



# A Proposed Pooled Fund Study: Continuous Asphalt Mixture Compaction Assessment using Density Profiling System (DPS)

[Brainstorming]



U.S. Department of Transportation  
Federal Highway Administration

AMERICAN ASSOCIATION  
OF STATE HIGHWAY AND  
TRANSPORTATION OFFICIALS

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# Objectives

- The objective of the proposed pooled-fund project is to establish a research consortium focused on
  - A) further advance and improve the system based on experience and needs from participants so that the system can effectively and efficiently support their Quality Assurance Program;
  - B) support communication;
  - C) provide participating agencies guidelines on data collection and analysis protocols, support AASHTO specification development and refinement;
  - D) provide training and technical assistance that include to provide support for specification development and strategies for agency full implementation;
  - E) conduct technology promotion and marketing for the system.

# Scope of Work

- **A). Further Advance and Improve the System**

1. Conduct a round robin test among the agencies that have the system and develop precision and bias statements and testing methods:

- ASTM E691 should be used by DPS vendor to provide the end user with information about precision and bias detailing the expected performance of the equipment.
- Development of a standard procedure and criteria for checking /verifying antenna stability and inter-antenna variation. Are the proposed stability and variation limits in AASHTO specification acceptable and reasonably achieved by the hardware? How do we verify correct operation of the antennas in the field (swerve test, multiple profile test, static foam test, and reference material)? How frequently should this be done?

# Scope of Work

- If the antenna variation does not meet the limits:
  - Develop criteria to reject antenna for data collection
  - Or develop standard method to correct the data: laboratory and field data correction.

2. Establish a regional certification center similar to pavement profiler certification program [**feedback from states needed**]. The center will certify all contractor's and agency's DPS equipment in the region (States that use the DPS for acceptance may want to develop their own center if they have enough devices)

- Need a material with precise dielectric constant that is close to asphalt mixture dielectric constant for equipment certification? 3D print such a material (not sure if this is possible?).
- Develop procedures or a standard for equipment certification and operator certification (could use AASHTO TC3 to provide some of the training?) [No need regional center?].

# Scope of Work

3. Enhance VETA software so that DPS output and associated construction data can be analyzed by VETA. (Note: VETA is a free software that is available to all states).

4. Develop standard data collection pattern and method:
- How many passes needed to cover the full lane width?
  - Data interpolation between antenna measurements?

# Scope of Work

5. How do data errors and sampling frequency change at higher travel speeds?

- Measuring void content at higher speeds (50+mph) would increase operator safety, improve data collection efficiency, and provide flexibility for scheduling data collection.
- We need to evaluate how the data precision/accuracy and sampling frequency changes as you increase the speed.
- This testing requires system modification. The current software does not allow testing at high speeds and the hardware needs to be strengthened to resist fatigue.

6. Develop software capability to share collected data and results in real time through cloud and/or cell phone?

# Scope of Work

## B). Support Communication

1. Semi-annual User Group Webinars.
2. Annual Face-to-Face User Group Meetings including invitation travel.
3. Quarterly Conference call Updates with Interested Parties.
4. Quarterly Conference call with TAC.
5. WEBSITE Establishment and Maintenance.

# Scope of Work

## C) Provide participating agencies guidelines on data collection and analysis protocols, support AASHTO specification development and refinement

1. Establish standard method(s) or guidelines on data collection and how to use measured data for compaction acceptance: uniformity and density?

a. What is the sample size (frequency) and data precision needed to (a) detect defects in paving and (b) quality assurance.

- Consider a producer/consumer risk analysis. (TTI has done this, but could be further refined.)
- Develop draft specification for states to use and adopt DPS technology: Create guidelines for data collection speed, the sampling frequency, the number of profiles, and the location of profile measurements based on what we want to know and how we are going to use the results.



# Scope of Work

b. Data analysis method: Use histogram? Develop draft specifications that can be used for implementation based on how the results will be used.

2. Support AASHTO and ASTM specification development, improvement and refinement.

- An AASHTO specification is being developed and balloted by states. The pooled fund will support further refinements and improvements of the specification. If needed, support new specification development.

## D). Provide Training and Technical Assistance

- More detailed hands-on training on set up, calibration and operation;
- Training on implementation strategies by an agency;
- Executive level training;
- Webinar training, help participants on training development, on-call technical assistance, etc.
- If needed, provide support to participating agencies for specification development and strategies for agency full implementation.

## E. Promote the technology through strategic marketing.

- Marketing to potential vendors on the SHRP R06C product that is to use GPR to assess HMA compaction. Successful implementation also needs GPR manufacture participation.
- Marketing to other DOTs, local government and other agencies.
- Preparing marketing materials.

### **Comments:**

This project is expected to have a minimum participation of at least five agency members (including FHWA). Minimum annual commitment of **\$25,000 (need to discuss)?** per year per agency for three years within Fiscal Years 2020-2023.