Memorandum

U.S. Department
of Transportation

**Federal Highway
Administration**

6300 Georgetown Pike
McLean, Virginia 22101

Subject: **ACTION**: LTPP Directive P-29
Revised Procedure for Performing Bounce Test

Date: July 3, 2001

From: Larry Wiser
Long Term Pavement Performance Team

Reply to
Attn of: HRDI-13

To: Dr. Frank Meyer, PI - LTPP North Atlantic Regional Contract
Mr. Tom Wilson, PI - LTPP North Central Regional Contract
Mr. Mark Gardner, PI - LTPP Southern Regional Contract
Dr. Sirous Alavi, PI - LTPP Western Regional Contract

Attached is the Long-Term Pavement Performance (LTPP) Directive P-29, which provides the revised procedure for performing the bounce test. The bounce test is performed to verify that the height sensors and accelerometers in the profiler are functioning properly. This directive should be transmitted to all appropriate personnel as soon as possible.

If you have any questions concerning this transmittal, please do not hesitate to call me at (202) 493-3079.

Attachment

FHWA:HRDI-13:LWiser:mad:493-3079:7/3/01
File: c:\mdeeney\wiser\p-29fhwa.doc
cc:
LAW PCS
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Directive File
Official File (180.20)
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LONG TERM PAVEMENT PERFORMANCE PROGRAM DIRECTIVE

For the Technical Direction of the LTPP Program

Program Area:	Monitoring	Directive Number:	P-29
Date:	July 3, 2001	Supersedes:	Portions of P-25
Subject:	Revised Procedure for Performing Bounce Test		

Background

The bounce test is performed to verify that the height sensors and accelerometers in the profiler are functioning properly. This directive describes the revised procedure to be followed by the regions, effective immediately, when performing the bounce test. This procedure supersedes the one contained in the LTPP Manual for Profile Measurements, Operational Field Guidelines, Version 3.1, January 1999.

Procedure

The bounce test shall be performed every day prior to data collection. The vehicle engine should be turned off while performing the test. In addition, because pavement surface texture can affect the IRI values obtained from the bounce test, the operator should place a dark brown masonite clipboard below all sensors when performing the test. To facilitate bounce testing, a default header with the correct options can be used.

LTPP profilers are currently equipped with one of two different types of distance measuring instruments (DMI). Those equipped with the newer DMI have to change their DMI calibration factor prior to performing the bounce test so that the test mode oscillator can simulate a 55 km/h profiling speed during the bounce test. Profilers equipped with the older DMI do not need to change the DMI calibration factor. **If the DMI calibration factor is changed to perform the bounce test, the factor needs to be changed back to the correct value after completion of the bounce test.**

The specific procedure for conducting the bounce test is as follows:

1. Take the sensor covers off and inspect the sensor lenses for cleanliness and damage. If the sensor lenses are dirty, carefully clean them with a clean cloth or paper towel.

2. Turn on the power to the electronic equipment and launch the K.J. Law profiling software so that the system warms-up and stabilizes. Equipment should be warmed up for at least 20 minutes prior to testing. It is suggested that the accelerometer signal be displayed on the monitor from the ***Calibration Menu*** so that the sensors are activated during this warm-up period.

3. This step is only required if the profiler is equipped with the new DMI components. If the profiler is equipped with the older DMI components go to step 4.

   - From the ***Main Menu***, select "B> CALIBRATION" to go to the ***Calibration Menu***.
   - From the ***Calibration Menu***, select "F> ENTER CALIBRATION VALUES", to go to the ***Enter Menu***.
   - From **t**he ***Enter Menu*****,** select "A> ENTER DIMENSION CALIBRATION VALUES" to go to the ***Dimension Menu***.
   - From the ***Dimension Menu***, record value indicated in the "DISTANCE ENCODER CALIBRATION VALUE" field. Next, select "A> DISTANCE ENCODER CALIBRATION VALUE" to clear the field, and enter 1.56.
   - Exit the ***Dimension Menu***, to get back to the ***Calibration Menu*** and from the ***Calibration Menu*** select "G> STORE CALIBRATION VALUES" to store new calibration factor.
   - Software will then prompt "Do You Want to Archive the Calibration Values (Y/N) ?". Enter "N" so that the calibration value will not be archived.
   - Exit ***Calibration Menu*** to go back to ***Main Menu***.

4. Select "A> Run Profile" from the ***Main Menu*** to go to the ***Setup Menu.***

   Note: Steps 5 through 9 describe procedures for creating a default header. When the test is performed again, the file that was created in step 9 can be retrieved, and appropriate entries can be made to perform another bounce test.

5. Select "A> SYSTEM SETUP" from the ***Setup Menu***. In the ***System Setup Menu*** change "C> GRAPHICS SCALE" to 3.12 mm by toggling the "Enter" key. Next, toggle "K> TEST MODE OSCILLATOR" with the "Enter" key so that the test mode oscillator is enabled. Exit the ***System Setup Menu*** to go back to the ***Setup Menu***.

6. Select "B> RUN IDENTIFICATION" from the ***Setup Menu***, to go to the ***Identification Menu***. In the ***Identification Menu***, select "B> OUTPUT FILE NAME" and type a file name. To make tracking of files easier, use of the following file naming convention is recommended: Smmddyy.p1 for static test (mm – month, dd – day, yy – year) and Dmmddyy.p1 for dynamic test. If a different file naming convention is used, it should be such that bounce test data files can easily be tracked according to date. Next select "C > OUTPUT FILE DIRECTORY" and type a directory name such as "BOUNCE" so that all bounce test files are kept in a standard directory. Exit the ***Identification Menu*** to go back to the ***Setup Menu***.

7. Select "E> RUN CONTROL" from the ***Setup Menu*** to go to the ***Run Control Menu***. In the ***Run Control Menu***, select "F> START RECORD METHOD" and toggle the "Enter" key so that Start Record Method is "pendant." Next, select "H> STOP RECORD METHOD" and toggle the "Enter" key so that Stop Record Method is "DISTANCE." Select "I> STOP RECORD DISTANCE" and enter 300.15 m. Exit the ***Run Control Menu*** to go back to the ***Setup Menu***.

8. Select "F> OPTION SETUP" from the ***Setup Menu*** to go to the ***Option Setup Menu***. In ***Option Setup Menu***, select "A> PROFILE INDEX TYPE" and set it to IRI, select "C> PROFILE INDEX AVG INTERVAL" and set it to "150 meters", select "B> PROFILE INDEX WHEEL PATH" and set it to "BOTH." Exit the ***Option Setup Menu*** to go back to the ***Setup Menu***.

9. From the ***Setup Menu***, select "G> STORE HEADER INFORMATION" and enter a suitable default header name so that the setup information to perform the bounce test can be retrieved when performing the bounce test.

10. The procedure described in this step will collect data in the Static Mode. Consequently, the operator should make sure no movements are induced on the vehicle during data collection. From the ***Setup Menu***, select "L> RUN PROFILE." The system will now be in the data collection mode and the operator should visually verify on the computer monitor that the system is collecting a simulated profile. If the operator wishes to check the functioning of the center sensor, toggle the "+/=" key on the keyboard to swap the left sensor profile with the center sensor profile. (NOTE: This action does not influence the data collection process.) Press the space bar or the operator pendant to start recording profile data. At the completion of 300 meters simulated distance, an auditory signal will be heard that indicates termination of data collection. The operator will then be prompted to enter a suitable end of run comment.

11. Next the software automatically launches the "Profile Spikes" (SPIKE.EXE) program, which will allow the operator to examine the profile data collected in step 10. The operator should enter "X" to exit the SPIKE.EXE program. If a plot of the static bounce profile is desired, follow the procedure outlined in step 19.

12. Upon exiting the SPIKE.EXE program, the software prompts the operator to copy the profile files to the hard disk, to copy the files to a floppy disk, and to delete the profile files from the RAM disk. The operator should copy the files to the hard disk but should not delete the files from the RAM disk at this time.

13. From the ***Setup Menu***, select "N> DISPLAY LAST RUN." Enter "Y" to display the index file and then enter "N" to prevent the index file from being printed on the printer. The 'I File' will be displayed on the screen, and the left and right IRI values for the distance between 150 and 300 m should be noted. Enter "X" to exit the 'I File' display and enter "N" to return to ***Setup Menu***.

14. From the ***Setup Menu***, select "B> RUN IDENTIFICATION" to go back to the ***Identification Menu***. Select "B> OUTPUT FILE NAME" and type a file name for the

dynamic bounce test profile. The file naming convention described in step 6 may be used to assign a file name. Exit the ***Identification Menu*** to go back to the ***Setup Menu***.

15. From the ***Setup Menu***, select "A> SYSTEM SETUP" to go to ***System Setup Menu***. Select "K> TEST MODE OSCILLATOR" and toggle the oscillator to 'ENABLE' using the "Enter" key. Exit the ***System Setup*** menu to go back to the ***Setup Menu***.

16. From the ***Setup Menu,*** select "L > RUN PROFILE." The system will now be in the data collection mode, and the operator should visually verify on the computer monitor that the system is collecting a simulated profile. If the operator wishes to check the functioning of the center sensor, toggle the "+/=" key on the keyboard to swap the left sensor profile with the center sensor profile. (NOTE: This action does not influence the data collection process.) Press the space bar or the operator pendant to start recording profile data.

    Note: There is a time lapse between time when the operator presses the space bar or pendant and time when the vehicle is bounced. Since the Stop Record Distance is set to 300.15 m (see step 7) and IRI for evaluating bounce test is computed for distance between 150 and 300 m, operator must ensure that vehicle is being bounced as described in step 17 before recording distance of 150 m is reached.

17. Stand on the rear bumper of the profiler and rock the vehicle to induce a pitching motion. This motion should pitch the vehicle along the longitudinal direction with no sideways motion. Motion should correspond to a 25 mm displacement of the rear bumper for each bounce (i.e., distance from highest position to lowest position is 25 mm during bouncing). Because the IRI value used to evaluate results of the bounce test is for the distance between 150 and 300 m, the vehicle must be bounced for complete time duration corresponding to these limits. If for any reason bouncing of the vehicle commences after 150 m has been reached, the test is considered invalid and must be repeated.

18 Stop bouncing when end of run auditory signal is heard. Again, operator must ensure that the vehicle is bounced until end of run. It is recommended that operator perform a trial run and obtain a time estimate of how long it takes for the end of run to be reached. This time estimate should be used when the bounce test is performed at a location where the end of run auditory signal cannot be heard (e.g. traffic noise).

19. When data collection is terminated, the operator will be prompted to enter a suitable end of run comment. Next, the software automatically launches the "Profile Spikes" (SPIKE.EXE) program, which will allow the operator to examine the profile data collected during the bounce test. Invoke the "I" command and enter 150 for the beginning log number and 300 for the ending log number so that the plot for the distance between 150 and 300 will be displayed. Enter "P" to enter into the profile plotting routine. If a hard copy of the profile plot is desired, enter "C" to enable the print plot and then press the "Enter" key to plot the bounce profile onto the screen and print a copy to the printer. The program will plot the profile to the monitor even if the print plot is not enabled. The plot will show data recorded by the left, right and center sensors between 150 and 300 m. Compare the plots recorded by the three sensors to verify that the center sensor is functioning properly. After examining the profile plots, press the "Enter" key to return to the SPIKE.EXE main screen, and enter

"X" to exit the SPIKE.EXE program; pressing the "Enter" key will also exit the SPIKE.EXE program, but a spike file is created. If problems are encountered in plotting profiles using the described method, the K.J. Law off line program may be used for plotting.

20. Upon exiting the SPIKE.EXE program, the software prompts the operator to copy the profile files to the hard disk, to copy files to a floppy disk, and to delete the profile files from the RAM disk. The operator should copy the files to the hard disk but should not delete the files from the RAM disk at this time.

21. From the ***Setup Menu***, select "N> DISPLAY LAST RUN." Enter "Y" to display the index file and then enter "N" to prevent the index file from being printed on the printer. The "I File" will be displayed on the screen, and the left and right IRI values should be noted for the distance between 150 and 300 m. Enter "X" to exit the "I file" display and enter "N" to return to the ***Setup Menu***.

    If the static test IRI value for the left and right wheel paths is less than or equal to 0.08 m/km and the difference between dynamic bounce test IRI and static test IRI values for each wheel path is less than or equal to 0.10 m/km, then the left and right sensors are considered to be functioning properly.

22. If the IRI value for either wheel path from step 21 exceeds specified values or printout from step 19 indicates that there may be a problem with the center sensor, repeat test two or three times to see if specified conditions can be achieved. If conditions are satisfied, the sensors are considered to be working properly.

23. If the IRI value for either wheel path from step 21 exceeds specified values or printout from step 19 indicates that there may be a problem with the center sensor, move vehicle and perform test at a different location. If specified conditions still cannot be achieved, contact K.J. Law Engineers, Inc. for advice. It has been observed that flakes can form inside the infrared sensors due to corrosion and they can have a significant effect on the bounce test results. Inability of the sensors to achieve specified tolerance could be related to this condition, but this is not the only reason that will cause the sensors to fail the specified criteria.

24. **If the DMI Calibration factor was changed in step 4, the correct value must be entered back into the software.**

    - From ***Main Menu*** select "B> CALIBRATION" to go to ***Calibration Menu***, and in ***Calibration Menu***, select "F> ENTER CALIBRATION VALUES" to go to ***Enter Menu***.
    - From ***Enter Menu***, select "A> ENTER DIMENSION CALIBRATION VALUES" to go to ***Dimension Menu***.
    - From the ***Dimension Menu***, select "A> DISTANCE ENCODER CALIBRATION VALUES" to clear field and to enter original calibration value.
    - Exit ***Dimension Menu*** to go back to ***Calibration Menu***.
    - From ***Calibration Menu***, select "G> STORE CALIBRATION VALUES."

- Software will then prompt “Do You Want to Archive the Calibration Values (Y/N)?” Enter “N” so that calibration value will not be archived.
- Exit ***Calibration Menu*** to go back to ***Main Menu***.

Other Consideration

- If an equipment problem is found and fixed, the operator should re-evaluate profile data collected during previous day. If the problem was in either the left or the right wheel path sensor, the IRI values and profile elevations obtained during the previous day should be compared with those obtained from the last visit to the site. If data problems are suspected, the section should be re-profiled.

- After the operator completes calibration of displacement sensors and accelerometers (see Section 2.5 of LTPP Manual for Profile Measurements, Operational Field Guidelines, Version 3.1, January 1999), a bounce test should be performed and a printout of the profile recorded by the left, right and center sensors should be obtained. These plots should be reviewed for cyclic amplitudes that differ between sensors and for other apparent discrepancies. If differences are noted, it should alert the operator that there is a potential problem with the sensors.

Question concerning this directive should be addressed to Larry Wiser of the FHWA LTPP Team office at (202) 493-3079. If there are any problems, please submit a Profiler problem report (PROFPR) form in accordance with LTPP Monitoring Directive P-03.

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Approved by:

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