LIGHT WEIGHT PROFILING SYSTEM

Calibration Verification & Operator Certification Program Manual

Department of Transportation
Bureau of Operations
Asset Management Division
Roadway Inventory and Testing Unit

pennsylvania
DEPARTMENT OF TRANSPORTATION

PUB 589 (3-24)

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Our quality policy is to provide effective information system management as well as supply timely and accurate roadway inventory and testing information. We will continually improve service to our customers by understanding and complying with regulations, industry related standards and customer requirements.

Introduction

To ensure that PennDOT's pavement smoothness specifications result in a product that provides a smooth ride for the motoring public, PennDOT bases pavement smoothness specifications on the International Roughness Index (IRI). IRI simulates a vehicle's response to the deviations of a surface from a smooth plane. It is an expression of the "rideability" of the roadway, as vehicle passengers experience it. IRI was developed as a reference measure by The World Bank and is based on a quarter-car simulation as described in NCHRP Report 228.

IRI is determined with devices called "profilers". Profilers are mounted with laser sensors and computers and may either be vans that travel at highway speeds, which PennDOT has been using decades, or "Light Weight Profiling" (LWP) devices. An LWP is an off-road utility vehicle that can be easily used within a construction project's confines due to its limited size and weight and added maneuverability.

PTM No. 428, (found here at PennDOT's Roadway Management & Testing website) defines how to measure pavement profile and determine pavement ride quality for acceptance and payment using an LWP device. This PTM is provided in Appendix A. PTM No. 428 does not include a list of acceptable models. That is for two reasons: 1) profiling technology is rapidly expanding, and it is not in PennDOT's best interest to publish a PTM that may continuously need to be updated to include new LWP manufacturers and/or models; and 2) PennDOT wants to be assured that each LWP device is operated proficiently and provides accurate and precise results, and not make "blanket approvals" based on type. With this second reason in mind, a program has been developed to verify that all LWP devices are calibrated and operating properly.

The second aspect of the program is to certify that LWP operators are competent and capable of operating the device, as well as collecting, analyzing, and reporting accurate results. The certification program ensures control of the use of LWP devices, promotes competence, proficiency, and professionalism, and increases confidence in the test data. Operator certification is necessary because PennDOT offers no training for LWP operations. The vendors that supply LWP devices may provide training, but the extent and quality of training is beyond PennDOT's control and will vary depending on the vendor, device type, and software of each LWP device.

PennDOT Contacts

The LWP Calibration Verification and Operator Certification Program is directed and controlled by PennDOT's Bureau of Operations, Asset Management Division, Roadway Inventory and Testing Unit (RITU).

Certification

All correspondence concerning equipment or operator certifications should be made to the Roadway Inventory and Testing Unit by contacting:

Roadway Inventory and Testing Unit
Attn: LWP & Operator Certifications
Pennsylvania Department of Transportation
907 Elmerton Avenue
Harrisburg, Pennsylvania 17110
Phone: (717) 787-7291 or (717) 783-6857

To schedule a certification contact:
(717) 787-7291

Data Analysis

Questions or concerns pertaining to profile data may be directed to:

(717) 783-6857 or (717) 783-0172

Administration Of Certification Program

Questions or concerns on policies or direction of PennDOT's Light Weight Profiler Calibration Verification and Operator Certification Program should be directed to:

Manager, Pavement Evaluation and Testing (717) 787-7294

Appointments will not be made prior to March 20th of each year. Please leave a message with a name and call back number and we will return your call.

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Scheduling

RITU will begin operating the LWP Calibration Verification and Operator Certification program in the spring of each year, typically mid-May. Most verifications/certifications are done in May, June, and July; however, they may also be performed throughout the summer and early fall*. The latest date for completing a certification is October 15th. The LWP device owner is responsible for contacting RITU for scheduling.

To schedule an LWP Calibration Verification and Operator Certification, please contact:
(717) 787-7291

- **When scheduling verifications/certifications, state how many operators are to be certified during the session. Do not send additional operators to the appointment without prior RITU approval.**

- **If time constraints arise, RITU reserves the right to deny the opportunity to certify all operators during a given day.**

- **If you schedule a certification and do not show, or if you fail to cancel a scheduled certification by 3:00 PM the day before the certification, you may be billed $225.00.**

In some cases, devices may need to be "reverified" during the year. Reasons for this include:

- LWP devices that were not accepted based on their initial tests.

- New operators that need to be certified.

- LWP devices or operators requested to be reverified by PennDOT personnel, due to questionable results and/or practices on a construction project.

- LWP devices that fail to provide results that match those derived by RITU in a follow-up analysis (see below).

- LWP devices that have been repaired and/or hardware or software that has been replaced. **The owner/operator of a certified LWP must report any software changes within seven days of the change to (717) 783-0172 or (717) 783-6857.**

Regardless of when an LWP device is verified, it will only be valid through June 30th of the following year. Operator certifications are valid through June 30th of the third year after issuance; for example, an operator certification issued in 2024 is valid through June 30th, 2027.

When utilized for ride quality acceptance, the profiler must be operated with the same software and settings used during LWP verification.

*Note that verifications/certifications will not be performed during the late fall and winter; reference values for the site may not be accurate during this time. RITU will determine new reference values each year prior to the start of the springtime verification/certification period; these reference values will be checked through the summer and fall as necessary.

Restrictions

The Light Weight Profiling System Calibration Verification and Operator Certification Program is not a training program. All participating operators are expected to be well versed in the operation of the LWP device to be verified. The RITU staff will serve as technical experts and may provide guidance during the verification/certification process but will not be responsible or accountable for the training of LWP operators, even if they are PennDOT employees.

Furthermore, RITU staff will verify the calibration of LWP devices, but cannot and will not be responsible for making corrections or modifications to devices. Assistance and guidance may be provided, but it is not the role of RITU to repair, maintain, or calibrate LWP devices. If repairs or modifications are necessary, the owner of the device must contact the manufacturer.

Successful completion of the certification program does not eliminate the need for daily calibration of the LWP on the project site (i.e., vertical, horizontal, etc.).

Profiling technology is rapidly expanding, and the number of manufacturers is expected to increase. As stated previously, PTM No. 428 does not include a list of previously accepted models. Therefore, RITU may not have prior experience, or the necessary software, for all LWP devices required to be verified. It is the responsibility of the owner/operator to assure that RITU is informed of the LWP device type and software version, and that RITU has the required software and/or file format before the scheduled calibration verification.

RITU must also be provided the methodology and/or software necessary to convert raw (unfiltered) profile data to “ERD” or “PPF” file format. ERD and PPF are standard file formats used by ProVAL, an engineering application utilized to view and analyze longitudinal pavement profiles. ProVAL was developed for the Federal Highway Administration (FHWA) under DTFH61-01-P-00159.

RITU reserves the right to analyze raw profile data with ProVAL and compare the IRI results to those produced by the device’s software. If the results of this analysis are not acceptable, the LWP device’s verification will be revoked or withheld.

- **RITU will disqualify any individual, manufacturer, or device owner that attempts to collect any type of profile data from the Newville test course without prior permission or notification given by\to PennDOT.**

- **RITU will not initiate contact with any manufacturer on behalf of an LWP device owner/operator.**

- **RITU will not schedule a calibration/verification for an LWP device that uses an unrecognized file format, unknown software, or cannot produce output that can be converted to ERD or PPF file format.**

- **RITU will not accept an LWP device that cannot analyze and produce IRI results equal to the results of ProVAL.**

- **RITU will not accept an LWP device that allows users to define or edit sensor or accelerometer constants. All such constants or factors must be automatically stored during calibration/verification procedures.**

- **RITU will not accept an LWP device that cannot meet the requirements of PTM No. 428, or ASTM E950/E950M.**

- **RITU will not accept results that are not based on a quarter-car simulation as described in NCHRP Report 228.**

- **RITU recommends that all equipment manufacturer specifications and manuals accompany the LWP device to be verified.**

- **RITU will not accept or certify contractor owned LWP devices that utilize more than one type of laser.**

- **Certification does not eliminate the need for daily calibration of the LWP on the project site (i.e., vertical, horizontal, etc.).**

In addition to reverifying LWP devices, RITU is also available to perform analysis of any data collected by a certified device and operator. LWP operators, or PennDOT personnel, may send raw profile data to RA-PDIRIDATACOLLECT@pa.gov. When submitting the data, specify the LWP device type used to collect the data, the software version the device uses, parameters of test area, and a contact to receive the results.

If the RITU analysis results in an IRI value that differs from the IRI value provided by the LWP device that collected the data, that device's acceptance will be revoked, and a reverification must be performed.

- **RITU will not analyze data collected by LWP devices that have not participated in the same year's calibration verification program. Furthermore, RITU will not analyze data collected by an LWP operator who does not have a valid Pennsylvania certification in the same year as the data was collected.**

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Requirements

1. All LWP devices used by PennDOT, or by contractors, must be verified each year prior to use on PennDOT construction projects. Furthermore, all operators of LWP devices must be certified prior to using the LWP devices on such projects each year. The owners of the LWP devices will be responsible for transporting the device(s) to the verification/ certification site and assuring that all necessary personnel are certified.

2. All LWP devices must meet the definitions and requirements of PTM No. 428 – Method of Test for Measuring Pavement Profile Using A Light Weight Profiler, provided as Appendix A. The devices and operators must be capable of providing results accordingly and in the defined formats.

3. During verification/certification, there may be exposure to hazardous materials, operations, and equipment. The operators are responsible for establishing and addressing all appropriate safety and health precautions prior to commencement.

4. All operators must be well versed in the operation of the LWP device to be verified and be able to perform all tasks associated with the verification/certification procedure.

5. All operators must be well versed in PTM No. 428.

6. Roughness data must be processed using a Butterworth 100’ high-pass filter.

7. All LWP operators must supply PennDOT with unfiltered ERD (.erd) or PPF (.ppf) files for all passes made during the certification. These files will be analyzed using ProVAL. PennDOT uses ProVAL to compare multiple profiler runs (i.e., repeatability test) and compare those repeated runs with a reference profile (i.e., accuracy test). The computation of cross-correlation will be based on the guidelines stated in the AASHTO R 56-14 R 2022). ProVAL is available, free of charge, from the Federal Highway Administration.

See their website at:
http://www.roadprofile.com for more information.

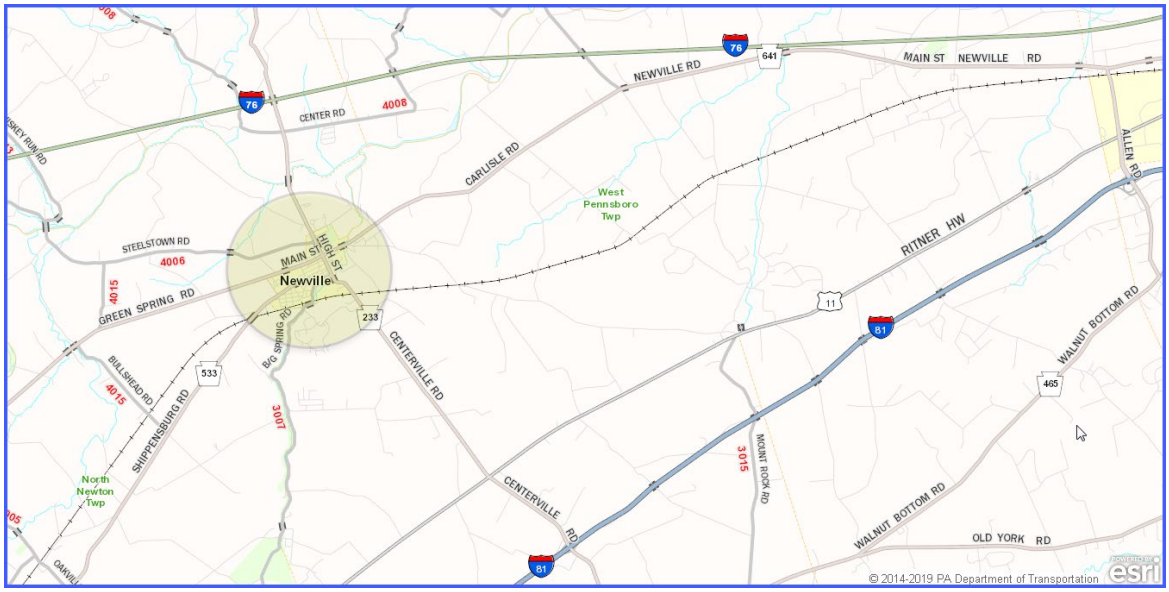
Information about the ERD files can be found on the UMTRI website: http://www.umtri.umich.edu/erd/software/erd_file.html, or by contacting your LWP manufacturer.

Profile repeatability must be > 92% and accuracy must be > 90% for the LWP to meet certification requirements.

Verification/Certification Center

LWP calibration verification and operator certifications are performed at a site located in Newville, PA. The site, constructed for PennDOT along a “rails to trails” property, has two one-tenth mile sections constructed of bituminous pavement, and two one-tenth mile sections constructed of plain cement concrete pavement. Each section was constructed to be at distinct IRI values, to ensure that the LWP devices can produce accurate results over a range of roughness levels and textures.

From I-81, Exit 37, follow SR 233 North into Newville. Turn left onto SR 533 West (Vine Street). Turn left on Cherry Street. The parking lot and office for the site are located on the left, at the end of Cherry Street.



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Newville Area Map

PennDOT LWP Certification Building

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Reference Value Determination

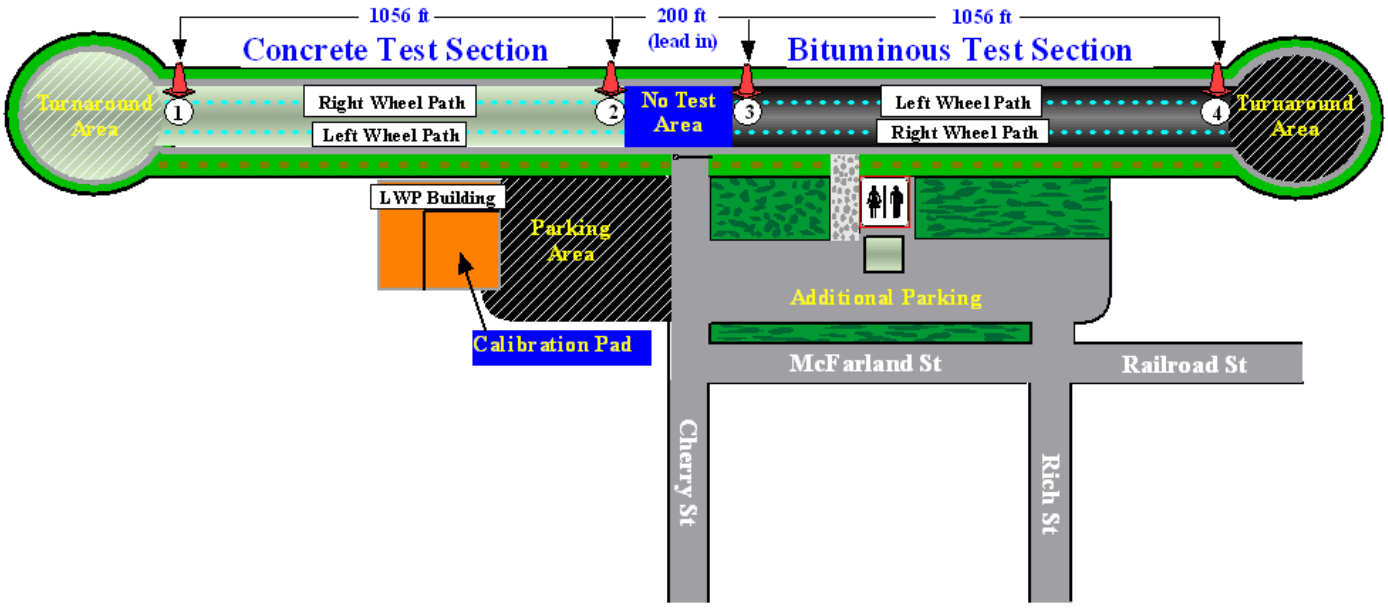
RITU will annually establish reference IRI values for each 528' test section as follows:

1. RITU will make five passes with a "reference device," such as the SurPRO 3500 Rolling Surface Profiler.

2. If the standard deviation of the five IRI values, determined by the reference device, are within a tolerable percentage of their mean, then RITU will make five passes with its LWP device.

3. If the standard deviation of the five IRI values, determined by the LWP, is within a tolerable percentage of their mean, and the "LWP" mean is within a tolerable percentage of the reference device mean, then the reference device mean will be established as the test section reference value.

4. This procedure is repeated for each wheel path for each section.



Verification/Certification Procedure

1. RITU will ensure that the intended LWP test path is clear of all loose material and foreign objects.

2. Perform all necessary start up procedures, and allow for the minimum acceptable warm-up period, per manufacturer specifications.

3. Set system displays and test results to English units (inches/mile), or as requested.

4. Perform all necessary profile system (sensor and accelerometer) calibration procedures, as per equipment manufacturer specifications. Save all values. Check that all sensor positions are displaying correctly and verify that sensor collection rates are properly set. RITU will not accept an LWP device that allows users to define or edit sensor or accelerometer constants. All such constants or factors must be automatically set and stored during calibration/verification procedures. The following must be successfully completed during the profile system calibration:

    a. Laser height verification (block test) must be performed in accordance with AASHTO R 57-14 (R 2022) or the manufacturer's recommended procedures.
    b. Vertical verification (bounce test) or the manufacturer's equivalent must be performed in accordance with AASHTO R 57-14 (R 2022).
    c. Accelerometer verification must be performed in accordance with the manufacturer's recommended procedures.

5. For LWP devices equipped with two sensors, the horizontal sensor spacing must be 69", +/- 1.5". If the sensor spacing is incorrect and cannot be corrected, or if the left sensor results are unacceptable, then the device must be considered and accepted as a single sensor device based on the right sensor. (The acceptance decal will reflect this.) If the right sensor results are not acceptable, then the device will not be accepted at all.

6. Check all tire pressures and verify that equipment manufacturer specifications are met.

7. Per equipment manufacturer specifications, perform all necessary distance sensor calibration procedures to determine and/or verify the calibration factor necessary to perform the operational distance measurements. Save all values. The operator must use feet or miles as the distance measurement units, and not make any calculations to determine the calibration factor.

8. After determining the distance calibration factor, one pass of at least 1056', is required to verify the distance measurement accuracy. Submit results. 5' per mile (or 1' per 0.2 miles) accuracy is required.

9. Collect, process, and submit pavement profile and roughness data for five passes for both wheel paths for each 528' test section. Roughness data must be processed using a Butterworth 100' high-pass filter. Profile data must be unfiltered, in ERD or PPF format.

10. If the operator believes that a particular pass is invalid, the operator may choose not to save the results and make an additional pass. However, no more than eight passes may be made to obtain the five to be submitted.

11. Printouts and a flash drive containing the IRI value calculated for each pass must be submitted. Provide values in English units, or as requested. All required data must be submitted to a PennDOT representative on the day of certification before leaving the facility.

A summary of this procedure has been developed, as well as a Customer Information Form. These documents are attached as Appendix B.

Acceptance

1. The results of each pass for each 528’ length will be compared to the corresponding reference value to determine acceptance. Likewise, results for each wheel path will be compared separately. For example, if four 528’ lengths are tested, and both wheel paths in each length are tested, then there will be a total of eight precision and bias comparisons to determine acceptance.

2. Each pass shall be clearly labeled so that PennDOT personnel can easily analyze the file data.

3. Reporting (for each pass): As a minimum, the following information must be printed. The operator must be able to define, interpret, and describe all of the information, and demonstrate data entry capabilities for all appropriate parameters:

    a. Date and time of day.

    b. Operator and equipment identification.

    c. Weather conditions: temperature, cloud cover, and wind.

    d. Surface description: type of pavement and condition.

    e. Location and description of section: Job ID, lot, lane, wheel path, beginning and ending stationing, and direction measured.

    f. Lot Length.

    g. Software version: the version number or identification of the LWP device operational system.

    h. Data filter settings. High-pass filter setting = 100’ (30 m).

    i. IRI value(s).

4. RITU reserves the right to process the raw profile data obtained from the LWP device using ProVAL software. This requires the ability to convert the raw profile data to ERD file format. As stated on page 4, it is the responsibility of the owner/operator to assure that RITU has the methodology and/or software to convert the raw profile data to ERD file format. Reasons for RITU opting to perform this analysis include unfamiliarity with the LWP device’s software and analysis methodology, or a change/upgrade to an LWP device’s software. If the results of this analysis are not acceptable, the LWP device’s verification will be revoked or withheld.

5. All LWP devices with acceptable test results will be designated with a decal. Denoted on the decal will be a device identifier, the date of acceptance, the date of expiration, the number of sensors, and the device type/operational system software version. This decal must be displayed at all times while the device is present on a PennDOT construction project. **PennDOT reserves the right to remove the decal if the LWP device’s acceptance is revoked.**

6. PennDOT will issue all certified LWP operators a certification card. The name of the operator, employer, date of certification, date of expiration, and LWP device type will be denoted on the card. Certified operators may operate LWP devices other than the one used during certification, but only those that are of the same type, owned by the same employer, utilizes the same collection and analysis software, and is designated with a valid verification decal. The operator's certification card must be carried at all times by the operator when employing a LWP device on a PennDOT construction project. Operator certification is typically valid for three years.

7. If more than one individual is to be certified to operate the same LWP device, then all individuals must perform the entire procedure separately. Each operator will be certified based upon their own acceptance.

8. If for any reason, an LWP device is reverified during the same year, an updated decal may be applied.

9. If the LWP device's acceptance is revoked, PennDOT will remove the certification decal, and all applicable operator certification cards will become invalid. Also, the LWP device will be removed from PennDOT's Approved Certification list.

10. If a device is required to be reverified for any reason, only one operator must return the device for the retest. All other previously certified operators do not need to return for recertification until their three-year certification period ends. If the device reverification is successful, the other operators' certification will remain valid.

11. Previously purchased LWP devices do not automatically become invalid if the manufacturer's business status changes (i.e., goes out of business, is sold, etc.). If the business status of an LWP device manufacturer change, all previously approved devices of that type, and all applicable operator certifications, remain valid through the previously established expiration dates. When the device is reverified and is accepted, an updated verification decal and certification cards will be issued. If the device fails, the decal will be removed, and all applicable certification cards will become invalid until there is a subsequent acceptable reverification.

12. If a certified LWP operator changes employer, that operator's certification is no longer valid. (RITU will make no efforts to revoke the certification card from the individual. Since the card states an employer that is no longer valid, PennDOT's construction personnel will disallow the individual from operating an LWP device.) However, if the operator's new employer owns a LWP device that is the same type and uses the same software that the operator used to certify, and the device has a valid verification decal, the operator does not need to be recertified. Upon notification from their employer, RITU will send an updated certification card for the operator, at no charge. The updated certification card will expire at the same time as the previously issued certification; it will not be valid for three years from when the new card is reissued.

13. PennDOT will maintain records of the results of the verification/certification program. The owner, LWP device type, collection software version, analysis software version, the name of the operator(s), and the date of acceptance or failure will be included in these records. RITU will provide this information on PennDOT's Bureau of Operations' website: https://www.penndot.gov/ProjectAndPrograms/ResearchandTesting/RoadwayManagementandTesting/Documents/LWP%20Certified%20Operators.pdf.

Payment

The following describes the costs charged to customers for LWP calibration verification and operator certification, and how the charges will be applied. These costs are based on the expense incurred by PennDOT to perform the verification/certification. All PennDOT-owned LWP devices and operators are excluded from these charges, but verification/certification is still required.

Cost for LWP verification and one operator certification: $510.00

Breakdown:		
RITU Manpower (2 employees):	5 hours x $29.50 + 5 hours x $29.50 =	$295.00
Salary Overhead:	$295.00 x 0.666920* =	$196.74
Decal & Card:		$10.00

Each additional operator, same day+: $225.00

Breakdown:		
RITU Manpower (2 employees):	2.20 hour x $29.50 + 2.20 hours x $29.50 =	$129.80
Salary Overhead:	$129.80 x 0.666920* =	$86.56
Card:		$8.64

* Salary overhead rate for Fiscal Year 2023-2024.

+ Due to time constraints, PennDOT may limit the number of additional operators scheduled to be certified per day. If more operators are to be certified than can be accommodated in one day, the additional operators will be scheduled for a different day. For each additional day, the initial $510.00 cost will be charged for the first operator and an additional $225.00 will be charged for each additional operator.

Payment is preferred prior to the verification/certification procedure. Credit card payments can be made at www.pay.penndot.gov/web. Checks are to be made payable to: "COMMONWEALTH OF PENNSYLVANIA." The costs listed above are applied "pass" or "fail," with the following exceptions and restrictions:

1. When scheduling a certification with more than one operator to be certified, in the same day, and you are paying with a check, provide separate checks with the appropriate amounts. One check, for the LWP devise with 1 operator and one check for each additional operator(s) as listed above.

2. $510.00 will be charged if a contractor/vendor/etc. returns its LWP device at a later date in order to certify additional operators. If the new operator fails to certify, then the LWP device's acceptance decal will be revoked, and any previously certified operators will no longer be approved to operate the device. This is because we cannot determine if the discrepancies are due to operator error or a change in the device. (Therefore, to keep costs down and avoid a later revoking, it behooves a contractor/vendor/etc. to send all potential operators at the same time. If any of the operators pass, then the LWP device will be approved; the passing operators will be certified, but the others will not.)

3. If a device (and associated operator) fails initially, and then returns for recertification during the same year, no charge will be applied. However, if the individual/device fails the second time, then all subsequent recertifications will be charged the $510.00 cost.

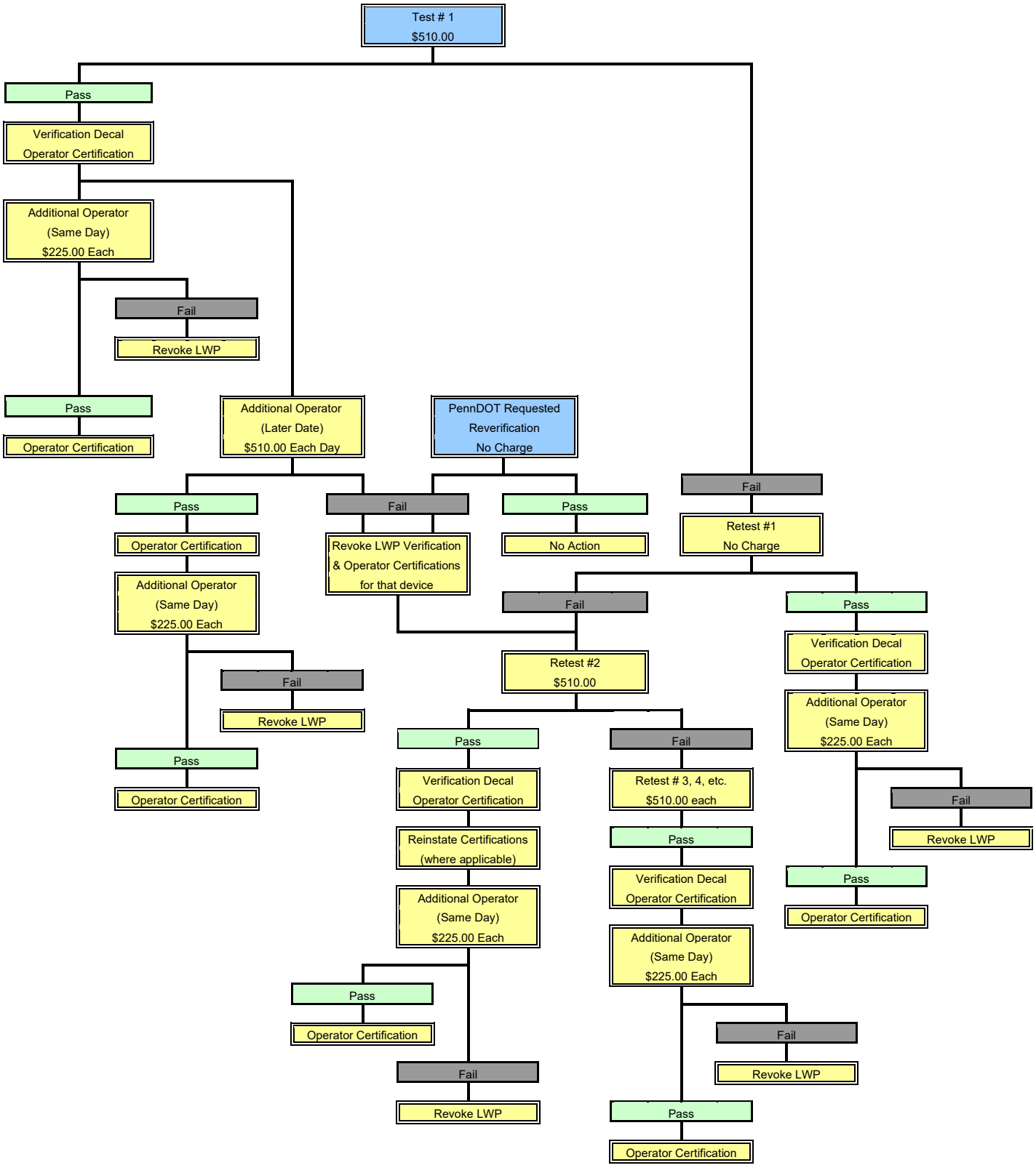
4. If a contractor/vendor/etc. owns two or more LWP devices, each device must be certified. Even if all devices are certified the same day, the $510.00 will be applied to each device. If all devices are of the same type, each operator that is certified to operate any of the devices will automatically be certified to operate them all. No charge will be applied in addition to the operator's initial certification.

5. If a PennDOT employee, such as a construction inspector, requires that a verified/certified device and operator retest, there will be no charge for the retest. However, the same operator must perform the retest.
    a. That device is not permitted to operate on any PennDOT project by any operator until it passes a retest. Additionally, that operator is not permitted to operate a LWP device on a PennDOT project until they pass a retest.
    b. If the device and operator pass, the appropriate PennDOT personnel will be notified that the device verification and operator certification are still valid.
    c. If the device and/or operator fail, the previously granted verification/certification will be revoked.
    d. If/when the revoked device and operator returns for retesting (during the same year), it will be treated as a new verification/certification, and $510.00 will be charged.

If the subsequent test is performed by a different operator than the one that failed, then upon passing, the operator that performed the successful retest will be certified, and the device will have its verification reinstated. Any other previously certified operators will be permitted to operate the device on PennDOT projects again. However, the operator that caused the revocation will not be recertified unless they subsequently pass a certification. (The charge will be $510.00 unless this retest is the same day as the test that reinstated the device, in which case the charge will be $225.00.)

6. When you are scheduled for a certification and don't show or if you don't cancel a scheduled certification by 3:00 PM the day before the certification, you may be charged $225.00.

The flow chart on the next page further illustrates the application and amount of the costs to be charged.



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Referenced Documents

1. NCHRP Report 228

2. PA Test Method No. 428 Method of Test for Measuring Pavement Profile Using A Light Weight Profiler (https://www.penndot.gov/ProjectAndPrograms/ResearchandTesting/RoadwayManagementandTesting/Documents/Ptm-428.pdf)

3. M E950/E950M Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

4. AASHTO R 56-14 (R 2022) Standard Practice for Certification of Inertial Profiling Systems

5. AASHTO R 57-14 (R 2022) Standard Practice for Operating Inertial Profiling Systems

Appendix A:

Pennsylvania Test Method (PTM) No. 428

Method of Test for

Measuring Pavement Profile Using a Light Weight Profiler

https://www.penndot.pa.gov/ProjectAndPrograms/ResearchandTesting/RoadwayManagementandTesting/Pages/default.aspx

Appendix B:

Procedure Summary

Procedure Summary

- ✓ Check that the test path is clear of all loose material and foreign objects.
- ✓ Document the company/agency name, address, operator name(s), device type, and device identifier.
- ✓ Check that all necessary start up procedures, and minimum warm-up periods, are followed.
- ✓ Check that all profile system calibration verification procedures are performed and properly set, sensor positions are correct, sensor collection rates are properly set, and all tire pressures are adequate.
- ✓ Check that pavement markings are clear and targets, if used, are properly positioned 1056' apart.
- ✓ Laser height verification (block test) must be performed in accordance with AASHTO R 57-14 (R 2022) or the manufacturer's recommended procedures.
    - This test should be performed on a flat level area.
    - Check the height measurements, in inches, from the height sensor(s) of the LWP using blocks of known heights. At a minimum, two base plate and three varying measurement plate (typically 0.25, 0.5 and 1") readings will be needed. The absolute difference should be less than or equal to 0.01 inch for each gauge block.
    - If the tests fail to meet these requirements, the LWP will be deemed to be not certified and prohibited from use on PennDOT projects until it is recertified.
    - A printed copy of the laser height verification results must be submitted to the PennDOT representative.
- ✓ Accelerometer verification must be performed in accordance with the manufacturer's recommended procedures. The tolerance for the accelerometer verification must meet the manufacturer's requirements.
- ✓ Vertical verification (bounce test) must be performed in accordance with AASHTO R 57-14 (R 2022)or manufacturer's equivalent.
    - With the base plates in position simultaneously under both wheel path sensors, place the LWP in an operating mode that simulates longitudinal movement and initiate profile data collection. Allow the profiler to collect a minimum of 828 feet (includes 300-foot lead-in) of static profile with the LWP as motionless as possible.
    - Sensor(s) should be moved vertically for a total displacement of approximately 1 to 2 inches keeping the sensors as close to perpendicular to the surface as possible during this movement. The bouncing must continue until a minimum of 528 feet of simulated distance has been traveled.
    - After a minimum of 528 feet of bounce profile is collected, allow the profiler to collect an additional minimum of 828 feet (includes 300-foot lead-out) of static profile with the LWP as motionless as possible.
    - The first and last (static) 528 feet segments shall not exceed 3 inches per mile, while the IRI for the middle (bouncing) segment shall not exceed 8 inches per mile for the bounce test. If the computed IRI values exceed 3 inches per mile for the static test and/or exceed 8 inches per mile for the bounce test, then the manufacturer's recommendations for performing sensor operational checks shall be followed. The static bounce test shall be repeated.
    - A printed copy of the bounce test results must be submitted to the PennDOT representative.
- ✓ Check that distance sensor calibration procedures are performed, and that the calibration is verified with at least 1 pass. 5' per mile (1' per 1056') accuracy is required.
    - If the LWP's distance measuring subsystem fails to measure the length of the test section to within 0.1 percent of its actual length, the calibration shall be adjusted per the manufacturer's guidelines and the longitudinal verification repeated.
    - No more than one single certified operator is to occupy the profiler during verification/calibration.

- If the LWP fails to meet these requirements, the LWP will be deemed to be not certified and prohibited from use on PennDOT projects until it is recertified.
- A printed copy of the distance calibration must be submitted to the PennDOT representative.

✓ Instruct the operator that pavement profile and roughness data must be collected, processed and submitted for five passes for both wheel paths for each 528' test section, and that no more than 8 passes may be made. If targets are to be used during testing, instruct the operators that they are responsible for their placement.

✓ Collect the necessary raw (unfiltered) binary data files.

- The operator will provide a USB flash drive or CD that contains the raw (unfiltered) binary data for each wheel path. Each pass shall be clearly labeled to include surface type, lot number, and wheel path.
- The operator will provide a USB flash drive or CD that contains the raw (unfiltered) ERD or PPF files.

✓ Collect the necessary hardcopy reports.
- Printouts must be collected for each wheel path.
  - As a minimum, the printed reports must include the parameters outlined in #3 of the Acceptance section (p.12). One of the printed reports must include an extended header.
- The light weight profiler must be capable of printing the stored data upon operator request.

✓ Check that all required information is provided on the printouts.

✓ Check that the high-pass filter length is set to 100'. A Butterworth filter must be used.

✓ Check the resultant precision of the device, based on each submitted pass (minimum of 5) for each baseline.

✓ Check the resultant bias of the device, based on each submitted pass (minimum of 5) for each baseline.

✓ Check that the operator is competent and generally capable in the device operation, data processing and other associated tasks.

✓ If all checks meet requirements, complete and apply a calibration verification decal to the device. If the device is equipped with two sensors, and both sensors meet requirements, denote the decal as such. If only the right sensor meets requirements, denote the decal as a 1 sensor system. If the right sensor does not meet requirements, do not approve the device and apply no decal.

✓ If all checks meet requirements and payment is confirmed, issue a permanent operator certification card.

✓ Repeat the complete process for additional operators.

✓ Confirm credit card payment receipt or collect a check, made payable to: "COMMONWEALTH OF PENNSYLVANIA" with the provided invoice number and the proper amount. If payment is not made at the time of verification/certification, inform the operator(s) that that a 30-day temporary operator certification card will be issued and a permanent certification card will not be issued until payment is received. If the device is not approved, inform the operator(s) that recertification will not be performed without prior payment.

✓ If a previously approved device does not meet all requirements, remove the decal.

Appendix B:

Customer Information Form

M-2 (12-23)

pennsylvania
DEPARTMENT OF TRANSPORTATION

CUSTOMER INFORMATION FORM

Date: _____

Company/Agency Name: _____ Company Phone: _____

Company Address: _____ Company Contact: _____

_____ Company Email: _____

_____

The above information will be made public at:
http://www.penndot.gov/ProjectAndPrograms/ResearchandTesting/RoadwayManagementandTesting

Operator 1 Name: _____ Operator 2 Name: _____

Address: _____ Address: _____

_____ _____

Contact Phone #: _____ Contact Phone #: _____

Email: _____ Email: _____

Send Operator Card To: ☐ Home ☐ Office Send Operator Card To: ☐ Home ☐ Office

Operator 3 Name: _____ Operator 4 Name: _____

Address: _____ Address: _____

_____ _____

Contact Phone #: _____ Contact Phone #: _____

Email: _____ Email: _____

Send Operator Card To: ☐ Home ☐ Office Send Operator Card To: ☐ Home ☐ Office

OFFICIAL USE PennDOT LWP ID Number: _____

Vehicle Make/Model/VIN: _____

LWP Device Type: _____ Sensor Type: _____ Paid: ☐ Yes ☐ No

SN#1: _____ SN#2: _____ Sensor Spacing/Angle: _____

Profiler Software Name and Version: _____

Analysis Software Name and Version: _____

Comments: _____

_____

☐ Accelerometer Calibration ☐ Block Check ☐ Bounce Check ☐ Distance Calibration

Appendix D:

Daily IRI Data Collection Form

M-7 (12-22)

pennsylvania
DEPARTMENT OF TRANSPORTATION
www.penndot.pa.gov

DAILY IRI DATA COLLECTION FORM

Current Date: _____

Instructions:
1. Construction Inspector should convene with Light Weight Profiler Operator and complete all of Section 1, before testing begins.
2. Light Weight Profiler Operator should complete all of Section 2, before or after testing.

SECTION 1 - Construction Inspector

To be filled out by the Construction Inspector overseeing profiler testing

Construction Inspector's Name _____
Construction Inspector's Phone Number _____
Pavement Type: ☐ Asphalt ☐ Concrete
Concrete Joint Spacing _____
Verify lasers are spaced 69 inches apart +/-1.5 in ☐ Yes ☐ No
If previous answer was "No", what is the actual laser spacing _____
Comments

Operator's Certification Date _____
Verified Operator's Certification Card ☐
Profiler's Certification Date _____
Profiler's Certification Number _____
Equipment Number _____
Did operator perform a laser block calibration ☐ Yes ☐ No

SECTION 2 - LWP Operator

To be filled out by the Operator of the profiler device (and verified by the Construction Inspector overseeing profiler testing)

Date of Testing _____
Operator's Name _____
Company _____
Operator's Phone Number _____
Type of Lasers/Beam Width ☐ Single Point ☐ 1/4" ☐ 1" ☐ 3" ☐ 4" ☐ > 4" ☐ Triod ☐ Other _____
Number of Lasers _____
Last Distance Calibration Date _____
Software Name and Version _____
Comments

County _____ State Route Number _____
Begin Segment/Offset _____
End Segment/Offset _____
Project Name or Number _____
Construction Station Begin _____
Construction Station End _____
Lot Numbers Tested _____
Pavement Condition ☐ Wet ☐ Dry
Approximate Air Temperature _____
Was a lead in performed before test area ☐ Yes ☐ No

SECTION 3 - Submittals

Inspector Responsibilities: Fill out Form M-7 daily, and submit Form M-7 along with the test data to the inspector in charge.

Note: *If you have any questions regarding the LWP field-testing contact RITU at 717-787-7291, or email your questions to RA-PDIRIDATACOLLECT@pa.gov.*