Specifications

1.0 Ground Penetrating Radar (GPR) Overview

The GPR shall consist of an array of non-contacting antennas and must be capable of high speed inspection of bridge decks for delamination and deteriorated concrete, measurement of rebar depth and overlay thickness. The GPR system shall be installed in a vehicle and the inspection conducted at highway speed, thereby eliminating the need for maintenance and protection of traffic.

2.0 Standards and Guidelines

The GPR inspection will be conducted in compliance with

- Strategic Highway Research Program, SHRP project C-101 Task B research for detection of deterioration in asphalt covered concrete decks.

3.0 GPR Apparatus

The GPR system shall consist of the following components:

3.1 Ground Penetrating Radar

- Each antenna shall operate with a minimum range scan of 15 ns and a range scan rate of 100 scans/second, minimum
- The radar equipment shall employ an Autolock capability to automatically lock and stabilize the surface reflection against antenna bounce.
- The radar equipment shall employ a Clutter Cancellation technique to improve signal quality by digital removal of internal system noise known as Clutter.

3.2 Data Acquisition System

- A data acquisition system shall consist of equipment for collecting radar data at a minimum rate of 80 kHz for each antenna.
- To ensure maximum longitudinal deck coverage, the data acquisition system shall be capable of acquiring every radar range scan from all antennas simultaneously without loss of data.
- The data acquisition system shall be capable of digital radar data acquisition and storage for four radars to the hard disk for continuous periods of no less than 4 hours.

3.3 Distance Measurement System
• A distance measurement system consisting of an appropriate distance measurement instrument (DMI) with accuracy of +/-100 mm per km ( +/- 6.5 inch per mile) and a resolution of 25 mm (1 inch) shall be used to register GPR data relative to traveled distance. The GPR must be capable of acquiring GPS (Global Positioning Satellite) information.

4.0 GPR Data Collection

• The radar inspection will be performed in a series of longitudinal passes along the length of the deck using an array of three or more air-coupled GPR antennas.
• The survey will be performed in all traffic lanes in the direction of traffic, and at no times shall the GPR vehicle be permitted to straddle lanes during data collection.
• The GPR inspection shall be conducted at highway speeds (40+ MPH) or at the posted speed, whichever is lower. This will minimize interference to traffic and eliminate the need for maintenance and protection of traffic (MPT).

5.0 GPR Data Analysis

Delamination – All GPR data will be analyzed for delamination at the top reinforcing steel level, in accordance with AASHTO TP36 and ASTM D6087-97/03 based upon measurement of signal attenuation through the concrete deck.

If applicable, the GPR data will be analyzed for the following:

Debonding – For decks with concrete or latex modified concrete overlays, all radar data will be analyzed and the locations of debonded overlay will be determined and presented graphically in plan-view.

Scaling (Freeze-thaw damage) – For decks with a bituminous overlay, all radar data will be analyzed and the locations of freeze-thaw damaged concrete will be identified and presented graphically in plan-view.

Depth of reinforcement – All radar data will be analyzed and reinforcement depth will be determined and presented graphically in a color topographical plan-view, and in numerical format.

Asphalt overlay thickness – For decks with a bituminous overlay, all radar data (every radar scan) will be analyzed and asphalt thickness shall be determined and presented in a color topographical plan-view, and in numerical format.

6.0 Submittals

1) The field inspection must be conducted within 10 days of the notice to proceed as per assignment.

2) A written report will be made of the results and delivered within 30 days of the GPR inspection. The report shall include an executive summary, description of the test procedure and equipment, technical discussion and an overall discussion of the GPR findings.
3) Deliverables shall include a plan-view map of the bridge deck, in hardcopy and electronic (PDF) format, graphically showing areas of delamination. The overall percent of delaminated deck concrete shall also be reported. The report shall also designate the location and quantity of concrete that should be removed (type 2 repairs), in square feet.

Optionally, a plan-view map of the bridge deck shall be produced in hardcopy and electronic (PDF) format showing the location and areas of debonded overlay, scaled concrete, asphalt thickness and depth of reinforcement, where applicable. The overall percent of deck overlay that is debonded and the quantity of scaled concrete will also be reported. Reinforcement depth and asphalt thickness shall be depicted in a color topographical, plan-view mapping, showing depth/thickness as color variations. A graphical distribution, including average and standard deviation, in reinforcement depth and/or asphalt thickness shall also be reported.