RESEARCH DIVISION

MDOT ProVAL Software User Guide

Mississippi Department of Transportation Research Division PO Box 1850 Jackson, MS 39215-1850 Phone 601.359.7650 • Fax 601.359.7634

Table of Contents

| Prefacei |
|---|
| How This Book Is Organizedi |
| Acknowledgmentsi |
| Introduction1 |
| Installing Software1 |
| Starting Software7 |
| Software Help (User's Guide)8 |
| Options Tab9 |
| Importing Templates11 |
| Profile File Manipulation13 |
| New File (Project)13 |
| Open Existing (Project)15 |
| Zoom In on Profile17 |
| Zoom Out on Profile |
| Display X and Y Coordinates18 |
| Change Units on Profile19 |
| Using Editor20 |
| Cropping Profile |
| Save a Cropped File |
| Open Cropped File |
| View Cropped File |
| Smoothness Assurance |
| Open File for Analysis25 |
| Select Appropriate Template |
| Apply 250mm Filter & Histogram Settings27 |
| Short Continuous Analysis |
| Long Continuous Analysis |
| Reporting for Smoothness Assurance |
| Grinding Simulation |
| Long Continuous Grinding Comparison36 |
| |
| Short Continuous Grinding Comparison |

| Processing Data41 |
|--|
| Reporting for Profiler Certification45 |
| Pay Incentive Calculation Procedure46 |
| Processing Data46 |
| Spreadsheet Inputs47 |
| Power Spectral Density |
| Processing Data48 |
| PSD Examples |
| Example 151 |
| Example 252 |
| Troubleshooting |
| Sending the log files |
| Remove potentially corrupted files53 |

Preface

This manual provides a step by step process of operating and understanding the ProVAL (Profile Viewing and Analysis) software program. ProVAL is an engineering software application used to view and analyze pavement profiles. The analyses of interest to Mississippi DOT and paving contractor personnel are described in this manual. The ProVAL software is developed by the Transtec Group through a contract with the US FHWA, Western Federal Lands, and the LTPP. This software is free of charge and can be downloaded from the Transtec Group website (www.roadprofile.com). Refer to the ProVAL Installation section of the ProVAL 3.4 User's Guide for hardware and software requirements for this program. This guide uses specific files in each example. However, the same principles apply to any files being used for that individual task within the ProVAL software.

How This Book Is Organized

This book is divided into multiple sections that provide the user with a basic step by step guide to using ProVAL 3.4. Each section explains a function of the software and how it can be used.

The Introduction explains how to download and open the software. It also shows information about the User's Guide and various other options to help get familiar with ProVAL.

Profile File Manipulation shows how to open a file, zoom in and out on a profile, and change units.

The Using Editor section explains how to crop a profile and save a file.

Smoothness Assurance (SAM) is a ProVAL analysis function that produces graphs for the MRI of a profile. A grinding simulation function is also included in this section.

Quality Assurance Check is to ensure the contractor's profiler is accurate before it is used to collect on a project. This function compares the contractor's profile of a control section to MDOT's profile of that same section.

Power Spectral Density (PSD) is a function that displays a graph of a profile's wavelength. There are PSD examples of typical pavement irregularities included in this section.

Acknowledgments

Milady Howard, Jordan Whittington and Matthew Strickland authored, in cooperation with the FHWA, a Mean Roughness Index (MRI) specification study. This study included data collection and analysis recommendations for MRI.

Alex Middleton, Alex Collum and Alan Hatch collected and processed data for the MRI pilot project.

Brian Schleppi of the Ohio DOT provided ProVAL examples and other information relating to MRI.

The Transtec Group, Inc. provided the ProVAL software that is used for this project, which was funded by FHWA, Western Federal Lands, and LTPP.

Introduction

The International Roughness Index (IRI) is a statistic used to determine the amount of roughness in a measured longitudinal profile. IRI values are meant to represent the ride quality experiences by passengers sitting in the left and right back seat. IRI is highly correlated to vertical passenger acceleration. A mathematical model is used to calculate the total vertical movement by one wheel of a vehicle as it travels over the pavement. The IRI values represent the total vertical suspension travel divided by distance (in/mi or m/km). An IRI value is representative of a single longitudinal profile, usually a wheel path of a travel lane. Mean Roughness Index (MRI) is the average of the IRI values from both wheel path profiles of a travel lane, therefore producing one roughness value for the entire lane. Two base lengths are used to evaluate pavement smoothness. The long interval (528 feet) is used to determine the overall quality and the short interval (25 feet) is used to guard against any minor imperfections on the pavement.

Installing Software

- 1.1 Go to the Transtec Group website (<u>http://www.roadprofile.com/</u>) and download the latest version of ProVAL.
- 1.2 For hardware and software requirements, refer to page 2 of the Transtec Group User's Guide which can be downloaded as displayed in section 1.4 of this document.
- **PROVAL** Search ProVAL Workshops Welcome to ProVAL ProVAL 3 40 0291 ProVAL is an engineering software application used to view and analyze pavement profiles. It is easy to use, yet powerful enough to April 2013 Release Notes perform many types of profile analyses. Contact us if you have any questions, comments, feedback, or to find out more about any of our Installation Guide workshops 1 2 3 4 5 6 Looking for smoothness specifications? Check out our companion website: SmoothPavements.com. 7 8 9 10 11 12 13 ntation Docu Take a look at a brief introduction to ProVAL in various languages 14 15 16 17 18 19 20 ProVAL 3.4 English Español 蕃德 化语 21 22 23 24 25 26 27 ProVAL 3.3 28 29 30 General FAQ Library ProVAL 3.40 Released ProVAL Workshop at UDOT ProVAL 3.4 April 3, 2013 at 8:30 AM User login We are pleased to announce the release of ProVAL 3.4! UDOT Region 2 UDOT Region 2 - 2010 South 2760 West - Salt Lake City, UT 84104 Username: * We have made many changes, and added several new features, all of which are included in the must-read Release Notes. Check out the ProVAL 3.4 intro document Password: * If you encounter an issue please contact us. Be aware that due to the holidays no new version of ProVAL will be available after this for at least a couple of weeks. Log in Highlights · Enhanced localized roughness report in Smoothness Assurance · Advanced report for Profiler Certification · Locating profiles on a map in a Web browser or Google Earth .NET Requirements changed · Other major changes Download ProVAL 3 40 0291 FASTER - EASIER - FUNNER http://www.roadprofile.com/
- 1.3 Click **Downloads** as shown below.

1.4 Click on the latest version of the ProVAL application for installation. The Transtec Group User's Guide can be downloaded by clicking on the link just below the latest version of the application.

| PROVAL | | | | | | | | s | earch |
|--|---|----------------------------|----------------------------------|-----------|-----------|---------|-------|---------|-------|
| | | | | Downloads | Workshops | Support | Forum | Contact | About |
| Software | Home | | | | | | | | |
| • ProVAL 3.40.0291 | Downloads | | | | | | | | |
| Release Notes Installation Guide | ProVAL 3.4 | | | | | | | | |
| | File | Date | | | | | | | |
| Documentation | 3.40.0291 | November 15, 2012 | | | | | | | |
| ProVAL 3.4 | User's Guide | November 07, 2012 | | | | | | | |
| ▶ ProVAL 3.3 | Sample Files | November 16, 2012 | | | | | | | |
| General FAQ | | | | | | | | | |
| • Library | ProVAL 3.3 | | | | | | | | |
| | File | Date | | | | | | | |
| User login | 3.30.0261 (installation or zip) | November 14, 2012 | | | | | | | |
| | 3.30.0257 (installation or zip) | August 7, 2012 | | | | | | | |
| Username: * | User's Guide | January 17, 2012 | | | | | | | |
| | Sample Files | January 17, 2012 | | | | | | | |
| Password: * | Transition from ProVAL 2.7 | to 3.2+ | | | | | | | |
| | Please read the "Transition from ProVAL 2. | 7 to 3.2 Document" to fac | iliate the transition. | | | | | | |
| Log in | The last ProVAL 2.7 version is posted here. | This version was frozen in | 2008 and is no longer supported. | | | | | | |
| Request new password | Installation Guide | | | | | | | | |

1.5 Click Save.



1.6 Click Save.



1.7 Once download has completed, click **Run**.



1.8 Click Next.



1.9 Read the license agreement. If you agree with it, select I accept the terms in the License Agreement then click Next.



1.10 If you do not want to install the application in the default folder, click **Browse** to find a location to install the ProVAL application.

| ProVAL 3.4 Setup |
|---|
| Select Installation Folder This is the folder where ProVAL 3.4 will be installed. |
| To install in this folder, dick "Next". To install to a different folder, enter it below or dick "Browse". |
| Eolder: C:\Program Files\FHWA\ProVAL 3.4\ Browse |
| Advanced Installer |

1.11 Once an installation folder is selected, click **Next**.

| ProVAL 3.4 Setup |
|---|
| Select Installation Folder This is the folder where ProVAL 3.4 will be installed. |
| To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse". |
| Eolder: C:\Program Files\FHWA\ProVAL 3.4\ Browse |
| Advanced Installer |

1.12 To create shortcuts for the ProVAL application, check the boxes next to **Desktop** and **Start Menu Programs folder**. This will create a ProVAL icon on the desktop screen and add a ProVAL folder to the start menu. Then click **Next**.

| novAL 3.4 Setup | x |
|---|---|
| Configure Shortcuts Create application shortcuts | 6 |
| Create shortcuts for ProVAL 3.4 in the following locations: | |
| Desktop Start Menu Programs folder | |
| Advanced Installer | e |

1.13 Click Install to begin installation process.



1.14 Click **Finish** to complete the installation process. If the Launch ProVAL 3.4 button is checked, the application will start after you click the finish button.



Starting Software

1.15 Once ProVAL is downloaded and installed, locate the ProVAL 3.4 icon on your desktop and double click it to open ProVAL 3.4.



1.16 ProVAL opens to the starting screen and is ready for a user to open a file. The two main sections on the screen are Recent Projects and ProVAL Online (if connected to web). ProVAL Online displays News (updated versions of the software) and Workshops (training classes scheduled).



Software Help (User's Guide)

1.17 For a more in depth look into ProVAL 3.4, click the **Help** tab and select **User's Guide**. <u>Note:</u> <u>Refer to pages 13-42 in the Transtec Group User's Guide for help with getting started</u>.

| ProVAL 3.4 | |
|---|--|
| New Open Clear History Getting Stated | |
| Recent Project | ProVAL Online |
| | News |
| Support | Thursday, November 15, 2012 ProVAL 3.40 Released |
| About | Wednesday, November 14, 2012 ProVAL 3.30.0261 Released |
| | Tuesday, August 07, 2012 ProVAL 3.30.0257 Released |
| | Friday, May 25, 2012 ProVAL 3.30.0255 Released |
| | Wednesday, January 25, 2012 ProVAL 3.30.0245 Released |
| | Workshops |
| | No upcoming workshops. |

1.18 The User's Guide will appear on the screen in PDF format. <u>Note: The Transtec Group 'User's</u> <u>Guide' is not to be confused with this User's Guide that MDOT has provided all trainees.</u>



Options Tab

1.19 Click **Options** in the **Tools** group. This feature allows you to change default settings and import templates.

| ProVAL 3.4 | |
|--|--|
| New Open Clear History Getting Started | |
| Recent Project Options (Ctrl+T) | ProVAL Online |
| | News |
| | Thursday, November 15, 2012 ProVAL 3.40 Released |
| | Wednesday, November 14, 2012 ProVAL 3.30.0261 Released |
| | Tuesday, August 07, 2012 ProVAL 3.30.0257 Released |
| | Friday, May 25, 2012 ProVAL 3.30.0255 Released |
| | Wednesday, January 25, 2012 ProVAL 3.30.0245 Released |
| | Workshops |
| | No upcoming workshops. |

1.20 Select **ERD (.erd)** from the **Default File Type** dropdown menu. Contractors will submit .erd files to MDOT project engineers so this will be the primary file type imported into ProVAL.

| Options | Area . |
|-------------------------|--|
| General Settings Analys | s Chart Style Alternate Chart Colors |
| 🗖 Use SI Units | |
| Enable Recording Log | |
| Show Online Content of | n the Start Page |
| Use Alternate Chart Te | nplate for printing and PDF reports. |
| Default File Type | Pavement Profile (ppf) 🔹 |
| Map source | All (*) Ames (adf. ldf) |
| Spreadsheet Program | Dipstick (elv) e\Office12\EXCEL.EXE Browse |
| Default Project Path | ERD (erd) Browse |
| | KJLaw (a*,p*) Pavement Profile (ppf) |
| | Texas (pro) |
| | |
| | |
| | |
| | |
| | |
| | |
| | OK Cancel |

1.21 Click **Browse** next to **Default Project Path** to create a default path for opening files. This will allow you to easily open files from a folder that contains the .erd files for all of your projects.

| Options | Reat |
|--------------------------|---|
| General Settings Analysi | is Chart Style Alternate Chart Colors |
| 🕅 Use SI Units | |
| Enable Recording Log | |
| Show Online Content o | n the Start Page |
| Use Alternate Chart Ter | nplate for printing and PDF reports. |
| Default File Type | ERD (erd) |
| Map source | Google Maps 🔹 |
| Spreadsheet Program | C:\Program Files\Microsoft Office\Office12\EXCEL.EXE Browse |
| Default Project Path | D:\ Browse |
| | — |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | OK Cancel |

1.22 Select the desired project folder and click **OK**.

| Browse For Folder |
|---|
| |
| |
| 🛛 🌗 Pavement Management Decision Tree 🔺 |
| 🌗 Profilograph Report |
| 4 🌗 ProVAL Manual |
| 🌗 ProVAL 3.2 |
| ProVAL 3.3 |
| DroVAL 3.4 |
| 🌗 ProVAL Other |
| ProVAL Training MDOT |
| ProVAL Training MDOT - Version 3.2 |
| 🛛 🖟 PROVAL_Training 🛛 🍡 🚽 |
| <) |
| Make New Folder OK Cancel |

Importing Templates

1.23 Click the **Analysis** tab and select **Add from File...** under the **Templates** heading. These templates are created based on the MDOT MRI specification. There are three categories of pavement construction. Each category has MRI values that the pavement's profile must meet. Once the template is imported, the user will select the correct category for the pavement being analyzed (see selecting template in section 4.3 on page 26). *Note: Refer to page 63 in the Transtec Group User's Guide for more information on templates.*

| ptions | | Revenue. | |
|---|---|-------------|---|
| General Settings | Analysis | Chart Style | Alternate Chart Colors |
| Automated Fault Automated Fault Profile Synchroni Profiler Certificat Optimal WIM Loc Precision and Bia Profilograph Sim Power Spectral D Ride Quality Rolling Straighted Smoothness Assu | ing zation ion ator s ulation ensity dge urance | | Add from File Add from ProVAL 3.3- Export to File Clear |
| Default Analysis Smoothness Assurar | nce | | |
| | | | |

1.24 Locate the **Test.pv3at** template and click **Open**.

| Open | Bernelling and the second | | | × |
|--|---|-------------------|------------------------------|-------------------------|
| 🔾 🗢 📕 🕨 Computer 🕨 | Data (D:) ProVAL Training MDOT Template | ▼ 4 9 | Search Template | Q |
| Organize 🔻 New folder | | | | |
| ☆ Favorites | Name | Date modified | Туре | Size |
| 📃 Desktop | Analysis Templates.pvat | 4/26/2011 1:54 PM | PVAT File | 11 KB |
| 🚺 Downloads | Test.pv3at | 3/30/2011 9:37 AM | PV3AT File | 19 KB |
| Recent Places Libraries Documents Music Pictures Videos | | | | |
| 🖳 Computer | | | | |
| 🚢 Local Disk (C:) | | | | |
| 👝 Data (D:) | | | | |
| WorkProgram\$ (\\RSCH! | + + | III | | • |
| File name: | Test.pv3at | | ProVAL Analysis Temp Open | olate (*.pv ▼ Cancel |

1.25 The template is imported and ready to be used when analyzing a project. Set the **Default Analysis** tab to **Smoothness Assurance** (this will be the most used ProVAL function).

| Options | Reat | |
|---|---|--|
| General Settings Analysis | Chart Style Alternate Chart Colors | |
| Selected Analyses | | |
| Automated Faulting Profile Synchronization Profiler Certification Optimal WIM Locator Precision and Bias Profilograph Simulation Power Spectral Density Ride Quality Rolling Straightedge Smoothness Assurance | Templates Add from File Add from ProVAL 3.3- Export to File Clear | |
| Default Analysis | | |
| Smoothness Assurance | | |
| Automated Faulting Optimal WIM Locator Power Spectral Density Precision and Bias Profiler Certification Profilograph Simulation Ride Quality Rolling Straightedge | | |
| Smoothness Assurance Profile Synchronization | OK Cancel | |

Profile File Manipulation

New File (Project)

2.1 To create a ProVAL 3.4 project (.pvp file), import the appropriate .erd file. In this example, double click **ERD File** from the **ProVAL Training Folder**. The ERD File will automatically open in the latest version of ProVAL that is installed on your machine.

2.2 Shown below is the **ERD File** shown after it opens in ProVAL 3.4.

| M [Untitled] * - ProVAL 3.4 | | |
|--|---|--|
| Close Add Files Save Report Project Project Viewer Editor Ana Sy Viewer Editor Ana | Image: signal system Image: signal system alysis Analysis AM Image: signal system Image: signal system Image: signal system < | Options Screenshot Help ~ Tools |
| ERD File | | |
| | 4 | • |

2.3 To save the file as a ProVAL 3.4 Project (.pvp file), select **Save As** from the **Save** dropdown menu.

| 😥 [Untitled] * - ProVAL 3.4 | | |
|--|---|---|
| Close Add Files Save Report Viewer Editor Ana Project | Inits Inits | ⊘ Options Screenshot ④ Help → Tools |
| ERD File Left Elevation Right Elevation | | |
| | | |
| | | |
| | | |
| | | |
| | 4 | |

2.4 Choose a File name and folder to save the project, then click **Save**.

| 💋 [Untitled] * - F | ProVAL 3.4 | |
|--------------------|--|---|
| Close Add File | s Save Report Viewer Editor Analysis Analysis ☐ 2 Units 2 Uni | |
| Project | Save As | |
| ERD File | Correction of the second secon | |
| | Organize 🔻 New folder 🛛 🕮 💌 🔞 | - |
| · V | Downloads Name Date modified Type Size | |
| | No items match your search. | |
| | 🛜 Libraries | |
| | Documents E | |
| | Pictures | |
| | Videos 💷 | |
| | 🖳 Computer | |
| | Local Disk (C:) | |
| | 🖓 WorkProgramS (| |
| | 💬 State Studies\$ (\\ 💌 | |
| | File name: ERD File ProVAL | |
| | Save as type: ProVAL Project (*,pvp) | |
| | Hide Folders | |
| | | |
| | | |
| | | |

2.5 Project is saved as a .pvp file (ProVAL Project). Close the project (top left of screen) after saving.

Open Existing (Project)

2.6 Click the **Open** button in the **Getting Started** group to open a file. <u>Note: Refer to pages 43-50 in</u> <u>the Transtec Group User's Guide for more information on this section.</u>

| ProVAL 3.4 | |
|--|--|
| New Open Clear History Getting Sta | |
| Rece ^{Open} rojects | ProVAL Online |
| ERD File ProVAL | News |
| | Thursday, November 15, 2012 ProVAL 3.40 Released |
| | Wednesday, November 14, 2012 ProVAL 3.30.0261 Released |
| | Tuesday, August 07, 2012 ProVAL 3.30.0257 Released |
| | Friday, May 25, 2012 ProVAL 3.30.0255 Released |
| | Wednesday, January 25, 2012 ProVAL 3.30.0245 Released |
| | Workshops |
| | No upcoming workshops. |

2.7 Select **Start and Stop in Profile** and click **Open**. <u>Note: ProVAL 2 Projects (.pv2 files) can be</u> <u>opened using ProVAL 3.4.</u>

| ProVAL 3.4 New Open Getting Star Recent P | Options Clear Options Open | ta (D:) → ProVAL Training MDOT → Ge | tting Started 🗸 🍕 | Search Getting Star | ed P | |
|--|---|-------------------------------------|-------------------|-------------------------------|------------------------|--|
| ERD File Pr | Organize 🔻 New folder | | | | | |
| | Favorites | Name | Date modified | Туре | Size | |
| | E Desktop | Section 1 | 4/7/2011 7:13 AM | ProVAL Project | 292 KB | |
| | Downloads | Start and Stop in profile | 4/26/2011 2:26 PM | ProVAL Project | 292 KB | |
| | □ Libraries □ Documents □ Music □ Pictures □ Videos □ Computer ▲ Local Disk (C:) □ Data (D:) □ WorkProgram\$ (\\RSCH: | < | " | ProVAL Project (*.pvj Open | p;*.pv3;*.pv Cancel | |

2.8 File opens in default **Viewer** window. Review the functions on the ribbons at the top of the screen to become familiar with ProVAL. <u>Note: Refer to the Transtec Group User's Guide for</u> <u>more information on each icon.</u>

| Start and Stop in profile * - ProVAL 3.4 | P ↓ </th <th>Options Screenshot W Help ~ Tools</th> | Options Screenshot W Help ~ Tools |
|---|---|---|
| Project View Start and Stop in profile Left Elevation Right Elevation | Profile Selection Display | Tools |
| | | |

2.9 To view the raw profile of the data, check the boxes next to **Left Elevation** and **Right Elevation**.

Zoom In on Profile

A profile can be taken over long distances. The user can use the zoom feature to look at a specific area of the profile to evaluate problems.

2.10 The pavement's profile will be displayed as shown below. To zoom in on a profile section, click and drag across a rectangular section of the profile. In this example, left and right elevations from longitudinal distance 3,300 ft to 4,900 ft.

2.11 The profile should look similar to the picture below.

Zoom Out on Profile

2.12 Select the **Full** button to return to the complete profile.

Display X and Y Coordinates

2.13 Place the cursor at a point on the graph to display its x-(distance) and y-(elevation) coordinates.

Change Units on Profile

Using Editor

The Editor function is used to isolate a certain section of a pavement for roughness evaluation.

Cropping Profile

3.1 Select **Editor** in the **View** group. Then, choose the desired filename from the **File** dropdown menu. *Note: Refer to pages 52-61 in the User's Guide for more information on editing a file.*

3.3 Select **Sections** in the **Navigate** dropdown menu.

3.3 Select **Add Section** in the **Editor** group as shown by the top arrow. Enter "Section 1" or a name that appropriately describes the section in the blank and click **OK**.

| Start and Stop in profile * - ProVAL 3.4 | | | | | | | - 🗆 X |
|---|--|---|--|--|---|---------|--------|
| Close Add Files Save Report Project Project | Editor Analysis RQ View P | rofile Selection | Show Events Use Mileposts Units ~ Display | Options Screenshot Help Tools | Add Section Remove Section Export Section Editor | | |
| Editor: Sections | | | File | Start and Stop i | n profile | - Navig | gate 🔻 |
| Default Full | ProVAL New Section r Section 1 | name | > | OK Cancel | | | |
| | far and a second | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | | | | |

For Section 1, enter 3,000 ft as start distance and 5,000 ft as end distance. Select Leave-Out under the Type dropdown menu. This section is now ignored in all analysis modules. "Leave-Out" sections are used for bridges so that portion of the profile is not included in the analysis.

| Start and Stop in profil | le * - ProVAL 3.4 | | | | | | | | × |
|--|-------------------------------|--|--|---|---|---|--------|----------|-----|
| Close Add Files Save Project Project | Report Viewer | Editor Analysis A RQ View | nalysis Profile Selection | Show Events Use Mileposts Units Display | Options Screenshot Help ~ Tools | Add Section Remove Section Export Section Editor | n | | |
| Editor: Sections | | | | | File Start and | Stop in profile | • | Navigate | - |
| Start Distance (ft) Sto 3000.00 | op Distance (ft) L 4999.91 | ength (ft) Type 1,999.91 Generic Generic Leave-or | Name - Section 1 | | | | | | |
| Default | Full | • | | | | | | | |
| ← → Q - 🖸 💼 🗑 | 14 | | | | | | | | |
| (ii) 0 to to t | manut | Marin | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | | | | | • |
| -30 - 2, | ,000 4, | 000 6,000 | 0 8,000 | 10,000 Distance (ft) | 12,000 1 | 4,000 16,00 | 00 18, | 000 20,0 | 000 |
| | | - | Left Elevation | Right Elevation | Generic | | | | |
| 4 | | | | | | | | | • |

Save a Cropped File

3.5 Select **Save As** on the **ProVAL icon** dropdown menu.

| Start and Stop in profile * - ProVAL 3.4 | | | | |
|--|----------------------------|--|---------------------|---------------|
| Close Add Files Save Report Viewer Editor Analysis RQ Viewer View | Analysis Profile Selection | Show Events Use Mileposts Units • Display | Add Section | |
| Editor: Sections | | File Start | and Stop in profile | - Navigate - |
| Start Distance (ff) Stop Distance (ff) Length (ff) Type 0 3000.00 4999.91 1,999.91 Generic | Name Section 1 | | | |
| Default Full - | | | | |
| ← → ♀ • ◎ 🔒 🛱 🖨 | | | | |
| (E 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 8000 1 | 0,000 12,000 | 14 000 16 000 | 18 000 20 000 |
| | Dis | tance (ft) | 14,000 10,000 | 10,000 20,000 |
| | Left Elevation Rig | t Elevation Ceneric |] | * |

3.6 Name the file **Section 1** and select **ProVAL Project (*.pvp)** as the file type, then click **Save**.

| 😥 Start and Stop | in profile * - ProVAL 3.4 | |
|----------------------------|--|------------|
| Close Add Files Project | Save Report Viewer Editor Analysis Analysis Analysis Viewer Section Viewer Section Save As | |
| Editor: Sec | Computer > Data (D:) > ProVAL Training MDOT > Getting Started + 4 Search Getting Started | Navigate 🔻 |
| Start Distance | Organize 🔻 New folder 🔠 🔻 🔞 | |
| Ç 30 | Downloads Name Date modified Type Size | |
| Default | Recent Places Recent Places Start and Stop in profile 11/28/2012 3:07 PM ProVAL Project 292 KB Documents Music Pictures Videos Videos Computer Local Disk (C:) Data (D:) VorkProgramS (| |
| 0 (i) 0 (ii) | State Studies (\\ - File name: Section 1 | |
| ≝ -20 -30 | Save as type: ProVAL Project (*.pvp) | |
| 0 | Hide Folders Save Cancel | 20,000 |

_ **D** _ X 妎 Section 1 - ProVAL 3.4 Add Section Show Events P Options 0 <u> 문</u> 문 권 1 Use Mileposts 🔞 Screenshot Remove Section Viewer Editor Analysis Analysis Close Add Files Save Report 0 🔀 Units 🕜 Help 🔜 Export Section RQ rojec Close Project ctions -File Start and Stop in profile Navigate • Start Distance (ft) Stop Distance (ft) Length (ft) Type Name ₿ 3000.00 4999.91 1,999.91 Generic - Section 1 Default Full -🔶 🚍 💁 💁 - 🖉 🔶 £ 10 0) 0 - 10 - 20 -30 -0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 Distance (ft) Left Elevation Right Elevation 📩 Generic -

3.7 Select **Close Project** on the **ProVAL icon** dropdown menu.

Open Cropped File

3.8 Select **Section 1** from its saved location then click **Open**.

3.9 Select **Editor** from the **View** Group. Choose the file **Start and Stop in Profile**. Select **Sections** in the **Navigate** tab.

View Cropped File

3.10 View the previously created section.

3.11 Close project and discard changes.

Smoothness Assurance

The Smoothness Assurance (SAM) function is used to calculate and graph the short continuous interval and long continuous interval MRI values.

Open File for Analysis

4.1 Open the **ProVAL Manual SAM Example** file in the **ProVAL Training MDOT** folder. <u>Note: Refer</u> to pages 101-123 in the User's Guide for more information on Smoothness Assurance and grinding.

4.2 Select the **Analysis** dropdown in the **View** group. Then click on **Smoothness Assurance**.

Select Appropriate Template

4.3 Click the **Template** button and select **Category B** and then click **Apply**. <u>Note: Refer to the MDOT</u> <u>MRI Specification for more information on pavement categories.</u>

| 🔊 ProVAL Manual SA | M Example - ProVAL 3.4 | 4 | | | | | | |
|---|------------------------|----------------|-----------------|--|--|-----------------------------|--------------|------------|
| Close Add Files S Project Project | iave Report | Editor Kiew | Analysis Pro | File Selection Show Ev Show Ev Use Mil Wits Disp | vents eposts ay Help Tools | Template Auto Grind Strateg | gy Locations | |
| Smoothness A | Assurance | | | | | MDOT Category B | Apply | Navigate 🔻 |
| Ride Quality | | | | File | Profiles Section A | MDOT Category A | Edit | |
| Ride Ouality Index | | MRI | • | ProVAL SAM Example | Left + Right Full 👻 | MDOT Category C | Save | |
| Analysis | Segment Length | Threshold | Histogram | | | New | Delete | |
| | (ft) | (in/mi) | | | | | | |
| Short Continuous | 25 | 100 | Histogram | | | | | |
| Long Continuous | 528 | 100 | Histogram | | | | | |
| Fixed Interval | 528 | 100 | | | | | | |
| | | | | | | | | |
| Comparison | | | | | | | | |
| Туре | None | | * | | | | | |
| Straightedge Length | (ft) | | 10.00 | | | | | |
| | | | | | | | | |
| Filter | | | None | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Apply 250mm Filter & Histogram Settings

Note: Filter & Histogram settings for each project category are included when importing templates as displayed in sections 1.23 & 1.24. Therefore, disregard sections 4.4 - 4.7 if template has been applied.

4.4 Check the **File** box and the **Apply 250mm Filter** box (if necessary based on type of profiler used to collect data). **Segment length** should always be 25' for short continuous, 528' for long continuous, and 528' for fixed interval. Next, click on <u>Histogram</u> next to **Short Continuous**. *Note: Refer to pages 59-61 in the User's Guide for more information on filtering*.

| ProVAL Manual SAM Example * - ProVAL 3.4 | |
|--|---|
| Close Add Files Save Report Project Project Project | Template Auto Grind Strategy Locations |
| Smoothness Assurance: Inputs | Analyze Grind Navigate 💌 |
| Ride Quality | File Profiles Section Apply 250mm Filter |
| Ride Quality Index MRI 👻 | ProVAL SAM Example Left + Right Full V |
| Analysis Segment Length Threshold Histogram (ft) (in/mi) | ₹ 7 |
| Short Continuous 25 140 Histogram | |
| Long Continuous 528 90 Histogram | |
| Fixed Interval 528 90 | |
| | |
| Comparison | |
| Two | |
| Type None * | |
| Straightedge Length (ft) 10.00 | |
| Filter None | |
| | |
| | |
| | |
| | |
| | |
| | |

4.5 For the Short Continuous Histogram, change the **Lower Bound (in/mi)** to 0.00, the **Upper Bound** (in/mi) to 200.00, and the **Class Interval (in/mi)** to 5.00 then click **OK**. <u>Note: The default Class</u> <u>Interval setting is 10.00 in/mi, but it must be 5.00 in/mi to correctly perform the pay incentive</u> <u>calculations.</u>

| Histogram | |
|------------------------|--------|
| Lower Bound (in/mi) | 0.00 |
| Upper Bound (in/mi) | 200.00 |
| Class Interval (in/mi) | 5.00 |
| ОК | Cancel |

4.6 Click on <u>Histogram</u> next to **Long Continuous**.

| 🔗 ProVAL Manual S/ | AM Example * - ProVAL 3 | 3.4 | | 1 | and a Manage | | | | | | × |
|---------------------------------------|-------------------------|------------------------------|------------------|---------------------------------|---|---|--------------------|-----------------|--------------|----------|---|
| Close Add Files Project Project | Save Report | Editor Analys SAM View | Analysis Pr | 는 몸 크 이 이 ofile Selection | Show Events Use Mileposts Units Display | Options Screens Help Tools | Template Auto | o Grind Strateg | ay Locations | | |
| Smoothness / | Assurance: Inpu | uts | | | | | | Analyze | Grind | Navigate | ~ |
| Ride Quality | | | | File | Profiles | Section | Apply 250mm Filter | | | | |
| Ride Quality Index | | MRI | | ProVAL S | AM Example Left + Rig | ht Full 👻 | V | | | | |
| Analysis | Segment Length (ft) | Threshold (in/mi) | Histogram | | | | | | | | |
| Short Continuous | 25 | 140 | <u>Histogram</u> | | | | | | | | |
| Long Continuous | 528 | 90 | <u>Histogram</u> | | | | | | | | |
| Fixed Interval | 528 | 90 | | K. | | | | | | | |
| Comparison | _ | | _ | | e. | | | | | | |
| Туре | None | | ÷ | | | | | | | | |
| Straightedge Length | (ft) | | 10.00 | | | | | | | | |
| Filter | | | None | | | | | | | | |

4.7 For the Long Continuous Histogram, change the Lower Bound (in/mi) to 0.00, the Upper Bound (in/mi) to 120.00, and the Class Interval (in/mi) to 5.00 then click OK. <u>Note: The default Class</u> Interval setting is 10.00 in/mi, but it must be 5.00 in/mi to correctly perform the pay incentive calculations.

| Histogram | |
|------------------------|--------|
| Lower Bound (in/mi) | 0.00 |
| Upper Bound (in/mi) | 120.00 |
| Class Interval (in/mi) | 5.00 |
| ОК | Cancel |

4.8 Once the desired boxes are checked (or correct template has been applied) and the histogram settings are correct, select **Analyze**.

| 🔗 ProVAL Manual S | AM Example * - ProVAL 3 | 3.4 | | - | and in the owner. | | | | |
|---------------------------------------|-------------------------|----------------------|-------------|------------------------------------|---|---|-------------------|---------------------------------------|--------------|
| Close Add Files Project Project | Save Report | Editor SAM | is Analysis | 한 폭 클 [] 이 Profile Selection | Show Events Use Mileposts Units Display | Option Screen Help Tools | ishot | tuto Grind Strategy Locat Analysis | ions |
| Smoothness | Assurance: Inpu | uts | | | | | | Analyze Grind | I Navigate 🔻 |
| Ride Quality | | | | File | Profiles | Section | Apply 250mm Filte | er 🔍 | |
| Ride Quality Index | | MRI | | ProVAL S | AM Example Left + R | ght Full 👻 | V | | |
| Analysis | Segment Length (ft) | Threshold (in/mi) | Histogram | | | | | | |
| Short Continuous | 25 | 140 | Histogram | | | | | | |
| Long Continuous | 528 | 90 | Histogram | | | | | | |
| Enved Interval | 528 | 90 | | | | | | | |

Short Continuous Analysis

The short continuous interval uses a base length of 25 feet to analyze a road profile and produce MRI values. This short interval is necessary to guard against any sudden surprises (bumps/dips) on the pavement.

4.7 To view the short continuous graph, click **Short Continuous** under the **Navigate** tab.

4.8 Short Continuous graph will appear. Areas above the allowable short continuous MRI threshold values are listed to the left of the graph.

4.9 Click on Short Continuous Histogram under the Navigate tab.

4.10 Short Continuous Histogram will appear. Numerical values are displayed to the left of the graph.

Long Continuous Analysis

The long continuous interval is uses a base length of 528 feet to analyze a road profile and produce MRI values. This long interval is used to set the overall quality of the pavement.

4.11 Click on Long Continuous under the Navigate tab.

4.12 Long Continuous graph will appear. Areas above the allowable long continuous remove and replace MRI threshold values are listed to the left of the graph.

4.13 Click on Long Continuous Histogram under the Navigate tab.

4.14 Long Continuous Histogram will appear. Numerical values are displayed to the left of the graph.

Reporting for Smoothness Assurance

4.15 To view data in a report format, click **Report** in the **View** group.

4.16 Select the desired file format (**PDF**, **Excel**, **or Text**), choose a filename/folder to save report, then click **Select**.

| 🔗 ProVAL Man | ual SAM Example | e * - ProVAL 3.4 | | | | | | | | | × |
|--------------------------------|------------------|------------------|-----------------------|----------------------|--|--|----------------|----------------|-----------|--------|-----|
| Close Add Fil Project Pr | les Save Repo | nt Viewer Editor | Analysis SAM ew | Profile Selection | Show Events Use Mileposts Units Display | Options Screenshot Help Tools | Template Auto | Grind Strategy | Locations | | |
| Smoothne | ess Assuran | ice: Long Con | itinuous His | togram | | | Analyze | Grind | Na | vigate | - |
| Total % Out of S | pec (No Grinding | g) O. | .23 Report | r for reports | | × | | | | | |
| Max MRI | Min MRI | No Grinding | ▲ D:\Pr | oVAL Training MD | OT - Version 3.2\Smo | othness Assurance | | | | | |
| (in/mi) | (in/mi) | (%) | | | | Colord | | | | | |
| 120.00 | 120.00 | 0.00 | | | | Select | | | | | |
| 120.00 | 115.00 | 0.00 | | rlude all data (slov | ver) | | | | | | |
| 110.00 | 105.00 | 0.00 | | .idde all data (slow | very | [| | | | | |
| 105.00 | 100.00 | 0.00 | = | × | | 人 | | | | | |
| 100.00 | 95.00 | 0.00 | | XLS | TXT | PDF | | | | | |
| 95.00 | 90.00 | 0.00 | | Excel | Text | | | | | | |
| 90.00 | 85.00 | 0.00 | | | | | | | | | |
| 85.00 | 80.00 | 0.00 | | | | | | | | | |
| 80.00 | 75.00 | 0.00 | 40 | | | | | | | | |
| 75.00 | 70.00 | 0.23 | 30 | J | | | | | | | |
| 70.00 | 65.00 | 1.66 | 20 | | | | | | | | |
| 65.00 | 60.00 | 2.67 | 10 | | | | | | | | |
| 60.00 | 55.00 | 5.06 | 10 | | | | | | | | |
| 55.00 | 50.00 | 6.88 | 0, | 10 | 20 30 | 40 50 | 60 | 70 | 80 | 90 | 100 |
| 50.00 | 45.00 | 16.04 | - | | | Occurrences - N | o Grinding (%) | | | | |

Grinding Simulation

ProVAL has the capability to perform a grinding simulation that will help predict the post-grinding MRI values.

- ProVAL Manual SAM Example * ProVAL 3.4 _ 0 J Options Show Events 4 🗖 😏 *-*3 % + NW <u> 문 폭</u> 립 🗌 Use Mileposts Screenshot Close Add Files Save Report Viewer Editor Analysis Project SAM 0 Template Auto Grind Strate 🔀 Units 🕜 Help Smoothness Assurance: Long Continuous Histogram Navigate Inputs Total % Out of Spec (No Grinding) 0.00 Grinding Short Continuous 130 Max MRI (in/mi) No Grinding (%) Min MRI Long Continuous 120 (in/mi) Fixed Interval ~ 120.00 0.00 110 120.00 115.00 0.00 Short Continuous Histogram 100 115.00 110.00 0.00 Long Continuous Histogram 110.00 105.00 0.00 90 105.00 100.00 0.00 100.00 95.00 0.00 80 95.00 90.00 0.00 (inclusion) 70 90.00 85.00 0.00 MRI (ir 85.00 80.00 0.00 60 80.00 75.00 0.00 50 75.00 70.00 0.23 40 70.00 65.00 1.66 65.00 2.67 60.00 30 60.00 55.00 5.06 20 55.00 50.00 6.88 50.00 45.00 16.04 10 45.00 40.00 38.52 0 35.00 40.00 26.86 10 20 30 40 50 60 70 80 90 100 0 35.00 30.00 2.10 Occurrences - No Grinding (%)
- 4.17 Select **Grinding** under the **Navigate** tab.

4.18 Select **Auto Grind** from the **Analysis** group. Note: The settings for the grinding simulation (left center of screen under **Grinder** heading) can be changed as needed.

| ProVAL Manual SAM Example * - ProVAL 3.4 | | | | | | | | | | | | |
|--|---|--|--|--|--|--|--|--|--|--|--|--|
| Close Add Files Save Report Project Project | is Analysis Profile Selection | Options Screenshot Help Tools Auto Grind Strategy Locations Analysis | | | | | | | | | | |
| Smoothness Assurance: Grinding | | | | | | | | | | | | |
| Grinder Grinder Type 18-foot Wheelbase | Enabled Start Stop Direction Distance (ft) Distance (ft) | Head Height Warning Length (in) (ft) | | | | | | | | | | |
| Maximum Grinding Depth (in) 0.30 | > V 12.49 35205.26 Forward | 0.00 n/a 35192.77 | | | | | | | | | | |
| Head Position 0.50 Wheelbase (ft) 18.00 | | | | | | | | | | | | |
| Tandem Spread (ft) 2.49 | T. t. (Council (6) 25102 | | | | | | | | | | | |
| | Total Ground (It) | | | | | | | | | | | |
| (i) c) | | | | | | | | | | | | |
| ↓ 2,000 4,000 5,000 8,000 10,000 3 | 12,000 14,000 16,000 18,000 20,000 22,000 24 Distance (ft) | ,,uuu 20,uuu 20,uuu 30,uuu 32,uuu 34,uuu 30,uuu 38,000 40,000 ♥ | | | | | | | | | | |

4.19 The graph on the bottom of the screen highlights, in orange, the areas that grinding should occur. The numerical values of the locations for grinding are displayed in a chart in the center portion of the screen.

| ProVAL Manual SAM Example * - ProVAL 3.4 | | | - | | | | | | - | | | |
|---|-----------|-----------------------------------|------------------------|-------------------------|----------------------|---------------------|-------------|--|---|--------|--|--|
| Close Add Files Save Report Project - Project Viewer Editor Anat Viewer Viewer | rsis M | sis Analysis Profile Selection | | Show Events Show Events | vents eposts v | Coptions | ot Templ | Template Auto Grind Strate Analysis | | ns | | |
| Smoothness Assurance: Grinding | | | | | | | | | | | | |
| Grinder | | Enabled | Start Distance (ft) | Stop Distance (ft) | Direction | Head Height (in) | Warning | Length (ft) | | ▲ = | | |
| Grinder Type 18-foot Wheelbase + | > | V | 17.80 | 91.70 | Forward | 0.00 | n/a | 73.90 | | | | |
| Maximum Grinding Depth (in) | | × | 3424.49 | 3449.17 | Forward | 0.00 | n/a | 24.68 | | | | |
| Head Position 0.50 | | V | 3458.37 | | Forward | 0.00 | n/a | 5.79 | | | | |
| Wheelbase (ft) | | | 3493.35 | 3503.69 | Forward | 0.00 | n/a | 10.34 | | | | |
| Tandem Spread (ft) 2.49 | | | 3519.04 | 3532.23 | Forward | 0.00 | n/a | 13.19 | | - | | |
| Short Cutoff Wavelength (ft) 0.820 |] To | tal Ground | (ft) | | 428 | | | | | | | |
| ← ⇒ ♀ • !! 🔒 🔒 🎒 | | | | | | | | | | | | |
| | | | | | | | | | | - | | |
| (y y y y y y y y y y y y y | | | | | | | | | | | | |
| • | | | | | | | | | | Þ | | |

4.20 To apply the grinding simulation to the short continuous and long continuous MRI graphs, select **Grind** as shown below.

Long Continuous Grinding Comparison

4.21 Select Long Continuous under the Navigate tab.

| ProVAL Manual SAM Example * - | ProVAL 3.4 | | | | | | | | | _ | | |
|---|------------------------|--|----------------------------------|--|---|--|--|--|---|----------|-------------|--|
| Close Add Files Save Report Project | Viewer Editor An S | alysis SAM | is Analysis Profile Selection | | Show Ev | vents eposts v | Coptions | t Templ | Template Auto Grind S Analys | | 3 trateg | y Locations |
| Smoothness Assurance: Grinding | | | | | | | | | | | | |
| Grinder Grinder Type 18-foot W Maximum Grinding Depth (in) Head Position Wheelbase (ft) Tandem Spread (ft) | /heelbase 0. 0. 18. 2. | > .30 .50 .00 .49 | Enabled V V V V V | Start Distance (ft) 17.80 3329.50 3424.49 3458.37 3493.35 3519.04 13079.11 | Stop Distance (ft) 91.70 3368.07 3449.17 3464.16 3503.69 3532.23 | Direction Forward Forward Forward Forward Forward | Head Height (in) 0.00 0.00 0.00 0.00 0.00 0.00 | Warning n/a n/a n/a n/a n/a - /- | Length (ft) 73.90 38.57 24.68 5.79 10.34 13.19 | 1 | V | Inputs Grinding Short Continuous Long Continuous Fixed Interval Short Continuous Histogram Long Continuous Histogram |
| Short Cutoff Wavelength (ft) (i) (i) | 0.8 | 320 Tot | tal Ground | 0 16,000 18 | ,000 20,000 Distance (f | 428 22,000 2 t) | 4,000 26,000 | 28,000 | 30,000 3 | Distance | (ft): 2 | 26150.5400 Elevation (in): 28.3495 |

4.22 The red line represents the long continuous MRI **before grinding** and the blue line represents the long continuous MRI **after grinding**. Notice the improvement in roughness values after grinding. <u>Note: The reason that the grinding was simulated around in these three locations is because these areas had some bumps/dips that exceeded the short continuous threshold as seen in sections 4.26 - 4.29.</u>

| ProVAL Manual SAM Example * - ProVAL 3.4 | | |
|---|--|---|
| Close Add Files Save Report Project Project Viewer Editor SAM | S Analysis Profile Selection Profile Selection | Auto Grind Strategy Locations Analysis |
| Smoothness Assurance: Long Continue | bus | Analyze Grind Navigate |
| No Grinding | ← → Q Q. | |
| Start Stop MRI (in/mi) Distance (ft) Distance (ft) (in/mi) | 90 80 75 70 65 50 65 50 65 50 65 50 65 50 65 50 65 50 65 50 65 50 65 50 65 50 65 60 65 60 65 60 60 60 60 60 60 60 60 60 60 | 0,000 25,000 30,000 35,000 |

4.23 Select Long Continuous Histogram under the Navigate tab.

4.24 The values for **Total % Out of Spec** before and after grinding are displayed below. This shows the estimated values for the long continuous MRI before and after grinding the pavement's rough areas.

| ProVAL | Manual SA | M Example * - | ProVAL 3.4 | | A 199 | | | | | | - | | | 1 X |
|--------------------|-----------------------|--------------------|--------------------------|----------------|----------------------|------------------------|------------------|--|-----------------------|--------------------------|--------------|--------|----------|-----|
| Close A Project | dd Files S Project | ave Report | Viewer Editor Sy View | alysis AM | is Profile Selection | Show Ever Use Milep | nts osts v | Options Screenshot Help Tools | Template | Auto Grind S Analysis | trategy Loca | ations | | |
| Smoot | hness A | ssurance | : Long Contin | nuous Hi | istogram | | | | | Analyze | Gri | nd | Navigate | • |
| Total % Ou | it of Spec (I | No Grinding) | 0.00 | | | | | | | | | | | |
| Total % Ou | it of Spec (/ | After Grinding) | 0.00 | 150 - | | | | | | | | | | |
| Max MRI (in/mi) | Min MRI (in/mi) | No Grinding (%) | After Grinding | | | | | | | | | | | |
| 00 | 120.00 | 0.00 | 0.00 | €100 | | | | | | | | | | |
| 120.00 | 115.00 | 0.00 | 0.00 | E L | | | | | | | | | | |
| 115.00 | 110.00 | 0.00 | 0.00 | ₩ 50 | | | | | | | | | | |
| 110.00 | 105.00 | 0.00 | 0.00 | | | | | | | | | | | |
| 105.00 | 100.00 | 0.00 | 0.00 | | | | | | | | | | | |
| 100.00 | 95.00 | 0.00 | 0.00 | 0 - | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 95.00 | 90.00 | 0.00 | 0.00 | | | | | Occurren | ces - No Grin | ding (%) | | | | |
| 90.00 | 85.00 | 0.00 | 0.00 | | | | | | | | | | | |
| 85.00 | 80.00 | 0.00 | 0.00 | 666 |) | | | | | | | | | |
| 80.00 | 75.00 | 0.00 | 0.00 | | | | | | | | | | | |
| 75.00 | 70.00 | 0.23 | 0.00 | 150 | | | | | | | | | | |
| 70.00 | 65.00 | 1.66 | 0.53 | | | | | | | | | | | |
| 65.00 | 60.00 | 2.67 | 2.43 | €100 | | | | | | | | | | |
| 60.00 | 55.00 | 5.06 | 5.05 | | | | | | | | | | | |
| 55.00 | 50.00 | 6.88 | 6.18 | ĕ. | | | | | | | | | | |
| 50.00 | 45.00 | 16.04 | 17.34 | ≥ 501 | | | , | | | | | | | |
| 45.00 | 40.00 | 38.52 | 39.32 | | | | | | | | | | | |
| 40.00 | 35.00 | 26.86 | 27.08 | 0 J | 10 | 20 | 20 | 10 | 50 | 60 | 70 | | 00 | 100 |
| 35.00 | 30.00 | 2.10 | 2.07 | 0 | 10 | 20 | 50 | 40 Occurrenc | ⊃U es - After Griv | oding (%) | 70 | 80 | 90 | 100 |
| 20.00 | 25.00 | 0.00 | 0.00 | | | | | occurrenc | es - Aiter Gri | iung (/o) | | | | |

Short Continuous Grinding Comparison

4.25 Select Short Continuous under the Navigate tab.

4.26 The red line represents the short continuous MRI **before grinding** and the blue line represents the short continuous MRI **after grinding**.

| ProVAL Manual S | AM Example * - Pro | VAL 3.4 | - | | | | | - | |
|--|---|--|------------------------------------|-------------------|--|--|------------------------------|-------------------|------------|
| Close Add Files Project Project | Save Report t | ver Editor A | Analysis SAM | Profile Selection | Show Events Use Mileposts Units Display | Options Screenshot Help Tools | Template Auto Gri | ind Strategy Loca | tions |
| Smoothness | Assurance: S | hort Con | itinuous | | | | Analyze | Grind | Navigate 🔻 |
| No Grinding Start Distance (ft) 3,509.79 14,050.89 14,106.39 27,394.89 | Stop Distance (ft) 25.77 3,538.06 14,070.84 14,107.31 27,412.38 | MRI (in/mi) 208.63 184.04 179.10 141.25 165.30 | 200 180 160 140 | | | | | | |
| After Grinding Start Distance (ft) 12.49 27,400.67 | Stop Distance (ft) 24.06 27,401.77 | MRI (in/mi) 198.75 140.78 | E 120 100 60 40 0 0 | 5,000 | 10,000 15, | 000 20,000 Distance (ft o Grinding | 25,000) ther Grinding | 30,000 35, | 000 40,000 |

4.27 This is a zoomed in view of the 13,950 ft to 14,250 ft interval. Notice the MRI improvement after the grinding simulation. This bump/dip is now within the allowable MRI threshold.

4.28 Select Short Continuous Histogram from the Navigate tab.

4.29 The values for **Total % Out of Spec** before and after grinding are displayed below. This shows the estimated values for the short continuous MRI before and after grinding the pavement's rough areas.

Quality Assurance Check

Before a contractor profiles on a jobsite, they are required to check the accuracy of their profiler at one of the MDOT control sections. The contractor must make five runs of the control section and their data will be compared to MDOT's data using the Profiler Certification feature in ProVAL. <u>Note: Refer to</u> pages 85-88 in the User's Guide for more information on the Quality Assurance Check.

Processing Data

5.1

| 4 | | | |
|---|-------------------|---------------------|---------------------------------------|
| Ø Open | | | X |
| 🚱 🔵 🗢 📕 « Data (D:) 🕨 ProVAL Training MDOT 🕨 Profiler Certification | | Search Profiler Cer | tification 🔎 |
| Organize 🔻 New folder | | 885 | • 🔳 🔞 |
| Favorites | Date modified | Туре | Size |
| Desktop Downloads Recent Places Documents Music Fitures | 4/26/2011 2:47 PM | ProVAL Project | 253 KB |
| Videos Computer Local Disk (C:) Data (D:) Q= WorkProgram\$ (\\RSCH: ← < | m | | , |
| File name: Profiler Certification | • | ProVAL Project (*.p | /p;*.pv3;*.p [,] ▼ Cancel |

5.1 Click **Profiler Certification** under the **Analysis** tab in the **View** group. Contractor's profile runs of control sections will be compared to MDOT's profile runs by using Profiler Certification function.

5.2 Check the box next to each run and select a basis for comparison. In this case, the basis runs are from the walking profiler which tests only one wheel path at a time. Therefore, check the **Basis** box next to each of the walking profiler runs.

| Profiler Certification * - ProVAL | 3.4 | - | | - | | | | | | | x |
|--|---------------|-----------------|--------------|--------------------|--------------------|--|---|----------|---------|----------|---|
| Close Add Files Save Report Project | Viewer Editor | Analysis PCM | iis | | ▼ S □ U 22 U | how Events Ise Mileposts Units • | Options Screenshot Help | Template | | | |
| Project | Vie | EW | Profile Se | lection | <u>10</u> | Display | Loois | Analysis | | | |
| Profiler Certification | | | | | | | | | Analyze | Navigate | W |
| Maximum Offset (ft) | 5.00 | File | Profiles | Basis | Run | Sample Interval (| in) | | | | |
| | | LWP1 | Left | V - | | 0.999 | 996 | | | | |
| Minimum Repeatability (%) | 92 | Path0404A | Left + Right | | 1 | 1.489 | 352 | | | | |
| Minimum Accuracy (%) | 90 | v path0404B | Left + Right | (FT) | 2 | 1.489 | 352 | | | | |
| | | path0404C | Left + Right | 1 | 3 | 1.489 | 352 | | | | |
| Basis Filter | | path0404D | Left + Right | (E ¹¹) | 4 | 1.489 | 352 | | | | |
| IRI (with 250mm Filter) | | path0404E | Left + Right | | 5 | 1.489 | 352 | | | | |
| Comparison Filter | | RWP1 | Right | V | | 0.999 | 996 | | | | |
| IRI (with 250mm Filter) | | | | | | | | | | | |

5.3 If data has already been filtered, the filters must be turned off. To turn off filter, first click IRI (with 250mm filter) next to Basis Filter. Note: Ensure that the profiler does not have a filter built into the device before using the 250mm filter.

| Profiler Certification * - ProVAL | 3.4 | - | | | | | | | 100 | | × |
|--|---------------|-----------------|-------------------|---------|--------------------|---|--|----------------------|---------|----------|---|
| Close Add Files Save Report Project | Viewer Editor | Analysis PCM | sis Profile Se | lection | ▼ S □ U 22 9 | how Events Jse Mileposts Units + Display | Options Screenshot Help Tools | Template Analysis | | | |
| Profiler Certification | | | | | | | | | Analyze | Navigate | • |
| Maximum Offset (ft) | 5.00 | File | Profiles | Basis | Run | Sample Interval | in) | | | | |
| | | VLWP1 | Left | V | | 0.999 | 996 | | | | |
| Minimum Repeatability (%) | 92 | 😨 path0404A | Left + Right | | 1 | 1.489 | 352 | | | | |
| Minimum Accuracy (%) | 90 | 😨 path0404B | Left + Right | 1 | 2 | 1.489 | 352 | | | | |
| | | path0404C | Left + Right | 1 | 3 | 1.489 | 352 | | | | |
| Basis Filter | | path0404D | Left + Right | 1 | 4 | 1.489 | 352 | | | | |
| IRI (with 250mm Filter) | | path0404E | Left + Right | | 5 | 1.489 | 352 | | | | |
| Comparison Filter | _ | RWP1 | Right | V | | 0.999 | 996 | | | | |
| IRI (with 250mm Filter) | | | | | | | | | | | |

5.4 Select **None** under the **Filter Type** tab, and then click **Close**. Repeat the process for the **Comparison Filter.**

| Profiler Certification * - ProVAL 3.4 | A REAL PROPERTY AND A REAL | | |
|---------------------------------------|--|--|--------------------|
| Close Add Files Save Report | alysis Analysis | Show Events Poptions Use Mileposts Screenshot Templa | ste |
| Project - Project View | Wavelength Filter | | is |
| Profiler Certification | Filter Type | IRI - | Analyze Navigate 💌 |
| Maximum Offset (ft) 5.00 | Fil | IRI | |
| Minimum Repeatability (%) 92 | | Participation Butterworth Low-pass | |
| Minimum Accuracy (%) 90 | | T Butterworth High-pass | |
| Basis Filter | | Close | |
| IRI (with 250mm Filter) | | | |
| Comparison Filter | RWP1 Right 💟 | 0.999996 | |
| IRI (with 250mm Filter) | | | |

5.5 Once filters settings are set, click **Analyze**.

| Profiler Certification * - ProVAL | 3.4 | - | | - | | | | | | x |
|--|---------------|-----------------|----------------|----------|---------------------------|---|---|---------------------------|------------------|---|
| Close Add Files Save Report Project Project | Viewer Editor | Analysis PCM | iis Profile Se | lection | ♥ SI ■ U <u>≥</u> U | how Events Ise Mileposts Units • Display | Options Screenshot Help Tools | Template • Analysis | | |
| Profiler Certification: In | nputs | | | | | | | | Analyze Navigate | • |
| Maximum Offset (ft) | 5.00 | File | Profiles | Basis | Run | Sample Interval (| in) | | | |
| | | V LWP1 | Left | V | | 0.999 | 996 | | | |
| Minimum Repeatability (%) | 92 | 💟 path0404A | Left + Right | | 1 | 1.489 | 352 | | | |
| Minimum Accuracy (%) | 90 | 👿 path0404B | Left + Right | | 2 | 1.489 | 352 | | | |
| D | | 👿 path0404C | Left + Right | | 3 | 1.489 | 352 | | | |
| Basis Filter | | 👿 path0404D | Left + Right | | 4 | 1.489 | 352 | | | |
| None | | 💟 path0404E | Left + Right | | 5 | 1.489 | 352 | | | |
| Comparison Filter | | RWP1 | Right | V | | 0.999 | 996 | | | |
| None | | | | | | | | | | |

5.6 Certification data is displayed for left and right wheel paths. The grades (Pass or Fail) for each wheel path's repeatability and accuracy are displayed at the bottom of the area boxed in red. If the vendor does not pass in all columns at the bottom of the window, please contact Research Division and someone will investigate.

| Profiler Certifica | ion * - ProVAL 3.4 | | | |
|-------------------------------------|--|-----------------------------------|--|------------------------------------|
| Close Add Files Project Proje | Save Report t Viewer Editor Analysis A Viewer View | alysis Profile Selection | ents posts v W Help Tools | |
| Profiler Certi | fication: Summary Results | | | Analyze Navigate |
| Statistics | K | | | |
| Statistic | Repeatability - Left Repeatability - Right | Accuracy - Left Accuracy - Right | | |
| Comparison Count | 10 10 | 5 5 | | |
| % Passing | 80.00 50.00 | 100.00 100.00 | | |
| Mean | 93.94 92.24 | 94.56 93.58 | | |
| Minimum | 90.76 88.03 | 92.20 90.91 | | |
| Maximum | 96.39 96.91 | 97.24 94.98 | | |
| Standard Deviation | 1.9 2.6 | 1.8 1.7 | | |
| Grade | Passed Passed | Passed Passed | | |
| Accuracy | Repeatability - Left Correlations (%) | Repeatability - Left Offsets (ft) | Repeatability - Right Correlations (%) | Repeatability - Right Offsets (ft) |
| Run Left Right | Run 2 3 4 5 | Run 2 3 4 5 | Run 2 3 4 5 | Run 2 3 4 5 |
| 1 94 91 | 1 95 91 91 95 | 1 0.1 0.6 0.5 0.2 | 1 97 91 88 90 | 1 0.1 0.7 0.5 0.2 |
| 2 95 93 | 2 94 95 96 | 2 0.5 0.2 0.1 | 2 92 91 93 | 2 0.5 0.3 0.1 |
| 3 92 95 | 3 93 94 | 3 -0.3 -0.4 | 3 95 94 | 3 -0.2 -0.4 |
| 4 95 94 | 4 95 | 4 -0.2 | 4 92 | 4 -0.3 |
| 5 97 95 | | | | |
| | | | | |

5.7 Select **Detailed Results** under the **Navigate** tab.

| 🖉 Pro | ofiler (| Certificat | ion * - F | ProV | AL 3. | 4 | | - 66 | _ | _ | _ | _ | | | | | | | | | 1 | | | | | _ D _ X |
|---------------|----------|--------------------|-----------|--------|---------|--------|-----------|-------------------------|---------|--------|---------------------|--------|--------|--|------------------|------|--------------------|-----------------------------|----------|----------------------|---------|--------|-------|--------------|-------|-----------------|
| Clos Proje | e Ac | Id Files Projec | Save | Repo | ort | View | er Editor | Analysis PCM View | nalysis | Profi | : ≡]⊘ Ie Se | lectio | n | Show Eve Use Milep Units Displa | nts osts y | | P Op Scr Hel | tions eensh Ip ols | iot • | Template Analysis | | | | | | |
| Prof | filer | Certi | ficatio | on: | Su | ımr | nary R | esults | | | | | | | | | | | | | | Analyz | e | | | Navigate 🔻 |
| Stati | stics | | | | | | | | | | | | | | | | | | | | | | | | In | puts |
| Statis | atic | | Repea | tabili | ity - l | .eft | Repeatab | ility - Right | Accurac | y - Le | eft . | Accu | racy - | Right | | _ | _ | _ | _ | _ | _ | _ | _ | \checkmark | ' Su | immary Results |
| Com | pariso | n Count | | | | 10 | | 10 | | , | 5 | | | 5 | | | | | | | | | | | D | tailed Results |
| % Pas | ssing | | | | 8 | 0.00 | | 50.00 | | 100 | .00 | | | 100.00 | | | | | | | | | | | | |
| Mean | 1 | | | | 9 | 3.94 | | 92.24 | | 94 | .56 | | | 93.58 | | | | | | | | | | \sim | | |
| Minir | num | | | | 9 | 0.76 | | 88.03 | | 92 | .20 | | | 90.91 | | | | | | | | | / | | | |
| Maxir | mum | | | | 9 | 6.39 | | 96.91 | | 97 | .24 | | | 94.98 | | | | | | | | | | | | |
| Stand | lard D | eviation | | | | 1.9 | | 2.6 | | | 1.8 | | | 1.7 | | | | | | | | | | | | |
| Grade | e | | | | Pa | ssed | | Passed | | Pass | sed | | | Passed | | | | | | | | | | | | |
| Accu | racy | | Repe | atal | bility | r - Lo | eft Corre | lations (%) | Repe | atab | ility | - Le | ft Of | fsets (ft) | Repe | atal | oility | - Rig | ht C | orrelati | ons (%) | Repe | eatal | bility | - Rig | ht Offsets (ft) |
| Run | Left | Right | Run | 2 | 3 | 4 | 5 | | Run | 2 | 3 | 4 | 5 | | Run | 2 | 3 | 4 | 5 | | | Run | 2 | 3 | 4 | 5 |
| 1 | 94 | 91 | 1 | 95 | 91 | 91 | 95 | | 1 | 0.1 | 0.6 | 0.5 | 0.2 | | 1 | 97 | 91 | 88 | 90 | | | 1 | 0.1 | 0.7 | 0.5 | 0.2 |
| 2 | 95 | 5 93 | 2 | | 94 | 95 | 96 | | 2 | | 0.5 | 0.2 | 0.1 | | 2 | | 92 | 91 | 93 | | | 2 | 2 | 0.5 | 0.3 | 0.1 |
| 3 | 92 | 2 95 | 3 | | | 93 | 94 | | 3 | | | -0.3 | -0.4 | | 3 | | | 95 | 94 | | | 3 | ; | | -0.2 | -0.4 |
| 4 | 95 | 5 94 | 4 | | | | 95 | | 4 | | | | -0.2 | | 4 | | | | 92 | | | 4 | | | | -0.3 |
| 5 | 97 | 95 | | | | | | | | | | | | | | | | | | | | | | | | |

5.8 A detailed result summary is displayed.

| 💋 Profiler (| Certification * - | ProVAL | 3.4 | | | | | | | | | | | | | x |
|--------------|---------------------------------------|----------|------------|-------------|-------------------|-----------------|---------------|---------------------|----------|-----------------------|--------------|----------------|------|----|---------|----|
| | d Files Save | Report | Viewer | Editor Ana | | 탄폭립 De | Show | Events 1ileposts | <i>#</i> | Options Screenshot | Template | | | | | |
| Project | * | Report | viewei | PC | M + | | 🔀 Units | · · · | 0 | Help 🔹 | * | | | | | |
| | Project | | | View | P | rofile Selectio | n Di | splay | | Tools | Analysis | | | | | |
| Profiler | Certificati | ion: C | Detaileo | d Result | s | | | | | | | Analy | ze | Na | avigate | |
| Repeatab | ility - Left | | | | | | | | | | | | | | | - |
| Basis | Comparison | Correla | tion (%) | Shape Coeff | icient Roughne | s Coefficient | Offset (ft) | Basis IRI (in | /mi) | Comparison | IRI (in/mi) | IRI Difference | (%) | | | |
| path0404A | path0404B | | 95.48 | | 0.988 | 96.64 | 0.1 | | 84.29 | | 84.83 | | 0.64 | | | |
| path0404A | path0404C | | 91.21 | | 0.973 | 93.72 | 0.6 | 1 | 84.29 | | 87.11 | | 3.34 | | | |
| path0404A | path0404D | | 90.76 | | 0.988 | 91.86 | 0.5 | | 84.29 | | 84.42 | | 0.15 | | | |
| path0404A | path0404E | | 95.49 | | 0.997 | 95.77 | 0.2 | i i | 84.29 | | 84.15 | | 0.17 | | | |
| path0404B | path0404C | | 93.92 | | 0.985 | 95.34 | 0.5 | | 84.83 | | 87.11 | | 2.68 | | | |
| path0404B | path0404D | | 94.89 | | 1.000 | 94.90 | 0.2 | | 84.83 | | 84.42 | - | 0.48 | | | |
| path0404B | path0404E | | 96.39 | | 0.985 | 97.85 | 0.1 | | 84.83 | | 84.15 | | 0.80 | | | |
| path0404C | path0404D | | 92.73 | | 0.985 | 94.11 | -0.3 | | 87.11 | | 84.42 | - | 3.08 | | | |
| path0404C | path0404E | | 93.74 | | 0.970 | 96.60 | -0.4 | | 87.11 | | 84.15 | | 3.39 | | | |
| path0404D | path0404E | | 94.86 | | 0.985 | 96.31 | -0.2 | | 84.42 | | 84.15 | | 0.32 | | | |
| Repeatab | ility - Right | | | | | | | | | | | | | | | |
| Basis | Comparison | Correla | tion (%) | Shape Coeff | icient Roughne | s Coefficient | Offset (ft) | Basis IRI (in | /mi) | Comparison | IRI (in/mi) | IRI Difference | (%) | | | |
| path0404A | path0404B | | 96.91 | | 0.998 | 97.07 | 0.1 | | 80.33 | | 80.69 | | 0.44 | | | |
| path0404A | path0404C | | 90.50 | | 0.995 | 91.00 | 0.7 | 1.1 | 80.33 | | 81.45 | | 1.39 | | | |
| path0404A | path0404D | | 88.03 | | 1.000 | 88.06 | 0.5 | | 80.33 | | 81.36 | | 1.28 | | | |
| path0404A | path0404E | | 90.01 | | 0.976 | 92.23 | 0.2 | 1 | 80.33 | | 79.09 | | 1.55 | | | = |
| path0404B | path0404C | | 92.19 | | 0.993 | 92.86 | 0.5 | | 80.69 | | 81.45 | | 0.95 | | | |
| path0404B | path0404D | | 91.24 | | 0.999 | 91.36 | 0.3 | | 80.69 | | 81.36 | | 0.84 | | | |
| path0404B | path0404E | | 92.59 | | 0.977 | 94.73 | 0.1 | | 80.69 | | 79.09 | - | 1.98 | | | |
| path0404C | path0404D | | 94.65 | | 0.994 | 95.21 | -0.2 | | 81.45 | | 81.36 | | 0.11 | | | |
| path0404C | path0404E | | 94.33 | | 0.970 | 97.20 | -0.4 | | 81.45 | | 79.09 | - | 2.90 | | | |
| path0404D | path0404E | | 91.96 | | 0.976 | 94.20 | -0.3 | | 81.36 | | 79.09 | | 2.79 | | | |
| Accuracy | - Left | | | | | | | | | | | | | | | |
| Comparise | on Correlation | n (%) Sł | hape Coeff | ficient Rou | ghness Coefficier | t Offset (ft) | Basis IRI (in | /mi) Com | parisor | n IRI (in/mi) | IRI Differen | ce (%) | | | | |
| path0404A | | 93.92 | | 0.987 | 95.1 | .8 -0.6 | | 94.04 | | 84.29 | | -10.37 | | | | |
| path0404B | 1 | 94.71 | | 0.975 | 97.1 | .4 -0.5 | | 94.04 | | 84.83 | | -9.80 | | | | |
| path0404C | | 92.20 | | 0.961 | 95.9 | 9 0.1 | | 94.04 | | 87.11 | | -7.38 | | | | |
| path0404D | · · · · · · · · · · · · · · · · · · · | 94.76 | | 0.975 | 97.1 | .9 -0.2 | | 94.04 | | 84.42 | | -10.23 | | | | |
| path0404E | 1 | 97.24 | | 0.990 | 98.2 | -0.3 | | 94.04 | | 84.15 | | -10.52 | | | | |
| Accuracy | - Right | | | | | | | | | | | | | | | |
| Comparise | on Correlation | n (%) Sł | hape Coeff | ficient Rou | ghness Coefficier | t Offset (ft) | Basis IRI (in | /mi) Com | parisor | n IRI (in/mi) | IRI Differen | ce (%) | | | | |
| path0404A | | 90.91 | | 0.994 | 91.4 | -0.4 | | 92.42 | | 80.33 | | -13.08 | | | | |
| path0404B | | 93.03 | | 0.996 | 93.4 | -0.3 | | 92.42 | | 80.69 | | -12.69 | | | | |
| path0404C | | 94.78 | | 0.989 | 95.8 | 4 0.2 | | 92.42 | | 81.45 | | -11.87 | | | | |
| path0404D | | 94.22 | | 0.995 | 94.7 | 2 0.1 | | 92.42 | | 81.36 | | -11.96 | | | | Ψ. |

Reporting for Profiler Certification

5.8 To view data in a report format, click **Report** in the **View** group then choose the desired file type.

| 💉 Prot | filer Ce | ertificati | ion * - Pro | οVA | L 3.4 | 1 | | - 66 | _ | _ | _ | _ | | | | | | | | | ß | 1 | | | | | - 0 X |
|-----------------|----------|----------------------|----------------------|-------|-------|-------|----------|-------------------------|----------|-------|--------|-------|--------|--|-------------------|---------------|----------------------------|---------------------------|----------|----------------------|-----|--------|------|--------|-------|-------|--------------|
| Close Projec | Add | G Files Projec | Save Re | epo | rt \ | /iewe | r Editor | Analysis PCM View | analysis | Profi | ile Se | ectio | n | Show Eve Use Milep Units Displa | nts iosts y | 2 10 20 | Opt Scre Help Too | ions eensh p ols | iot • | Template Analysis | | | | | | | |
| Prof | iler (| Certif | ficati. ^R | lepo | ort | mn | nary R | esults | | | | | | | | | | | | | A | nalyze | | [| | Navig | jate 🔻 |
| Statis | tics | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Statist | ic | | Repeata | bilit | y - L | eft | Repeatab | ility - Right | Accurac | y - L | eft | Accu | racy - | Right | | | | | | | | | | | | | |
| Comp | arison | Count | | | | 10 | | 10 | | | 5 | | | 5 | | | | | | | | | | | | | |
| % Pass | sing | | | | 80 | 0.00 | | 50.00 | | 100 | 0.00 | | | 100.00 | | | | | | | | | | | | | |
| Mean | | | | | 93 | 3.94 | | 92.24 | | 94 | .56 | | | 93.58 | | | | | | | | | | | | | |
| Minim | ium | | | | 90 |).76 | | 88.03 | | 92 | 2.20 | | | 90.91 | | | | | | | | | | | | | |
| Maxim | num | | | | 96 | 5.39 | | 96.91 | | 97 | .24 | | | 94.98 | | | | | | | | | | | | | |
| Standa | ard Dev | viation | | | | 1.9 | | 2.6 | | | 1.8 | | | 1.7 | | | | | | | | | | | | | |
| Grade | | | | | Pas | sed | | Passed | | Pas | sed | | | Passed | | | | | | | | | | | | | |
| Accur | acy | | Repeat | tab | ility | - Le | ft Corre | lations (%) | Repe | atab | oility | - Lei | ft Of | fsets (ft) | Repe | atabi | lity · | - Rig | ht (| Correlations (| (%) | Repe | atab | oility | - Rig | ght (| Offsets (ft) |
| Run | Left | Right | Run | 2 | 3 | 4 | 5 | | Run | 2 | 3 | 4 | 5 | | Run | 2 | 3 | 4 | 5 | | | Run | 2 | 3 | 4 | 5 | |
| 1 | 94 | 91 | 1 9 | 95 | 91 | 91 | 95 | | 1 | 0.1 | 0.6 | 0.5 | 0.2 | | 1 | 97 | 91 | 88 | 90 | | | 1 | 0.1 | 0.7 | 0.5 | 0.2 | |
| 2 | 95 | 93 | 2 | | 94 | 95 | 96 | | 2 | | 0.5 | 0.2 | 0.1 | | 2 | | 92 | 91 ! | 93 | | | 2 | | 0.5 | 0.3 | 0.1 | |
| 3 | 92 | 95 | 3 | | | 93 | 94 | | 3 | | | -0.3 | -0.4 | | 3 | | | 95 | 94 | | | 3 | | | -0.2 | -0.4 | |
| 4 | 95 | 94 | 4 | | | | 95 | | 4 | | | | -0.2 | | 4 | | | 1 | 92 | | | 4 | | | | -0.3 | |
| 5 | 07 | 05 | - | | | | | | | | | | | | | | | | | | | | | | | | |

5.9 Choose the desired report format, provide a destination folder for the report to be saved, then choose **Select**.

| 💋 Profiler Certificat | ion * - ProVAL 3.4 | | _ | | | 1 | | | - • × |
|---------------------------------------|----------------------|------------------------------------|-------------------------------|--|--|----------------------|----------|--------------|------------------|
| Close Add Files Project Project | Save Report t | ver Editor Analysis PCM View | Analysis Profile Selection | ✓ Show Events ─ Use Mileposts ✓ Units ✓ ✓ Display | Options Screenshot Help Tools | Template Analysis | | | |
| Profiler Certi | fication: Sum | mary Results | | | | | Analyze | | Navigate 🛛 🔻 |
| Statistics | | ſ | Report | | × | J | | | |
| Statistic | Repeatability - Left | Repeatability - Rig | | - | | 1 | | | |
| Comparison Count | 10 | 2 | Folder for reports | | | 1 | | | |
| % Passing | 80.00 | 50 | D:\ProVAL Training MD | OT\Profiler Certification | n - 🗼 | | | | |
| Mean | 93.94 | 92 | | | Select. | | | | |
| Minimum | 90.76 | 88 | | | ociccum | | | | |
| Maximum | 96.39 | 96 | Include all data (slow | /er) | | | | | |
| Standard Deviation | 1.9 | | | | (market 1) | | | | |
| Grade | Passed | Pass | | | <u>A</u> | | | | |
| Accuracy | Repeatability - L | eft Correlations (| Excel | Text | PDF | rrelations (%) | Repeatab | oility - Rig | ght Offsets (ft) |
| Run Left Right | Run 2 3 4 | 5 | | | | | Run 2 | 3 4 | 5 |
| 1 94 91 | 1 95 91 91 | . 95 | | | | | 1 0.1 | 0.7 0.5 | 0.2 |
| 2 95 93 | 2 94 95 | 96 | 2 0.5 0.2 | 0.1 2 | 92 91 93 | | 2 | 0.5 0.3 | 0.1 |
| 3 92 95 | 3 93 | 94 🥖 | 3 -0.3 - | 0.4 3 | 95 94 | | 3 | -0.2 | -0.4 |
| 4 95 94 | 4 | 95 | 4 - | 0.2 4 | 92 | | 4 | | -0.3 |
| 5 97 95 | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Pay Incentive Calculation Procedure

Processing Data

6.1 Enter the Smoothness Assurance Module and analyze the desired file as referenced on pages 25-32 (must re-analyze if you have already performed a grinding simulation). After processing, select the Long Continuous Histogram option under the Navigate tab as referenced in sections 4.11 to 4.14. Again, the Histogram Class Interval must be 5.00 in/mi as referenced in sections 4.4 to 4.6. Once the Long Continuous Histogram is open, right click on the top row of the table on the left hand side of the screen and select Copy table to Clipboard.

6.2 Open up the Excel spreadsheet entitled **MRI Pay Incentive Template Asphalt** and right click on the box **Max MRI** and select **Paste**.

Spreadsheet Inputs

6.3 Once the table is copied into the spreadsheet, input the proper values in the boxes for **Section** Length, Surface Lift Thickness, and Unit Price.

6.4 Once both of these values have been entered into the spreadsheet, you will find the section pay incentive value in the **Incentive Pay** box.

| A | А | В | С | D | E | F | G | н | 1 | J | K | |
|----|---|-----------------|-----------------------|-----------------|---|---------|---------------|--------------|------------|---|---|--|
| 1 | | PAY INCENTIN | /E THRESHOLD | • 70 in/mi | | | | | | | | |
| 2 | | 0 | INPUTS | | | | | | | | | |
| 3 | | Sei | ction Length (feet) = | 35218.00 | | | | | | | | |
| 0 | | Surface Lift T | hickness (inches) = | 1.50 | | | | | | | | |
| - | | Julia Ce cite 1 | nickness (menes) = | 75.00 | | | | | | | | |
| 5 | | OnitP | rice (donars/ton) = | 75.00 | | | | | | | | |
| 6 | | | | | | | | | | - | | |
| / | | | | | | | | | | | | |
| 8 | | Tota | I Section Tonnage = | 3873.98 | | | | | | | | |
| 9 | | | | | | | | | | - | | |
| LO | | ProVAL | Long Continuous H | istogram | | Tonnaae | Price Before | Price After | Difference | | | |
| 1 | | Max MRI (in/mi) | Min MRI (in/mi) | No Grinding (%) | | ronnage | Adjustment | Adjustment | bijjerence | | | |
| 2 | | 88 | 120 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | T | | |
| 3 | | 120 | 115 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 4 | | 115 | 110 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 5 | | 110 | 105 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | 1 | | |
| 6 | | 105 | 100 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 7 | | 100 | 95 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 8 | | 95 | 90 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 9 | | 90 | 85 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 0 | | 85 | 80 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 1 | | 80 | 75 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | | | |
| 2 | | 75 | 70 | 0.2255497 | | 8.74 | \$655.33 | \$622.56 | -\$32.77 | 1 | | |
| 3 | | 70 | 65 | 1.656558 | | 64.17 | \$4,813.10 | \$4,813.10 | \$0.00 | - | | |
| 4 | | 65 | 60 | 2.672606 | | 103.54 | \$7,765.22 | \$7,765.22 | \$0.00 | | | |
| 5 | | 60 | 55 | 5.064443 | | 196.20 | \$14,714.66 | \$14,714.66 | \$0.00 | 4 | | |
| 5 | | 55 | 50 | 6.875663 | | 266.36 | \$19,977.14 | \$19,977.14 | \$0.00 | - | | |
| 7 | | 50 | 45 | 16.03728 | | 621.28 | \$46,596.08 | \$46,596.08 | \$0.00 | 4 | | |
| в | | 45 | 40 | 38.5168 | | 1492.13 | \$111,909.98 | \$114,148.18 | \$2,238.20 | - | | |
| • | | 40 | 35 | 26.8557 | | 1040.38 | \$78,028.83 | \$81,149.99 | \$3,121.15 | - | | |
| 0 | | 35 | 30 | 2.095401 | | 81.18 | \$6,088.16 | \$6,453.45 | \$365.29 | 4 | | |
| | | 30 | 25 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | - | | |
| - | | 25 | 20 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | - | | |
| 3 | | 20 | 15 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | - | | |
| 4 | | 15 | 10 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | - | | |
| 5 | | 10 | 5 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | 4 | | |
| 6 | | 5 | 0 | 0 | | 0.00 | \$0.00 | \$0.00 | \$0.00 | 1 | | |
| / | | | | | | | | / | | | | |
| 8 | | | | | | | Incentive Pay | (| \$5,691.88 | | | |
| 39 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 41 | | | | | | | | | | | | |
| 42 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

Power Spectral Density

Processing Data

6.1 Select **peak in PSD** in the **ProVAL Training MDOT** folder and click **Open**. <u>Note: Refer to pages</u> 79-82 in the User's Guide for more information on PSD.

| ProVAL 3.4 | ADOT - Version 3.2 > Power Spectral Density | | h Power Spectral Density BE Carlow Construction (Construction) Size L Project 145 KB L Project 584 KB L Project 309 KB | |
|-------------|---|-----------|---|--|
| <pre></pre> | ak in PSD | III ProVA | . Project (*.pvp;*.pv3;*.pr ▼ pen Cancel | |

6.2 Select **Power Spectral Density** under the **Analysis** tab in the **View** group.

6.3 Check the box next to each wheel path and set filter to desired setting, then click **Analyze**.

| 🗹 peak in PSD * - ProVAL 3.4 | | | 10000 | |
|---|---|---|---------|------------|
| Close Add Files Save Report Project Project Viewer Editor Analysis Project Viewer Viewer Viewer | sis Profile Selection | Coptions Screenshot Help Tools | | |
| Power Spectral Density | | | Analyze | Navigate 🔻 |
| Use Octave Bands Bands Per Octave 12 | File Profile Section Filter peak in PSD ☑ LElev. Full ✓ None ☑ RElev. Full ✓ None | 1 | | |
| Constant Frequency Interval (cycle/ft) 0.003048 | 11 | | | |
| 💠 🔿 🔯 🛛 Log Scale 🛛 🛍 🗃 🎒 | | | | |
| | | | | |
| | | | | |
| | | | | • |
| < | | | | • |

6.4 Displayed below is the **Slope PSD (Wave Length)** graph. Notice the peak in PSD between the 5 to 6 foot wavelength bands.

| peak in PSD * - ProVAL 3.4 | | | |
|--|---|--|------------------|
| Close Add Files Save Report Project Project Viewer Editor Analysis Project | is Profile Selection | Options Screenshot Help Tools | |
| Power Spectral Density | | Ana | alyze Navigate 🔻 |
| Use Octave Bands Bands Per Octave 12 Constant Frequency Interval (cycle/ft) 0.003048 | File Profile Section Filter peak in PSD V LElev. Full × None V RElev. Full × None | | |
| 👄 💽 Log Scale 🔒 🔚 🚑 | | | |
| 1.0e-04 | 10 100 Wave Length (ft/cycle) peak in PSD_LElev. peak in PSD_RElev | 1000 : | 10000 |
| 4 | | | • |

6.5 Click the **Log Scale** button to display the graph on a log scale. Notice the same peak in PSD between the 5 and 6 foot wavelength band.

PSD Examples

Example 1

The figures in 6.6 and 6.7 display the PSD for pavement profiles that were collected in different lanes and directions on the same project. The project consisted of an interstate mill and fill thin AC overlay. In figures 6.6 and 6.7, the vibratory roller induces content into the profile by the amplitude and frequency settings and the rate of roller travel speed. The bumps and dips cycle in and out of phase with each other between the left and right wheel paths. This is because one half lane was rolled then the other half lane was rolled with the roller traveling at slightly different speeds. This will cause a decrease in ride quality.

6.6 The graph below shows that the pavement peaks in the 5 to 8 foot wavelength band. This induced content is a wavelength band which affects vehicle suspensions, therefore increasing the MRI value.

6.7 The graph below shows that the pavement peaks in the 2.2 to 2.5 foot wavelength band. This wavelength band is mostly outside what most effects vehicle suspensions and MRI.

| Vibratory Roller Example B - ProVAL 3.4 | | | | 100 | |
|--|------------------------|---------------------------------------|---|---------|----------|
| Close Add Files Save Report Project | | Show Events Use Mileposts Units | ✓ Options i Screenshot i Help | mplate | |
| | Profile Selection | Display | Tools | naiysis | |
| Power Spectral Density | | | | Analyze | Navigate |
| ✓ Use Octave Bands | File | Profile Section | n Filter | | |
| Bands Per Octave 12 | Vibratory Roller Examp | B Left Full | <u>None</u> | | |
| Constant Frequency Interval (cycle/ft) | | Right Full | * <u>None</u> | | |
| ← → 🔍 [Log Scale] 🗞 📾 | | | | | |
| E 10-03 E 10-04 E 10-05 S 10-05 S 10-07 S 1 | | www | MMM | | |
| 0.1 1 | 10 | 100 | 1000 | 1000 | 0 100000 |
| Wave Length (ft/cycle) | | | | | |
| | | | | | |
| 4 | | | | | |

Example 2

6.8 The PSD analysis shown below is for a rough road (avg. IRI = 122 in/mile). From the peak shown by the arrow below, there appears to be an issue occurring in approximately 32 ft intervals.

| 🔗 Rough_Road * - ProVAL 3.4 | Contraction of the local division of the loc | 100 | |
|--|--|--|------------|
| Close Add Files Save Report Project Project | Image: Show Events Image: Show Events Image: Ima | ? Options] Screenshot) Help Tools | |
| Power Spectral Density | | Analyze | Navigate 🔻 |
| Image: Weight of the second | ile Profile Section Filter ough ♥ Left Elevation Full ▼ <u>None</u> ♥ Right Elevation Full ▼ <u>None</u> | | |
| ← → 🖾 [Log Scale] 😭 🚰 🧁 | / | | |
| 1.0e-03 i) 1.0e-04 iu 00 iu | many | MMM | - |
| 0.1 1 | 10 100 Wave Length (ft/cvcle) | 1000 10000 | 100000 |
| < | Rough_Left Elevation — Rough_Right Ele | evation | • |

Troubleshooting

The ProVAL 3.4 program has a few known issues that can cause the software to not function properly. You can visit the ProVAL website (<u>www.roadprofile.com</u>) for help with correcting any issues. If there are any further issues with the ProVAL software, contact the Research Division.

The following two sections explain known fixes for ProVAL issues. This information was taken directly from the Transtec Group's website.

Sending the log files

For Windows XP (Vista may be different), your log files are located here: C:\Documents and Settings\[USERNAME]\Local Settings\Application Data\The Transtec Group

For Windows 7, look here: C:\Users\[USERNAME]\AppData\Local\The Transtec Group

This location is hidden so you will probably need to <u>Show Hidden Files</u>. Send us the *Recording Log.xml* and *Event Log.xml* files, preferably zipped first. It is possible these files will not exist. If this is the case, don't fret; just go to the next step.

Remove potentially corrupted files

For all files and folders listed below, we recommend moving them to a temporary location instead of just deleting them. If you find that one of these files is causing the problem, please send it to us so we can fix the problem.

Folder: C:\Documents and Settings\[USERNAME]\Local Settings\Application Data\The Transtec Group\ProVAL 3.1

Move the *AutoRecovery* folder (if it exists and contains files). If the software does not start, continue to the next step.

Folder: C:\Documents and Settings\[USERNAME]\Application Data\The Transtec Group\ProVAL 3.1

Move *Options.xml*. If PV3 does not start, then move *Analysis Templates.pvat*. If PV3 does not start, move *Analysis Templates.pv3at* again AND continue to the next step.

Folder: C:\Documents and Settings\[USERNAME]\Application Data\The Transtec Group\ProVAL 3.0

Move *Options.xml*. If PV3 does not start, then move *Analysis Templates.pv3at*. If PV3 does not start, move *Analysis Templates.pv3at* again AND continue to the next step.

Folder: C:\Documents and Settings\[USERNAME]\Local Settings\Application Data\The Transtec Group\ProVAL 2.7

Move *Input Sets.xml*. If PV3 does not start, contact us.