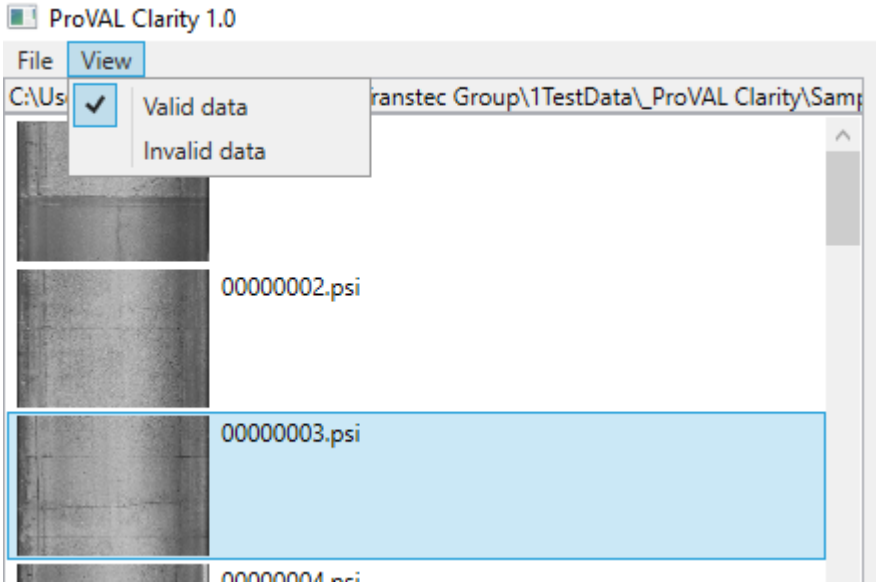
Users can input the inside edge and outside edge to allow the program to compute the inside wheel track's rut and outside wheel track's rut based on AASHTO R 87-18 (2022).



- Inside edge: user-defined inside edge of the lane.
- Outside edge: user-defined outside edge of the lane.
- Inside rut depth: calculated rut depth of the inside wheel track.
- Outside rut depth: calculated rut depth of the outside wheel track.

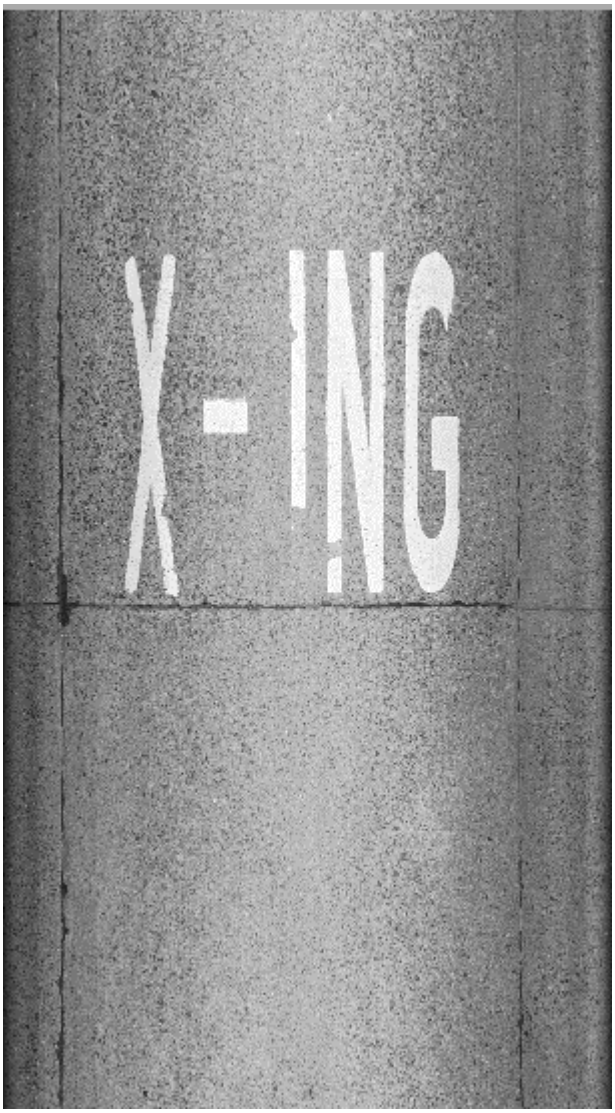
View Valid and Invalid Data

Use the View menu to select viewing Valid data, Invalid data, or both.



Valid Data only

The following example is valid data only.

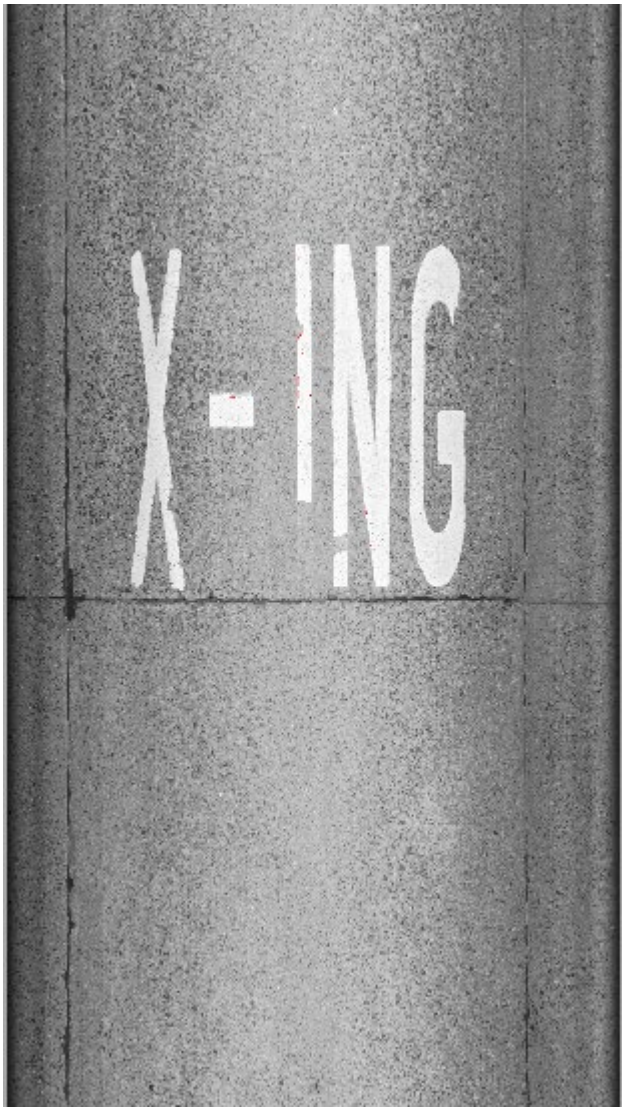


Invalid Data only

The invalid data is shown as red dots in an intensity image.

Both Valid Data and Invalid Data

The invalid data is shown as red dots in an intensity image.



Chapter 7

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