

PAVEMENT PERFORMANCE TRACKING

GOAL

Allow for more thorough performance tracking by integrating construction quality and pavement performance data.

CREDIT REQUIREMENTS

Use a process that allows construction quality measurements and long-term pavement performance measurements to be spatially located and correlated to one another. This implies four requirements:

1. Construction quality measurements must be spatially located such that the location of the quality measurement is known to within 25 ft of the actual location where the material or process that was measured is actually located.
2. Pavement condition measurements must be taken at least every 2 years and must be spatially located to a specific portion of roadway or location within the roadway.
3. An operational system, computer-based or otherwise, that is capable of storing construction quality measurements, pavement condition measurements and their spatial locations.
4. The designated system must be demonstrated in operation, be capable of updates and have written plans for its maintenance in perpetuity.

Details

This generally means spatially locating construction quality measurements in a permanent location system and maintaining those records indefinitely. Examples of construction quality records include but are not limited to:

- Density tests
- Water content tests
- Air content tests
- Slump tests
- Compressive strength tests
- Asphalt content tests
- Gradation tests

Examples of pavement condition measurements include, but are not limited to, the extent and severity of:

- Cracking
- Permanent deformation (rutting)
- Bleeding or flushing (in relation to hot mix asphalt pavements)
- Faulting (in relation to portland cement concrete pavements)
- Joint spalling (in relation to portland cement concrete pavements).

DOCUMENTATION

- A signed letter from an owner official stating that the performance tracking system is operational and has been populated with the required data.



PT-6

1 POINT

RELATED CREDITS

- ✓ PR-4 Quality Control Plan
- ✓ PR-9 Asset Management Plan
- ✓ CA-1 Quality Management System

SUSTAINABILITY COMPONENTS

- ✓ Extent
- ✓ Expectations
- ✓ Experience
- ✓ Exposure

BENEFITS

- ✓ Increases Service Life
- ✓ Reduces Lifecycle Costs
- ✓ Improves Accountability
- ✓ Creates New Information

APPROACHES & STRATEGIES

Develop and implement a pavement performance tracking system. Off-the-shelf systems that meet the credit requirements are difficult if not impossible to find.

Example: Sample Systems

Two examples of systems that could accomplish the intent of this credit are:

HMA View. A web-based system developed at the University of Washington between 2000 and 2004 (White et al., 2002). No significant development has happened since about 2005 and it is not ready for commercial use. However, it does demonstrate that such a system can be created and does work. It is capable of maintaining construction quality and pavement condition records in the same database. The spatial location feature was never fully developed. The system was used for a time by the Washington State Department of Transportation (WSDOT) and the Maryland State Highway Administration (SHA).

Pavement Interactive (PI) Maps. An system in proof-of-concept stage developed in 2008-9 and accessible at: <http://maps.pavementinteractive.org>. PI Maps is a tool for storing and sharing spatial data. It is currently in a public beta testing period, so the functionality may change from time to time. PI Maps uses the Google Maps API to allow viewing and input of points, lines, and polygons. PI Maps runs on Google App Engine, so it takes advantage of Google's robust storage and server infrastructure, which allows users to have confidence in their data's well-being.

Google My Maps or Windows Live Local Application. At the very simplest level, a Google My Maps (<http://maps.google.com>) could be created and a placemaker could be used to designate testing with the associated text used to describe the test and test result. Pavement condition could be described in association with a line that is drawn over the particular section of roadway being documented. While this system is simple it could quickly become unwieldy for larger organizations such as large cities, counties and states.

POTENTIAL ISSUES

1. The general trend in road construction is to dispose of construction records after a prescribed amount of time. Usually this time is set by legal obligations, but for this credit, records would not be able to be disposed.
2. There are no existing commercially available systems for accomplishing the actions of this credit. Where no system exists, implementing this credit (i.e. creating a system from scratch) will likely be very difficult. The project team has to develop a system or the owner must want to develop or operate a system like this independent of the Greenroads credit. However, long-term benefits of such a system may outweigh the costs of designing and implementing one.
3. It is difficult to define the concepts of performance and quality in simple terms. Tying construction quality and pavement performance data together can involve some very specific ideas.
4. The location of the construction quality test should be the final location of the material or process associated with the test and not the laboratory or testing location.
5. Currently there is no major organization that integrates construction quality control data with long-term pavement performance data. As a result, it is difficult to trace pavement performance issues back to construction quality.

RESEARCH

Many other industries (e.g., computers, automobiles, etc.) are able to trace each element of their final assembly back to original construction. The ability to accomplish this would improve pavement performance through a better understanding of how construction quality influences long-term pavement performance and allow existing data to be better used to evaluate the performance of new materials, concepts and design methods. Due to the limited research in this area for pavements, this section is necessarily short.

Current Means of Performance Tracking

Almost all agencies that track pavement performance do so by measuring surface defects and their qualities including such items as: cracking (longitudinal, transverse, reflective, alligator), rutting, raveling, faulting, spalling, roughness, etc.). However, databases that contain this information do not, as a general rule contain construction information and therefore are unable to link pavement performance with construction data. Typically construction data is saved for a finite amount of time (e.g., 3 or 5 years) and then discarded.

The Problem with Unlinked Data

Hudson et al. (2002) describe the problem when referring to their interview results with several state departments of transportation (DOTs):

“One of the main challenges discovered in all the states visited is the absence of a convenient link between essential data on materials characteristics used in each project on the one hand and PMS [Pavement Management System] data including performance data on the other. This is most often caused by the fact that the first group of data (information on design, testing, in-place properties, thickness, and QA data) is commonly stored in flat files, difficult to access and sometimes incomplete...Performance data can only be linked to materials and construction data when use is made of a common locator reference.”

The General Solution

Provide a pavement performance database that is linked spatially to a pavement construction database. This means that both performance and construction data must be available electronically. Whereas 10 years ago this was not likely (construction files were often paper files), today it is more likely since most files are now stored electronically. Ideally, linking and storage could be accomplished in a web-based system (White et al., 2002). To improve efficiency, White et al. (2002) proposed that construction data be initially recorded in electronic form and geotagged at the construction site. This would typically involve hand-held data entry devices and GPS units. At the time (2002) these types of GPS units were less common, however now they are relatively cheap and are routinely included in personal electronics such as smart phones.

Demonstration of a Pavement Performance Tracking System

Both Hudson et al. (2002) and White et al. (2002) describe the system developed primarily by White et al. called “HMA View” that allows integrated performance data to be uploaded, displayed and analyzed on the web. Figure PT-6.1 shows the basic architecture of what became HMA View (at the time it was simply known as the “hot-mix database”). This basic architecture (minus the mobile field setup) was demonstrated on a limited basis with the Maryland State Highway Administration (MDSHA) and the Washington State Department of Transportation (WSDOT) in the mid-2000s but has not been receiving new data since 2005 and has not been operational since about 2007. Currently, there are no plans to re-start the system or refine it.

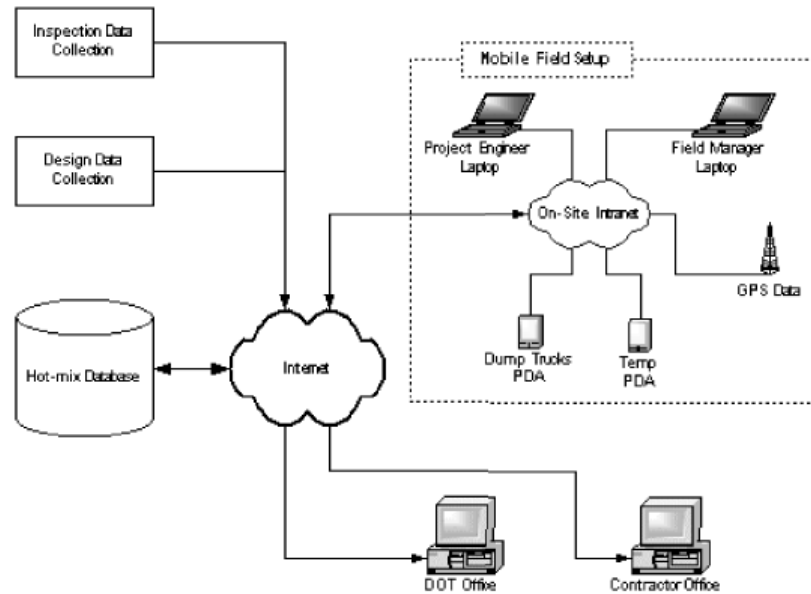


Figure PT-6.1: Overview of content acquisition and delivery for HMA View (from White et al., 2002).

REFERENCES

- Hudson, W.R., Monismith, C.L., Dougan, C.E., & Visser, W. (2002). *Use of PMS Data For Performance Monitoring With Superpave As An Example*. Volume 1. FHWA Contract DTFH61-98-C-00075, B98C75-007 Battelle Subcontract 156421 - TRDI Project 001. <http://www.fhwa.dot.gov/pavement/management/pms.cfm>. Accessed 8 January 2010.
- White, G.C., Mahoney, J.P., Turkiyyah, G.M., Willoughby, K.A., & Brown, E.R. (2002). Online Tools for Hot-Mix Asphalt Monitoring. *Transportation Research Record*, No. 1813, Transportation Research Board, National Research Council, Washington, D.C. p. 124-132.