Real-Time Work Zone Travel Time

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Overview

Work zones are a major source of non-recurrent congestion. Providing accurate and timely information to motorists regarding travel time and delays in and around work zones is critical and can improve mobility through work zones. The objective of this research is to investigate the capability of various travel time data collection technologies to produce accurate work zone travel time information in real-time. In this effort vehicle detection and travel time data were collected along freeway work zones in Atlanta, Georgia using multiple data collection technologies, including Automated License Plate Recognition (ALPR) Cameras, Bluetooth, and high definition video. The collected high definition video footage was post-processed utilizing a proprietary video-processing program developed at Georgia Tech that allows manual entry of vehicle license plate information. The travel times and vehicle count information from the manual video license plate processing are then used as ground truth for comparison against both the ALPR and Bluetooth data results.

Equipment

Bluetooth Technology

- Common in many standard devices: cell phones, headsets, and GPS
- Each active Bluetooth device constantly transmits a unique MAC (Media Access Control) address (e.g., 00:02:72:20:67:2A)
- Identify vehicles with Bluetooth devices moving in the traffic stream at multiple locations and calculate travel time
- Bluetooth detection systems for collecting travel time data: data can be collected continuously in remote locations at a relatively low cost

Automatic License Plate Recognition (ALPR) Technology

- ALPR systems digitally capture vehicle license plate characters
- Identify license plates at multiple locations and calculate travel time
- The ALPR system is comprised of three cameras with different focal lengths (25mm, 35mm, and 50mm)

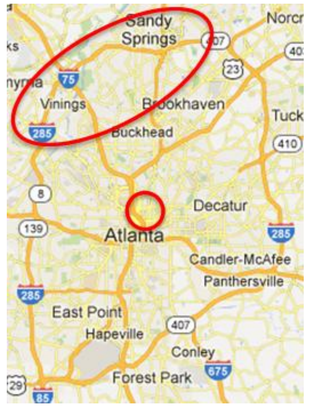
Set-up of the Digiwest and Custom Bluetooth units and the ELSAG ALPR cameras

Data Collection

- A camera angle configuration test was performed on an arterial in Atlanta, GA, Spring Street for one day
- Travel time tests were conducted on a freeway work zone corridor along the northwestern section of I-285 for six days

Deployment Location	# of Lanes	Length of Data Collections
Spring Street	4 lanes (one-way)	1.5 hours (1 day)
I-285	4-5 lanes/site (one-way)	13.5 hours (6 days)

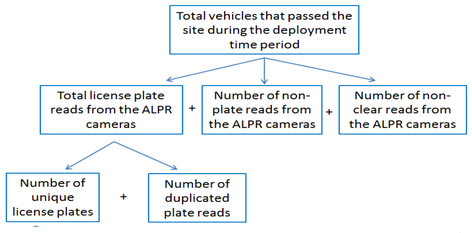
Summary of the deployments



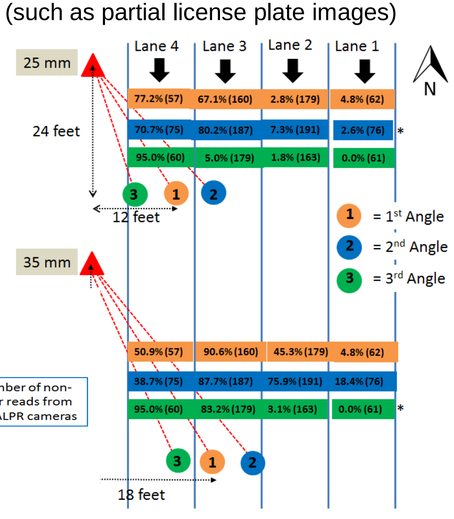
Location of the I-285 work zone corridor Source: Google Maps

Spring St. ALPR Detection Rate Results

- Step one: identify non-plate reads (such as words picked up from the side of a truck) and non-clear reads (such as partial license plate images)
- Step two: identify the unique license plate reads and the duplicated license plate reads that come from the use of multiple cameras
- Detection rate is calculated by dividing the number of unique license plate reads by the total vehicles passing the site



Flow chart of the ALPR detection rate analysis steps



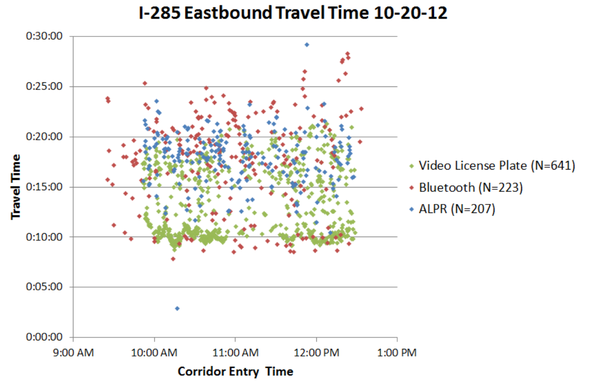
Spring Street detection rate results showing detection rate percentage and the number of vehicles passing

Travel Time Matching

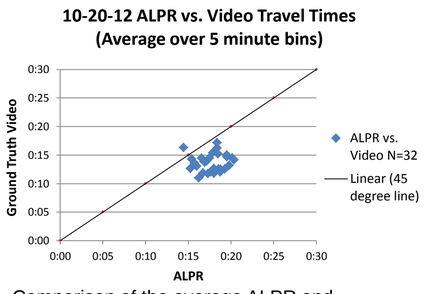
- Raw vehicle detection data from each of the three equipments are matched across the two sites using a travel time matching algorithm
- This matching algorithm finds exact matches from all of the equipment data and also finds additional ALPR matches by making all possible plate number combinations for plate reads containing bracketed digits (digits where the ALPR system cannot decide between 2+ characters (ex: A[B8]C1234))

I-285 Travel Time Results & Discussion

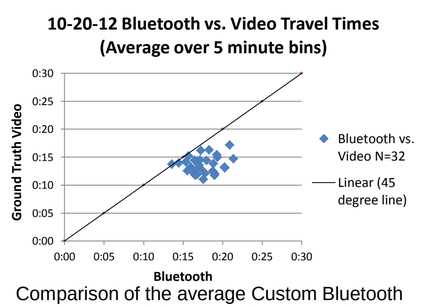
- Travel times from the various equipment were compared using travel time plots and Y-Y plots
- Results revealed that the Custom Bluetooth units and the ELSAG ALPR systems may be detecting a greater percentage of slower moving vehicles than faster moving vehicles and may therefore be introducing a bias into their average travel times.



Custom Bluetooth, ELSAG ALPR, and ground truth video comparison travel time plot



Comparison of the average ALPR and video travel times over five minute bins



Comparison of the average Custom Bluetooth and video travel times over five minute bins

- For the Bluetooth units: slower moving vehicles are within the detection zone for longer lengths of time
- ALPR system: faster moving vehicles (inside freeway lanes) are more likely to be obstructed from the side-fire ALPR camera view by vehicles travelling in the outside lanes

Planned Activities

- The ALPR plate reads from the I-285 deployments will be assessed for accuracy according to identified common plate errors.
- A second series of I-285 deployments consisting of ALPR Cameras, Digiwest Bluetooth units, iCone units, and VER-MAC units is planned to take place in April 2013

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