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Implementation of Arlington Ramp Metering System

PROJECT SUMMARY REPORT

Traditional freeway traffic-management systems (FTMS) in Texas use system and local control units (SCU and LCU) to provide limited communication between a central computer and field devices. In TxDOT project 0-1467, TTI researchers proposed an alternative communication architecture for a real-time ramp metering system that eliminates the need for SCU and LCUs by providing direct communication between a central computer and ramp controllers. In the same project, TTI subcontracted Eagle TCS of Austin, Texas, to develop an enhanced ramp metering controller and system software needed for implementing such a system. In addition, TTI researchers also identified a potential site for an operational testbed using this system. This site, illustrated in Figure 1, consists of 5 on-ramps and is located on a northbound section of SH 360 in Arlington, Texas. It was envisioned that once complete, this testbed would provide a means for investigating practical issues related to the implementation of real-time control strategies and for evaluating various levels of control. The objective of this research project was to install the ramp metering system proposed in Project 0-1467 and evaluate its performance.

What We Did . . .

Successful implementation of the proposed ramp metering system required coordination with other related projects and activities involving multiple
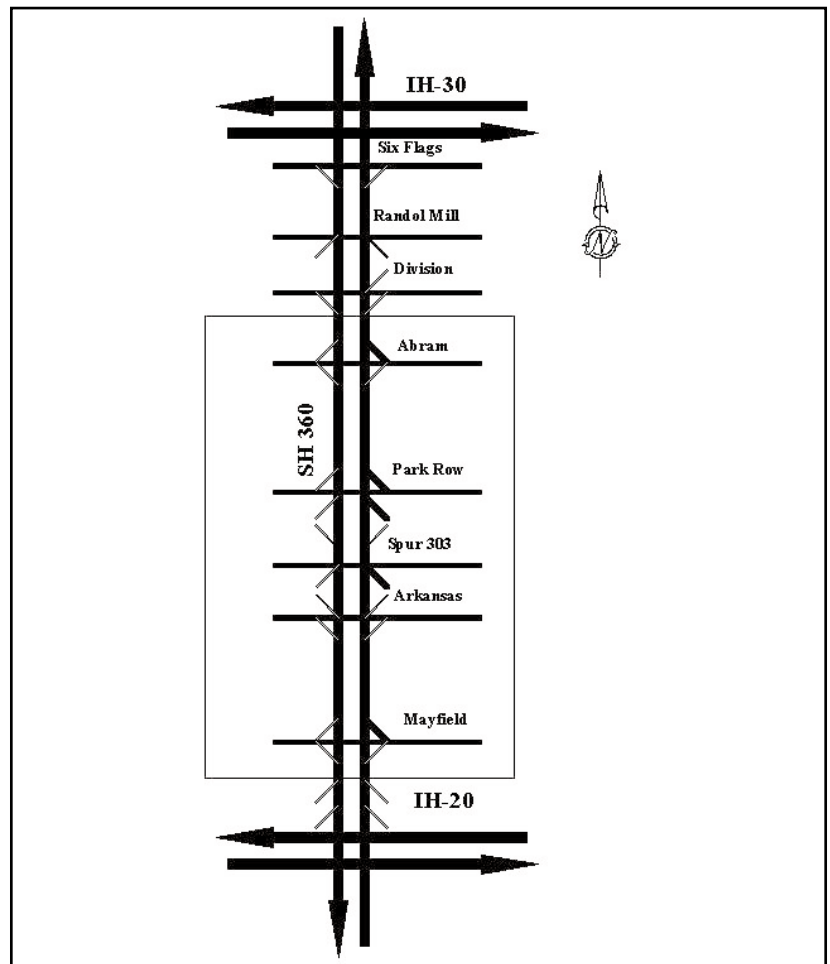

Figure 1. SH 360 ramp metering testbed in Arlington, Texas

Figure 2. TTI, TxDOT, and contractor personnel discussing detector design in the field

agencies. These included:

- TxDOT's construction project, a subtask under which was to install field hardware (loop detectors, controller cabinets, fiber optic cable, etc.) for the ramp metering testbed,
- TxDOT's interagency project with TTI Arlington to provide support for media campaign and public relations, and
- TTI's subcontract with Eagle TCS to deliver ramp controllers and software.

The city of Arlington and its local law enforcement agency were also partners in this project. During the course of this project, researchers regularly met with TxDOT staff and other partners to discuss coordination issues. In addition, the researchers conducted the following key tasks under this project:

- Used hardware-in-loop simulation to test the enhanced ramp-metering controller.
- Provided guidance in the placement of loop detectors and other field hardware (Figure 2).
- Assisted TxDOT and its contractor in wiring/testing the back panels and other components in the controller cabinet.
- Programmed and delivered six controllers to TxDOT. At that time, the researchers also performed field tests on the controllers.
- Delivered remote software developed by Eagle TCS for uploading/downloading data to/from the controller. This software is capable of talking to controllers from a central location via a party line.

- Provided several training sessions at TxDOT Fort Worth facilities on the use of ramp controller and remote software. Figure 3 illustrates one such session.
- Assisted TxDOT in testing the complete system of ramps.
- Turned the ramp metering system on and verified that it was performing as intended through field observations.
- Tested the central software at various stages of development. These tests used up to two controllers and hardware in loop simulation.
- Delivered a personal computer with central software to the Fort Worth Traffic Management center (TransVision). The researchers also assisted the District staff in bringing this system on line, provided software training, fine-

tuned the system, and assessed the performance of the system.

The ramp metering system became operational in June of 1999 and has been in operation since that time. Currently, meters operate in isolated-pretimed mode during the morning peak period only. Eagle TCS delivered an incomplete version of the central software several months after the official termination of this project. The researchers installed it on a personal computer, tested it in the lab, and delivered the computer to the Fort Worth district.

What We Found . . .

So far, we have observed good driver compliance. In addition, we observed that drivers adapted well to the initial ramp operation as well as to several adjustments made later, which did not cause any accidents. In addition, travel time on the freeway improved, but the improvement is not as high as achieved in other locations/jurisdictions. This is because the sources of heavy traffic on this section of the freeway are the two uncontrolled (freeway to freeway) ramps from IH 20 and the upstream section of SH 360. Furthermore, we found that a ramp with demand higher than its meter capacity for extended periods of time functions poorly. A meter may also function poorly if the ramp does not have sufficient storage space to absorb cyclic queues.

The Researchers Recommend . . .

Due to extensive detectorization and automated data collection and control capabilities from the central location, the Arlington ramp metering system provides a unique setting for testing various control strategies, optimization, and incident detection algorithms. TxDOT staff and researchers could take better advantage of these opportunities if a user-friendly and complete version of central software were available. Thus, the researchers recommend that TxDOT invest in the conversion of the current OS/2-based central software to Windows NT platform. This will also allow the District to link the ramp metering system to other components of the traffic management system.

Figure 3. TxDOT Fort Worth staff during a training session at the signal shop

For More Details . . .

The research is documented in Report 3982-1, *Implementation and Testing of Arlington Ramp Metering System* (unpublished)

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TxDOT Implementation Status
January 2001

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There were two products required from this project. Following are the products and their implementation status as of January 2001:

Product 1: Operational guidelines for a real-time freeway ramp metering system.
Status: Concepts implemented in FTW. Guidelines and software not delivered yet. Two versions of the primary central software (RAMCIS) have been delivered by contractor but still not fully functional – still trying to get a functional version. The software will need to be upgraded and improved to make it useable for system evaluation and control. Present software is able to manage the ramp meters independently and not as a system as it was designed by TTI.

Product 2: A real-time, advanced freeway ramp metering system for demonstrating advanced traffic control concepts that move beyond the current TxDOT Freeway Traffic Management System (FTMS).
Status: Operational in Fort Worth. Evaluated in SH360. The final software needs to be converted to Windows NT for future ease of integration into existing Traffic Management System.

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