HOW TO PERFROM BOUNCE TEST, BLOCK TEST AND CALIBERATE DMI

By:
Pathway Services Inc.

Pathway Services Inc.
AUTOMATED ROAD AND PAVEMENT CONDITION SURVEYS

DMI Calibration

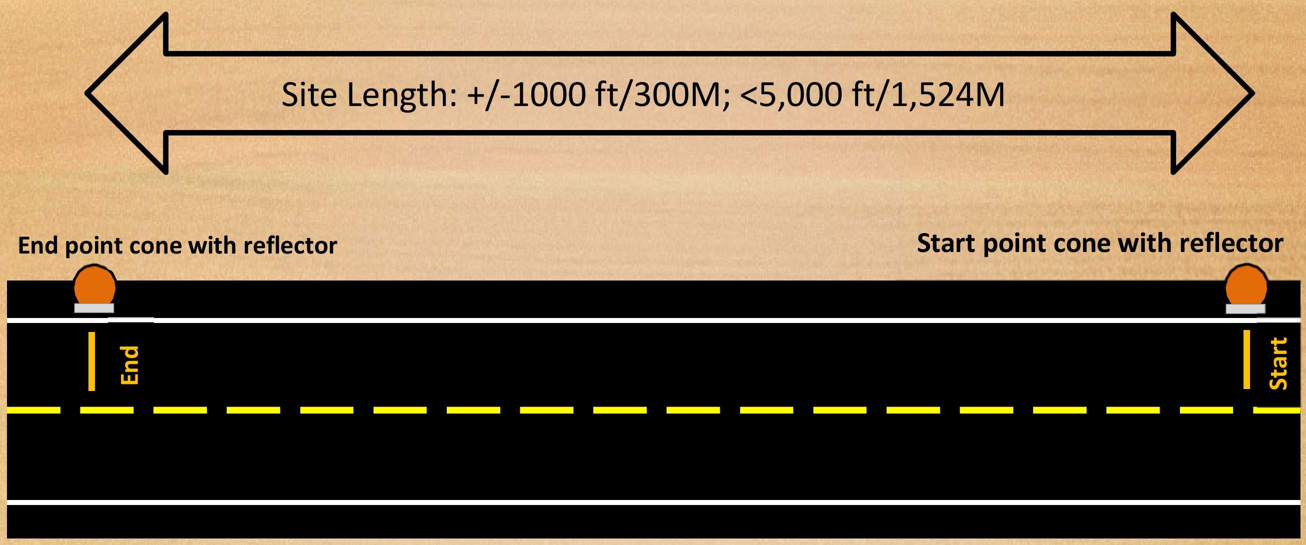
The DMI system must be calibrated from time to time. Reasons for re-calibration include tire rotation, tire replacement, time and mileage accrual. It is recommended the DMI be recalibrated every 50,000 miles/80,000 kilometers at minimum. To ensure proper calibration, a well maintained calibration site is necessary. The calibration site must be at least 1,000 feet/300 meters in length, must be flat, well maintained pavement and have as little horizontal and vertical curvature as possible. Sites longer than 5,000 feet are not recommended. Once a site has been located, very accurately and precisely, measure and mark the start and end locations for the site. (It is recommended that a professional survey crew be utilized to mark the start and end locations of the site using a steel tape or GPS positioning equipment.)

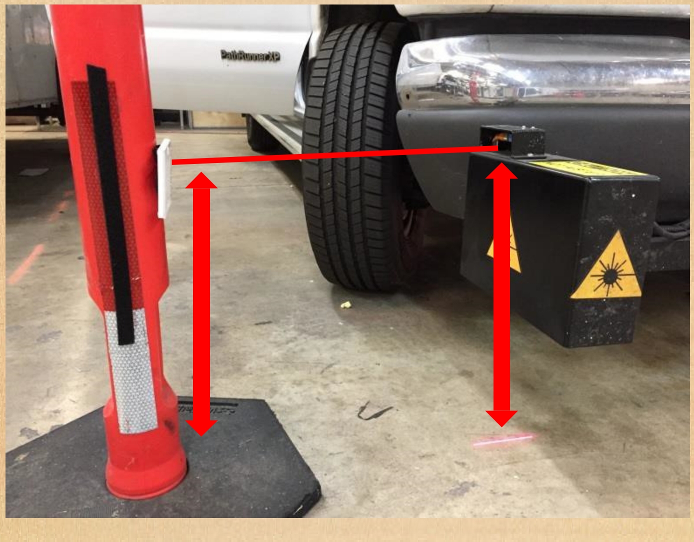
NOTE: For Pathrunners built in 2012 or after, a square rigid reflector MUST be used. The Pathrunner is equipped with a polarized photocell and will only be triggered by the square plastic photocell provided by Pathway Services, Inc. Standard reflective tape will not work. If a replacement photocell is needed, please contact Pathway Services Inc.

Step 1.

Ensure the tires are properly pressurized and have been "warmed" by being driven at highway speeds for at least 20 minutes. Place a rectangle reflector on a cone at the beginning and the end of the calibration site. It is very important the reflectors are place exactly on the measure marks of the calibration site. See picture, below. Note that the reflector is in line with the mark on the ground.

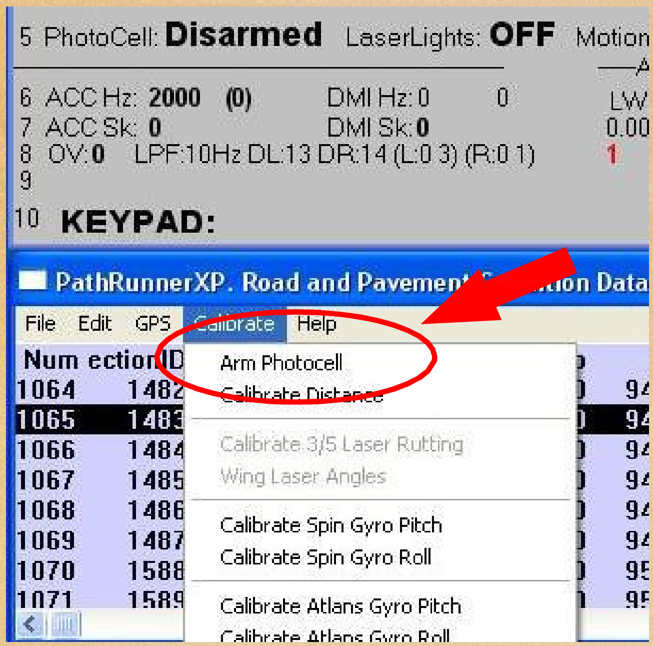
Place the reflectors on the edge of the road, a safe distance from the fog line/lane edge. Make sure the reflector is mounted to the cone at the correct height from the ground for the photocell to be triggered by the reflector.





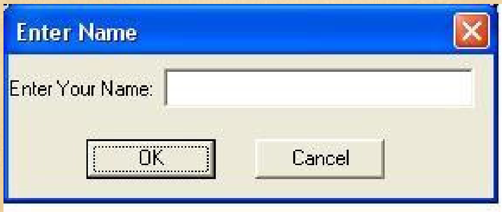
STEP 2.

Launch the Profiler computer and data collection software. Ensure the DMI is "Run" mode. Choose "Calibrate" → "Arm Photocell". Verify the photocell is armed on the Profiler screen on Line 5 of the collection software, the system should read "PhotoCell: Armed"

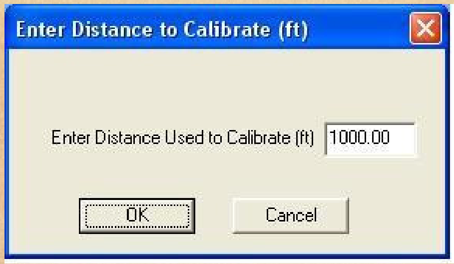


STEP 3.

Approach the DMI calibration site, and be prepared to maintain a steady speed through the entire process. Choose "Calibrate" → "Calibrate Distance". A text box will appear for the user to enter their name. Enter the user name and click "OK".

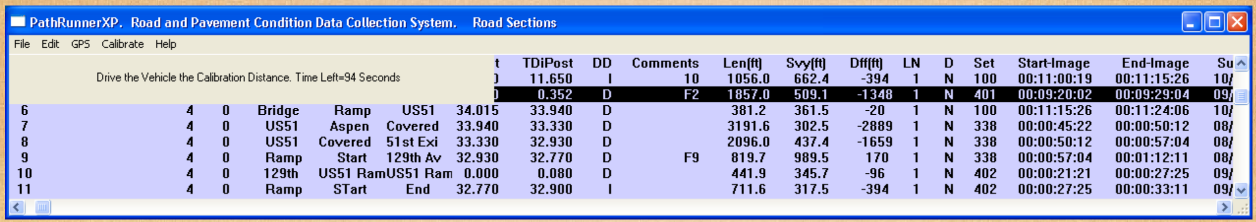


Another text box will appear for the user to enter the actual distance of the DMI Calibration site. Enter the appropriate distance to the nearest two decimals. MAKE SURE THE PROPER UNITS OF MEASURE ARE USED. Click “OK”. (The actual distance may not be 1000.00 as shown in the image, below. Ensure the actual distance of the calibration site is used.)



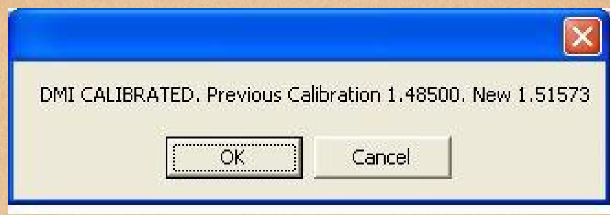
A dialogue box will appear instructing the user to advance to the start location of the DMI calibration site. WHILE the vehicle traveling toward the start location at a safe and steady speed (approximately 40 mph/65 kph), click “OK”. NOTE: It is recommended the driver utilize the cruise control feature of the vehicle for the entire calibration process. It is very important the vehicle maintain a steady speed and travels in the straightest path possible.

After the user clicks “OK”, a timer will start. The user will have 300 seconds to complete the calibration process. Once the driver travels past the first reflector, the system will give an audible alert “START”. If this alert is not given, the system has not been triggered successfully and will need to be checked.



STEP 4.

After the Pathrunner passes the end reflector, the system will automatically end the calibration process and calculate a new DMI calibration value. The new calibration value will be displayed, giving the user the option to accept or decline the new calibration value compared to the old calibration value. The new calibration value should be between 1.47 and 1.51, approximately. If the new calibration value is acceptable, click “OK”.



If the new calibration value is unacceptable, click “Cancel”. The new calibration value will be rejected, and the old calibration value will remain in place. Repeat the calibration process carefully to try to get a better calibration value. If the problem persists, there is an error with the system or the measured calibration distance is not accurate.

STEP 5.

After the calibration process is complete, verify the system is measuring the correct distance by collecting data for a known distance segment and compare the survey length with the expected length. If the surveyed length differs significantly from the expected survey length, the DMI will need to be re-calibrated.

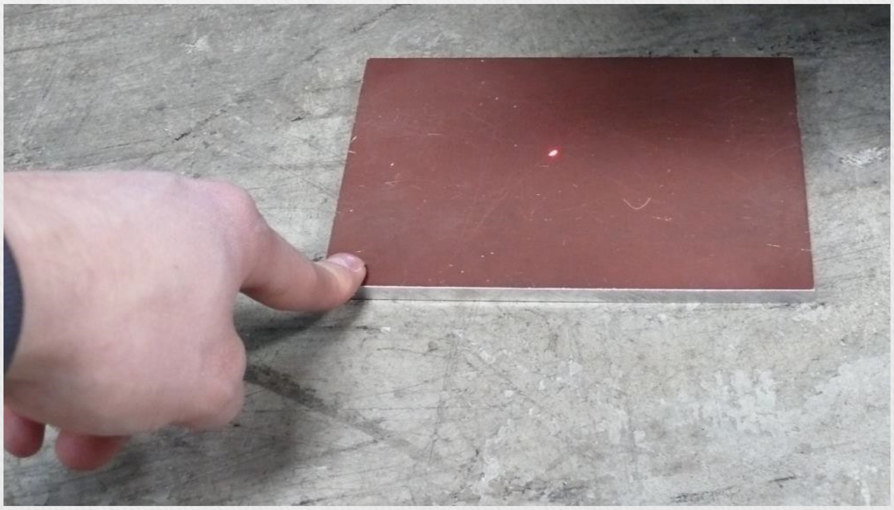
BLOCK TEST VERIFICATION

Block Test Verification

Please read this document in its entirety before performing a block test to make sure all steps are understood. The purpose of this document is to show how to perform a block test calibration with the Pathrunner XP software. This document will serve as a guide for performing a block test in compliance with AASHTO standard R56 and PP 49. The block test should be performed at least once per collection season and anytime the calibration of the wheel path lasers are suspected to have a become comprimised. Calibration with this method requires a set of calibration blocks from Pathway Services.

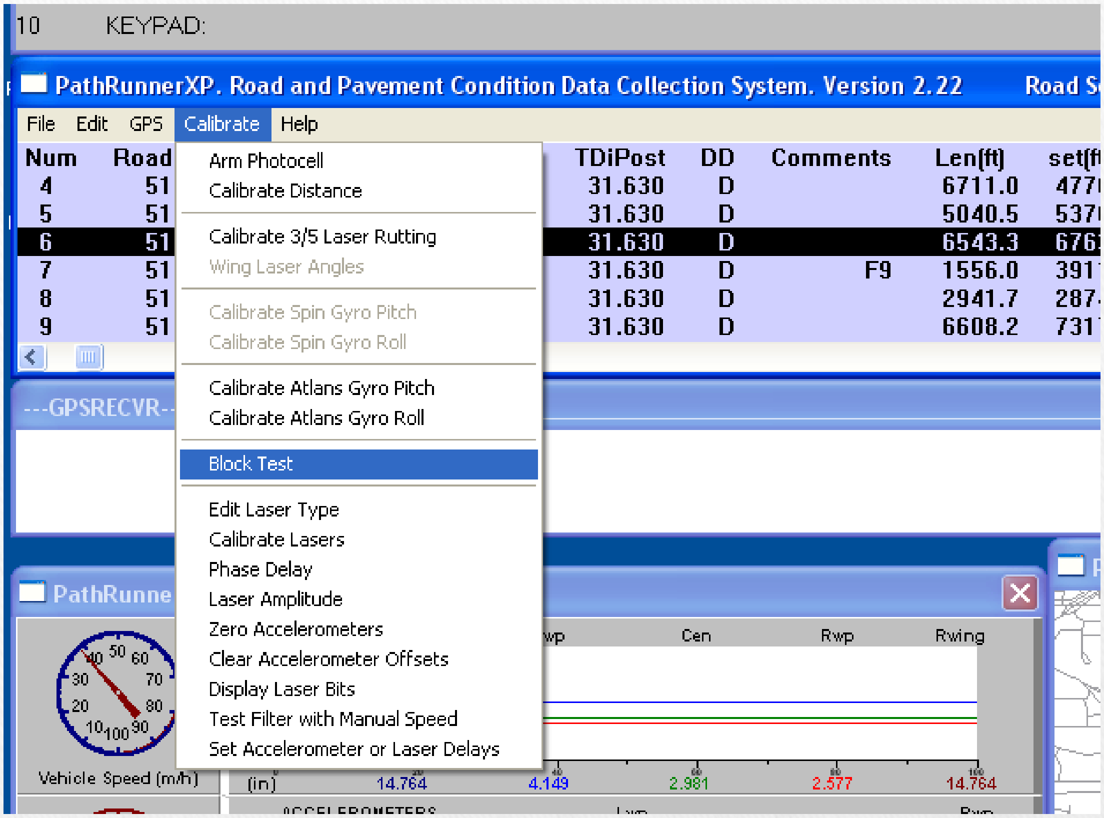
1. Plug Pathrunner into shore power with engine off. Pathrunner needs to be inside on a level floor.
2. Power up the Pathrunner and turn on the profiler software.
3. Put floor block (the wide one about ¼" thick) down under one of the lasers.
4. Check to make sure the block is on level ground by pressing on opposite corners of the block. The base plate should not move when you do this.

NOTE: If the base plate moves you can try to rotate the base plate and try again. Or move the Pathrunner to a more suitable spot.



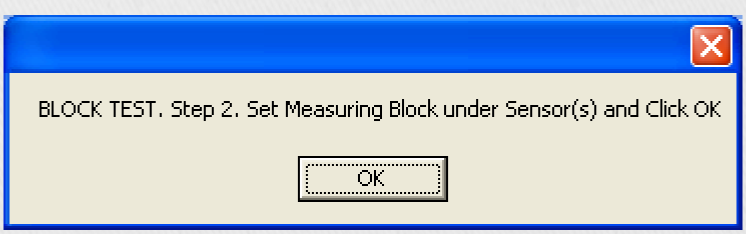
5. Once plate is down flat; stand (or sit) beside vehicle with the keyboard and the monitor turned to the passenger side for easy viewing from outside the vehicle.

6. Choose “Block Test” from the “Calibrate” menu. (NOTE: For experienced users, the following keyboard shortcut can be used to initiate the block test: Press “Alt → “C” → “B” in sequence, do not hold the “Alt” key…)



7. A message box, as shown below, will pop up. Press “Enter” on the keyboard or click “OK”.

8. A second message box will appear, as shown below.



9. Place down one of the calibration blocks under the laser.

10. Press “Enter” on the keyboard or click “OK”. A message box, as shown below, will show the absolute difference between the two readings taken.

11. Results are from left to right: (NOTE: Not every Pathrunner is equipped with all five lasers)
    - LWG = left wing laser
    - LWP = left wheel path laser
    - CEN = center laser
    - RWP = right wheel path laser
    - RWG = right wing laser
12. Record the results of the test by writing it down on a sheet of paper
13. Repeat steps 6-12 ten times, for every block height. (1/4”, 1/2”, 1”, and 2”)
14. Take the average of all ten readings and compare with the value written on the side of each block.

    Note: the average should be within +/- .005” of what is written on

    the block. Note: on the 2” block +/- .010 is acceptable
15. If the average does not fall within the acceptable range, the laser will need to be recalibrated. Reference the “How to Calibrate Wheel Path Lasers” document for

    instructions to calibrate a wheel path laser.

TIPS for a faster block test.

- Make sure that the base plate is on a flat surface; if the corner of the base plate is lightly tapped, there shouldn't be any movement. Be sure no one is touching the Pathrunner during the test.
- Perform 2-3 reading with every block height to ensure the test will pass, before doing all ten.
- Since the results are the absolute value of the difference of the two reading, it doesn't matter whether you take the block off or put it on during step 9, only that it changes. This means you can get 2 readings for every time you put the block down.
- The ¼" block can be used like a second base plate. You can use this (or another base plate if you have one) to do two lasers at the same time; switching the block from one side to the other in step 9.
- Press Alt → C → B → Enter, to start the block test instead of using the mouse.

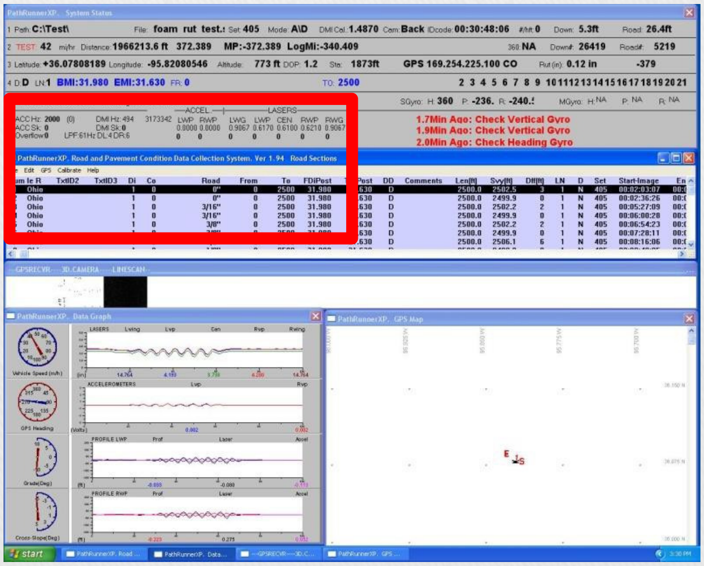
BOUNCE TEST

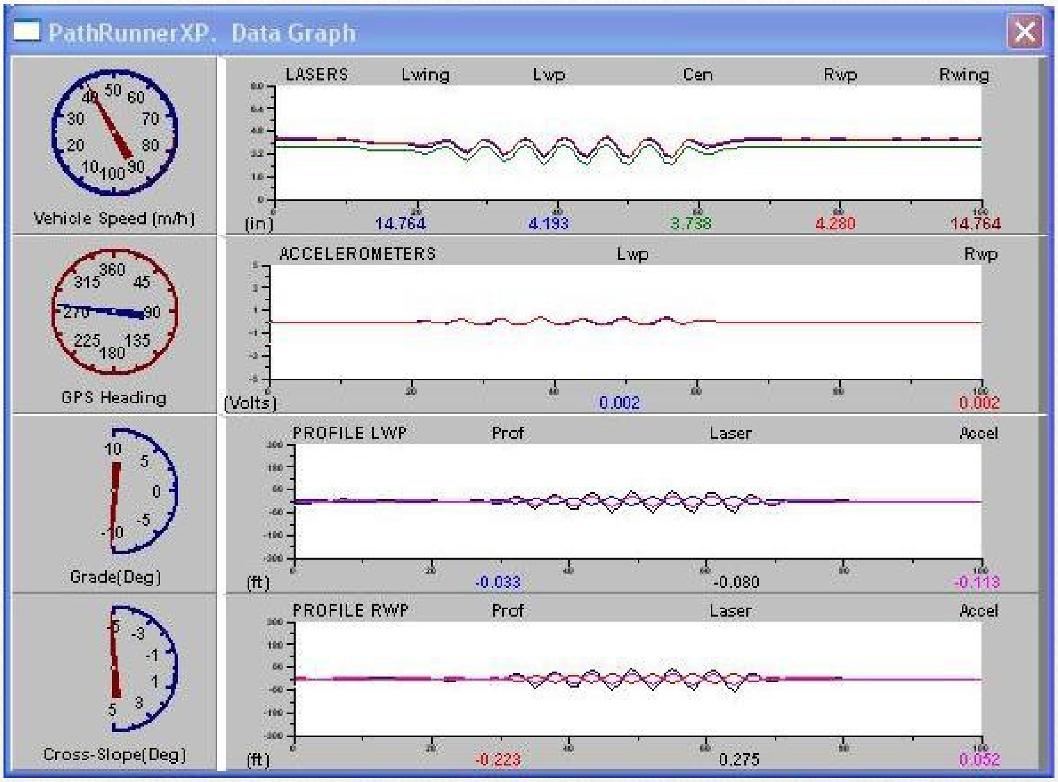
Bounce Test

A bounce test is used to verify the proper function of the accelerometers with relation to the wheel path lasers. Follow the instructions below for details of performing a bounce test on the PathRunner.

1. To begin, start up the Data Collection Unit as if to collect data and put the DMI in TEST mode. It is recommended to run the test at approximately 40 MPH (DMI in test mode). Using the precision machined testing blocks provided by Pathway Services, place the base plate and ¼" block underneath the Left Wheel Path (LWP) laser and the Right Wheel Path (RWP) laser located on the front bumper of the PathRunner.

2. For an initial check prior to conducting a full bounce test, bounce the front of the PathRunner a few times and inspect the data graphs of the Profiler computer (seen below). The blue line of the LWP and red line of the RWP should remain flat when the front of the vehicle is bounced. The other two lines, pink and black, should make smooth sinusoidal waves of equal amplitude.





3. To begin the test, open a test database and create a new test set number. At least one record must be blank to run this test.

NOTE A test database can be provided by Pathway Services if one does not exist. A test database is simply a road section file with multiple blank or "dummy" records to fill with sample data to testing purposes. It is recommended to use a new set number for each group of bounce tests. For example, if a user plans on performing multiple bounce tests in a single day, the same set number can be used for that instance. If a new bounce test is to be performed each week, a new set number should be used each week.

ACTIVATE (Ctrl+A) the system and let a distance of approximately 300 feet accrue to allow all sensor-filtering to stabilize.

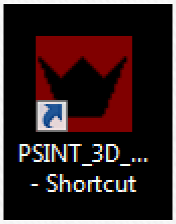
START (S) the system and allow the system to accrue approximately 528 feet. Bounce the front of the van smoothly 8 to 10 times, over the distance of another 528 feet. Step off the bumper and allow the system to accrue a third segment of 528 feet.

END (E) the system after the van has been bounced. Allow the system to accrue another 300 feet.

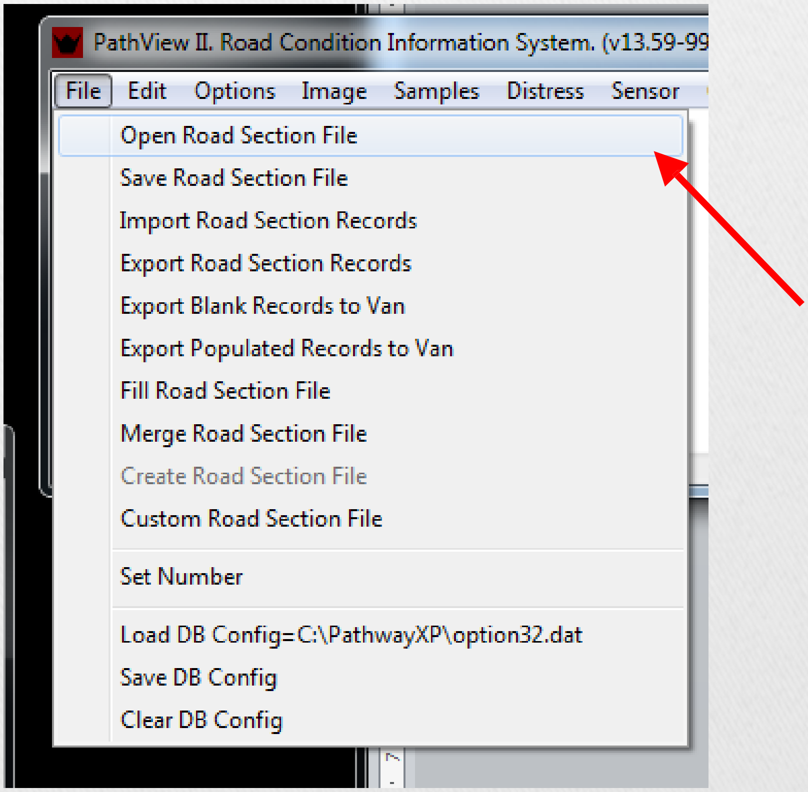
DEACTIVATE (Ctrl+D) the system.

The PathRunnerXP collection software can now be closed, collecting the data is complete.

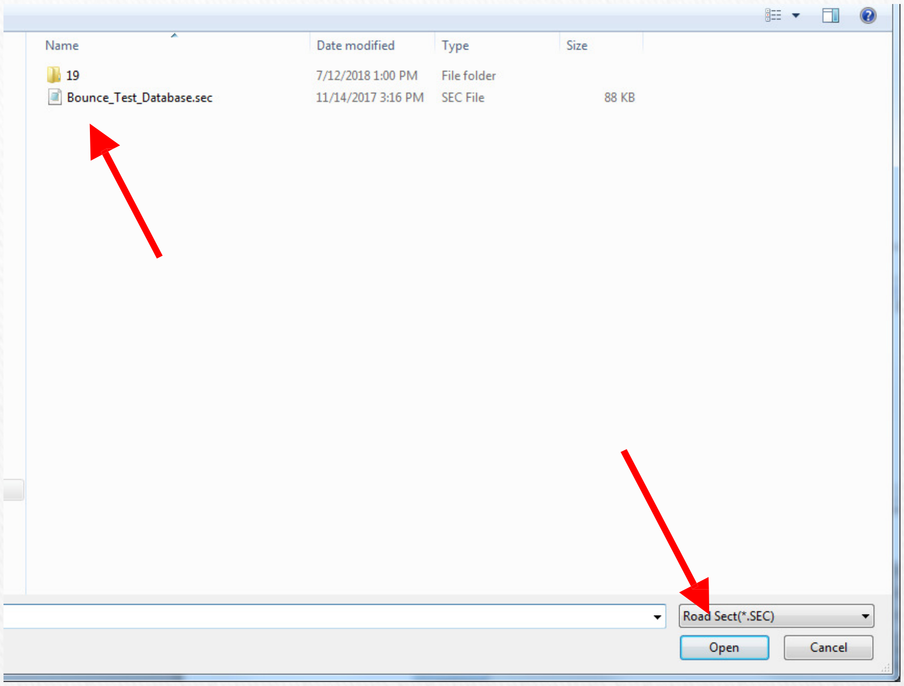
4. After the data has been collected, open the PathView II processing software by double clicking on the icon found on the Profiler desktop.



Load the database that was used to create the bounce test.

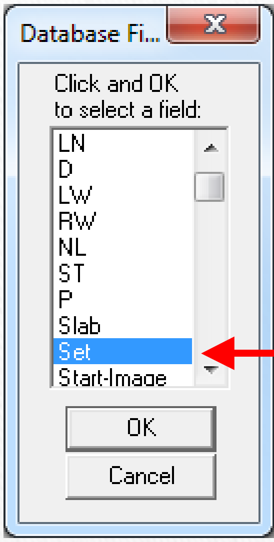


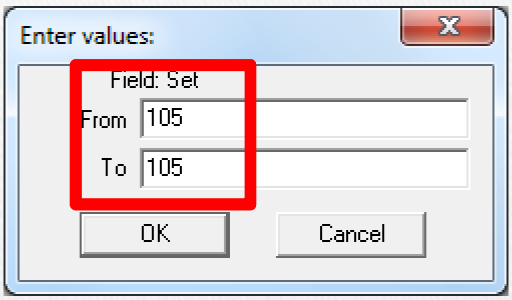
5. Click on the database file one time and then click “**Open**”.



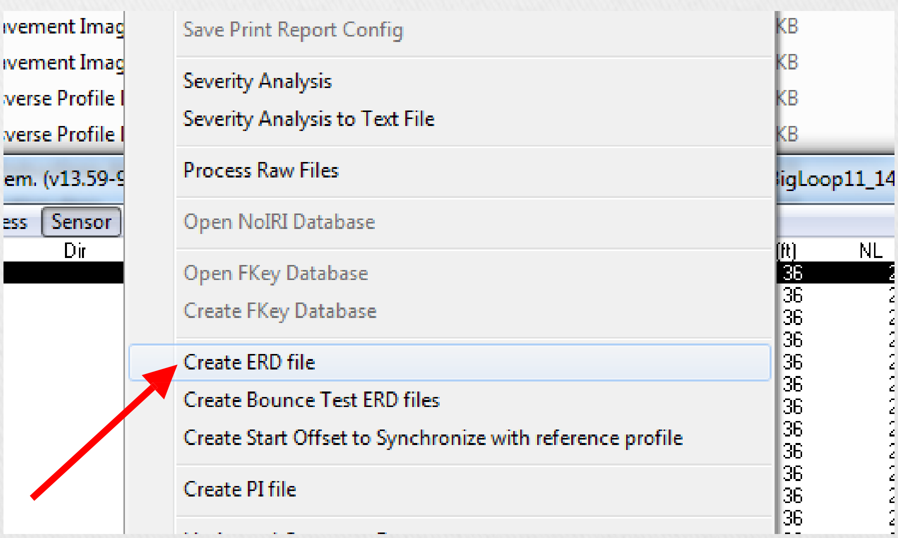
A window will appear asking the user if filters are desired to load the database… Filters allow the user to find specific records in the database based on user defined parameters. For example, if the user only wants to load records in the database from a specific set, the user can “filter” out all the other records in the database that don’t have the user defined set number.

(If a database has many sets in it, you can choose “Yes” and scroll down to the text that says “**Set**”, click “**OK**” and enter the single set. For example if the set used was 105, type “From: 105, To: 105”, click “**OK**”. When prompted to use more filters, choose “**NO**”.)

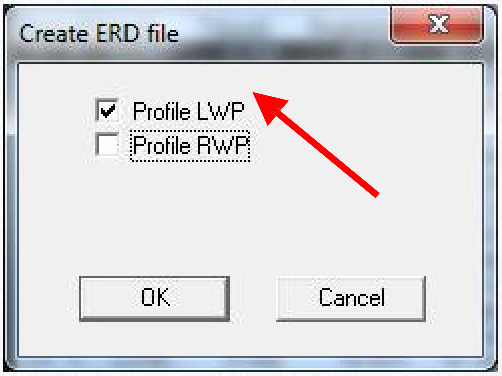




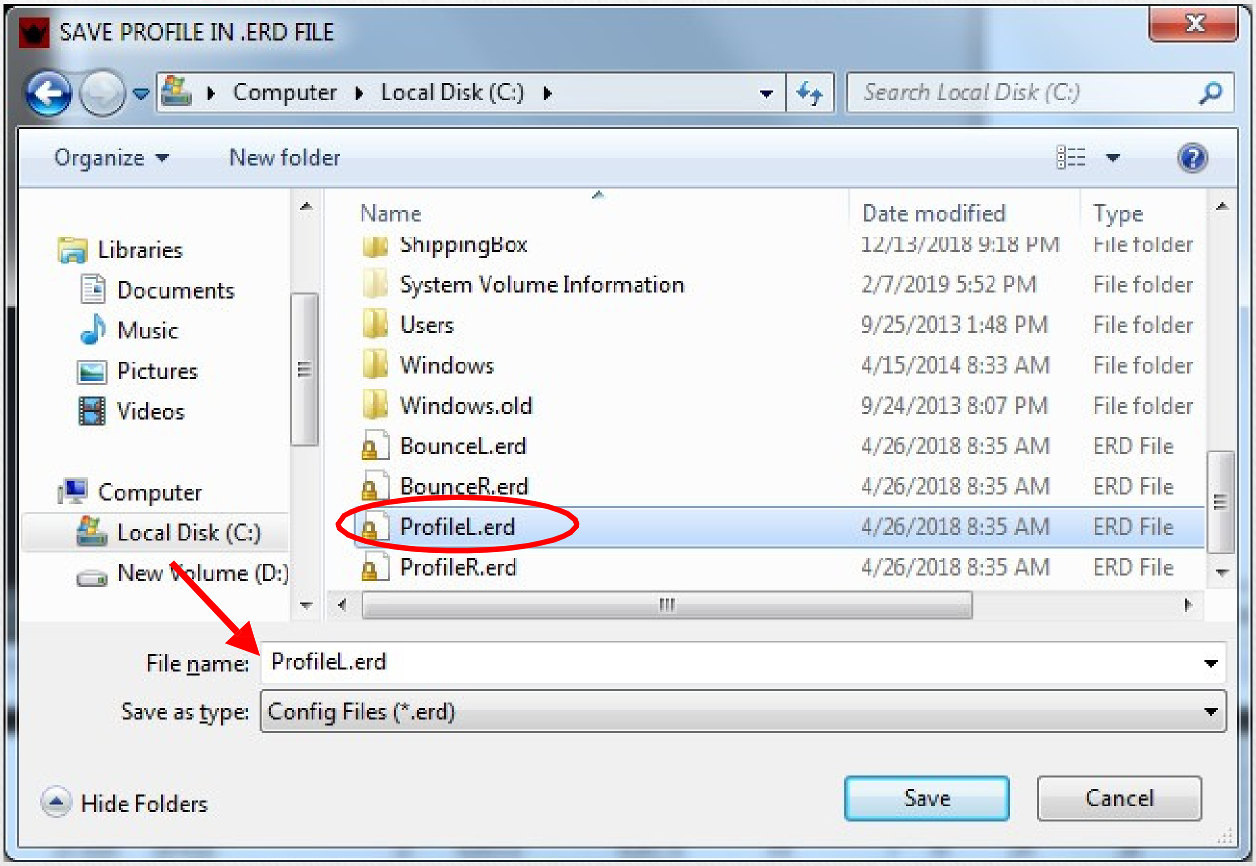
6. To create the *.ERD files for a bounce test, first highlight the correct database record and then select **"Create ERD Files"** from the Sensor menu. This will create a single set of *.ERD files for one wheel path at a time.



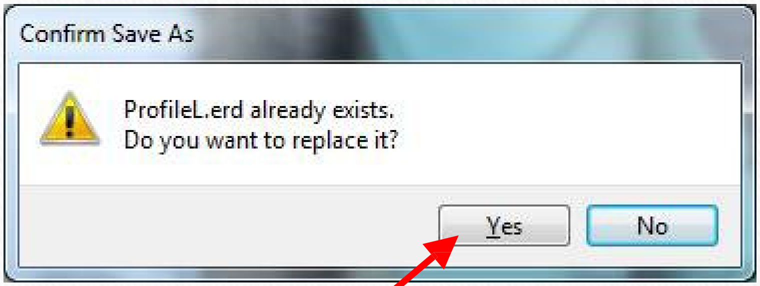
Select one wheel path (make sure to remember which one you choose), making sure to only choose one wheel path at a time. Click “**OK**”.



7. A window will appear asking the user where to save the file to. Navigate to the C: drive. The *.erd files will need to be saved directly to the C: drive (do not save them in a folder). Select the appropriate wheel path (the left wheel path in this example). The file should be named “**ProfileL**” (*DO NOT* choose “**BounceL**”, as this file will be automatically created).

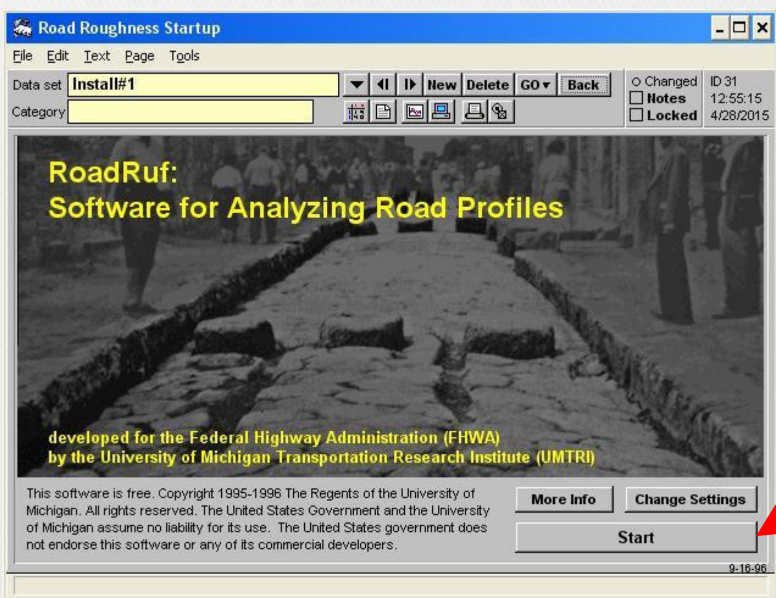


A warning message will appear asking if the user wants to replace an existing file with this name. Choose “**Yes**”.



8. The software may display an activity window for a short period of time. The *.erd files are complete for the left wheel path. Repeat steps 6 and 7, changing the check box in step 6 from "**Left Wheel Path**" to "**Right Wheel Path**". Make sure both check boxes aren't checked.

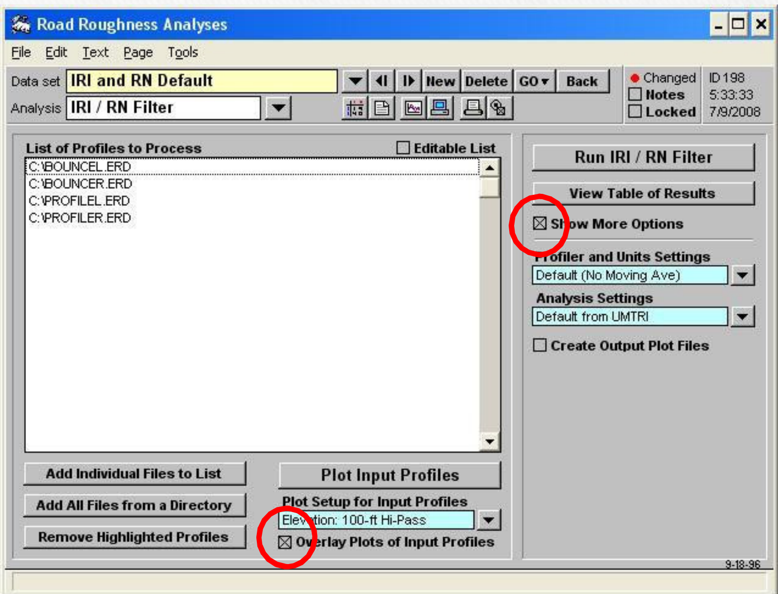
9. After the *.ERD files have been created, open the RoadRuf software found on the desktop of the computer (A yellow logo with two "R"s) and click the "**Start**" button.

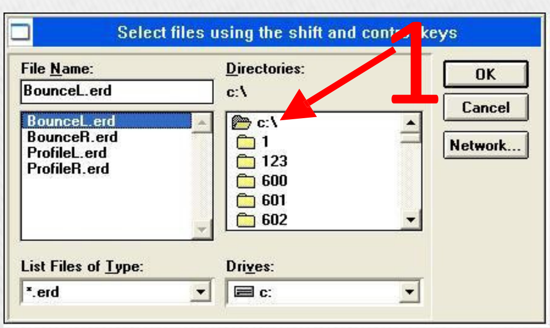


There are four *.ERD files which will need to be loaded in the RoadRuf software. These include:

- BounceL.erd
- BounceR.erd
- ProfileL.erd
- ProfileR.erd

If these files are already loaded, nothing will need to be done (proceed to step 10). If these files are not present then they will need to be added to the list. ONLY ONE FILE CAN BE ADDED AT A TIME, and make sure the bounce files are loaded before the wheel path files. To add a file, choose "**Add Individual Files to List**". Navigate to the C: by double clicking on the "c:\" in the window on the right (see #1, below), drive and select one file ("**BounceL**", "**BounceR**", "**ProfileL**", or "**ProfileR**") and click "**OK**". Repeat this for all four files, one at a time, until the screen matches what's shown below:



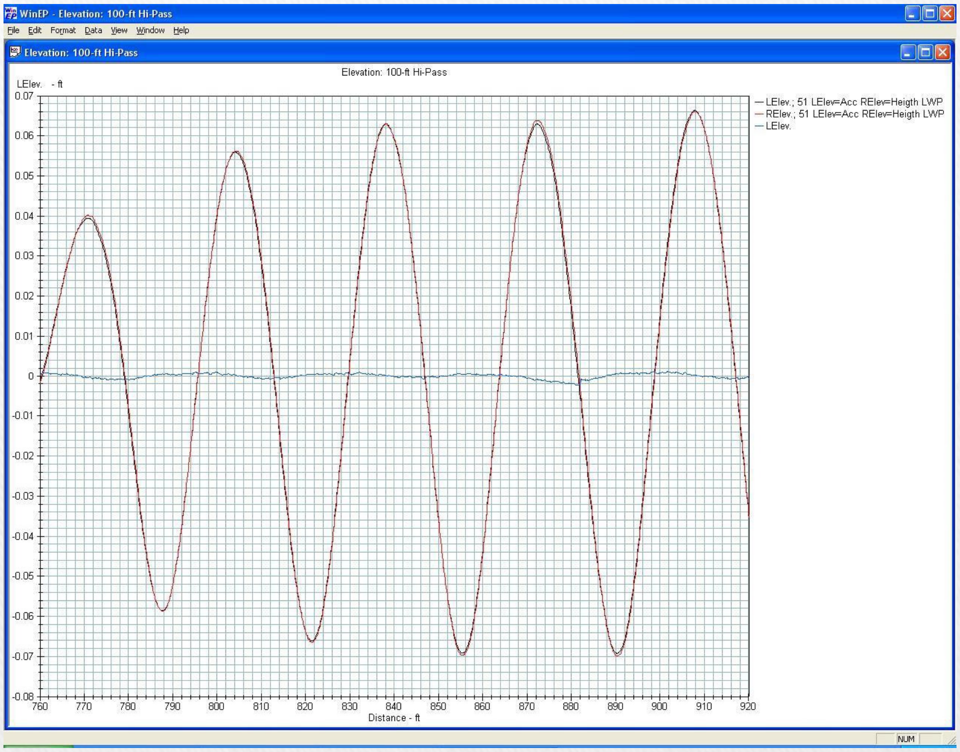


10. Once the needed *.ERD files are loaded, make sure the **"Show More Options"** box is checked and the **"Overlay Plots of Input Profilers"** box is checked.

11. Next, select the "**BounceL.ERD**" file and the "**ProfileL.ERD**" files by holding the **CTRL** key and using the Left-click of the mouse, click on each file ONE TIME. Then select **"Plot Input Profiles"**. See the image below for more details.

    This will create a graph of the laser, accelerometer, and the corresponding elevation profile found by combining the sensor data.

12. After the graphs are created they can be analyzed for calibration purposes. See image below for more details:



The blue line should be as close to flat as possible. Zoom in on a portion of the graph to closely look at the waves created by the laser and accelerometer data. Do this by left-clicking and hold the button, drag from the upper left side of the window and move the mouse curser to the lower right side of the window, drawing a box over 3-4 of the waves.

13. Repeat steps 10-12 for the right wheel path, selecting "BounceR" and "ProfileR" from the RoadRuf data window.

The red and black waves should be identical. If the amplitude of the black graph is smaller than that of the red graph, then increase the gain for the corresponding accelerometer box by rotating the potentiometer clockwise. If the amplitude of the black graph is larger than the red graph, then decrease the gain on the corresponding accelerometer box by rotating the potentiometer counter-clockwise.

Always make small adjustments and repeat these steps until the black and red waves, while viewed in RoadRuf, are as similar as possible and the blue line is as flat as possible.

You can also zoom in to the blue line in the middle of the graph and look at the magnitude of the .erd file. The .erd line should be within +/- .003.

For more information about measurement verifications please contact Pathway Services, Inc.