LONG TERM PAVEMENT PERFORMANCE PROGRAM DIRECTIVE

For the Technical Direction of the LTPP Program

Program Area:	Monitoring	Directive Number:	P-26
Date:	February 1, 2000	Supersedes:	N/A
Subject:	Alternate LTPP Profiler Comparisons		

Overview

The objective of this directive is to provide a less resource intensive program for comparison of regional profilers on those years when, and only when, the annual inter-regional profiler comparison tests cannot be performed in accordance with instructions provided in LTPP Directive P-19. The purpose of the comparisons is to perform a periodic evaluation of the operational status of the profilers. These comparisons shall be conducted on a date and at a site to be determined by the FHWA LTPP Team.

When required, FHWA will select a host RCOC who will be responsible for coordination of logistical arrangements (hotel, maps, traffic control, meeting places), selection and marking of four comparison test sections (two test sections are asphalt concrete and the other two jointed portland cement concrete), and measurement of longitudinal profile on one of those test sections using a Dipstick. In addition to the four comparison test sections, another test section is required to evaluate the profiler's distance measuring instrument (DMI).

After completion of preparatory activities, and on date specified by FHWA, non-host RCOCs will travel to the comparison sites and, together with host RCOC, perform profile measurements over a two- to four-day period with their respective profilers. During the comparisons, an assessment of the profiler's distance measuring system and static repeatability of the profiler height sensors will also be performed. Data resulting from the comparison tests will be submitted by each RCOC to the FHWA LTPP Office, with a copy to the LTPP Technical Support Services Contractor (TSSC), within 15 days after completion of the tests. Comparisons and analyses of the profiler test data will be performed by the TSSC, who will produce and submit to the FHWA LTPP Office a report of the results within 30 days after receipt of the individual RCOC reports.

Preparatory Activities (Host RCOC)

The host RCOC will be responsible for the following activities:

1. Coordination with FHWA LTPP Team and TSSC, including:

    a. Coordination of dates for profiler comparison tests.
    b. Site selection.
    c. Logistical arrangements (reserve block of rooms at or near selected site, meal arrangements, traffic control arrangements, etc.).
    d. Communication of final logistical arrangements to FHWA, TSSC and other three RCOCs.

2. Selection and marking of test sections in accordance with the following guidelines:

    Four profile and one DMI test section shall be used. Where convenient, one of the profile test sites maybe used for the DMI test section. The four profile test sections shall have the following attributes:

    a. Section 1 (AC-1): Asphalt concrete pavement structure with an IRI <1.6 m/km
    b. Section 2 (AC-2): Asphalt concrete pavement structure with an IRI > 2.2 m/km
    c. Section 3 (PCC-1): Jointed portland cement concrete pavement structure with an IRI < 1.6 m/km
    d. Section 4 (PCC-2): Jointed portland cement concrete pavement structure with an IRI > 2.2 m/km
    e. Asphalt concrete pavement sections shall be reasonably consistent with the criteria for GPS 1, 2 and 6 test sections. AC overlays on PCC pavements shall not be used.
    f. Jointed PCC test sections shall be reasonably consistent with GPS 3 and 4 guidelines. PCC overlay test sections shall not be used.
    g. Test sections shall have a marked outside lane edge stripe that can be used as an outside lane edge reference.
    h. Test sections shall be located on flat tangent sections with sufficient length at each end to allow for acceleration to a constant speed prior to section and safe deceleration past its end.
    i. Each test section shall be 152.4-m in length.
    j. Where possible, test sections should be located within a centralized locale with short travel distances between each test section to reduce travel time.
    k. Test sections do not have to be located on LTPP test sections; however, LTPP test sections can be used when convenient.

    An accurately measured section, 300-m long, shall be used as the DMI test section. A standard surveying tape, or equally accurate electronic method, shall be used in conformance with standard surveying practice to accurately locate the end point relative to the start point. The DMI test section shall be located on a reasonably level pavement suitable for such testing (i.e. low traffic volume, adequate sight distances, operator safety, etc.).

3. Longitudinal profile measurements with Dipstick in accordance with the following guidelines:

   Dipstick measurements shall be performed on, and only on, Section AC-1 (asphalt concrete pavement structure with IRI <1.6 m/km) using the procedures outlined in the current version of the **LTPP Manual for Profile Measurements, Operational Field Guidelines** (hereafter referred to LTPP Profile Manual). These measurements shall be performed within 14-days of the profiler comparison tests.

Profiler Comparison Tests (All RCOCs)

The profiler comparison tests shall consist of the following:

1. DMI Calibration and Measurements

   DMI measurements shall be obtained at the DMI test section **prior to and after profiling the four profiler comparison test sections**. The following procedure shall be used to obtain each of the two sets of DMI measurements:

   a. Measure tire pressure of profiler's front wheels and calibrate DMI following procedures described in the LTPP Profile Manual. Air temperature shall also be recorded.
   b. Perform six repeat runs at the DMI test section; the test section length displayed on the DMI after each run shall be recorded.
   c. After completing six runs, again measure tire pressure of profiler's front wheels and record air temperature.

   DMI calibration shall be performed following procedures described in the LTPP Profile Manual. The DMI calibration factor should be reset if the recorded distances are found to be outside of the tolerance of 0.05% over the 300-m test section. A log should be kept on the results of all distance measurements conducted on the DMI test section, and any changes to the DMI calibration coefficients.

2. Static Height Sensor Measurements

   Prior to obtaining measurements at profile test sections, the profiler's height sensors and accelerometers shall be calibrated in accordance with the procedures described in the LTPP Profile Manual. The static height sensor measurements shall be conducted immediately after calibration of the height sensors. For each height sensor obtain and record the heights at each of the following positions:

   Position 1. Leveling Plate
   Position 2. Leveling Plate + 25 mm Block
   Position 3. Leveling Plate + 50 mm Block
   Position 4. Leveling Plate + 75 mm Block

Repeat procedure five times for each sensor and compute average height and standard deviation at each position for each sensor.

3. Profile Measurements

The procedures described in the LTPP Profile Manual shall be followed prior to and during profile data collection. At each profile test section, obtain an acceptable set of profile measurements that satisfy the criteria described in Section 2.2.5 of the LTPP Profile Manual. Profile measurements shall be obtained at a test speed of 80 km/h.

Report

All data processing shall be performed using the latest active version of the PROQUAL software. Within 15-days after completion of the comparison testing, the RCOCs shall submit a report to the FHWA LTPP Office, with a copy to the LTPP TSSC, containing the following information:

Test Section Description (Host RCOC only)

Provide description of pavement test section location, physical and structural attributes, distress condition, and type of facility. Details shall be given on those attributes of the test section which are suspected of influencing the profile measurements, such as meandering cracks in the wheel paths, highly variable transverse profile, etc. Detailed measurements are not required. Subjective based descriptions are satisfactory.

Equipment Description (Host RCOC only)

Provide brief description of distance measurement device used to layout the DMI test section and of Dipstick unit used to perform longitudinal profile measurements on comparison test section AC-1. Also, include dates when these measurements were performed and summary description of DMI test section layout.

Test Results (All RCOCs)

Provide the following information based on the comparison test results:

1. Static height sensor measurements: For each profile height sensor, measurements recorded at each measurement position and associated average and standard deviation values shall be recorded on attached Table 1.

2. DMI measurements: Individual length measurements of the DMI test section and associated average and standard deviation values from the six individual runs shall be recorded on attached Table 2.

3. IRI summary: For each section, computed IRI values in each wheel path and associated average and standard deviation values shall be recorded on attached

Table 3 (separate table provided for each section). Use latest version of the PROQUAL software for the five runs that would have been normally selected for upload to the LTPP IMS in accordance with standard LTPP procedures.

All test results shall be reported in SI (metric) units.

Other Data and Files

Provide paper work normally required for field profile operations, including Profiler Field Activity Report, Profiler Calibration Log, Major Maintenance or Repair Report (during test period). Also submit print out and computer files generated by the PROQUAL software.

Raw Data

Submit p-files created by K.J. Law software and Dipstick data (host RCOC only) on diskette. Provide documentation permitting identification of data files with device and measurement date. A copy of all data and forms from these tests shall be kept at the RCOC offices for future reference.

Comparisons and analyses of the profiler test data submitted by the RCOCs will be performed by the TSSC, who will produce and submit to the FHWA LTPP Office a report of the results within 30 days after receipt of the individual RCOC reports. As part of this effort, the results generated will be reviewed and compare with the bias and precision criteria established in LTPP Directive P-19: Annual Inter-Regional Profiler Comparison Tests.

Questions concerning this directive should be addressed to Larry Wiser of the FHWA LTPP Team at (202) 493-3079.

Prepared by: TSSC

Approved by:

Aramis Lopez
Team Leader, LTPP Team Leader

Table 3. IRI Summary

RCOC: _____

Test Section ID: _____PCC-2_____ Test Speed: 80 kph

Profiler Unit	Survey Date	IRI Value (m/km) -- Left Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Profiler												

Profiler Unit	Survey Date	IRI Value (m/km) -- Right Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Profiler												

Notes: (1) report IRI values to the nearest 0.001 m/km.
(2) although space is provided in the above table for nine separate runs, the actual number of measurements shall be performed in accordance to standard LTPP procedures.

Table 3. IRI Summary

RCOC: _____

Test Section ID: _____PCC-1_____ Test Speed: 80 kph

Profiler Unit	Survey Date	IRI Value (m/km) -- Left Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Profiler												

Profiler Unit	Survey Date	IRI Value (m/km) -- Right Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Profiler												

Notes: (1) report IRI values to the nearest 0.001 m/km.
(2) although space is provided in the above table for nine separate runs, the actual number of measurements shall be performed in accordance to standard LTPP procedures.

Table 3. IRI Summary

RCOC: _____

Test Section ID: _____AC-2_____ Test Speed: 80 kph

Profiler Unit	Survey Date	IRI Value (m/km) -- Left Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Profiler												

Profiler Unit	Survey Date	IRI Value (m/km) -- Right Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Profiler												

Notes: (1) report IRI values to the nearest 0.001 m/km.
(2) although space is provided in the above table for nine separate runs, the actual number of measurements shall be performed in accordance to standard LTPP procedures.

Table 3. IRI Summary

RCOC: _____

Test Section ID: _____AC-1_____ Test Speed: 80 kph

Profiler Unit	Survey Date	IRI Value (m/km) -- Left Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Dipstick												
Profiler												

Profiler Unit	Survey Date	IRI Value (m/km) -- Right Wheel Path										
		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average of Five Selected Runs	Std. Dev. Of Five Selected Runs
Dipstick												
Profiler												

Notes: (1) report IRI values to the nearest 0.001 m/km.
(2) although space is provided in the above table for nine separate runs, the actual number of measurements shall be performed in accordance to standard LTPP procedures.

Table 2. DMI Measurements

RCOC: _____

Test Section ID: DMI Test Section

Before Profiling Comparison Test Sections

Test Date:_____

Tire Pressures and Air Temperature

Time of Measurements	Front Wheel Tire Pressures		Air Temp (^{o}C)
	Right (kPa)	Left (kPa)	
Before DMI Measurements			
After DMI Measurements			

DMI Measurements

Section Length (m)						Average	Standard Deviation
Run 1	Run 2	Run 3	Run 4	Run 5	Run 6		

After Profiling Comparison Test Sections

Test Date:_____

Tire Pressures and Air Temperature

Time of Measurements	Front Wheel Tire Pressures		Air Temp (^{o}C)
	Right (kPa)	Left (kPa)	
Before DMI Measurements			
After DMI Measurements			

DMI Measurements

Section Length (m)						Average	Standard Deviation
Run 1	Run 2	Run 3	Run 4	Run 5	Run 6		

Table 1. Static Height Sensor Measurements

RCOC: _____

Test Date: _____

Position	**Left Sensor** Reading 1	Reading 2	Reading 3	Reading 4	Reading 5	Average of Readings	Standard Deviation
Leveling Plate							
Leveling Plate + 25mm Block							
Leveling Plate + 50mm Block							
Leveling Plate + 75mm Block							

Position	**Middle Sensor** Reading 1	Reading 2	Reading 3	Reading 4	Reading 5	Average of Readings	Standard Deviation
Leveling Plate							
Leveling Plate + 25mm Block							
Leveling Plate + 50mm Block							
Leveling Plate + 75mm Block							

Position	**Right Sensor** Reading 1	Reading 2	Reading 3	Reading 4	Reading 5	Average of Readings	Standard Deviation
Leveling Plate							
Leveling Plate + 25mm Block							
Leveling Plate + 50mm Block							
Leveling Plate + 75mm Block							

Notes: (1) report height measurements to the nearest 0.01 mm
(2) recommended bias is $\pm$ 0.25 mm and precision is 2-Std.Dev. < 0.25 mm