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Alaska's Dept. of Transportation Mixes Asphalt and RFID

Topics/Verticals: Asset Tracking, Transport, Retail, Manufacturing, Logistics

With help from the University of Alaska, the DOT is evaluating how RFID can be used to track the amount of time that passes between the moment a truck is first loaded with asphalt and the instant the hot mixture is dumped.

By Claire Swedberg

Jan. 14, 2011—Having completed a pilot to track asphalt-carrying dump trucks as they travel from a weigh station to a road construction site, the Alaska Department of Transportation (DOT) is preparing a report to indicate how effectively RFID was able to gather data and send alerts about the movement of those vehicles, and what benefits that data will provide. Based on anecdotal reports, says Jim Sweeney, Alaska DOT research engineer, the pilot seems to demonstrate that RFID could reduce labor hours inputting handwritten paperwork regarding contractors' delivery of hot asphalt as well as detect problems such as delayed deliveries and send alerts to project superintendents or foremen. Sweeney says he intends to request at least one more pilot of RFID; testing it in more remote locations where a cellular connection would be unavailable, before the DOT begins discussing whether to require RFID technology of its contractors for future projects.

The pilot, held from June 30 to July 17, with assistance from University of Alaska researchers, tracked asphalt-filled dump trucks from a weigh station operated by asphalt contractor Granite Construction in Anchorage to the Glenn Highway construction site (about a one hour's drive away) using an RFID solution provided by a Canadian company named Minds Inc., which includes 900 MHz Identec Solutions active tags attached to trucks and Identec readers installed at the weigh station and attached to a paver (a vehicle that applies hot-mix asphalt to a new road surface) on the construction site.

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An Identec RFID reader and antenna were mounted to the rear of the paver.

The project, led by University of Alaska professor Oliver Hedgepeth, Department of Logistics, was initiated as an effort to find ways that RFID could be employed to improve visibility at construction sites, when the DOT met with the Alaska University Transportation Center (AUTC) of the University of Alaska Fairbanks. The AUTC often undertakes highway research for the DOT. Sweeney had been intrigued, he says, by an article in the RFID Journal describing an RFID system for tracking logging trucks (see Loggers Use Tags to Track Trucks, Timber) and had wondered if the technology could be used for other kinds of material. The pilot was funded by $45,000 from the AUTC and a matching $45,000 from the state DOT.

Sweeney and Hedgepeth began seeking an RFID-based solution to improve the process of road

construction in the state of Alaska. In March 2010, they contacted Minds Inc. regarding its PaveTag system, which uses RFID to track dump trucks carrying asphalt (see RFID Paves the Way for Road Construction). The PaveTag system is designed to track the movement of trucks from an asphalt plant to the paver and provide alerts and notifications by e-mail to a project's superintendent or foreman based on events such as a truck's arrival or departure.

During the Glenn Highway pilot, 50,000 tons of asphalt were tracked using RFID and then laid along a 10-mile-long section of six-lane roadway under construction. An RFID reader was installed at the Granite Construction asphalt scale, adjacent to the site where the firm's asphalt production operation pours hot asphalt into the beds of dump trucks. Another RFID reader was attached to Granite Construction's Caterpillar AP-1055 paver, located at the work site where the asphalt was needed, thereby allowing the users to track the location of a truck twice—once at the scale and again at the work site when it dumps its load in the paver.

"We chose to track asphalt because it is a high-value material," says Jim Sweeney, Alaska DOT research engineer. The asphalt, which costs about $60 per ton, must be laid while still warm. If the mix cools too much before being laid, it will not properly set and the road could experience future problems such as cracks. Therefore, pouring of asphalt at the wrong temperature could require future removal of that asphalt and reconstruction work on the road. In addition, if a truck is simply delayed in delivery, the construction foreman might then reject the truckload, which is potentially a costly event for the contractor or the DOT.

Asphalt delivery is typically tracked on paper. The time the asphalt is loaded, as well as its weight, is written on a paper ticket that the driver then hands to the DOT when he reaches the work site. Additional data is printed on ticket by DOT staff to indicate when asphalt was received. That paperwork is then collected for each delivery and later input into the DOT's system so that it can determine how much to pay each contractor. "That is subject to human error," says Sweeney, "especially when you're adding up 5,000 truck loads in a day." An RFID system, on the other, can electronically track that data, such how much was delivered, the time of that delivery and the load's approximate temperature based on how long it took from being filled to being dumped.

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An Identec reader mounted on a pole near the entrance of the scale captured the RFID tag transmissions of a loaded truck.

With the pilot, Identec active RFID tags were attached (some with adhesive tape, others with metal screws) to the rear of 10 dump trucks belonging to various subcontractors, and the name of the trucking company was stored with each tag's ID number in Minds' back-end server, says Curtis Kieres, the company's regional sales manager. The server stores data about each truck's movement, and participants could then generate reports and export data from the server in the CSV format. Minds can also provide custom reports on request, Kieres says.

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An Identec reader was mounted on a temporary pole near the entrance of the scale to capture the RFID tag transmissions as the loaded truck was weighed. The reader was cabled to a PC, which forwarded the data to the back-end server via a GPRS connection, including the weight, time, date and the unique ID number encoded to the tag. A PrintUp box—a device that received reader data and routing it data to a printer—was installed by Intertiviti (which also provided other consulting assistance and management at the pilot) inside the weigh scale house and was connected to the same computer at the scale. The printer produced a paper ticket that was printed (for redundancy of information) with details from the RFID-enabled weighing procedure including the truck's identity and loaded weight and a time stamp.

The driver took the paper ticket and then began the approximately one hour drive to the work site. Upon arrival at the site, the driver parked the truck near the paver, handed over the paper ticket and waited for the opportunity to dump the load. With the truck parked within 400 feet of the paver, the paver's reader began capturing the ID number transmitted by the truck's tags and sent it to the Minds-hosted back-end system via a cellular GPRS connection. Once the truck finished dumping its load and left the site, the paver's reader could no longer detect the transmission of the truck's tag and the system software deduced that the asphalt had been dumped. In this way, Minds Inc. had data it could provide to Granite Construction and the DOT indicating how long the trucks were waiting at the weigh scale at the Granite plant as well as how long they were waiting at the construction site waiting to dump their loads.

The system worked well and provided accurate and reliable data, says Hedgepeth. Since the pilot was concluded, he and his partner on the project, University of Alaska assistant professor of logistics Morgan Henrie, have been evaluating the data gained from the project. Hedgepeth identified some interesting details in the RFID-read data, including anomalies in which what had expected to be a one-hour trip took some trucks as much as four or five hours, while most took only the hour. "There's some very interesting data to play with," he says. Henrie agrees, commenting that the data could indicate whether the asphalt was at the proper temperature based on the length of time to deliver. The data has the potential also to provide the DOT with history of asphalt delivered to the site. If a problem occurs and a company or individual files a claim against the DOT or a contractor, the RFID data provides a record of exactly when the truck was at a certain location and how long it was there.

The system offers potential benefit for contractors as well, says JR Eker, Granite Construction's project manager, since it could collect data as to when trucks are delayed. "For example if a truck seems to be sitting too long at the paver," he says, that could indicate too many trucks were sent to the site too quickly. "Based on that type of data, I could be more effective in my decision making."

Eker says he is awaiting the DOT and University of Alaska's report before determining just how successful the system was, but he says he likes RFID's potential to provides more details about the locations of trucks, and could imagine installing such a system for future roadwork to better manage the trucks and the dispatching of them. "I think we may have further interest in going forward [installing an RFID system] on our own," he says, whether or not the state DOT continues to use RFID.

Throughout the trial the system sent approximately 145 e-mail alerts indicating each new event including completion of an asphalt dump, or arrival on site of a new RFID-tagged truck.

If the DOT proceeds with a test of PaverTag system in a more remote location with no cellular connection, employees on the work site would likely use handheld RFID readers, rather than a fixed reader installed on a paver. In this case handheld readers could store data and, possibly, send data to a server via a satellite connection. Such a pilot, however, has not yet been scheduled.