Predicted travel time information is a desirable feature for dynamic message sign (DMS) systems. Currently, the San Antonio District is routinely displaying such information on their DMS systems, which has received positive public reaction. The state-of-the-practice allows engineers to utilize existing high coverage detectors to design algorithms for calculating travel time. The basic idea of the algorithms is to divide distance between the DMS and prediction destination into segments, and taking distance between two detectors divided by detector measured speed, and summing up all the travel times in each segment using conservative figures generated by different detector data. Predictive algorithms are activated in time of congestion and/or incidents.

Given the success of the San Antonio district, one may think that the practical route is to transfer the entire system specification to other districts. One potential difficulty of such direct transferal of system capability is that different districts have differing levels of congestion, traffic flow compositions, and prediction accuracy requirements. So does the requirements of detector coverage and algorithm structure. The optimal configuration in one district may not work well in others.

The travel time calculated based on existing approach is essentially an instantaneous travel time measured at the instance of calculation, which could significantly deviate from the travel time that drivers actually experience, particularly during onset or dissipation of congestion. The simple reason is due to fast changing traffic dynamics. To take a practical application; if a freeway segment takes 15 minutes to travel, freeway inflow/outflow could significantly vary during the period with congested and unstable traffic flows, not to mention incidents could also occur. The core concept of providing reliable freeway travel time prediction during unstable traffic conditions is to have a short-term traffic prediction capability, or alternatively, a certain level of artificial intelligence that discerns predicted travel time given a traffic condition.

Comparing travel times derived via algorithms from point travel speed detection systems (loops, VIVDS, etc.) with travel times derived from automated vehicle identification (AVI) systems or even probe vehicles is another important issue to study. Most traffic management centers in Texas acquire travel data from these sources. The type of detection data, or even a fusion of several, that works best with which type of algorithms under what condition is another issue of great research need from a traffic operations perspective.

Furthermore, existing practice employs a half-mile detector spacing scheme. The relationship between the accuracy...
of travel time prediction and spacing of detectors is unknown. Reasoning by intuition, quality of travel time prediction degrades with sparser detector spacing. Moreover, how large of a spacing is acceptable under what accuracy requirements? In addition, what degree of accuracy one can one expect given a level of detector coverage? Will traffic flow composition, such as a high percentage of trucks, and differing congestion levels affect these decisions? These unanswered questions are of great importance to any district considering developing the capability for specifying prediction accuracy requirements, and budgeting capital investment for detectors.

In the current literature, there are a limited number of simulated or empirical studies addressing the issues discussed above, particularly the relationship between detector spacing and prediction accuracy using different detection data. A project to investigate such issues could be of great benefit to all TxDOT districts with DMS systems. This information can be posted on the internet where the user can select the start point and end point, and the estimated travel time will appear.

This research could focus primarily on achieving the following objectives:

1. Investigate the performance of existing algorithms in other districts using archived or real-time ITS data;
2. Develop, calibrate and demonstrate possible potential prediction models that complement and improve existing capabilities;
3. Compare travel times derived via algorithms from point travel speed detection systems (loops, VIVDS, etc.) with travel times derived from AVI systems or even probe vehicles under various traffic conditions;
4. Understand the performance of existing and proposed travel time prediction algorithms with respect to differing detector spacing specifications, and various types of detection data;
5. Determine detection data coverage requirements given a prediction accuracy requirement;
6. Develop an algorithm that forecasts traffic; i.e., based on date and time, what is going to be my travel time?
7. Develop an algorithm such that, given existing detection station locations, each district can input their speeds or detector information to predict travel times on a segment of roadway.

**Deliverable Products And Reports:**

- **P1** A guidebook discussing travel time prediction algorithms, required data characteristics, and real-time operations issues.
- **R1** Research Report that documents completely the research performed, methods used and algorithm developed and results achieved, which should provide thorough analysis of performance of travel time prediction algorithms with respect to detector coverage, calibration and testing results of algorithms using ITS data.
- **PSR** Project Summary Report

**Implementation:** The results of this study will provide guidance to TxDOT districts for implementing a travel time prediction capability on DMS systems or Advanced Traveler Information Systems (ATIS). For a district with established travel time prediction capability, the guideline can be used as an alternative to improve the existing algorithm. For other districts, not only the guideline can be used to implement travel time prediction capability, but also to design the required traffic surveillance systems.

**Pre-Proposal Meeting:** ☒ Yes ☐ No  Please contact the PC or PD for date, time and location of the pre-proposal meeting.

**Sole-Source Project:** ☐ Yes ☒ No

**Proposal Submission**

- Proposals are required to be submitted in both hard copy (4 copies) and PDF format (1 PDF file per proposal). Both formats are used within TxDOT for evaluating the proposals and must contain identical information.
- The “Background and Significance” portion of the proposal should be limited to 10 pages.
- All proposals from researchers should be sent directly to your university’s Research Liaison for submission to RTI. The Research Liaison is TxDOT’s official contact with the university.

**Additional Information:**

**Deadlines (for RTI use only):**

1. All individuals interested in proposing are encouraged to contact the PC or PD by February 12, 2004.
2. Proposals are due to RTI by 4:00 p.m. CST on March 24, 2004.