

CONNECTICUT DEPARTMENT OF TRANSPORTATION

PRELIMINARY FINDINGS

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Development of a Personal Digital Assistant-based (PDA) Hot-Mix Asphalt (HMA) Data Entry Program For "SUPERPAVE" Paving Projects

*Richard C. Hanley, P.E.
Principal Investigator*

OVERVIEW

During 2001, the Connecticut Department of Transportation (ConnDOT) began a research project to evaluate Personal Digital Assistant (PDA) use in the daily operations of ConnDOT's Hot-Mix Asphalt (HMA) materials testing and quality assurance activities. The project was conducted in cooperation with the Federal Highway Administration. It was believed the resulting system would be an accurate, convenient and cost-effective alternative to traditional paper/pencil or computer spreadsheet data recording systems. It would not require the use of expensive field-based portable computers, which were not hardened for the harsh construction environment. Finally, it would provide a structured data management process for managing both inspection software and data. This would be accomplished by automatically transferring field data into ConnDOT's Materials Testing Laboratory Database and then correlating that data with laboratory data collected from the same projects.



After a structured selection process, Palm Corporation's Palm Pilot IIIc unit running the Palm Operating System (Palm OS) was chosen over Handspring, Compaq, HP, and several others of Pocket PC-based systems as the PDA hardware platform. Pumatech's Satellite Forms was selected as the PDA software platform. Primary selection factors included the lower initial cost of units; lowest Total Cost of Ownership (TCO); the robustness of Palm OS vs. the just-released Microsoft Pocket PC Operating System; and simplicity of systems development and management with the Satellite Forms platform. Development and testing of the prototype system was completed by fall 2002, with implementation envisioned for the next paving season beginning in spring 2003.



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Upon completion of the system, ConnDOT chose not to implement the project for the 2003 paving season. Primary to this decision was low PDA reliability encountered under harsh field conditions. In addition,

many technical and organizational issues contributed to the final decision. These included:

Technical Issues

- The harsh field conditions to which the PDA's were exposed in field laboratories, including dust, oils and solvents, in conjunction with questionable robustness of the Palm screens, contributed to almost a 50% equipment failure rate during the testing phase. In addition, inability to repair Palm equipment and the project's inability to purchase similar replacement units were problematic;
- Palm Corporation's continually changing model line created obstacles to implementing a standard hardware platform;
- Palm-based Graffiti™ handwriting recognition system was used for inspection comments, but this proprietary process was laborious for inspectors to use; and,
- The Palm's small screen could not provide satisfactory spreadsheet-type displays that the inspectors requested for reviewing field data.

Organizational Issues

- Project objectives and expectations of the Department were changing as the project progressed. As development proceeded, ConnDOT was moving from a forty-year old Marshall testing system with agency-based control and acceptance to a quality assurance (QA) based SUPERPAVE testing process. This change required dropping the entire ConnDOT laboratory-based component of the original project proposal after development had been completed;
- With the development of the new PDA-based system, the HMA inspectors were wary of change, including the possibility of job privatization;
- Although HMA inspectors had been previously issued portable computers during ConnDOT's AASHTO SiteManager software installation, management was evaluating less-expensive PDA's as potential replacement equipment for those portables PC's;
- HMA laboratory personnel had been developing their own solution for managing inspection data. An Excel spreadsheet system previously developed for laboratory personnel had been adapted to collect SUPERPAVE test data, and plans were formulated to distribute it for the collection of inspection data. These spreadsheets represented an alternative to the PDA system under development, and their existence was unknown until late in the project development process;
- The program developers for this project were cooperative education (Coop) students from local colleges. Shortly before the project was completed, Coop student funding was discontinued for budgetary reasons. This led to concerns about ongoing maintenance and support of the PDA program; and,
- Management, for cost and deployment issues, had supported the Palm platform over the Microsoft platform. ConnDOT Information Systems personnel took the position that since the Palm platform was not a Windows-based solution, they were unable to provide technical support for the project. This led to minimal project involvement by ConnDOT IS personnel and concerns about ongoing PDA maintenance and support.

BENEFITS

Although the project results were not implemented at ConnDOT, the research was not without noteworthy findings. These included:

Technical

- Pumatech's Satellite Forms Development software is a viable platform for managing a fleet of PDA's. Updates are straightforward, programming is object-oriented and the latest versions interfaced with standard Oracle databases. In addition, the program code runs on both Palm and Pocket PC-based systems;
- The project employed a Total Cost of Ownership (TCO) valuation in the hardware and software selection process. The amount expended on hardware to operate in harsh environments, as well as software in a world of ongoing maintenance agreements and distribution licenses can add significantly to the ongoing system costs. Both the Palm OS and Satellite Forms platform offered affordable one-time licensing and run-time agreements; and,
- The printers selected for the project, Canon Bubblejet BJC-85, were well received by the inspectors and are now widely used in conjunction by field personnel with their portable computers.

NEXT STEPS

ConnDOT has completed its research effort in this project and plans to publish a final report in the near future. Combined with this will be a release to the public domain of the programming code developed for the project. After this, no future work is planned related to this project, but items of future interest might include:

- Reevaluation of PDA hardware platforms - new PDA designs now integrate keyboards, larger screens, cell phones, beepers and/or GPS receivers;
- Reevaluation of the software platform - Pocket PC has now become a viable and robust operating system, and Palm OS has continued to retain market share, indicating both are viable PDA software technologies;
- Tablet PC computers - these computers combine the lightweight versatility and touch screen functionality with a fully-configured PC; and,
- Reassessment of PDA technology within ConnDOT - the replacement cycle for portable computers used by ConnDOT laboratory personnel offers periodic opportunities to revisit PDA technology and reconsider its application to the HMA QA function within ConnDOT.

CONTACT INFORMATION

For more information regarding this project, please contact:

Mr. James M. Sime, P.E.	Telephone: (860) 258-0309
Manager of Research	Fax: (860) 258-0399
Connecticut Department of Transportation	Email: James.Sime@po.state.ct.us
Division of Research	Internet: www.ct.gov/dot/research
280 West Street	
Rocky Hill, CT 06067-3502	