# LONG TERM PAVEMENT PERFORMANCE PROGRAM DIRECTIVE

**For The Technical Direction Of The LTPP Program**

**Program Area: GPS & SPS** **Directive Number: S-10**

**Date: July 27, 1994** **Supersedes:**

**Subject: Global Positioning Measurements**

Attached are the instructions of procedures and forms to be used in collection of location data for SPS and GPS projects using the global positioning system receivers. The data collected from the global positioning system will replace existing latitude and longitude data in the IMS. A input screen placing the data into the IMS from the field form will be developed soon.

Data collection should be initiated immediately and once successfully collected on a project need not be repeated on subsequent site visits. Data collection arrangements (vehicle etc.) are at the RCOC discretion but data should be collected in a timely, systematic manner. It is anticipated that all projects will be covered within 18-24 months but separate trips exclusively for this data collection effort should not be made.

Approved: Monte Symons

Date: 7/27/94

Attachment (5 pages)

# LTPP SECTION OR PROCESS LOCATION DATA COLLECTION PLAN

Accurate section or project location data -- latitude and longitude -- are critical to the LTPP program. Among other things, the availability of accurate location data will allow us to verify the contents of the existing LTPP climatic database and to perform future updates of the climatic database with confidence and in a timely manner.

At present, the most reliable, economical and expedient way of obtaining this information is through the use of Global Positioning System (GPS) receivers. GPS receivers track several satellites at a time and provide latitude, longitude, and elevation data with and can achieve accuracies of 15 to 30 meters.

GPS receivers have been purchased by the Regional Coordination office Contractors (RCOCs) to measure the location of LTPP test sections. Guidelines for the collection of LTPP section or project location data are provided below:

- Location measurements shall be performed in conjunction with normally scheduled profile measurements. For off-shore test sections and in special circumstances, location measurements can be performed in conjunction with other measurements.

- Location measurements shall be made when the profiler (or alternate vehicle) first arrives at the site. This will provide time to make repeat measurements if necessary.

- Location measurements shall be performed in accordance with the guidelines provided by the GPS receive manufacturer. The operator shall verify that the unit contains adequately charged batteries. When in use, the unit shall be set to metric measurements in the setup menu.

- Location measurements shall be performed at station 0+00 for GPS test sections. For SPS projects, measurements shall be performed at station 0+00 of the first test section on the project.

  Notes: (1) if more than one GPS sections and/or SPS projects exist at a site, separate measurements shall be made for each GPS section or SPS project.

  (2) repeat measurements shall not be made unless the estimated position error (EPE) is greater than 200 m or the unit is not able to track enough satellites to provide a measurement.

  (3) record location measurements and other information requested on Inventory Data Sheet lA.

- If the EPE is greater than 200 m or a measurement was not obtained, the GPS operator shall make a second set of measurements at least 15 minutes after the initial readings were made. If the EPE is still greater than 200 m or a measurement has not been obtained, complete all other planned activities at the site (for the day) and then perform a third set of measurements at the end of the monitoring period. If the EPE is still high or a measurement has not been obtained, perform one last set of measurements.

  Note: (1) No more than four sets of measurements per visit shall be performed at a given section or project.

  (2) If multiple sets of measurements are required, the minimum time interval between readings shall be 15 minutes.

  (3) If after four rounds of measurements the EPE is still greater than 200 m, record the set of measurements that had the lowest EPE value on Inventory Data Sheet lA and provide notes on the comment line on the number of measurements performed. RCOCs shall keep track of those sections for which no measurements were obtained or an EPE value less than 200 m was not achieved so additional measurements can be made during future visits.

- Location measurements shall be recorded on Inventory Data Sheet lA - Global Positioning Measurements (attached to this document). Data elements in this data sheet include: State Code, LTPP Section ID, GPS Instrument Type and Model Name, Measurement Date, Latitude, Longitude, Elevation, Dilution of Precision (DOP), Estimated Position Error (EPE), Comments, Preparer, and Employer.

  Note: (1) only latitude and longitude shall be entered into the IMS; elevation measurements shall be used by the RCOCs to check the reasonableness of the data currently stored in the IMS; all other data elements shall be used for quality control purposes by the RCOCs.

  (2) instructions for completing this data sheet are attached to the form.

Should the RCOCs have any questions regarding the collection of location data with the GPS receivers, they should contact:

Monte Symons, Federal Highway Administration, LTPP Division
Phone: (703) 285-2730; Fax: (703) 285-2767

or

Gonzalo R. Rada, LTPP Technical Support Contractor, PCS/Law Engineering
Phone: (301) 210-5105; Fax: (301) 210-5032

# LTPP INVENTORY DATA
# GLOBAL POSITIONING MEASUREMENTS
# INVENTORY DATA SHEET lA

This data sheet is to be filled out in the field for each L TPP test section for which latitude and longitude measurements are made using Global Positioning System (GPS) receivers. Latitude and longitude data entered in this sheet will supersede those values stored in the IMS, which were originally entered in Inventory Data Sheet 1, Project and Section Identification.

*STATE CODE:* the state code is a number used to identify the state or Canadian province in which the LTPP pavement section is located (see Table A.l, Appendix A for codes).

*LTPP SECTION ID:* the LTPP section ID is a four-digit identification number assigned by SHRP or the FHWA LTPP Division. This number if used to facilitate the computer filing of the projects and will identify the section in the field. It will be cross-referenced with the State assigned ID.

1. *GPS Instrument Type and Model Name:* space is provided to enter type and model of GPS receiver used to measure latitude and longitude. This information is not entered into the IMS.

2. *Measurement Date:* a set of numbers to identify the day, month and year in which latitude and longitude measurements were made with the GPS receiver. The format for this data element is dd/mm/yyyy; e.g., 03/04/1994 for GPS measurements made on April 3, 1994, 20/12/1996 for GPS measurements made on December 20, 1996. This information is not entered into the IMS.

3. *Latitude:* latitude of LTPP test section or project, as determined from the GPS measurement, in degrees, minutes and seconds to the nearest tenth of a second. This information supersedes that currently stored in the LTPP IMS. (Note: North or South direction is not entered on this data sheet, since it is assumed to be North; however, direction will be included in the IMS at a future date to allow for sections in the Southern Hemisphere).

4. *Longitude:* longitude of LTPP test section or project, as determined from the GPS measurement, in degrees, minutes and seconds to the nearest tenth of a second. This information supersedes that currently stored in the LTPP IMS. (Note: West or East direction is not entered on this data sheet, since it is assumed to be, West; however, direction

will be included in the IMS at a future date to allow for sections in the Eastern Hemisphere).

5. *Elevation:* elevation of the LTPP section, as determined from the GPS measurement, in meters to the nearest meter. This information is not entered into the IMS, but should be used by the RCOCs to check the reasonableness of the elevation data currently stored in the IMS.

6. *Dilution of Precision (DOP):* measure of satellite geometry quality and relative accuracy of the GPS measurement. The DOP ranges from 1.0 (best) to 9.9 (worst), with value entered to the nearest tenth. This information is not entered into the IMS, but is used by the RCOCs for quality control purposes.

7. *Estimated Position Error (EPE):* overall measure of position accuracy computed using the DOP, signal and data quality, receiver tracking status and other factors. The EPE is expresses in meters, with value entered to the nearest meter. This information is not entered into the IMS, but is used by the RCOCs for quality control purposes.

8. *Comments:* space is provided to enter any pertinent comments related to the latitude and longitude measurements using the GPS receiver. This information is not entered into the IMS .

*PREPARER:* space is provided to enter the name of the GPS operator who made the latitude and longitude measurements. This information is not entered into the IMS, but is used by the RCOCs for quality control purposes.

*EMPLOYER:* space is provided to enter the name of the GPS operator employer. This information is not entered into the IMS.

| LTPP INVENTORY DATA<br>GLOBAL POSITIONING MEASUREMENTS<br>INVENTORY DATA SHEET 1A | STATE CODE [ __ __ ]<br><br>TEST SECTION NO. [ __ __ __ __ ] |
|---|---|

1. GPS Instrument Type and Model Name _____
2. Measurement Date (dd/mm/yyyy) __ __ / __ __ / __ __ __ __
3. Latitude (Degrees, Minutes, Seconds) [ __ __ ° __ __ ′ __ __ . __ ″]
4. Longitude (Degrees, Minutes, Seconds) [ __ __ ° __ __ ′ __ __ . __ ″]
5. Elevation (meters) __ __ __ __ .
6. Dilution of Precision (DOP) __ . __
7. Estimated Position Error (EPE, meters) __ __ __ __
8. Comments

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Notes:

(1) Only data elements in brackets are entered into the IMS.
(2) For GPS sections, perform measurement at station 0+00.
(3) For SPS sections, perform measurements at station 0+00 of the first test section located on the project; use project ID with 00 for last two digits.

PREPARER_____ EMPLOYER_____ DATE _____