TECHSUMMARY *January 2020*

State Project No. DOTLT1000168 / LTRC Project No. 17-6SS

Evaluation of HeadLight: An E-Construction Inspection Technology

INTRODUCTION

Project inspection and delivery are challenging, resource-intensive tasks. Project inspectors working for the Louisiana Department of Transportation and Development (DOTD) are responsible for collecting vast amounts of data and information in the field.

Traditionally, DOTD has relied on a primarily paper-based process for field data collection. Mobile technology (defined as hardware and software that can be used in concert to allow integrated data collection, access to project-related information, and real-time communication capabilities) continues to improve and has become affordable.

This research project explored the feasibility of replacing the traditional, paper-based inspection process with a cloud-based, mobile project inspection technology named HeadLight. Based on previous research conducted by three DOTs outside of Louisiana, HeadLight has been reported to increase inspector productivity and improve the quality of the inspection data collected in the field. This report assesses the productivity and inspection data quality impacts of using HeadLight on DOTD project inspection in the field.

Figure 1
Screenshot of HeadLight mobile and web client

OBJECTIVE

The objective of this research was to understand the impacts on DOTD for leveraging e-construction innovations, more specifically a mobile project inspection system called HeadLight. The specific objectives of this research were as follows:

1. Measure increase in available time spent on field inspection.
2. Measure change in quality and quantity of inspection data.
3. Measure timeliness of submission of daily diary documentation.
4. Measure leading indicators for improving claims abatement.
5. Understand information requirements needed for effective maintenance of constructed assets.
6. Map relevant maintenance information requirements to data collected during construction phase.

Early on, the research team determined that for the HeadLight tool to be evaluated properly, a Materials Module would also have to be developed and piloted. The objectives were then revised and Objectives 5 and 6 were then removed with the addition of the creation and pilot of a Materials Module.

SCOPE

To meet the objectives of this project, DOTD evaluated and used a new e-construction technology called HeadLight. Field inspectors and their project teams initially piloted HeadLight over 12-18 projects across the state. The final pilot project count is 182 users of HeadLight on over 50 projects in four Districts during the 18-month program.

LTRC Report 618

Read online summary or final report:
www.ltrc.lsu.edu/publications.html

PRINCIPAL INVESTIGATOR:
Tyson Rupnow, Ph.D., P.E.
225.767.9124

LTRC CONTACT:
Kirk Zeringue, P.E.
225.767.9169

FUNDING:
SPR: TT-Fed/TT-Reg - 5

Louisiana Transportation Research Center

4101 Gourrier Ave
Baton Rouge, LA 70808-4443
www.ltrc.lsu.edu

As the project kicked off with its initial pilot program, field personnel stated that for adoption of any e-construction technology, the entire workflow process would have to be e-construction related. This included integration with SiteManager Materials. Due to this observation, the researchers revised the scope to remove the asset management portion of the project and add in the creation of a Materials Module.

During the pilot program period, researchers used data captured and compiled by inspectors, information in daily diary documentation, data and information in legacy systems, and participant surveys to quantify improvements offered by HeadLight as compared to current practices. This empirical data was then evaluated using the following data quality and process change evaluation metrics: time savings, data volume, data variety, data timeliness, and data availability.

These quantified metrics were used to better describe the likely benefits of cloud-based, mobile technology; evaluate its adoption implications; and include or implement resulting benefits in business process models. In addition, qualitative feedback from pilot program participants and novel applications of the technology was gathered to identify potential business process impacts alongside the introduction of the technology.

METHODOLOGY

This research evaluated the impacts to DOTD business processes, field data collection, and information dissemination resulting from the use of the HeadLight mobile inspection system through empirical field-testing and observation. The impacts were determined by comparing the process and methods of the traditional inspection process with the HeadLight process using several evaluation metrics such as timeliness of Daily Work Report (DWR) submittals, number of observations, observation type, and productivity.

CONCLUSIONS & RECOMMENDATIONS

This research project evaluated the e-construction inspection tool HeadLight documenting its impacts compared to that of the traditional paper-based inspection process. The results of this study warrant the following conclusions:

- Project inspectors using HeadLight increased their productivity without increasing their work hours. Researchers estimate that the increase in productivity for Department wide adoption will exceed 117,000 hours per year.
- Inspectors collected and shared 1.9 times more observations while increasing the number of photo and other media observations. This contributes to a more complete record of the project, which provides value to DOTD. All HeadLight observations are tagged with time and location metadata, and DWRs are automatically generated from daily observations eliminating omission and transcription errors.
- The use of HeadLight improved the timeliness of DWR submissions. Compared with traditional processes, HeadLight provided substantial improvements in submission rates within 24 hours (45 to 66 percent) and 72 hours (67 to 82 percent).
- HeadLight provided data centrality, security, and searchability. Compared to the traditional process, information collected using HeadLight was automatically integrated and stored in a central repository and improved the accessibility and searchability of the information.
- Data stored in HeadLight provides a wealth of material for future training of new employees, and the material can be used to train existing employees for particularly unique construction scenarios.
- HeadLight improved communication amongst project teams and contractors, potentially reducing project claims and change orders. Researchers observed that none of the projects using HeadLight had a lost claim that occurred during this pilot study.
- The Materials Module is fully functional and further streamlines the e-construction inspection process.

Finally, this research project showed substantial, quantifiable gains when HeadLight was used in place of traditional inspection processes. Researchers anticipate that these gains will be more considerable when the technology is further leveraged using big data analytics.

Figure 2
DOTD inspector using HeadLight in the field