

Curriculum Vitae

Natacha E. Thomas

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DATE OF BIRTH

March 7, 1961

NATIONALITY

American

LANGUAGES

- American English
- French
- Haitian Creole

PROFESSIONAL MEMBERSHIP

- Institute of Transportation Engineers, Washington, D.C., U.S.A.
- American Society of Civil Engineers, New York, N.Y., U.S.A.
- Transportation Research Board, Washington, D.C., U.S.A.
- Data Committee, Transportation Research Board, Washington, D.C., U.S.A.

PROFESSIONAL LICENSE

- Registered with the Illinois Professional Board of Registration as an engineer in training under license number 061-026198.
- Registered with the New York State Education Department as a professional engineer under license number 078556-1.

HONORS, SCHOLARSHIPS AND AWARDS

- Awarded the 1992 Greater Chicago Student Scholarship from the Women's Transportation Seminar.
- Awarded a fellowship from the Graduate School at the University of Maryland in 1985-1986.
- Won award for outstanding tutoring services provided to undergraduate students in Linear Algebra, Statistics, Calculus, and Physics by the Office of Minority Students Education, University of Maryland, College Park, MD.
- Graduated Summa Cum Laude from the Université d'Etat d'Haiti, Port-au-Prince, Haiti, 1984.

EDUCATION

- PhD, Civil Engineering, Transportation Program, University of Illinois, Chicago, Illinois, December 1994.
- MS, Civil Engineering, Transportation Program, University of Maryland, College Park, Maryland, December 1989.
- BS, Civil Engineering, Université d'Etat d'Haiti, Port-au-Prince, Haiti, August 1984.

EMPLOYMENT EXPERIENCE

• 07/02 – Present, Associate Professor, University of Rhode Island, Kingston, RI.

Duties include the teaching of various graduate and undergraduate Civil Engineering courses, the advising of graduate students on research issues, theses and dissertations, the pursuit and successful accomplishment of community service and research, as well as the publication of books and articles. The list below summarizes the funded research undertaken.

Funded Research Projects

NSF Award: CMS 0331984, Amount: \$470,000, **Support Period:** 09/03 – 08/07.

Title: Behavioral Model of Pedestrian Dynamics under Emergency and Non-Emergency Scenarios Using Cellular Automata (PI: Natacha E. Thomas; Co-PIs: Jean-Yves Hervé, Manbir Sodhi, Benigno Aguirre, and Joan Peckham)

The project developed a Cellular Automata (CA) model and associated prototype software for the simulation of environmentally-constrained and managed pedestrian motion during normal times and during emergency situations that result in evacuations. The model captured naturally occurring interactions involving the environment, the pedestrians, physical constraints, emergency constraints, and the evacuation policies and controls that a management authority would attempt to implement. The project results were interpreted in light of accumulated knowledge on the sociology of disasters, allowing for the provision, to local and federal government agencies as well as private organizations, of a useful blueprint to follow during crisis evacuations. This provision of guidance was an important benefit to society, as it improved disaster response programs at the local, state and federal levels.

The need for a social science study of crisis evacuation is particularly keen nowadays as terrorist threats have increased. Project conduct entailed the training of graduate and undergraduate students in the mastery of analysis approaches and the participation of female and minority faculty in science.

NSF Award: CMS 0323359, **Amount:** \$199,971, **Support period:** 09/03 – 08/06.

Title: Design and Operation of Community Based Resource Recovery Services (PI: Manbir Sodhi; Co-PIs: Natacha E Thomas, and Winston Knight)

The project addressed a number of problems associated with the collection and the processing for resource recovery of end-of-life products, including design for disassembly, bulk recycling and collection logistics. It investigated important fundamental questions related to the design and efficient operation of community based recycling services. Through collaboration with local resource recovery companies (Cleanscape and Metech) data was collected to identify specific operational problems in the industry. Models were formulated to investigate latter issues with the aim of developing optimal operating procedures.

RIDOT Award: 01164, **Amount:** \$75,000, **Support Period:** 01/04 - 08/08.

Title: Trade-off between Cyclist Safety, Bicycle Lane Selection, and Widths of Bicycle and Adjacent Parking Lanes (PI: Natacha Thomas)

The project established guidelines, if not warrants, for the selection of bicycle lanes over other bikeway facilities based on maximizing bicyclist safety. The study further established and quantified the crash reduction potential of various bicycle facilities. The knowledge gained will help ensure the deployment of the safest bicycle lanes consistent with budget within Rhode Island State.

University of Rhode Island Partnership Award, Amount: \$450,000, Support Period: 07/04 – 06/07

Title: 3D Group for Interactive Visualization (PI: Jean-Yves Herve, Ron Hutt, Timothy Henry, Frank Heppner, Marian Goldsmith, Mary Hollinshead, Liliana Gonzalez, James Kowalski, Joan Peckham, Angelo Lucia, Manbir Sodhi, Natacha Thomas, Lenore Martin, Clinton Chichester, Nesser Zawia, Miguel Encarnacao, Peter Stephenson, Kevin Culley, and William Steinkamp)

Project established a special interest group involved in the research, development, teaching and cross-disciplinary utilization of 3-dimensional modeling, animation, and interactivity. The 3D Group's operational core was composed of faculty, staff and students who gained expertise by means of a series of courses coordinated between the departments of Computer Science and Art.

NEUTC Award: 01519, **Amount:** \$22,839, **Support Period:** 09/04 – 12/06

Title: Using Real-Time Traffic Data to Improve Traffic Flow

(PIs: Natacha E. Thomas, Co-PIs: Peter Swaszek, Joan Peckham and Christopher Hunter)

The recent installation of traffic monitoring equipment by Mobility Technologies in the greater Providence, Rhode Island, area provides an unprecedented opportunity to study real traffic flows in a mix of urban and suburban New England. Through agreements with both Mobility Technologies and RIDOT, and in collaboration with the UMass Transportation Center, the project employed this data to refine methods and calibrate models for incident detection and for travel time prediction under normal and incident conditions.

University of Rhode Island Transportation Center Award, Amount: \$102,318, **Support Period:** 2005-2007

Title: Enhancing the Preparedness and Response of the Transportation System in Natural or Human-Caused Disasters

(PI: Jay Wang, Co-PIs: Natacha Thomas, Valery Maier Speredoluzzi, Charles Collier)

The rapid advance of technology has presented authorities with many new tools to monitor and control roadways for safe, efficient, and convenient use by motorists, working toward an intelligent transportation system that adapt to dynamic situations to best serve motorists. Recent natural and human-caused disasters have demonstrated that there are significant challenges yet to be overcome by the advancing technology of transportation systems. A significant problem is a lack of clear, efficient communication during emergencies. The public requires timely information and guidance during and after a catastrophic event. This project investigated the feasibility of enhancing transportation system preparedness by creating messages to aid motorists during natural or human-caused disasters, supplementing the existing message display libraries for variable and dynamic message signs (VMS and DMS). This investigation considered the current transportation emergency communication environment and attempted to enhance communication and preparedness by improving the design and display of VMS/DMS messages.

URI Water Resource Center Award, Amount: \$56,174, Support Period: 03/06-02/07.

Title: Assessment of Downstream Hazard Potential for Dam Failure in Rhode Island (PI: Mayrai Gindy, Co PI: Natacha Thomas)

Potential dam failure poses a real threat to public safety, carries environmental risk, and has a significant economic impact on public and private property and infrastructure (roads, bridges, etc.). This threat has not gone unnoticed by the Rhode Island Department of Environmental Management (DEM), Dam Safety Program, responsible for inventory and inspection of state-owned dams. DEM descriptively classifies dams by size (small, medium or large) and hazard (high, significant or low) ratings. This project investigated several viable techniques for risk assessment of Rhode Island dams that account for the probabilistic behavior of natural and structural parameters. A comparative example was performed on a selected Rhode Island dam and hazard potential was compared with the 2004 DEM rating. Recommendations were made for possible alternative techniques to improve the hazard assessment of RI dams.

RIDOT AWARD: 00988 Amount: \$255,000, Support Period: 03/06/06 – 06/30/08

Title: Multi-Modal Hurricane Evacuation Plan

(PI: Natacha E. Thomas, Co-PIs: Christopher Hunter, Donald Cunnigen and Talia McCray)

Recent hurricanes, Katrina and Rita, have demonstrated a need for multi-modal evacuation under hurricane threat. A commonly accepted framework of mass disaster evacuation postulates the dependency of the actual risk posed to actual resilience and actual exposure. Actual resilience relates closely to the material and conceptual resources available within reach or through the larger community including the availability of transportation means. Actual exposure varies with such factors as actual location relative to disaster agent's pathway, magnitude and scope. Actual resources can be employed to control actual exposure through population evacuation, for instance, thereby controlling risk.

This project derived and mitigated the actual risk posed by hurricanes to the coastal population segments of Rhode Island. To this end, it assessed the resilience and the exposure to hurricanes at varied coastal transportation analysis zones. It further scrutinized the feasibility of enhancing resilience, to minimize overall societal risk, through the enactment of a multi-modal phased evacuation. The empirical data necessary to study conduct was gleaned from disaster-related literature, proposed surveys of representative groups of potential or past evacuees, emergency management agencies, metropolitan planning organizations and readily available GIS databases.

URI Water Resource Center Award, Amount ~ \$55,000, Support Period: 03/05-02/06.

Title: Risk Assessment Method for Water Infrastructure Systems (PI: Natacha E Thomas)

This study addressed the need for a standard methodology for assessing security risk at water resource infrastructures in Rhode Island. The standard methodology proposed provides for a breadth of coverage of risk assessment themes and for efficiency and effectiveness. The aim is to enhance the preparedness of administrators at meeting security risks and at protecting the built water infrastructure, its human operators and users.

• **09/98 – 07/02, Senior Transportation Engineer, Liro-Kassner, Inc., Syosset, NY.**

Charged with managing and conducting varied traffic engineering projects encompassing traffic operation, roadway geometric design, roadway access management, and traffic calming. The below list describes a sample of undertaken projects.

Town of Brookhaven Traffic Calming Program – Established a traffic calming program for the Town of Brookhaven, New York. Having implemented a small number of traffic calming projects in isolation, the Town sought to integrate the planning for future projects into a comprehensive program. The program established the procedures for requesting traffic calming projects. It further outlined the policies for their initiation, assessment, prioritization, funding, implementation, and evaluation. Care was taken to minimize the potential negative impacts and the liabilities from traffic calming.

Key feature: traffic calming program and policies

Traffic Calming Smith Road, Lake Ronkonkoma – Applied, and successfully attracted funding, \$350,000, for a Local Safe Streets and Traffic Calming Grant at Smith Road, Lake Ronkonkoma in the Town of Brookhaven, New York. Smith Road borders a high school nested within a residential neighborhood. The roadway provides little pedestrian protection against vehicles. A sag vertical curve, a crest vertical curve, a horizontal curve, and a reverse curve restrict sight distance along the road. Resident complaints further cite poor sight distance from driveways at abutting properties. On fair weather days, students continuously brave speeding traffic to access food catering businesses.

Key feature: traffic calming proposal

Route 112 Reconstruction Project - Simulated the performance of the State Route 112 geometric and signal timing designs under the existing and proposed scenarios. Generated all input files to HCS and Netsim, a microscopic traffic simulation model. Sought outputs include the average travel time and delay along varied section of Route 112. Wrote all traffic related sections of the associated Environment Impact Statement Report.

Key features: traffic operation analysis (level of service analysis, and signal timing)

Route 80 Reconstruction Project - Simulated the performance of the Route 80 geometric and signal timing designs under the existing and proposed scenarios. Generated all input files to Synchro, a macroscopic traffic simulation model. Conducted the accident data reduction and analysis tasks. Wrote all traffic related sections of the associated Environment Impact Statement Report.

Key features: traffic operation analysis (level of service analysis, and signal timing)

Newark Airport – Conducted numerous intersection design studies, parking designs, and safety analyses on airport ground and its immediate vicinity. Proposed a signing plan to guide freight trucks to numerous construction sites during the expansion of Terminal C and the remodeling of the control tower.

Key features: traffic safety analysis, intersection design study, parking design, signing

• **09/94 – 05/98, Assistant Professor, Department of Civil and Materials Engineering, University of Illinois, Chicago, IL.**

Duties include the teaching of various graduate and undergraduate Civil Engineering courses, the advising of graduate students on research issues, theses and dissertations, the pursuit and successful accomplishment of community service and research, as well as the publication of books and articles. Below is a sample project undertaken.

Fifteen Street Development Community Project - Provided technical support to the Pilsen community on transportation policy issues. Served as interface between the community and the city of Chicago DOT during the redesign of the Cermak Rd., Ashland Ave., and Blue Island Ave. intersection. This multi-leg intersection experiences heavy pedestrian and vehicular traffic while being crossed at one leg by a railroad track. Bus stops at the far side of the crossed leg provided little protection to students en route to a school at the northeastern intersection corner. The crossed leg further offered a poor sight distance of the railroad track. The intersection was successfully redesigned to minimize conflicts between pedestrians, vehicles, and trains. The industrial community of Pilsen experiences heavy truck traffic, and is conveniently located near three major interstate highways, I-55, I-290, and I90/94.

Key features: transportation policy, community service, intersection redesign (geometric design, signing, pavement marking, signal timing)

• **03/90 - 05/94, Research Assistant, Urban Transportation Center, University of Illinois, Chicago, IL.**

Participated in the mitigation of nonrecurring congestion, and the traffic surveillance aspects of a pilot Intelligent Transportation System project as described below.

Advance Pilot Intelligent Transportation System - Modified the source code of the INTRAS micro-simulation model to implement incidents, and generate probe travel time reports on arterial streets. Simulated the ADVANCE test bed under incident and incident-free conditions. The resulting incident and incident-free probe reports were used to calibrate varied incident detection algorithms for the ADVANCE ATMS. Participated in seminar sessions on the ADVANCE development effort. ADVANCE was a pilot ITS system demonstrated in a northern suburb of Chicago.

Key features: intelligent transportation system, advanced traffic management system, traffic surveillance system, traffic micro-simulation.

• **09/92 - 05/93, Teaching Assistant, Department of Civil and Materials Engineering, University of Illinois, Chicago, IL.**

Assisted in the teaching of classes CEMM 429, Introduction to Transportation and Traffic Engineering, and CEMM 302, Introduction to Construction Management.

• **03/87 - 12/87, Planner, Landrum and Brown, Chicago, IL.**

Worked in the Ground Access Division for O'Hare International Airport. Prepared the 1988 Arrival Curbfront Allocation Plan. Participated in the development of the Call Down System for taxis and limousines. Conducted traffic impact studies of alternative site locations for structural/surface parking. Reviewed signing plans of ground access roadways for all phases of the departure deck remodeling. Participated in the design of the access roadway for projected Terminal 5.

O'Hare International Airport - Provided ground access support at O'Hare International Airport for Chicago DOA. Reviewed numerous maintenance and protection of traffic plans during the remodeling of the Upper Level Roadways at O'Hare airport. Redesignated varied remote parking facilities and conducted their impact studies on neighboring roadways. Devised the curb front allocation plan for the Lower Level roadways. Participated in the design of the "Call-Down System" for limousines and taxis. The system restricts access to the airport arrival curb front to only authorized vehicles through use of a priority roadway. Participated in the design of the access roadway to the international terminal, Terminal 5. Participated in the development of the "People Mover System", a monorail that provides access to the airport core from remote parking.

Key features: traffic sign (guide and construction) system design, roadway system design, parking lot design and analysis, pavement marking design, traffic operation (capacity and level of service) analysis, traffic signal design and operation, pavement marking design, curb front allocation

• **09/86 - 03/87, Tutor, Office of Minority Student Education, University of Maryland, College Park, MD.**

Provided tutorial assistance to undergraduate students. Subjects tutored included: Linear Algebra, Calculus, Probability, Statistics, and Physics.

• **02/86 - 09/86, Planner, Goodell Grivas, Rosslyn, VA.**

Participated in the retiming of traffic signals for the Michigan Department of Transportation.

Traffic Signal Control System - Involved in the timing of signals for a wide surface street network of the City of Ann Harbor. Generated all input files to the Transyt-7F macroscopic traffic simulation and signal optimization model.

Key features: traffic signal systems design and operation.

• **10/80 - 08/81 (part-time), Teacher, Centre International d'Education Primaire et Secondaire, Port-au-Prince, Haiti.**

Taught Physics to high school seniors.

• **06/81 - 09/81 (full-time), Intern, Department d'Electricite d'Haiti, Section de Genie Civil, Port-au-Prince, Haiti.**

Participated in feasibility studies of various hydraulic electricity plants throughout Haiti.

COURSES TAUGHT

Traffic Flow Theory, 3 students, spring 08; 2 students, spring 06; 10 students, spring 97.

Traffic Engineering, 11 students, fall 10; 16 students, spring 10; 12 students, fall 08; 14 students, fall 06; 10 students, fall 05; 1 student, spring 04; 5 students, fall 04; 4 students, spring 03; **Fundamentals of Traffic Engineering**, 7 students, spring 98.

Advanced Traffic Control Theory, 9 students, fall 95; 4 students, spring 95.

Geometric Design of Highways, 7 students, spring 11; 7 students, spring 09; 3 students, spring 08; 10 students, spring 05; 5 students, fall 02; 12 students, spring 98; 30 students, spring 97; 12 students, spring 96; 12 students, spring 95.

Surveying/Geomatics, 43 students, fall 08; 42 students, fall 07; 45 students, fall 06.

Introduction to Civil Engineering Tools, 44 students, fall 10.

Civil Engineering Design I, 32 students, spring 09; 32 students, fall 08; 25 students, fall 05.

Civil Engineering Design II, 26 students, spring 08; 26 students, spring 06.

Mechanics of Materials, 49 students, spring 10.

Special Problems, 1 student, spring 10; 2 students, spring 09; 1 student, spring 08; 1 student, fall 08; 1 student, spring 07; 1 student, fall 07; 2 students, spring 05; 1 student, fall 05; 1 student, fall 03; 1 student, spring 02; **Independent Study**, 1 student 96.

Master's Thesis Research, 1 student, spring 07; 1 student, fall 07, 2 students, spring 06; 3 students, fall 06; 1 student, Summer 05; 1 student, spring 05; 2 students, fall 2005.

Doctoral Dissertation, 1 student, spring 11; 1 student, fall 10; 2 students, spring 09; 1 student, spring 08; 1 student, fall 08; 1 student, fall 07; **Doctoral Thesis**, 1 student, fall 96;

Highway Engineering, 38 students, spring 11, **Introduction to Transportation Engineering**, 39 students, fall 97; 43 students, fall 96; 31 students, fall 95; 42 students, fall 94.

Undergraduate Research, 1 student, fall 95; 1 student, spring 96.

Graduate Seminar, 6 students, spring 10.

RESEARCH INTERESTS

- The optimization of roadway and airport alignments, using mathematical programming.
- The operational impacts of roadway geometries.
- Traffic congestion detection and mitigation; especially the automatic detection of freeway and arterial incidents, within and outside the framework of Intelligent Transportation Systems, using statistical pattern recognition and time series analyses, signal frequency decomposition.
- Dynamic traffic assignment and dynamic signal system control.
 - Pedestrian Dynamics Under Routine and Evacuation Operation
 - Safety Analyses of Transportation Facilities including green facilities (bicycle and pedestrian facilities)
- Disaster risk assessment and mitigation studies; especially hurricane evacuation and socio-economic vulnerability analyses.

TEACHING INTERESTS

- Highway engineering, Traffic flow theory, Control of traffic signal systems, Geometric design of highways, Airport design, Transportation demand analysis.

AREAS OF STUDY

- Traffic Flow Theory, Surveillance, and Control
- Linear and Nonlinear Forecasting Techniques
- Probability and Statistics
- Operations Research and Mathematical Programming
- Advance Optimal Control Theory and Application
- Transportation Systems: Analysis and Planning (Airport, Railway and Highway)
- Airport Design
- Transportation Demand/Supply and Network Analysis
- Fortran and Pascal Programming
- Engineering Economics

AREAS OF PROFICIENCY

- **Traffic and Highway Engineering**

Background in traffic flow theory and control, traffic operations, traffic measurements, highway geometric design, traffic safety. Familiarity with traffic simulation and control optimization software.

- **Airport Design**

Theoretical background and working experience with the planning and design of groundside and airside airport facilities. Familiar with airport design issues such as: curbside allocation, gate and terminal demand and supply analyses, runway design.

- **Intelligent Transportation Systems**

Familiar with the basic concepts and issues of ITS. Participation in various seminars and conferences on Advanced Traffic Management Systems and Advanced Traveler Information Systems. First hand experience in recurring/non recurring congestion detection. Interest in adaptive signal timing systems, congestion detection and management, in particular, and traffic surveillance and control in general.

- **Time Series Analysis**

Background in linear and nonlinear modeling of time series data using SAS and B34S. Extensive experience with ARIMA, Transfer Function, Kalman Filter, VARMA, MARS, and Spline models.

- **Transportation Systems Analysis**

Background in travel demand analysis including sequential, logit and probit, and combined models.

- **Mathematical Programming and Control Theory**

Background in formulating and solving mathematical programming problems including, linear, nonlinear, dynamic, and stochastic programming.

- Hurricane Disaster risk analysis and mitigation

Background in evacuation analyses of hurricane flood areas.

COMPUTER EXPERIENCE

- **Transportation Engineering Software**

HCM, SYNCHRO, TRAF-NETSIM, MAXBAND, TRANSYT-7F, PASSER-II, INTRAS, SOAP84, SIDRA.

- **Computer Languages**

Pascal, Fortran, C.

- **Database**

Oracle.

- **Computer Aided Design Software**

AutoCad, Microstation, Civil 3D, Inroads

RECENT PUBLICATIONS

Journal Publications

Campbell, A., N. E. Thomas and C. Hunter (2007). *Evacuation Risk Index for the Rhode Island Coastal Regions*. Transportation Research Board, Transportation Research Record 2009, Washington, D.C., pp. 121-129.

Park, K.; N. E., Thomas and K. W., Lee (2007). *Applicability of the International Roughness Index as a Predictor of Pavement Condition*. American Society of Civil Engineers, Journal of Transportation Engineering, Vol. 133, No. 12, New York, N.Y., pp. 706-709.

Lieberman, C., D. Kurowski, M. R. Avila, L. Ricci, N. Thomas, J-Y. Herve, J. Peckham, C. Collyer, B. Aguirre, M. Wan, (2007). *SIMPED - A Concept for the Immersion of Social Science Constructs into Simulations of Pedestrian Evacuation from Buildings*. Fire safety, Technology & Management, Vol. 10:1, pp. 19-26.

Thomas N. (1999). *Multi-state and Multi-sensor Incident Detection Systems for Arterial Streets*, Transportation Research, Part C, 6, Elsevier, Tarrytown, N.Y., pp. 337-357.

Thomas N., B. Hafeez (1999). *Simulation of an Arterial Incident Environment with Probe Reporting Capability*. Transportation Research Board, Transportation Research Record 1644, Washington, D.C., pp. 116-123.

Thomas N., B. Hafeez, A. Evans (1998). *Revised Control Parameters for Vertical Curves*. Journal of Transportation Engineering, Vol. 124, No. 4, American Society of Civil Engineers, New York, N.Y., pp. 326-334.

Peer-Reviewed Conference Publications

Peckham, J.; B. E. Aguirre, Thomas, N. E. et al (2005) A Pattern for the Integration of Conceptual Models in Support of Multidisciplinary Efforts to Develop Software, Proceeding of 2005 Conference of Computing in Civil Engineering.

Thomas N. (1996) Multi-Sensor, Multivariate and Multi-Class Incident Detection System for Arterial Streets. Proceedings of the 13th International Symposium on Transportation and Traffic Theory, Elsevier, Paris, France.

Editorial Reviewer

Federal Highway Administration, Turner-Fairbank Highway Research Center, *Revised Monograph on Traffic Flow Theory*, www.tfhrc.gov/is/tft/tft.htm, Accessed on Dec. 20, 2005.

PRESENTATIONS

Presented "Multi-Sensor, Multivariate and Multi-Class Incident Detection System for Arterial Streets" at the 13th International Symposium on Transportation and Traffic Theory in Lyon, France, in July, 1996.

Presented "Multiple Attribute Incident Detection Systems for Arterial Streets" at the Pre-Bid Workshop organized by Oak Ridge National Laboratory in Phoenix, Arizona, in August, 1996.

Presented "Multiple Attribute Incident Detection Systems for Arterial Streets" at the Informs Seminar, Analysis to Support Public Sector Decision Making, organized in Washington, D.C., in August, 1996.

Presented "Simulation of an Arterial Incident Environment with Probe Reporting Capability" at the Transportation Research Board Meeting, Washington, D.C., in January 1998.

THESIS AND DISSERTATION

• Ph.D. Dissertation

Title: A Traffic Incident Detection Model for Surface Streets Equipped with Fixed and Mobile Detection Systems.

Advisor: Nagui Roupail

Incident detection systems typically emphasize incident presence and location over incident severity and incident removal. Yet, Advanced Traveler Information Systems and Advanced Traffic Management Systems rely on the latter states to implement and terminate diversion, and its supportive control strategies. Further, incident detection systems directly benefit from processing measurement vectors rather than scalars.

Vectors of lane measurements favor detection through lane imbalances and identification of incident host lanes. Intelligent Transportation Systems promise new sensor data to control centers, including the travel times experienced by probe vehicles. Vectors of new and old sensor inputs may possess enhanced discriminatory powers.

To accommodate added detection states and the fusion of multi-sensor input vectors, this thesis reformulates the arterial incident detection problem as a multiple attribute decision making problem with Bayesian scores. This novel approach utilizes as input the combinations of simulated probe travel times, number of probe reports, lane specific detector occupancies and vehicle counts. Models based solely on probe data lack in performance due to excessive overlaps in class distributions. Models based on detector occupancies and vehicle counts by lane perform outstandingly. They display a propensity to detect through lane measurement imbalances. The probe data is shown to enhance the performance of detector data based models.

• M.S. Thesis

Title: Capacity Analysis of an Added Through Lane

Advisor: Paul Schonfeld

Intersection approaches constitute the main bottlenecks of roadway networks. Approach lanes only discharge during the green portion of a signal cycle. Basic highway sections can discharge at capacity throughout the entire cycle, provided they are unconstrained by approach queues. Short through lanes, achieved through the removal of parking, or the roadway widening, at intersection approaches and departures, may raise approach capacities to levels commensurate with those of basic sections. This study describes three analytical models that predict the capacity and optimize the design and operation of a short

through lane at signalized approaches with one continuous lane. The service discipline of the short lane is first-in first-out. The models are based on traffic flow theory. Through comparative use of all three models, the impacts of signal timing, short lane designs, downstream merging conditions, and acceleration and deceleration profiles of added lane vehicles are assessed. It is shown that for a first-in first-out service discipline, and green to cycle length ratios smaller than 0.5, the maximum design capacity of the short lane matches that of a continuous lane.

REFERENCES

- Dr. David Boyce, Professor, Department of Civil Engineering, University of Illinois, 842 W. Taylor St. #2095 ERF, Chicago, IL 60607, (312) 996-4820, dboyce@uic.edu.
- Dr. Paul Schonfeld, Professor, Department of Civil Engineering, University of Maryland, College Park, MD 20742, (301) 405-1954, pschon@eng.umd.edu.
- Dr. Pitu Mirchandani, Professor, Systems and Industrial Engineering Department, The University of Arizona, Tucson, AZ 85721, (520) 621-2990, pitu@sie.arizona.edu.
- Dr. Everett Carter, Professor, Department of Civil Engineering, University of Maryland, College Park, MD, 20742, (301) 405-1950, EC10@umail.umd.edu.