Project # 5: Mobility Reliability of Transportation Systems

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Project Summary

According to *The 2007 Urban Mobility Report* by Texas Transportation Institute, congestion has been getting worse in America's 437 cities of all sizes since 1982. In 2005 this resulted in an additional 4.2 billion hours of travel and use of an extra 2.9 billion gallons of fuel at a cost of $78 billion. More states face challenges over the next decade in improving roadway safety as highway deaths continue to rise (43,000 in 2003). The US DOT (Department of Transportation) and state DOTs have launched initiatives and studies aimed at measuring mobility reliability over transportation networks. Such reliability indices are quantified using statistics and algebraic methods. The teacher's feedback in response to a recent survey indicates that students need to put abstract ideas into practical application, learn how to test hypothesis, evaluate alternatives, and deploy technology to interpret trends. To cultivate these skills, the teacher needs to identify in the curriculum where infusion of technology makes the learning more vivid. This project offers opportunities for teachers to learn different modes of data collection (Websites, manually, or sensor technology, and GPS), and demonstrate abstract concepts of mobility reliability with the concepts taught in algebra and statistics. Computer simulated learning enables students to make decisions without running risks, unlike physical testing. Additionally, a field trip will be scheduled for the teachers to better understand mobility reliability with live observations in the Cincinnati traffic information center.

The teachers will be trained to: (1) understand the mathematical methods and base-data to measure traffic mobility reliability; and (2) learn techniques for collecting field base-data. A research assistant will provide guidance to procure base-data from relevant governmental Websites and develop a Network Reliability Data Source (NetReds) website to categorize linkages of relevant data sources; and (3) mathematically establish reliability models with web-sourced data, and validate the models using field observed data and results from running software Highway Capacity Software (HCS) and VISSIM. Training HCS/VISSIM and development of NetReds will be conducted at UC *Art-Engines Lab* and Computer Labs.

In this project, freeway I-71 within the Greater Cincinnati Area during peak and non-peak hours will be selected as a case study. The teachers will be required to complete the following tasks:

(1) Collect web-based data (including mainline and ramp volumes) and design an architecture of the NetReds;
(2) Measure travel times and delays during peak- and non-peak-hours along I-71 between Exit 19 and Cincinnati Downtown for three days;
(3) Measure reliabilities using field data and techniques learned in a specially designed training course;
(4) Simulate examples depicting different possible congestions scenarios and alternative routes along I-71 and measure travel times for each possible scenario of routes, and compare results with those obtained from step (3);
(5) Use HCS to estimate the level of service of the selected freeway facilities;
(6) Build the freeway system within VISSIM and using collected web-based and field data validate the simulation model by comparing predicted results with the observed data;
(7) Simulate mobility reliabilities under varied scenarios of traffic volumes and summarize the results obtained.
(8) Finally, develop classroom implementation plan from the whole experience.

Possible Ideas for Classroom Implementation

The teachers could develop a lesson plan on the basic theme of *"Transportation Impact on Your Community and Daily Life?"* which introduces students to analyzing impact of mobility on our life (e.g., more hours on travel caused by congestion, more money spent on fuel use caused by delays, etc.). Another lesson, *"Cincinnati Congestion Alternative Routing Planning for Freeways,"* may be an alternative theme that focuses on a hypothetical scenario of diverting congested freeway traffic using local streets and exemplary alternate routes. Fundamental math skills learned in algebra, geometry and statistics will be applied in these applications by the students.

This Project Offers Opportunities to Learn Data Collection and Simulation-Methods to Measure Mobility and Safety of Urban Transportation Systems

Advanced Regional Traffic Interactive Management & Information System (ARTIMIS) provides incident, congestion, and freeway management for the Cincinnati-Northern Kentucky Region