SUMMARY OF
CONNECTICUT COOPERATIVE TRANSPORTATION RESEARCH PROGRAM PROJECTS

May 23, 2008 – May 22, 2009

JHR 09-320 September 2009

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http://www.cti.uconn.edu/chwrp/index.php

Preface

Connecticut Cooperative Transportation Research Program
with the
University of Connecticut

On July 9, 1962, the Connecticut State Legislature established a continuing joint highway research program between the Connecticut Department of Transportation (Department) and the University of Connecticut (UConn). Section 13a-256 of the General Statutes, as amended, provides for continuing funding of this research program. The continuing agreement between the Department and UConn created the eight-member Joint Highway Research Advisory Council (JHRAC or Council) with complete authority over the research program. The Council consists of four members designated by the Commissioner of Transportation and four members designated by the President of the University of Connecticut.

On June 17, 2009, to better reflect the long-held multimodal goals of the research program, the Council formally changed the name of the research program to Connecticut Cooperative Transportation Research Program (CCTRP).

The University maintains an informational Web site for the Connecticut Cooperative Transportation Research Program through its Connecticut Transportation Institute (http://www.cti.uconn.edu/chwrp/index.php). You may freely view the site to learn about transportation research conducted under this research program.

TRANSPORTATION RESEARCH GOALS OF CCTRP

On September 19, 1972, in response to the 1969 merger and creation of a unified multimodal State Department of Transportation, Council revised its research goals, as follows:

Whereas the State is committed to create, maintain and operate a viable, safe and economical, transportation system, and, whereas the Joint Highway Research Advisory Council is authorized, under the "Agreement for a Continuing Cooperative Highway Research Program to be undertaken by the Connecticut Highway Department and the University of Connecticut," to provide technical facilities and professional services to accomplish this commitment; the Council adopts the following goals:

- To improve and facilitate the movement of goods and services on the state system.
- To introduce improved materials and methods of operation for the design, construction, maintenance, and management of the state system.
- To increase the safety and convenience of the state system for the people of this state, and
- To minimize any undesirable environmental impact of existing and proposed transportation facilities on adjacent properties and communities.

Identifying, evaluating and researching transportation related problems shall achieve these goals. The results of various research projects are to be disseminated and implemented to effect beneficial changes in the State Transportation System.

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JOINT HIGHWAY RESEARCH PROJECTS
UNIVERSITY OF CONNECTICUT
and
CONNECTICUT DEPARTMENT OF TRANSPORTATION
Summary for Program Year 2008-2009

Project Number: 04-6

Project Title: Designing Roads that Guide Drivers to Choose Safer Speeds

Principal Investigators: John Ivan and Norman Garrick

Project Status: Active

Initial Agreement Date: May 2004

Objective:

To answer the following three questions:

1) How do the prevailing road characteristics such as the design geometry and roadside environment influence the actual travel speeds chosen by drivers?
2) How do the actual travel speeds along with these road characteristics influence the incidence of crashes?
3) How can we use the answers to these first two questions to design the safest road for a given condition?

Progress:

A draft final report was prepared and submitted to ConnDOT for review and comment on 5/18/2009.

Major Findings:

This project has investigated how physical characteristics of the roadway and the roadside environment are associated with actual vehicle running speeds, and how actual vehicle running speeds are associated with the occurrence and severity of motor vehicle crashes in conjunction with other roadway and roadside characteristics. Actual vehicle running speeds were observed at about 300 locations in urban, suburban and rural areas across Connecticut, at locations without horizontal curves or traffic control devices. Only vehicles traveling through the section unimpeded either by leading or turning vehicles were observed in order to get true free flow traffic speeds. Roadway and roadside characteristics were observed, and statistical prediction models were estimated to learn more about how free flow vehicle speed, roadway and roadside characteristics and crash incidence and severity are related.

The factors associated with higher average running speeds are wide shoulders, large building setbacks and a residential location. The factors associated with lower average running speeds are on-street parking, sidewalks and a downtown or commercial location. These findings suggest that drivers slow down where the road feels “hemmed-in” or there is noticeable street activity, and they speed up where the road feels “wide open” or street activity is less noticeable. This finding is not surprising, but these relationships are quite strong in the observed data, and it is a useful result to isolate this short list of factors that are significantly correlated with actual vehicle running speeds.

Products/Outcomes:

G. Hanson, N. Garrick, J. Ivan and T. Jonsson, "Variation in Free Flow Speed Due to Roadway Type and Roadside Environment," Transportation Research Board Annual Meeting, Paper No. 07-3136, Washington, DC, January 2007.

W. Marshall, N. Garrick, G. Hansen, "Reassessing On-Street Parking", *Transportation Research Record: Journal of the Transportation Research Board*, No. 2046, p. 45-52, 2008.

Benefits/Results:

These findings demonstrate that through careful, intentional selection of roadway and roadside design elements, it is possible to influence the running speed of traffic on a road. The results suggest that drivers indeed take cues from elements of the roadway and roadside environment to decide how fast to drive and these cues are independent of the posted speed limit and other considerations that might be important to the community for reducing speeds. So the good news is that it is possible to influence drivers' choice of speed through design of roadway and roadside elements; but the bad news is that many existing roads cue drivers to travel much faster than the posted speed limit and the community would like.

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Summary for Program Year 2008-2009

Project Number: 05-6

Project Title: Value Pricing in Connecticut: A Policy Simulation

Principal Investigators: Norman Garrick

Project Status: Completed

Initial Agreement Date: May 2005

Objectives:

To: 1) determine realistic road value pricing scenarios in Connecticut; 2) model these scenarios and determine the short-term impact on automobile travel; and, 3) determine the mode shift and the traffic impacts as a result of each pricing scenario

Progress:

The final report was submitted to ConnDOT on September 29, 2008 and the project was officially closed on December 18, 2008.

Major Findings:

This study was conducted to determine which roadways and/or regions in Connecticut were candidates for congestion pricing and to evaluate the impacts of pricing in these areas. Congestion is a problem on major arterials in the larger metropolitan regions in Connecticut. Two routes (I-95 and Route 15) in Connecticut were identified as potential candidates for congestion pricing. Multiple congestion pricing scenarios were simulated in TransCAD during the AM peak hour to investigate the impact on mode choice and congestion.

The results of this analysis indicate that when pricing only one of these routes, the other route (which runs parallel) experiences a significant increase in congestion. The results suggest that the biggest and most positive outcome in terms of reducing traffic and decreasing congestion on I-95 and Route 15 would come from pricing both routes simultaneously. However, this strategy would require a significant increase in rail capacity and rail level of service in the region since the resultant shift to rail travel would tax the existing rail service. Our preliminary assessment of income suggests that the proposed pricing scheme could generate some of the income needed for upgrading the rail system.

Products/Outcomes:

N. Garrick, W. Marshall and E. Jackson, “Value Pricing in Connecticut,” September 2008, JHR 08-313.

Benefits/Results:

Results from the project have been presented to the Transportation Strategy Board for use in developing a state plan for value pricing in Fairfield County.

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Project Number: 05-7

Project Title: Design and Feasibility Study: Connecticut Transportation Planning Data

Principal Investigators: Lisa Aultman-Hall and John Ivan

Project Status: Completed

Initial Agreement Date: May 2005

Objectives:

To rank and prioritize the household travel data needs of Connecticut transportation planners and to evaluate the available options, including new-technology driven options, to routinely collect the data

Progress:

The final report was submitted to ConnDOT on October 20, 2008 and the project was officially closed on December 18, 2008.

Major Findings:

The priority needs for planning data were determined using focus group to be household trip rates and trip length distributions. Three viable options exist for the state of Connecticut to collect the type of basic household travel information desired by transportation planners. First, a telephone survey collecting the most basic information could be collected for relatively little cost. Survey design efforts could be minimized by adapting the web-based survey conducted for this project. In addition to response burden and sampling issues, this survey method would not be on-going, would be limited in scope and could not provide some of the more advanced data options suggested by planners in this project's roundtables including geo-coding of trip ends. Second, a web-based survey could be adapted from the survey in this project and placed on-line for continuous data collection. We would recommend an interactive map be considered for geo-coded trip ends and better trip lengths. Careful attention to recruiting and sample bias would be required. This option would require a moderate level of resources for initial deployment but then become an on-going data source with relatively minimal effort. We recommend the team develop a program website in place of off the shelf software if this survey method is used again. Finally, the analysis of national and New York City datasets in this project re-confirms the transferability results found by others. Stratification by very basic household variables such as the number of workers and vehicles yields good mean trip rates and reasonable mean trip lengths. Weighting and transfer of the 2008 NHTS dataset which is about to be collected, might be the most cost effective way to obtain updated basic planning model data input for Connecticut. However, a well designed and managed web-based data source, while suffering from lack of complete random sampling, seems the best approach to create an on-going comprehensive planning, policy and research tool for travel data in Connecticut. Although the team originally proposed consideration of technology approaches to planning data collection including ITS and GPS, evaluation during this project indicated these methods could not provide the most key

variables sought by transportation planners. Data mining these ITS and GPS data sources is valuable for other applications and advancing techniques could allow these sources as a complement to a household travel survey.

Products/Outcomes:

S. Mather, "Evaluating the Feasibility of Updating Trip Rates and Trip Lengths for Connecticut TAZs using Existing Household Travel Survey Data," Master's Thesis, University of Connecticut, 2007.

L. Aultman-Hall, S. Mather, E. Jackson, H.-S. Shin and J. Ivan, "Design and Feasibility Study: Connecticut Transportation Planning Data," October 2008, JHR 08-315.

Benefits/Results:

A review and pilot study of alternative methods to collect household travel survey data indicated accurate and reliable data could be collected in a continuous manor for much less than the NHTS add-on cost of $175 per household. The price of $175 per completed household and a minimum sample size in the state of 1500 was considered potentially cost prohibitive for CT. This project resulted in the collection of over 1000 households in a 2 month period for a fraction of the NHTS cost. This translates into cost savings for the state of Connecticut and a more robust, larger dataset for transportation planners. This project suggests that the development and fine tuning of data collection methods could allow ConnDOT to efficiently update their Origin-Destination travel datasets.

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Project Number: 05-9

Project Title: Detailed Modal Analysis of Particulate Emissions from Connecticut Transit Buses for Emissions Modeling

Principal Investigators: Britt Holmén

Project Status: Completed

Initial Agreement Date: May 2005

Objective:

To provide new understanding in particulate number emissions from diesel transit buses with different transmission, fuel and aftertreatment configurations in disaggregate form to enable transit bus emissions modeling at high temporal and spatial resolution within the Connecticut transportation network

Progress:

The final report was submitted to ConnDOT on December 15, 2008 and the project was officially closed on December 18, 2008.

Major Findings:

This study establishes preliminary relationships between particle emissions and driving mode for diesel, clean-diesel and hybrid diesel-electric transit buses in Connecticut to improve real-world particle number emissions estimates at the microscale. Quantifying the relationships between heavy-duty vehicle driving mode, vehicle type and particle emissions is important for developing particle modal emission models, understanding the spatial distribution of particle emissions and for improving population exposure models based on travel behavior and transportation infrastructure design and planning.

Products/Outcomes:

H.O. Gao and B. Holmén, "Temporal Alignment in On-Board Diesel Transit Bus Particle Measurement and Modal Emissions Analysis," Control Technology Poster Session, International Aerosol Conference, St. Paul, MN, September 2006

D. Sonntag, H.O. Gao and B. Holmén, "Modeling On-Road Particulate Matter Number Emissions from a Hybrid Diesel-Electric Bus: An Exploratory Econometric Analysis," Transportation Research Board Annual Meeting, Paper No. 07-3129, Washington, DC, January 2007.

D. Sonntag, H.O. Gao and B. Holmén, "On-Road Particle Number Emissions from a Hybrid Diesel-Electric Bus: Exploratory Econometric Analysis," *Transportation Research Record: Journal of the Transportation Research Board*, No. 2011, 2007.

H.O. Gao and A Bapat, “Diesel Particulate Matter Number Emissions: Evaluation of Existing Modal Emission Modeling Approaches,” Transportation Research Board Annual Meeting, Paper No. 08-2730, Washington, DC, January 2008.

D. Sonntag, H.O. Gao and B. Holmén, “Variability of Particle Number Emissions from Conventional and Hybrid Diesel-Electric Buses in Real Driving Conditions,” Transportation Research Board Annual Meeting, Paper No. 08-2452, Washington, DC, January 2008.

D. Sonntag, H.O. Gao and B. Holmén, “Variability of Particle Number Emissions from Diesel and Hybrid Diesel-Electric Buses in Real Driving Conditions,” *Environmental Science and Technology*, 42 (15), American Chemical Society, June 2008.

E. Jackson and B. Holmén, “Modal Analysis of Vehicle Operation and Particulate Emissions from Connecticut Transit Buses,” Transportation Research Board Annual Meeting, Paper No. 09-0533, Washington, DC, January 2009.

D. Sonntag, H.O. Gao, B. Holmén and E. Jackson “Development of a Modal Particle Number Emissions Model from a Diesel Transit Bus,” Transportation Research Board Annual Meeting, Paper No. 09-2306, Washington, DC, January 2009.

D. Sonntag and H.O. Gao, “Developing Link-Based Particle Number Emission Models for Diesel Transit Buses using Engine and Vehicle Parameters,” *Transportation Research Part D: Transport and Environment*, Volume 14, Issue 4, June 2009.

Benefits/Results:

The results of this study can guide ConnDOT and CT Transit on future bus purchases and route section for existing alternative powered buses. Understanding the air quality impacts and between the different vehicle technologies are important for improving air quality in the capital region and the state.

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Project Number: 06-3

Project Title: Extending the Lifespan of Existing Highway Bridges through Controllable Stiffness and Damping Devices

Principal Investigators: Richard Christenson

Project Status: Completed

Initial Agreement Date: May 2006

Objectives:

To: 1) examine the application of state-of-the-art controllable stiffness and damping devices to reduce peak stresses in highway bridges; 2) develop and validate a coherence-based structural health monitoring technique utilizing the controllable stiffness and damping devices; and, 3) develop a design methodology to implement controllable stiffness and damping devices in Connecticut highway bridges for the dual functionality of both structural control and health monitoring

Progress:

The final report was submitted to ConnDOT on December 15, 2008 and the project was officially closed on December 18, 2008.

Major Findings:

The purpose of this study was to examine mitigating heavy vehicle traffic induced highway bridge vibrations utilizing several structural control strategies.

This investigation began by developing an analytical model for an in service highway bridge under heavy vehicle truck loading. Four types of control devices were investigated through analytical testing; passive stiffener, passive damper, active device, and semiactive device. The bridge system with integrated control device was tested for various loading cases and structural parameter values in order to observe the performance efficiency and robustness that each device was able to achieve. The results obtained from the simulations illustrate the effectiveness of each of the devices over a range of loading cases and bridge parameters. The semiactive controller offers several benefits over the other devices while still affording performance levels and robust behavior very near that of the active control device, which achieves the highest performance efficiency. The benefits of the semiactive device over its competitors include: it requires little energy to operate, it is controllable in real time, and it is inherently stable. Additionally, the semiactive device exhibits a multi-bridge application characteristic. More specifically, one semiactive device can be designed and that design can be used on many different bridges, while still offering consistent performance and behavior. This is demonstrated through the robustness of the semiactive device displayed in the numerical testing results.

Next this study experimentally verified the performance of a semiactive structural control device to reduce vehicle induced highway bridge vibration through real-time hybrid simulation. This work was funded with supplemental funding from the National Science Foundation (NSF) under the East Asia and Pacific Summer Institute program where Ms. Leah Loebach travelled to New Zealand to conduct the experimental tests at the University of Canterbury. Hybrid testing of the bridge and truck system with the integrated semiactive control device was conducted for several truck loadings and bridge properties. Peak stresses/strains were reduced by as much as 33% and peak displacements were reduced by as much as 40%. The semiactive control device demonstrated robust performance for the various truck speeds and bridge parameters.

This final part of the study developed and evaluated a structural health monitoring (SHM) method for identifying local nonlinear damage on a highway bridge. The proposed SHM method utilizes the coherence relationship between the semiactive device input and vibration response midspan acceleration output. An analytical study is conducted to investigate the SHM method's ability to accurately and precisely detect local nonlinear damage. Results of the study demonstrate a high sensitivity of the SHM method to identify local nonlinear damage accurately and precisely. The proposed SHM method is unique in several respects: a semiactive structural control device is used to excite the structure (rather than traditional application of vibration mitigation) and the coherence relation is used as the tool to detect damage.

Products/Outcomes:

L. Loebach. "Extending the Life Span of Existing Highway Bridges Using a Resettable Semiactive Damping Device", presentation, University of Connecticut, Department of Civil and Environmental Engineering, *Structures & Applied Mechanics Seminar Series*, October 2007.

L. Loebach, Z. Jiang and R. Christenson, "Extending the Lifespan of Existing Highway Bridges using Semiactive Control" presented at the Inaugural International Conference of the Engineering Mechanics Institute (EM08), Minneapolis, Minnesota, May 2008.

R. Christenson, "Extending the Lifespan of Existing Bridges through Controllable Stiffness and Damping Devices," December 2008, JHR 08-317.

L. Loebach, Z. Jiang and R. Christenson, "Examining the Effectiveness of Semiactive Structural Control to Reduce Traffic Induced Bridge Vibration," submitted to *Journal of Engineering Mechanics*.

L. Loebach, E. Mulligan, G. Chase and R. Christenson, "Experimental Verification of a Semiactive Resettable Control Device to Reduce Vehicle Induced Bridge Vibration," submitted to *Smart Materials and Structures*.

L. Loebach and R. Christenson "Development of a Coherence-Based Structural Health Monitoring Method for Semiactive Controlled Structures," submitted to *Journal of Structural Engineering*.

Benefits/Results:

This research examined through analytical testing, and small-scale experimental testing, how an existing bridge structure might be retrofit to reduce peak strains (and stresses) due to heavy truck traffic. Reducing stresses in the bridge can significantly increase the safe life of the bridge. This increased safe life will improve safety and can reduce maintenance costs and disruption to traffic associated with bridge repair. Furthermore, the means to monitor for damage in the structure will increase safety and can provide more efficiency in the bridge maintenance.

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Project Number: 06-9

Project Title: Evaluating Stormwater Quality Associated with Milling of HMA

Principal Investigators: Allison MacKay and James Mahoney

Project Status: Active

Initial Agreement Date: May 2006

Objective:

To characterize differences in water quality parameters between stormwater runoff from milled roadway surfaces and undisturbed roadway surfaces

Progress:

Draft project report completed.

Major Findings:

Examination of stormwater quality originating from milled and unaltered roadway surfaces indicated differences in total suspended solids and total lead concentrations, but no difference in copper or zinc concentrations. Overall, observed concentrations of these water quality parameters were within the ranges reported for studies from other unaltered roadway surfaces. The presence of lead in milled roadway surface runoff suggests a contribution of particles from roadside soil. Future milling operations should proceed with consideration not to create new hydraulic connections with adjacent roadside areas that would not contribute to roadway surface runoff under unaltered conditions.

Products/Outcomes:

Manuscript in preparation for submission to *Science of the Total Environment*.

Benefits/Results:

The findings of this research indicate that milled surface runoff water quality is not significantly different from roadway runoff obtained from unaltered surfaces in Connecticut, or elsewhere. As a result, re-design of best management practices associated with roadway milling operations is not required. Such an outcome is associated with a virtual cost-saving of not needing to develop and validate new best management practices for roadway milling operations.

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Project Number: 06-10

Project Title: Improving Surveying Accuracy and Efficiency in Connecticut: An Accuracy Assessment of GEOID03

Principal Investigators: Thomas Meyer, Robert Baron, Steven Fish and Derek Massalski

Project Status: Active

Initial Agreement Date: May 2006

Objectives:

To: 1) evaluate GEOID03's performance throughout Connecticut; 2) provide the NGS staff responsible for geoid modeling with our GPS data that will be included in future geoid models; 3) highlight problem areas that may require additional attention to resolve; 4) create a local geoid model that will bring GEOID03 into acceptable levels of accuracy until such time as the federal model meets Connecticut DOT criteria; and 5) disseminate these results via the World-Wide-Web and continuing education seminars

Progress:

GPS and leveling observations were conducted and completed by UConn personnel. Initial analysis was performed and appears reasonable.

Major Findings:

The initial analysis shows major discrepancies between GEOID03 and published orthometric heights at half dozen bench marks. Without computing these stations with a third software package, no certain conclusions can be drawn. On the whole, the project is successful thus far.

Products/Outcomes:

None to date.

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Summary for Program Year 2008-2009

Project Number: 07-2

Project Title: Creating Useful Products from Connecticut's 2000 LIDAR Data Set

Principal Investigators: Thomas Meyer and John David

Project Status: Completed

Initial Agreement Date: May 2007

Objectives:

To provide the public with access to the data and several standard derived products via the World Wide Web by creating web-accessible applications that return: 1) point cloud subsets as a list of ENU triplets; 2) triangulated irregular networks for a user-specified area; 3) digital elevation models for a user-specified area; and, 4) polyline data sets containing elevation contours

Progress:

The final report was submitted to ConnDOT on October 14, 2008 and the project was officially closed on December 18, 2008.

The final technical report was posted on the University of Connecticut's Digital Commons. To date, the report has been downloaded approximately 150 times. The data were made available to the public via the World-Wide Web on the UConn CLEAR website. The "raw" point set was processed into ArcGIS shapefiles, triangulated irregular networks, and contour map shapefiles.

Major Findings:

The State of Connecticut owns a Light Detection and Ranging (LIDAR) data set that was collected in 2000 as part of the State's periodic aerial reconnaissance missions. Although collected eight years ago, these data are just now becoming ready to be made available to the public. These data constitute a massive "point cloud", being a long list of east-north-up triplets in the State Plane Coordinate System Zone 0600 (SPCS83 0600), orthometric heights (NAVD 88) in US Survey feet. Unfortunately, point clouds have no structure or organization, and consequently they are not as useful as Triangulated Irregular Networks (TINs), digital elevation models (DEMs), contour maps, slope and aspect layers, curvature layers, among others. The goal of this project was to provide the computational infrastructure to create a first cut of these products and to serve them to the public via the World Wide Web. The products are available at http://clear.uconn.edu/data/ct_lidar/index.htm.

Products/Outcomes:

J. David and T. Meyer, "Creating Useful Products from Connecticut's 2000 Statewide LiDAR Data Set," poster presented at *The Second National Lidar Strategy Meeting*, Reston, VA, May 2008.

J. David, “Open Data Exchange Standards: Lessons Learned from the Connecticut Statewide LiDAR Initiative, and an Open Call for Discussion,” poster presented at *The Second National Lidar Strategy Meeting*, Reston, VA, May 2008.

T. Meyer, “Creating Useful Products from Connecticut's 2000 LIDAR Data Set,” October 2008, JHR 08-314. Connecticut LIDAR-derived products available at http://clear.uconn.edu/data/ct_lidar/index.htm

Benefits/Results:

The data are now freely available to the public in forms more useful than were provided by the vendor. The final report includes a quality assessment, which allows the data’s users to anticipate how suitable the data might be for their particular purposes. The final report also includes recommended requirements for future vendors in hopes of preventing problems in these data.

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Summary for Program Year 2008-2009

Project Number: 07-5

Project Title: Incorporating Wet Pavement Friction into Traffic Safety Analysis

Principal Investigators: John Ivan and Nalini Ravishanker

Project Status: Active

Initial Agreement Date: May 2007

Objective:

To conduct a statistical analysis of the association between wet pavement friction and road safety experience, controlling for pertinent roadway characteristics

Progress:

A database of **"**Found Data", corresponding to locations with archival wet pavement friction measurements, was prepared by identifying the locations of the measurements and adding the following additional information for each location selected: road characteristics (lane and shoulder width, speed limit, presence of curves, presence of intersections and driveways), crash counts by severity and collision type, and traffic counts.

To reduce the bias towards potentially higher crash counts in the found data, a second database of "Random Data" was also created. The locations for this database were selected to match the distribution of characteristics in the found data as much as possible, except for crash count and friction measurements. Road characteristics, crash and traffic count data were added to the database as for the found data. ConnDOT personnel then collected friction data for these random data locations, with one project team member accompanying the crew during the collection procedure.

Once the databases were completed, count data models using three different distributions were fit to the found and random data together to identify factors associated with crash incidence and to answer the questions listed in the project objectives. Preliminary findings were presented to the JHRAC, and drafting of the final report is in progress. Additional statistical analyses of the data are ongoing based on findings and revised statistical methods.

Major Findings:

The statistical analysis for this project is still being refined. However, **preliminary results** indicate that on divided highways low pavement friction is significant when predicting crashes. For undivided highways friction is significant but low friction numbers correspond to a reduced crash rate. This is unexpected and is being reviewed further for significance and explanation. Furthermore, the **preliminary analysis** indicated that friction is or is not significant based on the types of crashes being investigated. This indicates there are certain crash types where friction does not play a major role in crash rates.

Products/Outcomes:

J. Ivan, N. Ravishanker, B. Aronov, S. Guo and E. Jackson, "Selection Bias in a Study of the Effect of Friction on Expected Crash Counts on Connecticut Roads" presented at the Quality and Productivity Research Conference, June 3-5, 2009, Yorktown Heights, New York.

Benefits/Results:

Connecticut DOT currently maintains a program of measuring wet pavement friction at locations where collisions have occurred or have been flagged as potentially high collision locations. This program helps to determine whether or not the wet pavement friction in these areas meets Department standards, and to correct the situation if necessary, or to confirm whether or not it may have been a factor contributing to the collision. This research will determine on a larger scale to what degree wet pavement friction is associated with the incidence of collisions, and the types of locations on the road network at which the association is strongest. This information will help the Department to better identify road locations where the wet pavement friction should be tested and improved to most effectively reduce the incidence of fatal and serious injury collisions.

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Summary for Program Year 2008-2009

Project Number: 08-1

Project Title: Structure and Properties of Ionomer Modified Asphalts (IMAs)

Principal Investigators: Robert Weiss

Project Status: Active

Initial Agreement Date: May 2010

Objective:

To develop improved binders based on ionomers for polymer modified asphalts, especially for low temperature applications

Progress:

We have prepared ionomer-modified asphalts using a number of commercial ethylene-based ionomers and these have been characterized with respect to thermal behavior, morphology and viscoelastic behavior. We have synthesized another ionomer based on sulfonation of a commercial ethylene-propylene-ethylidene norbornene (EPDM) rubber, which will also be evaluated as an ionomer-modified asphalt.

Major Findings:

The ionomers were more compatible with asphalt than is polyethylene (a commonly used material in polymer-modified asphalts). The concentration of the ionic groups in the ionomer and the choice of the neutralizing cation affected the compatibility of the ionomer with asphalt.

Products/Outcomes:

None to date.

Benefits/Results:

The research is assessing the properties of a new type of polymer-modified-asphalt. The benefit to the State and citizens of Connecticut would be improved performance of asphalt roads if the PMA's being developed prove to be superior to currently used materials.

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Project Number: 08-5

Project Title: Assessing and Quantifying Public Transportation Access

Principal Investigators: Nicholas Lownes

Project Status: Active

Initial Agreement Date: August 2010

Objectives:

To 1) investigate the current state of the practice of quantifying public transportation access; 2) develop the best method for quantifying public transportation access in Connecticut's unique transit system, accommodating spatial, temporal, and travel demand coverage; 3) apply this method to selected Connecticut public transportation corridors as a pilot study; and, 4) make recommendations regarding the use of the method in public transportation project selection and design.

Progress:

We have made progress in line with expectations of where the project would be at this date. We have essentially completed the technology scan – finding a variety of transit availability measures from across the globe and identifying several that are to be included in the technology testing. The first wave of technology testing is largely completed, providing an interesting contrast between the various simpler measures. The more sophisticated measures are also in the testing phase, with data collection and preprocessing being a primary preparatory task this summer.

Meetings with the Technical Advisory Committee (TAC) have led to a further investigation of transit planning practices within the state of CT. The PI and his graduate researchers (including the GRA assigned to this project) have met with the CTDOT statewide planning modelers and the Capitol Region Council of Governments (CRCOG) regional planning modelers to discuss the planning process and how transit fits into those processes. Additionally, TAC meetings have yielded interesting suggestions for creating a more useful survey instrument. The survey instrument, which will be developed and deployed this summer, will focus more on the scale of analysis (local, regional, state) and broad data needs as opposed to focusing solely on origin-destination data.

Major Findings:

Preliminary results from the comparison of simpler methods has yielded some interesting results. The research team has applied three of the transit availability measures, LITA, TCQSM and the time-of-day measure, to the small transit network of Meriden, CT. Significant inconsistency exists between even the simple methods as to whether a particular analysis zone (TAZ or census tract) has "good" transit availability. In fact, in the small test area of Meriden, which has only 17 census tracts, there were 7 cases in which significant discrepancies (more than 2 letter grades, i.e., A vs. D) existed in availability grades

between the three methods tested. This means that depending upon the metric used, one could rate the same tract "excellent" or "below average". These results are preliminary and will be subsequently verified. Interestingly, the three methods tended to agree on the extreme cases: very good or very poor availability. It is likely that an improved transit availability metric will utilize components of all three tested methods and will further draw upon socio-demographic information from the tracts or TAZs.

Products/Outcomes:

N. Lownes, "Measuring Rural Transit Availability" presented at the 18th National Conference on Rural Public and Intercity Bus Transportation, Omaha, NE, October 21, 2008.

S. Al-Mamun and N. Lownes, "A Comparative Analysis of Transit Availability Metrics," working paper to be submitted to Transportation Research Board for publication in Transportation Research Record and presented at the annual meeting of the TRB January 2010.

Benefits/Results:

What we have found is that the vast majority of transit availability metrics in use focus on the service and spatial characteristics of the service and the region being served. What is often missing is a measure of the social aspect of transit service design, often referred to as environmental justice. We will look to incorporate measures of social accessibility (forced car ownership, zero car ownership) into a metric for CT. This research focuses on helping CT transit planners identify areas of opportunity for new service or service reconfiguration – the social aspect will allow planners a way to assess the equity implications of their current service configuration, or a proposed configuration.

Furthermore, our investigations will allow us to compare current data availability with data needs to perform accurate transit availability assessments. This contrast will provide a means to target future survey and data collection efforts to fill any identified gaps.

JOINT HIGHWAY RESEARCH PROJECTS
UNIVERSITY OF CONNECTICUT
and
CONNECTICUT DEPARTMENT OF TRANSPORTATION
Summary for Program Year 2008-2009

Project Number: 08-6

Project Title: Experimental Testing of Controllable Damping Devices toward Extending the Lifespan of Existing Highway Bridges

Principal Investigators: Richard Christenson

Project Status: Active

Initial Agreement Date: May 2010

Objective:

To fundamentally advance the state-of-the-art in highway bridge control and monitoring by: 1) experimentally verifying the application of controllable MR dampers to reduce the maximum stresses in highway bridges due to heavy truck traffic; and, 2) demonstrating experimental methodologies to utilize the controllable damping devices for enhanced bridge monitoring.

Progress:

Initial real-time hybrid tests were conducted using the highway bridge model and truck traffic loading with a simulated damper attached to the 2000kN hydraulic actuator at Lehigh. Tests were conducted to examine the envelope of stability in the test setup.

Major Findings:

The purpose of this study is to experimentally validate semiactive control of highway bridges using Magneto-Rheological (MR) fluid dampers and a new method of experimental testing called real-time hybrid testing. The major findings to date are the development of a highway bridge model with truck loading that can be used in the Lehigh University real-time hybrid test facility to provide stable and accurate test results and validation of the performance of the MR dampers in the velocity range of interest.

Products/Outcomes:

Z. Jiang and R. Christenson, “Structural Control of a Highway Bridge using MR Dampers” presented at the Asian-Pacific Network of Centers for Research in Smart Structure Technology (ANCRiSST) 5th Annual Workshop, Boston, MA, July 2009.

Benefits/Results:

This research will demonstrate experimentally in large-scale laboratory tests how an existing bridge structure might be retrofit to reduce peak strains (and stresses) due to heavy truck traffic. Reducing stresses in the bridge can significantly increase the safe life of the bridge. This increased safe life will

improve safety and can reduce maintenance costs and disruption to traffic associated with bridge repair. Furthermore, the means to monitor for damage in the structure will increase safety and can provide more efficiency in the bridge maintenance.

Joint Highway Research Advisory Council Expenditures						
Program Year 2008-2009						
		Original		May 23, 2008		Estimated
Project		Estimated	Prior Years	to	Total to	to
Number	Title	Costs	Expended	May 22, 2009	May 22, 2009	Complete
I. Regular Projects:						
04-6	Designing Roads that Guide Drivers to Choose Safer Speeds	$110,000	$126,318.49	$54.21	$126,372.70	$0
05-6	Value Pricing in Connecticut: Policy Simulations and Economic Impacts	$99,731	$126,937.84	$0	$126,937.84	Completed and Closed 12/18/08
05-7	Design and Feasibility Study: Connecticut Transportation Planning Data	$67,500	$83,116.50	$0	$83,116.50	Completed and Closed 12/18/08
05-9	Detailed Modal Analysis of Particulate Emissions from Connecticut Transit Buses for Emissions Modeling	$89,784	$118,905.36	$0	$118,905.36	Completed and Closed 12/18/08
06-3	Extending the Lifespan of Existing Highway Bridges through Controllable Stiffness and Damping Devices	$84,453	$100,962.41	$0	$100,962.41	Completed and Closed 12/18/08
06-9	Evaluating Stormwater Quality Associated with Milling of HMA	$41,718	$56,607.32	$1,083.43	$57,690.75	$0
06-10	Improving Surveying Accuracy and Efficiency in Connecticut: An Accuracy Assessment of GEOID03	$77,949	$94,493.82	$14,977.07	$109,470.89	$0

Project Number	Title	Original Estimated Costs	Prior Years Expended	May 23, 2008 to May 22, 2009	Total to May 22, 2009	Estimated to Complete
07-2	Creating Useful Products from Connecticut's 2000 LIDAR Data Set	$49,768	$59,776.07	$0	59,776.07	Completed and Closed 12/18/08
07-5	Incorporating Wet Pavement Friction into Traffic Safety Analysis	$60,000	$13,258.95	$91,307.49	$104,566.44	$4,866
08-1	Structure and Properties of Ionomer Modified Asphalts (IMAs)	$115,892	N/A	$29,835.06	$29,835.06	$131,108
08-5	Assessing and Quantifying Public Transportation Access	$90,534	N/A	$31,259.55	$31,259.55	$90,266
08-6	Experimental Testing of Controllable Damping Devices toward Extending the Lifespan of Existing Highway Bridges	$110,526	N/A	$59,342.04	$59,342.04	$66,559
II. Other:						
08-100	Other (Supplies, Printing, Postage)	$2,185	N/A	$1,575.83	$1,575.83	N/A
08-101	Vehicle	$1,500	N/A	$1,665.45	$1,665.45	N/A

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Project No.	Title
51-1	Study of Hydraulic Design of the Curb Inlet Grate. Report - V.E. Scottron and C.J. Pelletier, "The Hydraulic Performance of Inlet Gratings," 1954.
51-2	Investigation of Run-off from Small Drainage Areas. Report - J.E. Stephens, "Rainfall and Runoff Study of Small Drainage Areas," February 1973, JHR 73-65.
51-3	Variation in Amount of Frost Heave with Depths of Ground Water Table. Reports - R.J. Leonard, "A Study of the Effect of the Depth of Water Tables on Frost Action in Soils," 1954. E.V. Gant, "Studies of Frost Action in Soils as a Function of Selected Soil Properties, Climatic Factors and Elevation of Ground Water Table," 1963.
51-4	Effect of Washed Concrete Sand in Increasing Capillary Rise and Frost Heaving in Adjacent Soil. Report - E. Budzik, "The Effect of Concrete Sand on Capillarity in Parent Material," 1953.
51-5	Capillary Potential of Various Materials. Report - A.V. Giodano, "Criterion for Filter Stability," 1955.
51-6	Filter Test of Various Materials. Reports - E.R. Phelisse, "Some Aspects of Filter Action in Highway Underdrains," 1954. B.K. Ramiah, "Stability of Filters for Highway Underdrains," 1956.
53-1	Development of Miniature Filter Test. Report - B.K. Ramiah, "Stability of Filters for Highway Underdrains," 1956.
54-1	Pile Drag Study - New Haven Harbor. Report - E.V. Gant, J.E. Stephens, and L. Moulton, "Measurement of Forces Produced in Piles by Settlement of Adjacent Soil," 1958. Published in HRB Bulletin No. 173.
54-2	Laboratory Evaluation of Frost Characteristics. Report - P.V. Cuomo, "A Study of Moisture Migration in Freezing Soils," 1956.
57-1	Study of the Relationship between the Degrees of Consolidation and the Shearing Strength of Varved Clays and Marine Muds. No formal report written. Results applied by ConnDOT, Division of Soils and Foundations.
57-2	Study of the Relationship between the Orientation of the Principal Stresses and the Shearing Strength of Varved Clays. Report - T.M. Meda, "Stability Analysis of Highway Embankments," 1958.

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Project No.	Title
57-3	Attempt to Correlate Laboratory Triaxial Shear Tests with Miniature Laboratory and Larger Field Vane Shear Tests. No formal report written. Results applied by ConnDOT, Division of Soils and Foundations.
57-4	Development and Use of Consolidation Apparatus, Which Will Make Use of Extra-Thick Samples of Varved Clay. No formal report written. Results applied by ConnDOT, Division of Soils and Foundations.
63-1	Split Cylinder Tests of Flexible Pavements. Report - J.J. Breen and J.E. Stephens, "Split Cylinder Test Applied to Bituminous Mixtures at Low Temperatures," 1965. Published in Journal of Materials, ASTM, Vol. 1, No. 1, 1966.
63-2	Fatigue Characteristics of Flexible Pavements under Repeated Loads at Various Temperatures. Reports - J.J. Breen, "Fatigue and Tensile Characteristics of Bituminous Pavements at Low Temperatures," 1966, JHR 66-3. Published in Journal of the Canadian Technical Asphalt Association, Vol. 11, 1967. J.J. Breen and J.E. Stephens, "Preliminary Report on the Fatigue and Bituminous Pavements at Low Temperatures," published in Journal of the Canadian Technical Asphalt Association, Vol. 10, 1966. J.J. Breen and J.E. Stephens, "The Glass Transition Temperature and the Mechanical Properties of Asphalt," October 1967, JHR 67-16.
63-4	Study of Bridge Vibrations and Deflection - Effect on Slab Durability. Reports - J.C. Longley, "An Investigation of the Dynamically Induced Stresses in a Typical Highway Bridge," July 1966, JHR 66-4. Civil Engineering Department, University of Connecticut, "Interim Report on the Study of Bridge Deck Deterioration for the Connecticut Highway Department," 1965.
63-5	Effect of Aging in Asphalt. Report - D. Anderson, "Artificial Aging of Some Various Penetration Grade Asphalts," 1964.
63-6	Density of Bituminous Concrete Pavement by Nuclear Methods. Reports - J.E. Stephens, "Connecticut Procedure for Pavement Density Measurements," published as Discussion of Compaction of Asphalt Concrete in Proceedings, Association of Asphalt Paving Technologists, 1967. J.E. Stephens, "Effect of Roller Passes on Density" presented at the 6th Annual Paving Conference, Connecticut Bituminous Concrete Producers Association, 1964.

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Project No.	Title	
		Density charts, Silly Putty gauges and instructions supplied to ConnDOT.
63-7	An Investigation of the Brittle Plastic Behavior of Asphalt Mixtures by Use of an Impact Device.	
	Report -	J.E. Stephens and G.J. Gromko, "An Investigation of the Brittle Plastic Behavior of Asphalt Mixtures by Use of an Impact Device," 1967. Published in Highway Research Record No. 256.
		G.J. Gromko, "An Investigation of the Brittle Plastic Behavior of Asphalt Mixtures by Use of an Impact Device," August 1967, CE 67-12.
63-9	Effects of Aggregate Shape on Bituminous Mix Characteristics.	
	Report -	J.E. Stephens, "Effect of Aggregate Shape on Bituminous Mix Characteristics, Project 63-9 Final Report," December 1974, JHR 74-87.
64-1	Salt Concentration in Run-off Water.	
	Report -	W.J. Widmer, "Preliminary Study of the Effects of Highway Salt Run-off on Adjacent Surface Water," 1965.
64-2	Erosion Control in Ditches and Waterways.	
	Reports -	K.B. Shivarudrappa, "Friction Flow over Bound Rock Erosion Proofing," July 1966, JHR 66-5.
		C.J. Posey, "Erosion Prevention Experiments" presented at the 1969 Meeting of the International Association for Hydraulic Research, Kyoto, Japan.
		C.J. Posey, "Erosion Protection," 30 minute 16mm color motion picture, shown at 1970 Highway Research Board Meeting, Washington, DC.
		C.J. Posey, "Design and Construction Specifications."
64-3	Triaxial Consolidation of Varved Clay.	
	Reports -	G.S. Ramanjaneya, "Consolidation Characteristics of a Varved Clay," 1969 Ph.D. dissertation, JHR PR 69-26.
		K.A. Healy and G.S. Ramanjaneya, "Consolidation Characteristics of a Varved Clay," Final Report, July 1970, JHR 70-30.
65-1		Quality Control of Asphaltic Concrete.
	Report -	J.E. Stephens, "Reduction of Apparent Aggregate Variation through Improved Sampling," May 1966, JHR 66-1.
65-2	Field Control of Deck Concrete.	
	Report -	Civil Engineering Department, University of Connecticut, "Interim Report on the Study of Bridge Deck Deterioration," 1965.

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Project No.	Title
65-3	Laboratory Simulation of Deck Deterioration. Reports - K.A. Healy, R.W. Borjeson and J.C. Perazella, "Investigation of Concrete Bridge Deck Deterioration," September 1966, CHD 66-5 K.A. Healy, R.W. Borjeson and J.C. Perazella, "Investigation of Concrete Bridge Deck Deterioration," May 1967, JHR 67-11.
65-4	Salt Build-Up in Roadway Soils. Report - G.A. Prior and P.M. Berthouex, "Study of Salt Pollution of Soil by Highway Salting," January 1967, JHR 67-9.
66-1	Effect of Straightening Damaged Steel. Reports - M. Apostle, "The Bauschinger Effect and Its Implications on the Straightening of Accidentally Bent Structural Steel Members," Master's Thesis, June 1974. E.R. Johnston, "Effect of Straightening Damaged Steel," March 1976, JHR 76-98.
66-3	I-84 Freeway Surveillance and Control. Report - W.B. Perruccio, "Analysis of Ramp Service Time Distribution by Monte Carlo Simulation," 1968, JHR 65-18. R.F. Dawson and W.B. Perruccio, "I-84 Freeway Surveillance and Control Project," September 1969, JHR 69-28. R.F. Dawson and W.B. Perruccio, "Summary Report I-84 Freeway Surveillance and Control Project."
66-4	Expressway Traffic Simulation. Report - K.C. Sinha, "The Development of a Digital Simulator for the Analysis of Freeway Traffic Phenomena," December 1968, JHR 68-14.
66-5	Hyperland Function as a Traffic Model. Report - R.F. Dawson and L.A. Chimini, "The Hyperland Probability Distribution - A Generalized Traffic Headway Model," 1967. Published in Highway Research Record No. 230, JHR 67-13.
66-6	Salt Concentration in Vegetation. Report - E.F. Button and D.E. Peaslee, "The Effect of Rock Salt upon Roadside Sugar Maples in Connecticut," 1966, Published in Highway Research Record No. 161.
67-1	Frost Susceptible Soil, I-91, Wallingford. Reports - K.A. Healy, G.S. Ramanjaneya and G. Meitzler, "Investigation of Shoulder Heaving in Wallingford-Meriden Area of I-91," September 1966, CHD 66-6.

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		K.A. Healy and G. Meitzler, "Frost Heaving in the Wallingford-Meriden Section I-91," October 1967, JHR 67-15.
67-2	Prefabricated Underdrains.	
	Reports -	K.A. Healy and R.P. Long, "Preliminary Report - Prefabricated Underdrains," January 1969, JHR 69-23.
		K.A. Healy and R.P. Long, "Interim Report on Prefabricated Subterranean Drains," March 1970, JHR 70-28.
		R.P. Long and K.F. Briggs, III, "Installation of Prefabricated Underdrains along Route 44A," September 1970, JHR 70-31.
		K.A. Healy and R.P. Long, "Field Performance of Prefabricated Underdrains," Report #4," June 1979, JHR 71-39.
		R.P. Long and K.A. Healy, "Prefabricated Subsurface Drains," December 1970, CE 70-33.
		K.A. Healy and R.P. Long, "Prefabricated Subsurface Drains," Publication in Highway Research Record No. 360, 1971.
		K.A. Healy and R.P. Long, "Installation of Prefabricated Underdrains on Route 82 Extension, Haddam," July 1971, JHR 71-41.
		K.A. Healy and R.P. Long, "Final Report, Prefabricated Underdrains," October 1972, JHR 72-52.
		K.A. Healy and R.P. Long, "Prefabricated Filter-Fin for Subsurface Drains," ASCE Journal of Irr. and Drainage Div., Vol. 98, No. IR4, December 1972, pp. 543-552.
		K.A. Healy and R.P. Long, "Design and Construction Specifications."
		R.P. Long and K.A. Healy, "Fabric Filters on Prefabricated Underdrains," April 1977, CE 77-106.
67-3	Applicability of Electro-Osmosis to Marginal Soils.	
	Reports -	R.P. Long, "Interim Report on the Reduction of Frost Heave of a 'Dirty' Connecticut Gravel with Chemical Dispersants," July 1969.
		R.P. Long and T.F. Zimmie, "Final Report, Application of Electro-Osmosis to Marginal Soils," March 1973, JHR 73-62.
		R.P. Long and T.F. Zimmie, "Mean Pore Size from Flow Measurements," ASCE Journal of Soil Mechanics and Foundations Div., July 1973.

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Project No.	Title
67-4	Correlation of Molecular Size and Asphalt Characteristics. No formal report written. Data presented in discussion of AAPT paper by J.E. Stephens, 1969, and used later in Project 69-1.
67-5	Bituminous Mix Density by Coated Specimens. Report - J.E. Stephens, "Bituminous Mix Density by Coated Specimen," January 1973, JHR 73-59.
67-6	Control of Moisture under Pavements. Reports - K.A. Healy and R.P. Long, "Interim Report on Moisture under Pavements," June 1969, JHR 69-25. R.P. Long and K.F. Briggs, III, "Final Report - A Rapid Field Test to Identify Frost Susceptible Soils," August 1972, JHR 71-45. R.P. Long and K.F. Briggs, III, "Device for Measuring Subsieve Sizes in the Field," HRB Highway Research Record 426, 1973.
67-7	Stresses in Curved Girder.
68-1	Study of Permeability of Calcium Chloride Stabilized and Crusher Run Bases. Reports - R.P. Long and K.A. Healy, "Interim Report - Suitability of Calcium Chloride Stabilized Base Material," June 1968. K.A. Healy and R.P. Long, "Final Report - Suitability of Calcium Stabilized Bases," July 1972, JHR 72-49.
68-2	Pilot Roadway Design Project ROADS Subsystem of ICES. Report - R.F. Dawson, "Final Report - Roadway Design Research Project," May 1969, JHR 69-24.
69-1	Effect of Heat and Air on Asphalt by Gel Permeation Chromatography. Report - C.E. Dougan, "Molecular Size Distributions of Asphalt as Determined by Gel Permeation Chromatography (Final)," Research Project 175-210, published by Research and Development Section, Bureau of Highways.
70-2	Analysis of Thermally Loaded Laminated Circular Plates. Reports - J.F. Carney, "Analysis of Thermally Loaded Laminated Circular Plates": Report #1, May 1971, JHR 71-37. Report #2, August 1971, JHR 71-43. Report #3, March 1972, JHR 72-50. Final Report, December 1972, JHR 72-58.

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Project No.	Title
70-3	Field Consolidation of Varved Clay. Reports - R.P. Long and K.A. Healy, "Preliminary Report, Field Consolidation of Varved Clay, Phase I," January 1971, JHR 71-34. "Field Consolidation of Varved Clay," Report #2," June 1971, JHR 71-38. "Field Consolidation of Varved Clay," Report #3," August 1972, JHR 72-55. "Analyzing Field Data for Initial Settlements," October 1972, JHR 72-56. "Field Consolidation of Varved Clay," Report #4, March 1974, JHR 74-78. "Field Consolidation of Varved Clay," Report #5, June 1975, JHR 75-89. "Field Consolidation of Varved Clay, Final Report," April 1978, JHR 78-113.
70-4	Air Jet Snow Plow. Reports - M.M. Kasinskas, "Development of the Air Jet Snowplow," Report #1, June 1970. "Development of the Air Jet Snowplow, Final Report," July 1972.
70-5	Simulation of Traffic Flow of the I-291 and Route 15 Three-Level Diamond Interchange. Reports - R.P. Jain, "Traffic Flow Simulation on I-291 and Route 15 Three-Level Diamond Interchange," July 1971, JHR 71-40. C.H. Knapp and R.P. Jain, "Simulation of Traffic Flow on the I-291 & Route 15 Three-Level Diamond Interchange," January 1974, JHR 74-79.
71-1	Multiple Truck Loading on Bridges. Report - R.D. Desrosiers and R.J. Grillo, "Estimating the Frequency of Multiple Truck Loadings on Bridges, Project 71-1," May 1973, JHR 73-68.
72-1	Effects of Deicing Salts and Lead Particulates upon Chemical Composition of Trees and Shrubs. Reports - E.F. Button, "Determination of the Effects of Deicing Salts Upon Trees, Shrubs and Soils - Report I," November 1973. E.J. Rubins, "Summary 175-331 Soil Samples - 1973," December 1973. E.F. Button, E.J. Rubins, W.A. Woodward and G.F. Griffin, "Effects of Deicing Salts and Lead Upon Trees, Shrubs, and Soils in Connecticut - Final Report," January 1977, Report No. 331-F-76-9.

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Project No.	Title
72-2	Measurement of Bridge Deck Status by Dynamic Modulus. Reports - J.E. Stephens, "Measurement of Bridge Deck Status by Dynamic Modulus, Final Report," August 1979, JHR 79-129. J.F. Risley, "A Method of Investigating Bridge Deck Quality Through Dynamic Analysis and Appropriate Testing Comparison," Master's Thesis, May 1977.
73-1	Negative Skin Friction on Piles and Foundation Design Methods for Poles and Towers. Reports - R.P. Long and K.A. Healy, "Final Report - Foundation Design Methods for Poles and Towers," December 1973, JHR 73-71. R.P. Long and K.A. Healy, "Final Report - Negative Skin Friction on Piles," January 1974, JHR 74-77.
73-2	Analysis of Connecticut Department of Transportation Traffic Paints. Reports - L. Shih and R.M. Fitch, "Analysis of Traffic Paints," Research Report, June 1973. J.E. Stephens, L. Shih and R.M. Fitch, "Hot White Traffic Paint, Laboratory and Summer Condition Study," February 1974, JHR 74-76.
73-3	Short Term Effects of Highway Construction. Report - B.J. Houghton and R.H. Wortman, "Short Term Consequences of Highway Construction - The Allyn Street Connector Case Study," May 1975, JHR 74-82.
73-4	A Portable Energy Absorbing System for Highway Service Vehicles. Reports - J.F. Carney, "A Portable Energy Absorbing System for Highway Service Vehicles," June 1974, JHR 74-80. J.F. Carney, "A Portable Energy Absorbing System for Highway Service Vehicles, Final Report," September 1974, JHR 74-83. J.F. Carney, "Experimental Evaluation of a Portable Energy Absorbing System for Highway Service Vehicles, Final Report Phase I," June 1977, CE 77-109.
74-1	Measurement of Foundation Strains under Lateral Loads. Report - R.P. Long, K.A. Healy, P.J. Carey and M. Powers, "Measurement of Foundation Strains under Lateral Loads," December 1976, JHR 76-102.
74-3	A Review of Traffic Restraint Concepts and the Potential Application in Connecticut. Report - H. Miller and R.H. Wortman, "The Potential Application of Traffic Restraint in Connecticut," February 1977, CE 77-103.

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74-4	Design of Test Installation of Bitumen Coated Piles. Report - R.P. Long, "Design of Test Installation for Bitumen Coated Piles, Final Report," February 1976, JHR 76-96.
75-2	Split Cylinder Test for Tension Strength of Concrete. Report - T. Pastor, J. Pelliccione and J.E. Stephens, "Split Cylinder Test for Tension Strength of Concrete," March 1976, JHR 76-97.
75-4	Statistical Utilization of Past Quality Control Data. Report - J.E. Stephens, T. Pastor and J.R. Pelliccione, "Statistical Analysis Applied to Management Decisions," February 1977, JHR 77-104.
77-1	Reducing Highway Maintenance through Effective Drainage. Report - R.P. Long, K.A. Healy, P.J. Carey and W. Hover, "Reducing Highway Maintenance through Effective Drainage, Final Report," March 1979, JHR 79-124.
77-2	Development of a Process for the Review of Queuing Models to be used in Air Quality Analysis. Report - C.F. Davis and T. Ryan, "Queuing Models for Pollution Analysis," February 1979, JHR 79-123.
77-3	A Legal Determination of the Navigability of the Quinebaug and Shetucket Rivers. Report - K. Fox, "Legal Determination of the Navigability of the Quinebaug and Shetucket Rivers," May 1978, JHR 78-114.
77-4	Solar Energy Augmentation for Hot Water Needs in Connecticut Highway Rest Areas. Report - D.R. Jackson, J. Callahan and W.W. Bowley, "Solar Energy Augmentation for Hot Water Needs in Connecticut Highway Rest Areas, Final Report," March 1982.
77-5	False-Color Infrared Aerial Photography as an Aid in Evaluating Environmental Impacts on Inland Wetlands by Proposed Highways in Connecticut: A Feasibility Study. Report - W.C. Kennard, M.W. Lefor and D.L. Civco, "False-Color Infrared Aerial Photography as an Aid in Evaluating Environmental Impacts on Inland Wetlands by Proposed Highways in Connecticut: A Feasibility Study, Final Report," September 1978, JHR 78-120.
77-6	Chemical Reactivity of Selected Connecticut Rock Strata. Report - I. Kaseoru, "Chemical Reactivity of Selected Connecticut Rock Strata," Term Paper 1979.
78-1	Development of a Steel Pipe Vehicle Impact Attenuation System. Reports - J.F. Carney, "Development of a Steel Pipe Vehicle Impact Attenuation System, Final Report," September 1978, JHR 78-121.

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Project No.	Title
	J.F. Carney, "Experimental Evaluation of a Portable Energy Absorbing System for Highway Service Vehicles, Final Report for Phase II," April 1979, CE 79-125.
78-2	Assessment of Highway Environmental Impact in Connecticut Using Remote Sensing Procedures. Report - W.C. Kennard, M.W. Lefor and D.L. Civco, "Identification on Inland Wetlands for Transportation Planning Using Color Infrared Aerial Photography, Final Report," May 1980, JHR 80-132.
78-3	Analysis of Air Pollution, Traffic Congestion and Fuel Consumption by Computer Simulation. Report - C.F. Davis and T.A. Ryan, "Analysis of Air Pollution, Traffic Congestion and Fuel Consumption by Computer Simulation, Final Report," February 1980, JHR 80-131
78-4	Determining the Shear Strength of Varved Clay Using Vane Shear. Report - R.P. Long, P.J. Carey and W.H. Hover, "Determining the Shear Strength of Varved Clay Using Vane Shear," February 1980, JHR 80-130.
79-1	A Study of Para-Transit in Connecticut. Report - C.F. Davis and M.F. Makuch, "Final Report - Paratransit: A Review of Selected Connecticut Programs and Comparison with National Experience," May 1983, JHR 83-150.
80-1	Residential Relocation as a Conservation Strategy to Cope with Rising Gasoline Prices and Uncertain Supply. Report - C.B. Monroe and T. Maziarz, "Residential Relocation as a Conservation Strategy to Cope with Rising Gasoline Prices and Uncertain Supply," July 1981, JHR 81-139.
80-2	A Performance Test for Bitumen Coated Piles. Report - R.P. Long, "Performance Test for Bitumen Coated Piles, Final Report," February 1982, JHR 82-142.
80-3	The Addition of Lignin from Gasohol Plants to Asphalts. Report - D.W. Sundstrom, H. Klei and J.E. Stephens, "Final Report - The Addition of Lignin from Gasohol Plants to Asphalts," April 1983, JHR 83-139.
80-4	Energy Efficiencies of Transportation Modes. Report - C.F. Davis and O.G. Brown-West, "Final Report - Energy Efficiencies of Transportation Modes," October 1982, JHR 82-147.
80-6	Estimating Bus Ridership. Reports - H.S. Levinson and O.G. Brown-West, "Interim Report 1, Hartford Bus Rider Characteristics."

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		"Interim Report 2, Hartford Bus Ridership Penetration Curves."
		"Final Report - Estimating Bus Ridership," July 1983, JHR 83-152.
81-1	Rate and Quantity of Distillate Evaporation from Bitumen Concrete.	
	Report -	J.E. Stephens and G.E. Hoag, "Volatiles in MC-3000 Bituminous Paving Mixture," June 1982, JHR 82-143.
82-1	PCB Analysis in Bituminous Materials.	
	Reports -	G.E. Hoag and S.E. Alexander, "Polychlorinated Biphenyls Analysis in Bituminous Materials, Final Report," August 1984, JHR 84-160.
		G.E. Hoag and S.E. Alexander, "Executive Summary - Polychlorinated Biphenyls Analysis in Bituminous Materials. Based on Final Report: Project 82-1," October 1984, JHR 84-161.
82-3	Transportation Management in Connecticut.	
	Report -	H.S. Levinson and K.G. Zografos, "Transportation System Management in Connecticut, Final Report," May 1987, JHR 87-172.
82-4	Development of Optimum Pavement Maintenance/Reconstruction Strategies Based on Serviceability and Fiscal Parameters.	
	Report -	J.E. Stephens and C.F. Davis, "An Analysis of Highway Pavement Deterioration and a General Technique for Optimization of Maintenance/Reconstruction, Final Report," January 1984, JHR 84-156.
83-1	Further Development of Optimization Procedures in Pavement Management.	
	Report -	J.E. Stephens and H.H. Ridgeway, "Further Development of Optimization Procedures in Pavement Management," June 1989, JHR 89-186.
83-3	Aging of Recycled Bituminous Binder.	
	Report -	J.E. Stephens and J. Rivenburgh, "An Evaluation of Aging of Recycled Asphalt, Final Report," May 1986, JHR 86-166.
84-1	Study of Bridge Vibrations for Connecticut.	
	Report -	J.T. DeWolf, E.V. Gant, S.M. LaShomb and J.W. Kou, "Study of Bridge Vibrations for Connecticut, Final Report," October 1985, JHR 85-165.
84-2	Monitoring & Remediation of Gasoline Storage Facilities.	
	Report -	G.E. Hoag and B. Cliff, "Method Development for the Gas Phase Analysis of Gasoline and Solvent Contaminated Soil, Final Report," March 1988, JHR 88-177.
86-2	Monitoring and Remediation of Gasoline Storage Facilities.	
	Report -	G. Hoag, D. Ahlfeld, A. Dahmani, and D. Strother, "Monitoring and Remediation of Gasoline Storage Facilities: Aqueous Leachability of Gasoline in Connecticut Sand, Final Report," April 1991, JHR 91-200.

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86-3	Development of an Automated Bridge Monitoring System. Report - J.T. DeWolf, "Development of an Automated Bridge Monitoring System," May 1990, JHR 90-192.
86-5	Determining the Permeability of Granular Soils by Air Flow. Report - R.P. Long, K.R. Demars, R. Mankbadi and A. Covo, "The Relationship Between Permeability Coefficients for Soil Obtained Using Liquid and Gas," September 1988, JHR 88-180.
86-6	Conversion to Unified Soil Classification System. Report - R.P. Long and K.R. Demars, "Conversion to Unified Soil Classification System, Final Report," December 1987, JHR 87-176.
86-7	Adapting the Quick-Load Method of Pile Testing to Connecticut Soils Needs. Report - R.P. Long, K.R. Demars, W.A. Shaheen and V. Mekagaroon, "The Applicability of the WEAP-86 Pile Capacity Prediction Method for Connecticut Soils and Behavior of a Sheetpile Wall for Stabilization of a Slope in Portland," October 1988, JHR 88-181.
86-8	Evaluation of Rubber Modified Pavement Sections. Report - J.E. Stephens, "Nine Year Evaluation of Recycled Rubber in Roads," May 1989, JHR 89-183.
86-9	Aging of Bituminous Concrete. Report - J.E. Stephens, "The Effects of Temperature Cycles on the Aging of Bituminous Concrete," April 1990, JHR 90-190.
86-10	Proposal to Install and Monitor the Performance of a Post-Tensioned Laminated Timber Deck Bridge at Wadsworth Falls State Park. Report - M.L. Accorsi, "Implementing Stress-Laminated Timber Bridge Technology for Connecticut Bridge Construction," June 1989, JHR 89-185.
86-11	Developing and Financing Independent Transit Districts. Report - H.S. Levinson, "Developing and Financing Independent Transit Districts," September 1987, JHR 87-175.
86-12	Improving Rural Transit Efficiency. Report - H.S. Levinson, "Improving Rural Transit Efficiency," February 1989, JHR 89-182.
86-13	A Feasibility Study of the Use of Video as an Aid in the Guidance/Navigation Driving Task. Report - C.F. Davis and H.H. Ridgeway, "A Feasibility Study of the Use of Video as an Aid in the Guidance/Navigation Driving Task," March 1990, JHR 90-188.
87-1	Evaluation, Training and Reevaluation of Management at the Connecticut Department of Transportation.

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Project No.	Title	
	Report -	D.W. Huffmire, "Management Training and Development Manual for Improving Managerial Effectiveness at the Connecticut Department of Transportation," January 1990, JHR 90-187.
87-2	High Pressure Gel Permeation Chromatographic Color Analysis of Asphalt.	
	Report -	N.W. Garrick, "Evaluation of High Pressure Gel Permeation Chromatography for Asphalt Characterization," December 1990, JHR 90-197.
87-3	Tests on Prestressed Concrete Bridge Beams.	
	Reports -	G. Frantz, "Tests of Prestressed Concrete Bridge Beams PART I - Structural Tests of the Bridge Beams, Final Report," March 1991, JHR 91-198a.
		G. Frantz, "Tests of Prestressed Concrete Bridge Beams PART II - Chloride Penetration in the Bridge Beams, Final Report," March 1991, JHR 91-198b.
87-4	Development of a Strain Monitoring System for Bridges.	
	Report -	J.T. DeWolf, "Development of a Strain Monitoring System for Bridges: Analysis of Diaphragm-to-Stringer Connection Failures in Composite Bridges," June 1992, JHR 92-210.
87-5	Daily Temperature Cycles and Bituminous Concrete.	
	Report -	J.E. Stephens and W. Santosa, "Aging of Bituminous Concrete," July 1992, JHR 92-211.
87-6	Wetland Mitigation.	
	Reports -	M. Lefor, "An Annotated Bibliography for Wetland Mitigation," April 1990, JHR 90-189.
		T.E. Murray and P.H. Rich, "Sodium and Project Phosphorus Loading in Urban Wetlands," Urban Non-Point Source Pollution and Stormwater Management Symposium, University of Kentucky, Lexington, July 1990.
		M. Lefor, "Wetland Mitigation: Interim Report," May 1991, JHR 91-205.
		M. Lefor, "Transcript of a Colloquium on Wetlands and Water Quality," March 1992, JHR 92-209.
		M. Lefor, et al., "Wetland Mitigation: Executive Summary," February 1994, JHR 94-225.
		M. Lefor, et al., "Wetland Mitigation: Technical Summary Report," February 1994, JHR 94-226.

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		P.H. Rich and T. E. Murray (ed. M.W. Lefor), "Wetland Mitigation. Wetland Mitigation and Water Quality Associated with the Central Connecticut Expressway," March 1994, JHR 94-227.
		J.C. Cooke (ed: M.W. Lefor),"Wetland Mitigation. Mycorrhizal Associations in Some Connecticut Wetland Plants," March 1994, JHR 94-228.
		M.W. Lefor (Appendix I), and M.W. Lefor and M. Morgan (Appendix II), "Wetland Mitigation. Appendix I, Lists of Names of Vascular Plants in Connecticut, with Synonyms and Notes." "Appendix II, Propagation of Selected Wetland Plants," April 1994, JHR 94-229. (to be printed)
88-1	Resilient Modulus of Subgrades.	
	Report -	R.P. Long and M.G. Delgado, "Resilient Modulus of Subgrades," March 1991, JHR 91-199.
88-2	Measurement of Capacity of Drilled Shaft Foundation.	
	Report -	R.P. Long and F. Huang, "Corrosion of Driven Steel Piles," May 1990, JHR 90-193.
88-3	Age and Origin of Small Upland Wetlands in Connecticut.	
	Reports -	R. Thorson, "Development of Small Upland Wetlands: A Stratigraphic Study in Northeastern Connecticut," April 1990, JHR 90-191.
		R. Thorson, "How 'Natural' are Small Inland Wetlands?" December 1990, Journal of Environmental Management.
89-1	Research Planning for the Joint Highway Research Advisory Council.	
	Report -	R.P. Long and G.M. McCarthy, "Research Planning for the Joint Highway Research Advisory Council, Final Report," April 1991, JHR 91-201.
89-2	Insitu Detection of Pile Corrodibility.	
	Report -	R.P. Long and S. Lele, "Insitu Detection of Pile," April 1992, JHR 92-207.
89-3	A Developmental Model for Upland Red-Maple Swamps in Connecticut.	
	Report -	R. Thorson, "Remaking the Wetlands in Lebanon, Connecticut. Cultural and Natural Changes in the Postglacial Epoch," October 1992, JHR 92-215.
89-4	Development of Micro-Computer Based Optimization Model for Pavement Management.	
	Report -	C. Davis and C.P. VanDine, "Development of a Micro-Computer Based Optimization Model for Pavement Management, Final Report," April 1991, JHR 91-202.

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89-5	Effects of Hot Storage on the Properties of Asphalt Concrete Mixes. Report - N. Garrick, "Effects of Hot Storage on the Properties of the Asphalt Concrete Mixtures," July 1992, JHR 92-213.
90-1	Full-Scale Bridge Testing to Monitor Vibrational Signatures. Report - D.A. Bagdasarian and J. DeWolf, "Bridge Signature Development," Interim Report, September 1993, JHR 93-222.
90-3	Development of a Screening Model for Prioritizing the Remediation of Groundwater Contamination Sites. Report - D. P. Ahlfeld and M.S. Islam, "Development of a Screening Method for Prioritizing the Remediation of Groundwater Contamination Sites," March 1992, JHR 92-208.
90-4	Measurement of Resilient Modulus of Connecticut Soils. Report - R.P. Long and J. Crandlemire, "The Resilient Modulus of Some Connecticut Soils," December 1992, JHR 92-216.
90-6	Comprehensive Planning Study of Maintenance Facilities for the Connecticut Department of Transportation. Report - C.F. Davis and G. Campbell, "Comprehensive Planning Study of Maintenance Facilities for the Connecticut Department of Transportation," December 1991, JHR 91-206.
90-7	Demonstration of Low Capital Technologies to Reduce Diesel Bus Engine Emissions. Report - B.M. Cetegen, E.K. Dabora and M. Gendron, "Demonstration of Low Capital Technologies to Reduce Diesel Bus Engine Emissions, Interim Report No. 1," February 1994, JHR 94-223.
90-8	A Demonstration Geographic Information System for ConnDOT Operations. Report - C.R. Ferguson, "A Demonstration Geographic Information System for ConnDOT Operations," May 1993, JHR 93-219.
91-1	An Experimental and Analytical Study of Timber Bridges Comprised of Longitudinal Stringers, Transverse Decking, and Diaphragms. Report - M. Accorsi and S. Anderson, "An Experimental and Analytical Study of Timber Bridges Comprised of Longitudinal Stringers, Transverse Decking, and Diaphragms," February 1993, JHR 93-217.
92-1	Assessment of Transit Management Training Needs. Report - G.M. McCarthy and A.C. Rusaw, "Assessment of the Professional Education Needs of Public Transportation Management Personnel in Connecticut. A Plan for Developing and Delivering Training and Technical Assistance for Connecticut's Public Transit Agencies," February 1994, JHR 94-224.

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Project No.	Title
92-2	Cracking in Connections between Floor Beams and Supporting Girders. Reports - K.J. Bernard and J.T. DeWolf, "Fatigue Failure Investigation - Putnam Bridge," December 1994, JHR 94-237. R.R. Sartor and J.T. DeWolf, "Cracking in Connections Between Floorbeams and Supporting Girders - Development and Use of a Portable Strain Monitoring System for Bridge Evaluations," March 1996, JHR 96-246.
92-3	Durability of High Performance Concrete (HPC) Repair Materials. Report - S. Li, D.G. Geissert, G.C. Frantz and J.E. Stephens, "Durability and Bond of High Performance Concrete and Repaired Portland Cement Concrete," June 1997, JHR 97-257.
92-4	Investigation of Steel Pile Foundations in Corrosively Active Locations. Report - R.P. Long, J. Badinter and P.R. Kambala, "Investigation of Steel Pile Foundations in Corrosively Active Areas," March 1995, JHR 95-239.
92-5	Development of a Two-Stage Facility Location Model for ConnDOT's Maintenance System. Reports - G.M. Campbell and C.F. Davis, "Development of a Two-Stage Facility Location Model for ConnDOT's Maintenance System, Phase One - Model Development," August 1993, JHR 93-221. G.M. Campbell and C.F. Davis, "A Prototype Decision Support System for Two-Stage Facility Location in ConnDOT's Maintenance System," October 1995, JHR 95-244.
92-6	Use of Incinerator Ash as a Construction Fill. Report - D. Lentz, KR. Demars, R.P. Long and N.W. Garrick, "Performance and Analysis of Incinerator Bottom Ash as Structural Fill," September 1994, JHR 94-232.
93-1	Feasibility Study for the Establishment of a GIS/GPS Resource Center at the University of Connecticut. Report - C.F. Davis, "Feasibility Study for the Establishment of a GIS/GPS Resource Center at the University of Connecticut," February 1995, JHR 95-238.
93-2	Evaluating the Applicability of Analytical Decision Support Tools for the Connecticut Department of Transportation. Report - G.M. Campbell and C.F. Davis, "Evaluating the Applicability of Analytical Decision Support Tools for the Connecticut Department of Transportation," August 1994, JHR 94-231.
93-3	Strategies for Using Stabilized Wastes in Construction. Report - R.P. Long and D. Grasso, "Strategies for Using Stabilized Wastes in Construction," May 1996, JHR 96-249.

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Project No.	Title
93-4	Hydrodynamic and Transport Models of Coastal Water for Use in the Design and Management of Highway Structures. Reports - J.D. Lin, M.W. Lefor, J.S. Hua, K.J. Qiu and W.G. Liao, "A Pseudo-2D Hydrodynamic Model for a Tidal River-Wetland System," December 1996, JHR 96-253. J.D. Lin, W.G. Liao, K.J. Qiu and M.W. Lefor, "Two-Dimensional Finite-Volume Hydrodynamic Model for Coastal River-Marsh Systems: User's Manual," June 2002, JHR 02-275. J.D. Lin, W.G. Liao, K.J. Qiu and M.W. Lefor, "Two-Dimensional Finite-Volume Hydrodynamic Model for Coastal River-Marsh Systems: Tutorial," June 2002, JHR 02-277. J.D. Lin, K.J. Qiu, W.G. Liao and M.W. Lefor, "A Two-Dimensional Finite-Volume Hydrodynamic Model for Coastal Wetlands: Final Report," December 2003, JHR 03-294.
93-6	Fatigue Tests of 27 Year Old Bridge Beams. Report - C. Rao and G. Frantz, "Test on Prestressed Concrete Bridge Beams - Fatigue Tests of the Bridge Beams," December 1995, JHR 95-245.
94-2	Implementing Decision Support Techniques for the Selection of Pavement Markings and Other Applications. Report - G.M. Campbell and C.F. Davis, "Applying Multi-Criteria Decision Making to the Selection of Pavement Marking," September 1994, JHR 94-233. G.M. Campbell and C.F. Davis, "Applying Multi-Criteria Decision Making to the Selection of Pavement Markings: A User's Guide," October 1994, JHR 94-235.
94-3	An Automated System for Pavement Distress Evaluation (Phase II) . Report - H. Oh, N.W. Garrick and L.E.K Achenie, "Automated Pavement Evaluation System for Pavement Distress Assessment," September 1997, JHR 97-261.
94-4	Effective Use of the ConnDOT GPS Base Station. Report - J. E. Bean and C.R. Ferguson, "Effective Use of the ConnDOT GPS Base Station," February 2003, JHR 03-289.
95-1	Decision and Risk Analysis Applications for Congestion Management. Report - C.F. Davis, J.N. Ivan and G.M. Campbell, "Application of Multi-Criteria Decision Making and Risk Analysis to Congestion Management," September 1996, JHR 96-252.

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95-2	Data Reconciliation Based on Traffic Count Analysis System. Reports - M. Zhao, N.W. Garrick and L.E.K. Achenie, "Data Reconciliation Based on Traffic Count Analysis System - User's Manual," August 1997, JHR 97-256. M. Zhao, N.W. Garrick and L.E.K Achenie, "Data Reconciliation Based on Traffic Count Analysis System," November 1997, JHR 97-260.
95-3	Safety Belt/Motorcycle Helmet Usage Survey. Report - C.F. Davis and C. I. Vinsonhaler, "Safety Belt/Motorcycle Helmet Usage Survey," March 1996, JHR 96-248.
95-4	Evaluation of Community Traffic Safety Programs and Motorcycle Operator Training Programs. Report - C. F. Davis, "Evaluation of Community Traffic Safety Programs and Motorcycle Operator Training Programs" April 1997, JHR 97-255.
96-1	Field Treatment of Soil Contaminated with Lead. Reports - R. Bruell, "Evaluation of Remedial Alternatives of Lead from Shooting Range Soil," a Thesis submitted in partial fulfillment of the Requirements of the Degree of Master of Science at the University of Connecticut. R. Bruell, N.P. Nikolaidis and R.P. Long, "Mobility and Remediation of Lead from Shooting Range Soils," Proceedings of the Thirteenth Mid-Atlantic Industrial and Hazardous Waste Conference, Villanova, PA, June 1998. R. Bruell, N.P. Nikolaidis and R.P. Long, "Evaluation of Remedial Alternatives of Lead from Shooting Range Soils," Environmental Engineering Science, Vol. 16, No. 5, pp. 403-14, 1999. R.P. Long, N.P. Nikolaidis and R. Bruell,, "Field Treatment of Soils Contaminated with Lead," August 1999, JHR 99-271.
96-2(1)	Protection of Reinforcement with Corrosion Inhibitors, Phase I. Report - M.A. Allyn, G.C. Frantz and J.E. Stephens, "Protection of Reinforcement with Corrosion Inhibitors, Phase I," November 1998, JHR 98-266.
96-2(2)	Protection of Reinforcement with Corrosion Inhibitors, Phase II. Report - P.D. Goodwin, G.C. Frantz and J.E. Stephens, "Protection of Reinforcement with Corrosion Inhibitors, Phase II," December 2000, JHR 00-279.

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96-3	Peak Period Trip Estimation Considering Level of Service and Socio-Economic Characteristics. Report - J.N. Ivan and U. Jha, "Predicting Peak Period Trips within the Four-Step Transportation Planning Process," September 1997, JHR 97-258.
96-4	Relaxation in High-Strength Bolted Connections on Galvanized Steel. Report - J.T. DeWolf and J. Yang ,"Relaxation in High-Strength Bolted Connections with Galvanized Steel," May, 1998, JHR 98-262.
96-5	Evaluation of Source-Separated Compost for ConnDOT Projects. Report - K.R. Demars and R.P. Long, "Field Evaluation of Source-Separated Compost and CONEG Model Procurement Specifications for Connecticut DOT Projects," December 1998, JHR 98-264.
97-1	Estimating Benefits from Specific Highway Safety Improvements: Phase I - Feasibility Study. Reports - F. Yuan, J. Ivan, N. Garrick and C. Davis, "Estimating Benefits from Specific Highway Safety Improvements: Phase I – Feasibility Study" presented at the Annual Meeting of Transportation Research Board, January 1999. F. Yuan, J. Ivan, N. Garrick and C. Davis, "Estimating Benefits from Specific Highway Safety Improvements: Phase I – Feasibility Study," May 1999, JHR 99-268.
97-1(2)	Estimating Benefits from Specific Highway Safety Improvements: Phase II – Initial Implementation. Reports - F. Yuan, J. Ivan, N. Garrick and C. Davis, "Estimating Benefits from Specific Highway Safety Improvements: Phase II – Safety Benefits of Intersection Approach Realignment," December 2000, JHR 00-281 F. Yuan, J. Ivan, X. Qin, N. Garrick and C. Davis, "Safety Benefits of Intersection Approach Realignment on Rural Two-Lane Highways" presented at the Annual Meeting of Transportation Research Board, January 2001.
97-1(3)	Estimating Benefits from Specific Highway Safety Improvements: Phase III, Safety Benefits from Left Turn Treatment Report - J. Rimiller, J. Ivan and N. Garrick, "Estimating Benefits from Specific Highway Safety Improvements: Phase III, Safety Benefits from Left Turn Treatment," February 2003, JHR 03-290.
97-2	Estimating Temporal Distribution of Traffic within the Peak Period. Reports - S. Allaire and J. Ivan, "Factors Influencing Peak Spreading on Connecticut Freeways: A Preliminary Investigation" presented at the Annual Meeting of Transportation Research Board, January 1999.

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	J. Ivan and S. Allaire, "Estimating the Temporal Distribution of Traffic Within the Peak Period," January 2000, JHR 99-273.
97-3	Enhancement of Photolog Applications and Display Environment. Report - C. Davis, "Enhancement of Photolog Applications and Display Environment," June 1999, JHR 99-269.
97-4	State-of-the-Art Rapid Non-Destructive Pavement Assessment. Report - L. Liu, "State-of-the-Art Rapid Non-Destructive Pavement Assessment: Ground Penetrating Radar (GPR) in Monostatic Mode," February 1999, JHR 99-267.
98-1	Development of a Test to Measure the Tendency for a Hot Mix to Segregate. Report - J. Stephens, J. Mahoney and C. Dippold, "Development of a Test to Measure the Tendency for a Hot-Mix Asphalt to Segregate," February 2000, JHR 99-274.
98-3	Evaluation of Sign Support Structures. Report - J. DeWolf and J. Yang, "Stability Analysis of Truss Type Highway Sign Support Structures," December 2000, JHR 00-280.
99-1	Determination of PG Binder to Use in Hot Mix Containing RAP. Report - J. Stephens, J. Mahoney and C. Dippold, "Determination of the PG Binder Grade to Use in a RAP Mix," April 2001, JHR 00-278.
99-3	Estimating Link Traffic Volumes by Month, Day of Week, and Time of Day for Crash Rate Prediction. Report - J. Ivan, W. ElDessouki, W. Zhao, and F. Guo, "Estimating Link Traffic Volumes by Month, Day of Week and Time of Day," September 2002, JHR 02-287.
00-2	GPR for Fast Pavement Assessment. Report - L. Liu, "GPR for Fast Pavement Assessment," May 2007, JHR 07-310.
00-4	Automated Detection and Analysis of Speed Limit Signs. Report - B. Javidi, M.-A. Castro, S. Kishk and E. Pérez, "Automated Detection and Analysis of Speed Limit Signs," February 2002, JHR 02-285.
00-5	Field Monitoring and Evaluation for Sign Support Structures Subject to Dynamic Loads. Report - M. DelGrego and J. DeWolf, "Field Monitoring and Evaluation for Sign Support Structures Subject to Dynamic Loads," March 2003, JHR 03-291.
02-1	Incorporating Truck Flows Into the State-wide Planning Traffic Model. Report - L. Aultman-Hall, F. Guo, C. O'Brien, P. Padlo and B. Hogge, "Incorporating Truck Flows into the State-wide Planning Traffic Model," November 2004, JHR 04-299.
02-2	Developing a Methodology to Evaluate the Safety of Shared-Use Paths.

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Project No.	Title
	Report - L. Aultman-Hall and J. LaMondia, "Developing a Methodology to Evaluate the Safety of Shared-Use Paths: Results from Three Corridors in Connecticut," May 2004, JHR 04-297.
02-11	Pilot for Automated Detection and Classification of Road Surface Degradation Features.
	Report - B. Javidi, J. Stephens, S. Kishk, T. Naughton, J. McDonald and A. Isaac, "Pilot for Automated Detection and Classification of Road Surface Degradation Features," November 2003, JHR 03-293.
03-2	A Laser-based 3D Data Acquisition System for the Analysis of Pavement Distress and Roughness.
	Report - B. Javidi, D. Kim and S. Kishk, "A Laser-based 3D data Acquisition System for the Analysis of Pavement Distress and Roughness," December 2004, JHR 04-300.
03-5	Factors Affecting Young Driver Safety.
	Report - L. Aultman-Hall and P. Padlo, "Factors Affecting Young Driver Safety," November 2004, JHR 04-298.
03-7	Development of New Rheological Tools for Asphalt Binder and Bituminous Concrete Characterization.
	Report - M. Shaw, P. Mather, A. Senador and Y. Patil, "Development of New Rheological Tools for Asphalt Binder and Concrete Characterization," June 2006, JHR 06-306.
03-8	Ultrafine Particle Size Distributions of Hybrid-Electric and Particle-Trap Diesel Connecticut Transit Buses.
	Report - B. Holmén, Z. Chen, A. Davila, O. Gao and D. Vikara, "Particle Matter Emissions from Hybrid Diesel-Electric and Conventional Diesel Transit Buses: Fuel and Aftertreatment Effects," August 2005, JHR 05-304.
04-1	Pavement Crack Sealing—Emulsified vs. Traditional Hot Pour Materials.
	Report - S. Zinke and J. Mahoney, "Evaluation of Pavement Crack Treatments," February 2006, JHR 06-305.
05-6	Value Pricing in Connecticut: A Policy Simulation.
	Report - N. Garrick, W. Marshall and E. Jackson, "Value Pricing in Connecticut," September 2008, JHR 08-313.
05-7	Design and Feasibility Study: Connecticut Transportation Planning Data.
	Report - L. Aultman-Hall, S. Mather, E. Jackson, H.-S. Shin and J. Ivan, "Design and Feasibility Study: Connecticut Transportation Planning Data," October 2008, JHR 08-315.
05-9	Detailed Modal Analysis of Particulate Emissions from Connecticut Transit Buses for Emissions Modeling.
	Report - B. Holmén, E. Jackson, D. Sonntag and H.O. Gao, "Detailed Modal Analysis of Particulate Emissions from Connecticut Transit Buses for Local Emissions Modeling," December 2008, JHR 08-316.

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06-3	Extending the Lifespan of Existing Bridges through Controllable Stiffness and Damping Devices. Report - R. Christenson, "Extending the Lifespan of Existing Bridges through Controllable Stiffness and Damping Devices," December 2008, JHR 08-317.
07-2	Creating Useful Products from Connecticut's 2000 LIDAR Data Set. Report - T. Meyer, "Creating Useful Products from Connecticut's 2000 LIDAR Data Set," October 2008, JHR 08-314. Connecticut LIDAR-derived products available at http://clear.uconn.edu/data/ct_lidar/index.htm.