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For Calendar Year 2010

NEW ENGLAND TRANSPORTATION CONSORTIUM

NETCR84

April 2011

This report was sponsored by the New England Transportation Consortium, a cooperative effort of the Departments of Transportation and the Land Grant Universities of the six New England States, and the U.S. Department of Transportation's Federal Highway Administration.

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A. INTRODUCTION

The New England Transportation Consortium (NETC) is a cooperative effort of the transportation agencies of the six New England States, the six New England state land grant universities and the Federal Highway Administration (FHWA). Through the Consortium, the states pool professional, academic and financial resources for transportation research leading to the development of improved methods for dealing with common problems associated with the administration, planning, design, construction, rehabilitation, reconstruction, operation and maintenance of the region's transportation system. The Consortium's activities are currently being managed by the University of Massachusetts, Dartmouth (UMass-D), with the Connecticut Department of Transportation (ConnDOT) acting as the Lead Agency.

The program is intended to supplement, not to replace, ongoing state and federal research activities and other national programs such as the National Cooperative Highway Research Program (NCHRP). To this end, a Memorandum of Understanding (MOU), establishing NETC has been consummated by the six New England state transportation agencies.

The following goals were established for NETC in order to focus the resolve of participating state transportation agencies and universities:

- Implementation of a three-pronged program for the New England region consisting of research and development; technology transfer; and education and training.
- Development of improved methods for dealing with common transportation problems.
- Providing an important source of trained professionals for employment in the Region.

NETC membership now extends to the following agencies: ConnDOT; Massachusetts Department of Transportation; Maine Department of Transportation; New Hampshire Department of Transportation (NHDOT); Rhode Island Department of Transportation (RIDOT); Vermont Agency of Transportation (VAOT); and, FHWA.

Each of the member state transportation agencies has designated a state university to participate with the state transportation agency in developing and conducting the transportation research program. The following universities have been designated as member universities: University of Connecticut, University of Maine, University of Massachusetts System, University of New Hampshire System, University of Rhode Island, and University of Vermont.

NETC was first established, and work began, in 1986 and, over the years, has undergone a transformative process wherein the management and administrative processes have been under the governance of various governmental and non-governmental organizations. With each change in leadership, the experiential and institutional lessons that have been learned were incorporated into the administration of the program. And so, at the current

time, the collective experience of over two decades is now addressed and incorporated in the administration of the NETC program.

In 1984, the Massachusetts Institute of Technology (MIT), the state transportation agencies of five New England states (Maine, Massachusetts, New Hampshire, Rhode Island and Vermont), the American Association of State Highway and Transportation Officials (AASHTO) and FHWA initiated the first transportation pooled fund (TPF) study, administered by RIDOT, to determine the feasibility of establishing a regional consortium. In 1985, the same group of organizations initiated a second TPF study, again administered by RIDOT, to develop a work program. From 1986 to 1995, various research projects were funded through the NETC program in five funding blocks called "Rounds".

RIDOT was the Lead Agency for the first two pooled fund studies. For the five Rounds, state funds were transferred to AASHTO, the Lead Agency (i.e., Administrative Agency), through FHWA, and a single contract was effected between AASHTO and MIT, the Coordinator. MIT would then enter into a no-overhead contract with the selected university for a particular research project.

In 1994, ConnDOT stated its intention to participate in NETC and offered to act as Lead Agency. During Federal Fiscal Year (FFY) 1994, FHWA assumed the Lead Agency designation to facilitate the transition process. MIT and AASHTO exited NETC, effective FFY1994. ConnDOT entered NETC, effective FFY1995, and has been the Lead Agency since then. Currently, the Lead Agency designation is being transitioned from ConnDOT to VAOT.

B. 2010 HIGHLIGHTS

1. THE FOLLOWING NETC-FUNDED TRANSPORTATION RESEARCH PROJECTS, VALUED AT \$1,257,373, WERE ACTIVE AT NEW ENGLAND STATE UNIVERSITIES IN 2010:

a) UNIVERSITY OF CONNECTICUT: \$267,751

- Dr. Ramesh Malla: "Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring" - \$75,000
- James Mahoney:
 - 1) "Recycling Asphalt Pavements Containing Modified Binders" - \$82,751
 - 2) "Establish Default Dynamic Modulus Values for New England" - \$110,000

b) UNIVERSITY OF MAINE: \$100,000

- Dr. Thomas Sanford: "Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets"

c) UNIVERSITY OF MASSACHUSETTS AMHERST: \$100,000

- Dr. John Collura: "Evaluation and Implementation of Traffic Simulation Models for Work Zones"

- d) **UNIVERSITY OF MASSACHUSETTS DARTMOUTH: \$203,451**
 - Dr. Walaa Mogawer:
 - 1) “Relating Hot Mix Asphalt Pavement Density to Performance” - \$103,524
 - 2) “Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments” - \$99,927
- e) **UNIVERSITY OF NEW HAMPSHIRE: \$401,171**
 - Dr. Jennifer Jacobs: “Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England” - \$120,000
 - Dr. Jo-Sias Daniel:
 - 1) “Determining the Effective PG Grade of Binder in Recycled Asphalt Pavement Mixes” - \$130,876
 - 2) “New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs” - \$150,295
- f) **UNIVERSITY OF RHODE ISLAND: \$185,000**
 - Dr. Jyh-Hone Wang: “Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers’ Message Comprehension” - \$60,000
 - Dr. Sze Yang: “Measurement of Adhesion Properties Between Topcoat Paint and Metalized/Galvanized Steel with ‘Surface-Energy Measurement Equipment’” - \$125,000

2. TECHNOLOGY TRANSFER:

- a) **MASSDOT RESEARCH SYMPOSIUM:** The NETC Coordinator presented an overview of the NETC research program to the Research Symposium held at the MassDOT headquarters in Boston, MA on June 14, 2010. The presentation emphasized how the Consortium is uniquely organized to develop solutions to regional transportation issues through research and to bring those solutions to decision makers in New England’s State Transportation Agencies.
- b) **REQUESTS FOR INFORMATION AND TECHNICAL ASSISTANCE:** The NETC Coordinator’s office responded to the following requests:
 - **Vermont Agency of Transportation:** Findings from NETC research projects on: ‘Bridges, Signs & Guardrails’; ‘Road Construction & Maintenance’; and ‘Materials’.
 - **Nason Jacobson Associates, Chester, CT:** Construction drawing of the NETC 4-Bar Bridge Rail.
 - **Victaulic Co. (Piping Systems):** Contacts at the New England state Departments of Transportation regarding storm water drainage piping systems.

c) **NETC RESEARCH PROJECT REPORTS, TECHNICAL PAPERS AND PRESENTATIONS:**

- **Research Project Reports:** Findings from the following research projects were distributed to: New England's State Transportation Agencies and State Universities, The American Association of State Highway and Transportation Officials' Region 1 Research and Advisory Committee, The National Technical Information Service, and the US Department of Transportation's National Transportation Library:
 - **NETC 02-1: "Relating Hot Mix Asphalt Pavement Density to Performance"**
 - **NETC 04-3: "Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England"**
 - **NETC 04-4: "Determining the Effective PG Grade of Binder in RAP Mixes"**
 - **NETC 05-6: "Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension"**
 - **NETC 05-8: "Evaluation of Alternative Traffic Simulation Models, Including CA4PRS for Analysis of Traffic Impacts of Highway Construction, Reconstruction, and Rehabilitation"**
- **Technical Papers and Presentations:**
 - "Evaluation of the Effects of Hot Mix Asphalt Density on Mixture Fatigue Performance, Rutting Performance and MEPDG Distress Predictions," Mogawer, W.S., Austerman, A.J., Daniel, J.S., Fujie, Z., and Bennert, T., International Journal of Pavement Engineering, 2011.
 - "Laboratory Evaluation of a Silicone Foam Sealant for Field Application of Bridge Expansion Joints," Malla, R.B., Swanson, B., and Shaw M.T., Proceedings of the 2010 SEM Annual Conference & Exposition, SEM, Bethel, CT, 12 pages, June 2010.
 - "Development and Installation of Foam Sealant for Small Movement Bridge Expansion Joints," Malla, R.B., Swanson, B., and Shaw M.T., Poster presentation to the Proceedings, 27th Annual International Bridge Conference, Pittsburgh, PA, June 6-9, 2010.
 - "Laboratory Evaluation of a Silicone Foam Sealant Bonded to Various Expansion Joint Header Materials," Malla, R.B., Swanson, B., and Shaw M.T. (2010), Construction and Building Materials - An Internet Journal, submitted for publication, September 19, 2010.
 - "Laboratory Evaluation, Field Application, and Monitoring of a Silicone Foam Sealant Bonded to Various Bridge Expansion Joint Headers," Swanson, Brian, M.S. Thesis, University of Connecticut, Storrs, CT., December 29, 2010, 127 Pages.

- “Laboratory Evaluation of HMA Containing RAP and PMB,” Zofka A., Bernier A., Mahoney J., and Zinke S., presented at NEAUPG Annual Meeting Poster Session, October 6-7, 2010, Saratoga, New York.
- “Laboratory Evaluation of HMA Containing RAP and PMB,” Zofka A., Bernier A., Mahoney J., and Zinke S., presented at ASCE 1st T&DI Green Streets & Highways Conference Poster Session, November 14-17, 2010, Denver, Colorado.
- “The Impact of RAP on the Volumetric, Stiffness, Strength and Low Temperature Properties of HMA,” Krishna Swamy, A., Mitchell, L.F., Hall, S.J., and Daniel, J.S., submitted for publication to the Journal of Materials in Civil Engineering.
- “Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies,” Collura, J., Heaslip, K., Moriarty, K., Wu, F., Khanta, R., and Berthaume, A., Paper presented at the TRB Annual Meeting in January 2010.
- “Evaluation of dynamic modulus of typical asphalt mixtures in Northeast U.S Region,” Zofka A., Bernier A., Mahoney J., and Zinke S., Paper submitted to the International Journal of Road Materials and Pavement Design.

3. OTHER:

a) NEW LEAD AGENCY:

- Progress continued on the transition of the responsibility for the Consortium’s Lead Agency from ConnDOT to VAOT.

C. PROGRESS OF ACTIVE PROJECTS

PROJECT NUMBER: 02-1

PROJECT TITLE: Relating Hot Mix Asphalt Pavement Density to Performance

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, PI, UMass Dartmouth; Rajib Mallick, Co-PI, Worcester Polytechnic Institute; Jo Sias Daniel, Co-PI, University of New Hampshire

STATUS: Completed

AGREEMENT TERM: 9/1/2003 – 7/31/2007

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

The objective of the proposed study is to determine relationship between pavement density and performance through testing of pavements at different levels of in-place density with accelerated pavement loading equipment and environmental simulation. Another objective is to use the obtained relationship to determine pay adjustments for different densities.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

UMass Dartmouth addressed comments from the project technical committee and finalized the report for this project.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Evaluation of the Effects of HMA Density on Mixture Fatigue and Rutting Performance,” Mogawer, W.S., Northeast Asphalt User/Producer Group (NEAUPG) Annual Meeting, South Portland, Maine, October 8, 2009.

“Evaluation of the Effects of Hot Mix Asphalt Density on Mixture Fatigue Performance, Rutting Performance and MEPDG Distress Predictions,” Mogawer, W.S., Austerman, A.J., Daniel, J.S., Fujie, Z., and Bennert, T., International Journal of Pavement Engineering, 2011.

“Relating Hot Mix Asphalt Pavement Density to Performance,” Mogawer, W.S., Daniel, J.S., and Austerman, A.J., April 1, 2010, NETCR76.

PROJECT NUMBER: 02-6 (Phase 2)

PROJECT TITLE: Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Ramesh B. Malla, PI, and Montgomery Shaw, Co-PI, University of Connecticut

STATUS: Continuing

AGREEMENT TERM: 8/1/2008 – 7/31/2011

ANTICIPATED COMPLETION: 7/31/2011

PROJECT OBJECTIVES:

The main objective of this NETC 02-6 (Phase 2) project is to test the behavior of the silicone foam sealant under various in-field conditions, make any necessary changes, and evaluate its performance while on an operating highway bridge in order to determine its cost effectiveness and durability. The project involves pre-field laboratory testing, field installation, post installation monitoring, report preparation, and specification preparation.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

The accomplishments of Phase 2 encompass both laboratory testing, field installation/application and post-installation field monitoring of the silicone foam sealant developed in Phase 1 of this project in bridge expansion joints. The data collected from these laboratory tests were used to assess the sealant's ability to bond to asphalt, steel, and polymer concrete substrates. In addition to the laboratory tests, the sealant was installed in expansion joints on four (4) bridges located throughout New England. The bridges were located in Connecticut, New Hampshire, Rhode Island, and New York. The foam sealant was installed using an application method that was developed in the laboratory using a simulated expansion joint. The sealed bridge expansion joints were monitored for over a year. The laboratory tests, field application and monitoring of the silicone foam sealant are briefly described below.

1. **Laboratory Tests and Evaluation of Sealant Materials:** The following tests performed in the lab have been completed for both the silicone foam and Wabo solid sealants:

- Tension Test

Two types of tension tests were performed: pull-to-fail and load/unload. For these tests, 8 specimens - 4 using the foam and 4 using the solid - were made using each of the following substrates; asphalt, steel, and polymer concrete. For the pull-to-fail test each specimen was cured for 21 days at room temperature (23°C), after which they were placed in an Instron

tensile tester, model 1011. This machine was used to pull the two substrate blocks apart at a crosshead velocity of 10 mm/min until failure.

For the load/unload test the specimens were also cured for 21 days at room temperature (23°C). This time, however, the specimens were pulled at a crosshead velocity of 10 mm/min up to 300% strain and then unloaded until they reached zero strain. This loading and unloading process was repeated for another 4 cycles for a total of 5 cycles.

- Repair – Retrofit Test

It is possible that the sealant could be damaged after it has been applied to a bridge expansion joint in the field. Thus, it is important to determine if a damaged sealant can be repaired simply by adding a fresh mixture of sealant to the damaged section. To evaluate this situation, a “repair” test was devised and performed. Test specimens were made where each of the samples had a cured sealant, foam (using the crosslinker from Gelest, Inc. 2008 or solid, on the surface of the bonding area. The specimens were then sealed with new (freshly made) sealant. The test units were made with the following characteristics: 4 samples of new foam sealed to old (previously cured/used) foam, 4 samples of new solid to old foam, 4 samples of new foam to old solid, 4 samples of new solid to old solid. A pull-to-fail tension test was performed on each sample at a crosshead velocity of 10 mm/min.

- Oven – Aged Bond Test

An oven-aged bond test was performed on the sealants to evaluate the effects of extreme changes in temperature on the bonding capabilities of the sealant as it cures. Tests were done on specimens with steel, asphalt and polymer concrete substrates. For each bonding substrate, eight test specimens - four for the foam sealant and four for the solid sealant - were prepared. These specimens were cured for 7 days at room temperature (23°C), and then they were placed in an oven for 7 days at 70 °C. After the oven aging, the specimens were placed in an insulated box and held at -29 °C for 4 h using dry ice. After this cooling period, the test units were tested by loading them at a crosshead velocity of 6 mm/min until they reached 300% strain. The specimens were removed from the machine and left out on a table for 4 h to regain their original length. The specimens were then put in the dry ice at -29 °C for 4 h again, tested, and allowed to recover. The process of freezing, testing, and recovery was repeated for 5 cycles. This test procedure follows substantially the ASTM D 5893-96 standard.

- Salt Water Immersion Test

A salt water immersion test was performed on test specimens to evaluate the effects of prolonged exposure to salt water on the material and bonding of the foam and solid sealants to different substrates. For this test also two types of substrates, asphalt and steel, were used. For each substrate 8 specimens were made, 4 with foam (using crosslinker from GE Bayer) and 4

with solid. The specimens were allowed to cure for 7 days at room temperature (23°C), and then placed in a bucket of saturated salt water for 14 days. During this time period, the salt water was kept at a temperature of 45°C. After the 2 weeks of submersion, the specimens were removed from the water, allowed to dry for 4 h, and tested. A pull-to-fail tension test was performed on the samples using a crosshead velocity of 10 mm/min.

- **Modulus Over Time Test**

The amount of time that the sealant has cured may have an effect on the strength of the sealant. To test this effect, laboratory specimens were made by bonding the foam and solid sealants to asphalt and steel substrates. For each type of substrates used, 8 specimens were made, 4 with the foam and 4 with the solid. The specimens were extended to 100% strain at 10 mm/min and then unloaded completely. The first was done on the sealants right after they were allowed to cure for 3 h. Subsequently, this loading and unloading was repeated on the same specimens at several other time intervals, including 6 hours, 18 hours, 24 hours, and then once every day for the next 42 days.

- **Freeze – Thaw Test**

Tests were performed to evaluate how freezing the sealant will affect its performance. 3 sets of specimens were made with the foam, and 3 other sets were made with the solid sealant. Each set required the sealing of samples for multiple cure rate times: 1 hour, 2 hour, and 3 hour. For each of these curing times 4 samples were made with the foam sealant and 4 samples were made with the solid sealant (64 samples total for each set). The type of substrate used did not matter, but for this particular test a concrete substrate was used. After the samples were allowed to cure for their designated amount of time, each set was subjected to different tests. The first set of samples were soaked in water for 10 days, after which a pull to fail tension test was performed, extending the samples at 10mm/min (Submerge). The second set of samples were soaked in water for 7 days, placed in a freezer for 3 days at -20°C, and pulled to failure in the Instron machine at 10mm/min (Submerge - Freeze). The third set were soaked for 7 days, placed in the freezer for 3 days, taken out of the freezer and allowed to thaw for 2 hours, and then pulled to failure at 10mm/min (Submerge - Freeze - Thaw).

- **Water Ponding Test**

The foam sealant needs to be tested to see if during storm whether or not the material will permit water from leaking through to the underside of a bridge. To evaluate this, a ponding test was conducted. Taking plastic cylinders, each measuring 4 inches in diameter, Styrofoam stoppers were placed 5.5 inches below the top of the container. The foam was poured on top of the stoppers, which after foaming measured 1 inch in thickness. Finally, water was filled to the surface of the cylindrical container, creating a water depth of 4 inches. The surface of the water was 0.5 inches below the top of the cylinder. The top of the container was, then, covered. A major concern

about using the sealant is how the sealant will react to external factors, like rain, during its initial stage of curing. Therefore, prior to adding water, the sealants were allowed to cure for just 1 hour or 2 hours. Four test units were made for the foam sealant cured for 1 hour prior to ponding, and four other units were made with foam cured for 2 hours prior to ponding. Over the course of the next 7 days the submersed sealant was monitored to see if water was leaking through to the bottom of the cylindrical container. Figure 8 is a schematic of the apparatus used in the water ponding test.

- **Cure Rate Test**

For the cure rate test, a set of samples using asphalt and steel substrates were made with both the foam and solid sealants. Unlike the modulus over time test where one set of samples were made and pulled to 100% strain at specific time intervals, the cure rate test required a set of samples to be made for each specified cure time. After a particular sample set reached its designated cure time, it was tested by pulling until the sealant failed internally or at the bonding interface with the substrate. 8 specimens - 4 using the foam and 4 using the solid - were made using asphalt and steel. Specimens were made with the following cure rate intervals: 3 days, 7 days, 10 days, 14 days, 21 days, 28 days, 35 days, and 42 days.

2. **Sealant Application Procedures and Joint Sealing in that Laboratory:** Using the simulated expansion joint set up in the laboratory (Fig. 1), various types of applicator tools (Fig. 2) were used to try and seal the joint. With each of these tools the sealant material would be pressed out manually into the expansion joint. These application devices required all the materials to be mixed in a separate container and then poured into the applicator. This method created a problem. Once the materials are mixed together to create the sealant the reaction is immediate. To pour the materials into one container, mix them, pour them into an applicator gun, and then apply it to the joint is too long of a process. What was decided on was simply pouring the mixed sealant components into the joint via a bucket that was flexible. The application procedure called for specific measuring of each material needed (WABO white, WABO gray, crosslinker, water, platinum catalyst), which depended on the size of the expansion joint. The materials were put into a bucket, mixed together using a mixer that was attached to a drill, poured into the expansion joint, and leveled off. The application procedure is described below:

- Obtain the necessary materials
 - Chemicals (WABO white, WABO black, crosslinker, distilled water, and platinum catalyst)
 - Syringes to hold crosslinker, distilled water, and platinum catalyst
 - Closed Cell Backer Rod
 - Tool to adjust depth of backer rod
 - Tool to level poured sealant at a specific depth
 - Plastic mixing container
 - Battery powered drill

- Mixer to attach to drill
 - Spatula
 - Cooler with ice
 - Pre-measure the volume of each material given the known dimensions of the expansion joint to be filled.
 - Pack all the chemicals in a cooler with ice. When the materials are mixed while cool the reaction is slowed. For every decrease of 10°C the reaction of the chemicals when mixed together decreases by one half. This will give more time to apply the sealant before the major foaming reaction takes place. This is especially important when the application of the sealant is performed in hot temperatures.
 - On site, place the closed cell backer rod into the expansion joint. Press the backer rod down to a specific depth below the bridge surface using a tool specifically designed for this process. For this particular procedure, the top of the backer rod was placed 1 inch below the surface.
 - Pour the WABO white, WABO black, distilled water, and platinum catalyst into the plastic mixing bucket. Using the drill and attached mixer thoroughly mix these four materials together. The crosslinker is left out of this step because of its high reactivity to the water. It would be best that the water is dispersed evenly throughout the entire mixture before the crosslinker is added.
 - Add the crosslinker. Mix all the materials one last time.
 - Pour the mixed sealant material into the expansion joint.
 - To ensure the sealant is at the proper depth before it begins to foam, another person needs to follow behind the person applying the silicone foam with a leveling tool.
3. **Field Installation of Sealants in Bridge Joints:** With the help of the NETC Project Technical Committee members, four bridges one in each of the 4 New England states (Connecticut, New Hampshire, Rhode Island, and New York) were identified for field installation of the silicone foam expansion joint sealant developed in the Phase 1 of this NETC 02-6 project. On each bridge, the application procedure was demonstrated to the Departments of Transportation from the 4 New England States. The expansion joints on these bridges were sealed using the silicone foam sealant and the WABO, two part solid silicone sealant for comparison. Given below are the bridges where the expansion joints were sealed:
- The bridge on Mansfield Ave. spanning Route 6, west bound in Mansfield, CT (Fig. 3) was sealed on August 17, 2009. Figures 4, 5, and 6 are pictures taken from the joint sealing operation. Figure 7 shows the setup the two sealants used in the expansion joint. Figure 8 shows the dimensions of the bridge.

- The bridge on E. Thetford Rd. spanning the Connecticut River in Lyme, CT (Fig. 9) was sealed on September 16, 2009. Figures 10 and 11 are pictures taken from the joint sealing operation. Figure 12 shows the setup the two sealants used in the expansion joint. Figure 13 shows the dimensions of the bridge.
 - The Pascoag River Bridge on Route 102 in Burrillville, RI (Fig. 14) was sealed on October 21 & 22, 2009. Figure 15 is a picture taken from joint sealing operation. Figure 16 shows the setup the two sealants used in the expansion joint. Figure 17 shows the dimensions of the bridge.
 - The bridge in New York on Route 22 in Dover Plains, NY (Fig. 18) was sealed on November 6, 2009. Figures 19 and 20 are pictures taken from the joint sealing operation. Figure 21 shows the setup the two sealants used in the expansion joint. Figure 22 shows the dimensions of the bridge.
4. **Post-Installation Field Monitoring of Bridge Joint Sealants:** After the sealing, each bridge expansion joint was monitored visually over the period of 14 months. During the field monitoring any damage to the foam and solid sealants were recorded. The monitoring. Figures 23 to 30 display pictures taken from these field monitoring trips to the bridges. The foam sealant was observed to perform well except at few spots where there were already damage in the joint header and other special circumstances.

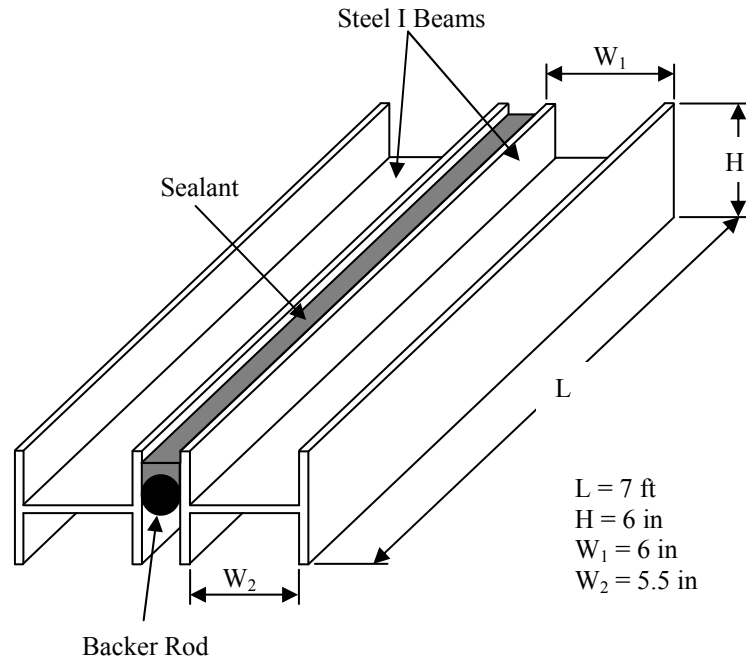


Figure 1. Schematic of Simulated Expansion Joint



(a)



(b)

Figure 2. Sealant Applicator Options Consisting of (a) a Grease Gun and (b) a Modified Pressure Applicator



Figure 3. Candidate Bridge in Mansfield, Connecticut



Figure 4. Placement of Backer Rod into Joint in CT –
August 17, 2009



Figure 5. Sealing of the Bridge Joint in CT –
August 17, 2009



Figure 6. Sealant in the Connecticut Bridge Joint – August 17, 2009

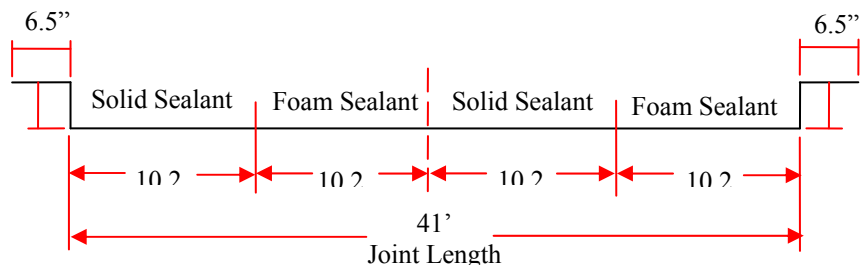


Figure 7. Schematic of Elevation showing the staggering of the joint sealant on the Connecticut Bridge

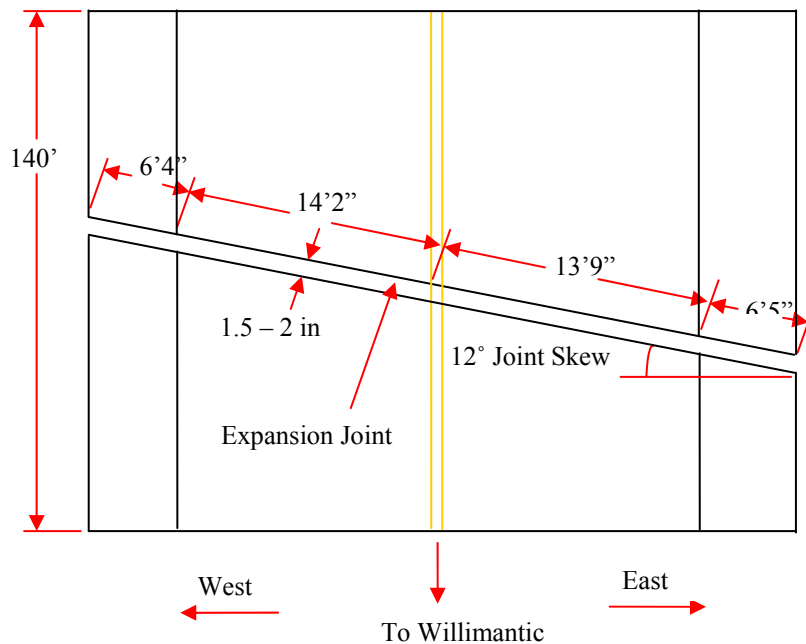


Figure 8. Top schematic view of the expansion joint on the Connecticut Bridge along with the joint and bridge dimensions



Figure 9. Candidate Bridge in Lyme, New Hampshire



Figure 10. Candidate Bridge in NH –
September 16, 2009



Figure 11. Sealed Expansion Joint in NH –
September 16, 2009

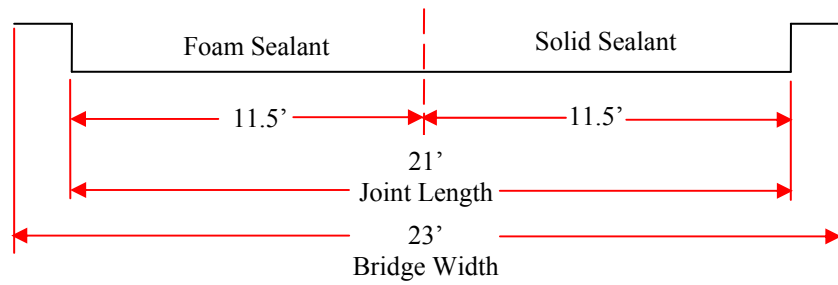


Figure 12. Schematic of Elevation showing the staggering of the joint sealant on the New Hampshire Bridge

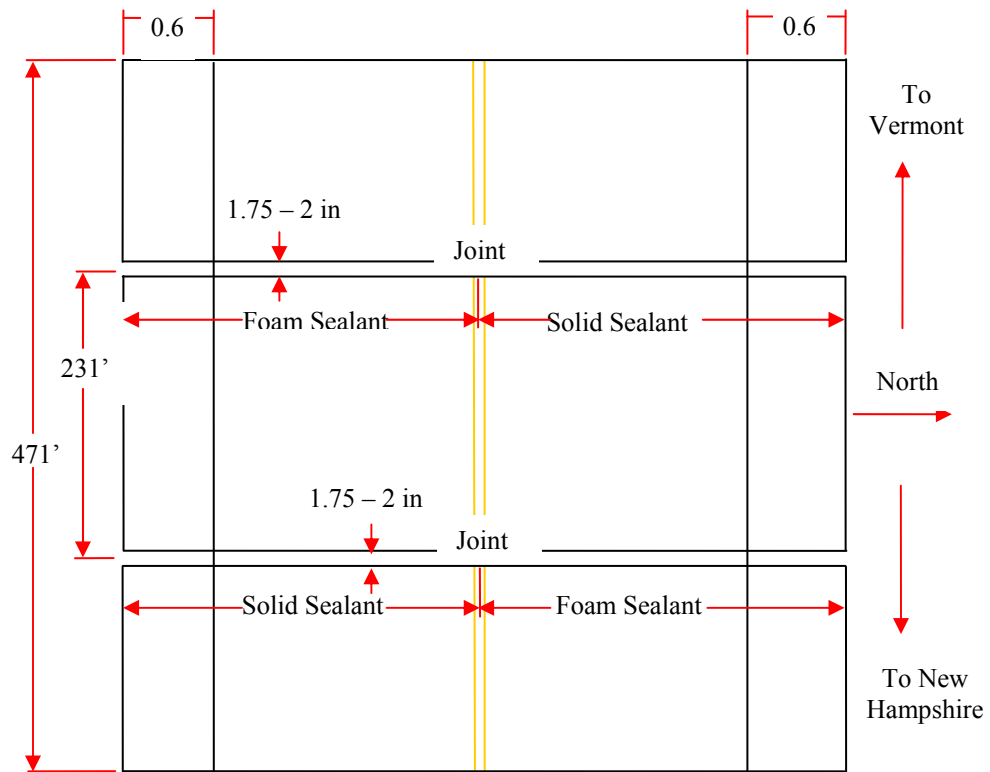


Figure 13. Top view schematic of the expansion joint on the New Hampshire Bridge along with the joint and bridge dimensions



Figure 14. Candidate Bridge in Burrillville, Rhode Island – October 21, 2009



Figure 15. Sealed Rhode Island Bridge Joint – October 22, 2009

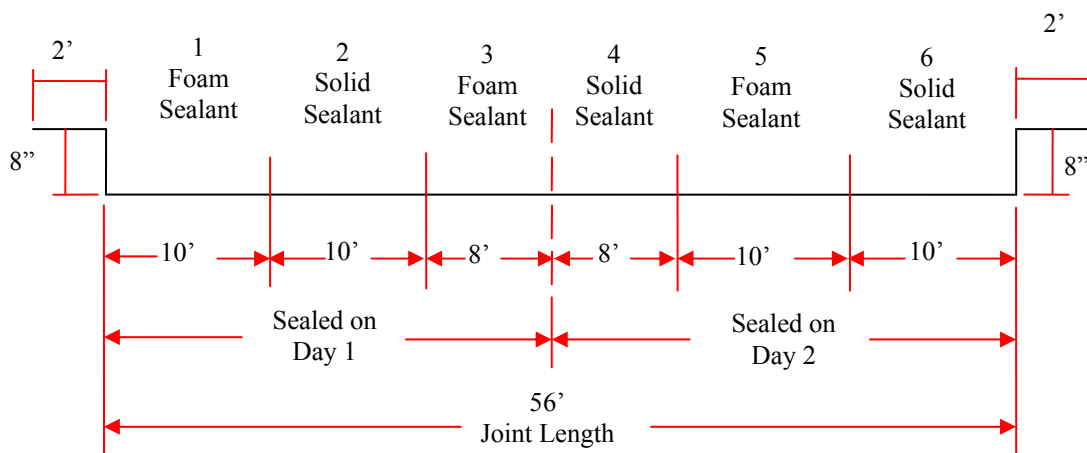


Figure 16. Schematic showing the staggering of the joint sealant on the Rhode Island

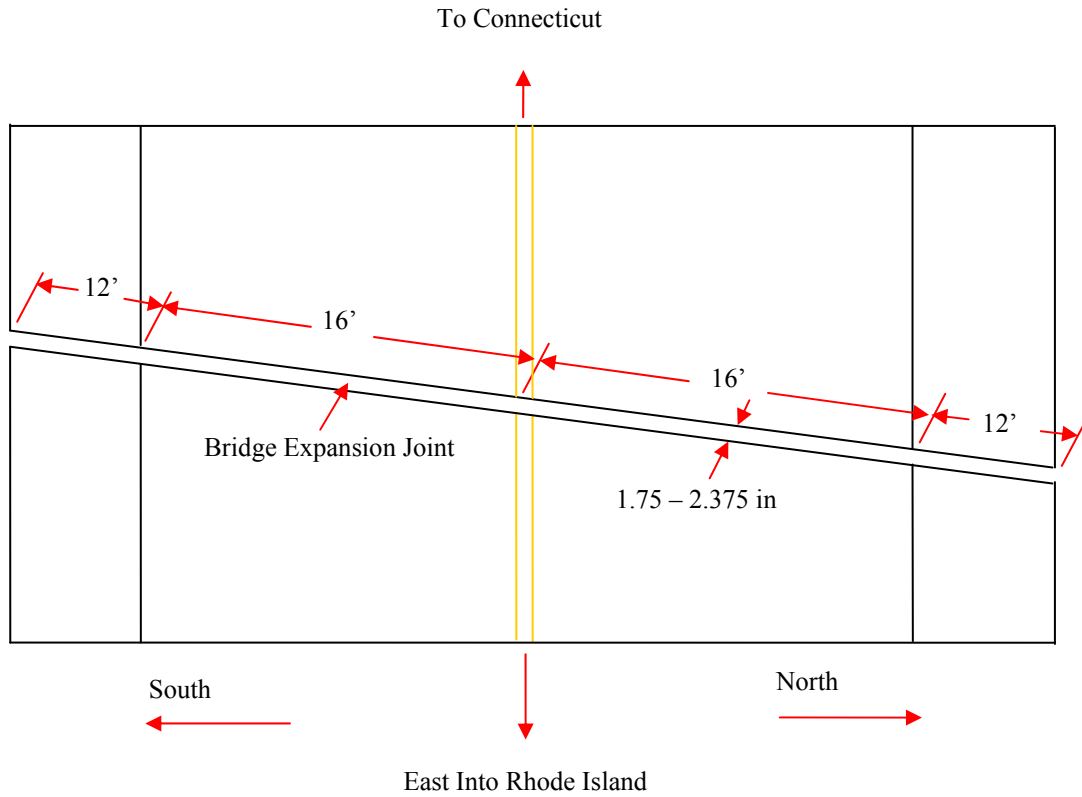


Figure 17. Top schematic view of the expansion joint on the Rhode Island Bridge along with the joint and bridge dimensions



Figure 18. Candidate Bridge in Dover Plains, NY – November 6, 2009

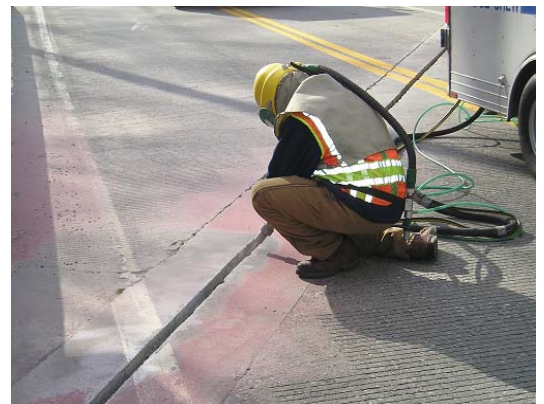


Figure 19. Cleaning of New York Expansion Joint – November 6, 2009



Figure 20. Sealing of New York Expansion Joint – November 6, 2009

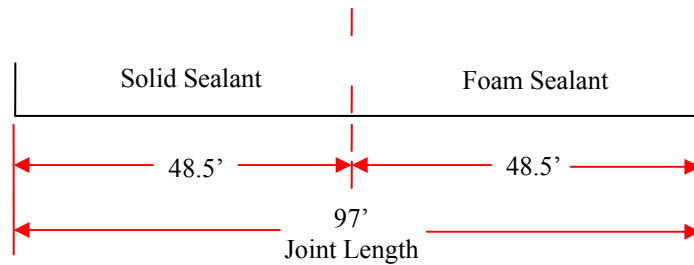


Figure 21. Schematic of Elevation showing the staggering of the joint sealant on the New York bridge.

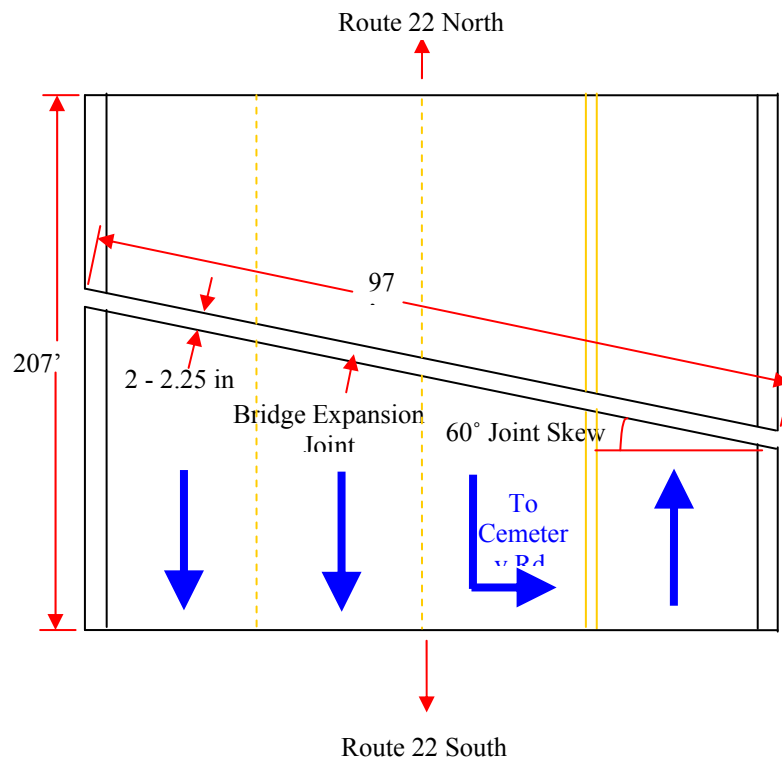


Figure 22. Top view schematic of the expansion joint on the New York Bridge along with the joint and bridge dimensions

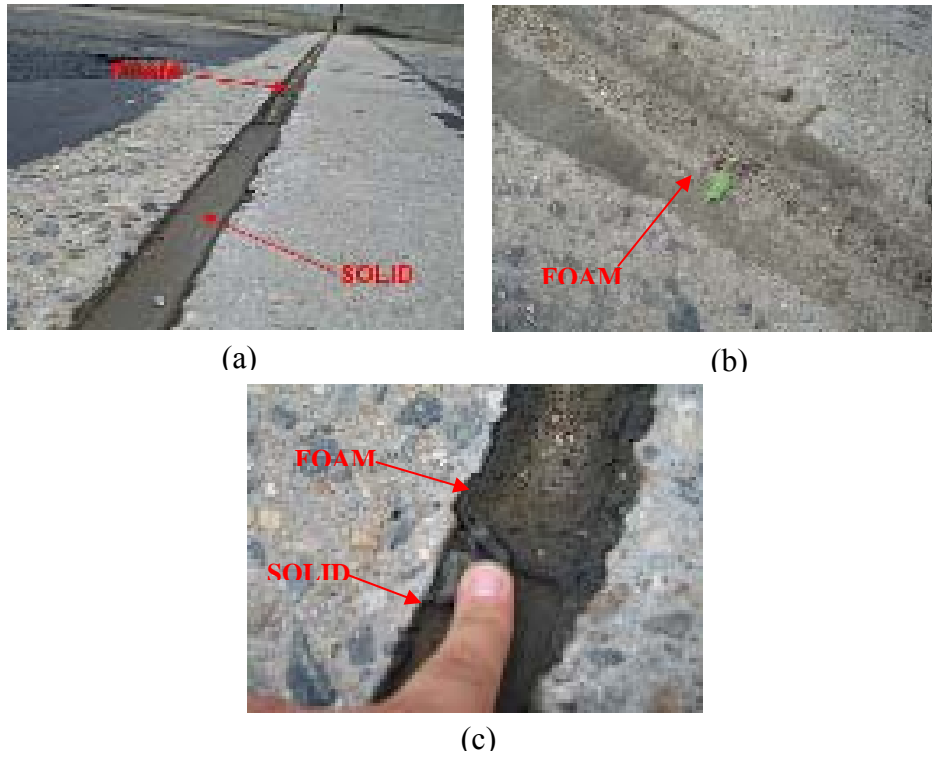


Figure 23. Foam and Solid Sealants on Connecticut Bridge, October 7, 2010

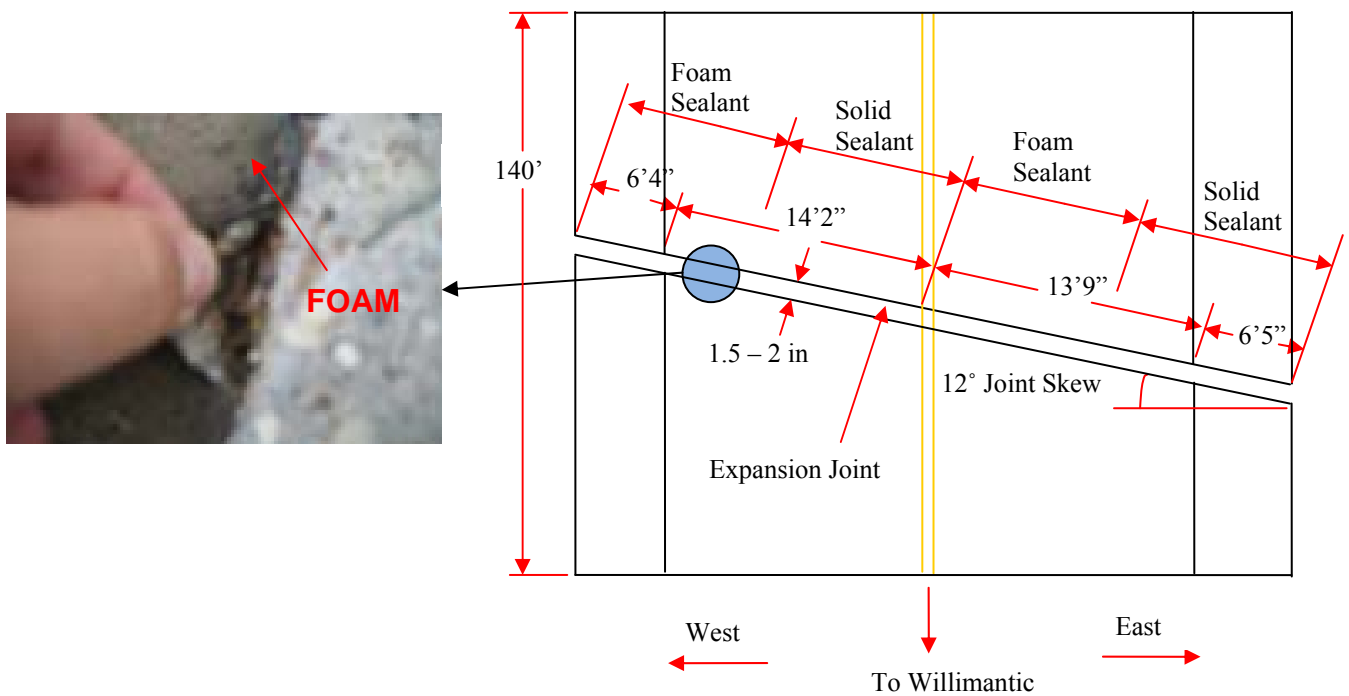


Figure 24. Peeling of Foam Sealant from Road Deck Surface, Connecticut Bridge, October 7, 2010

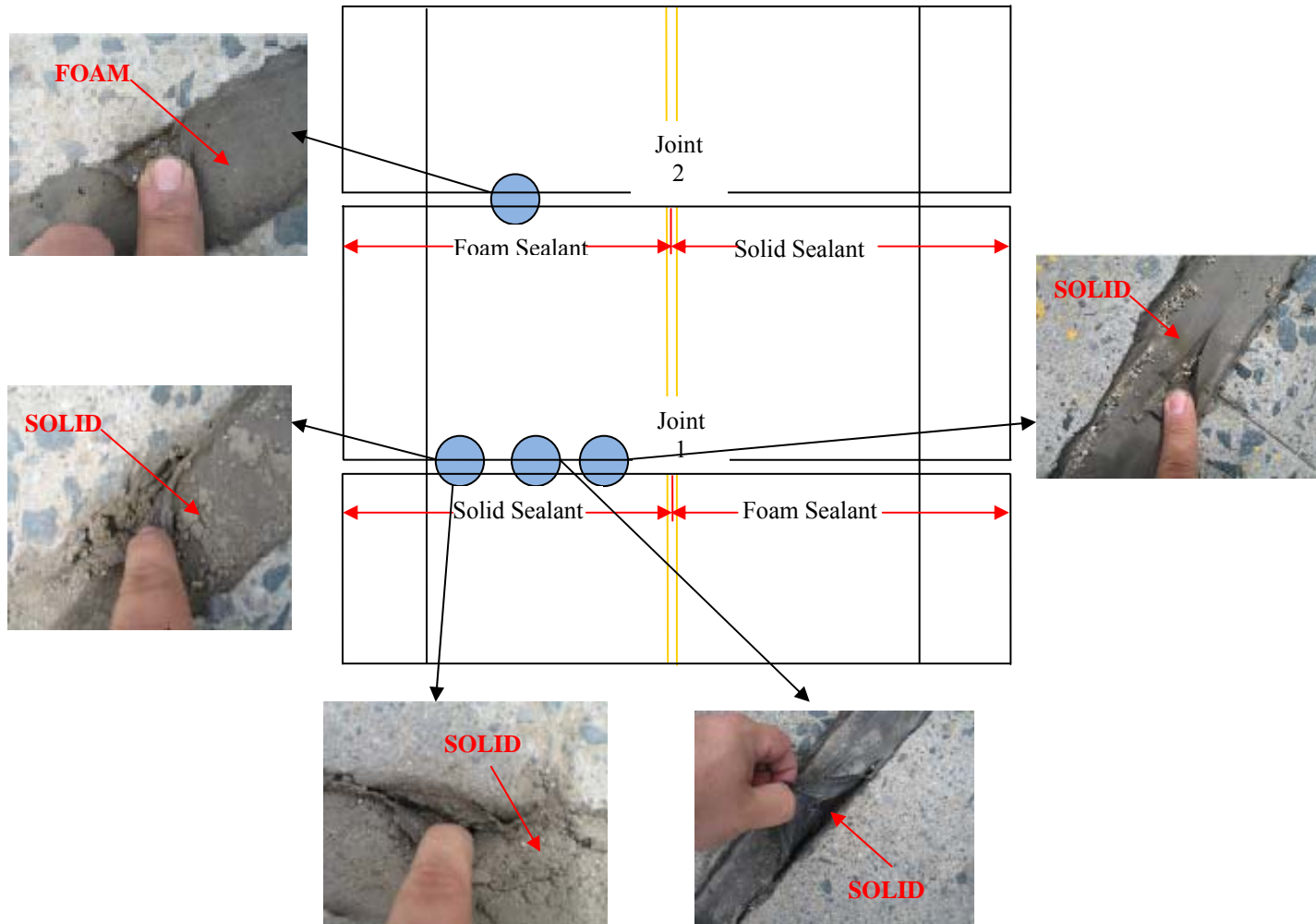


Figure 25. Location of Damage at the New Hampshire Bridge on May 16, 2010 and October 8, 2010

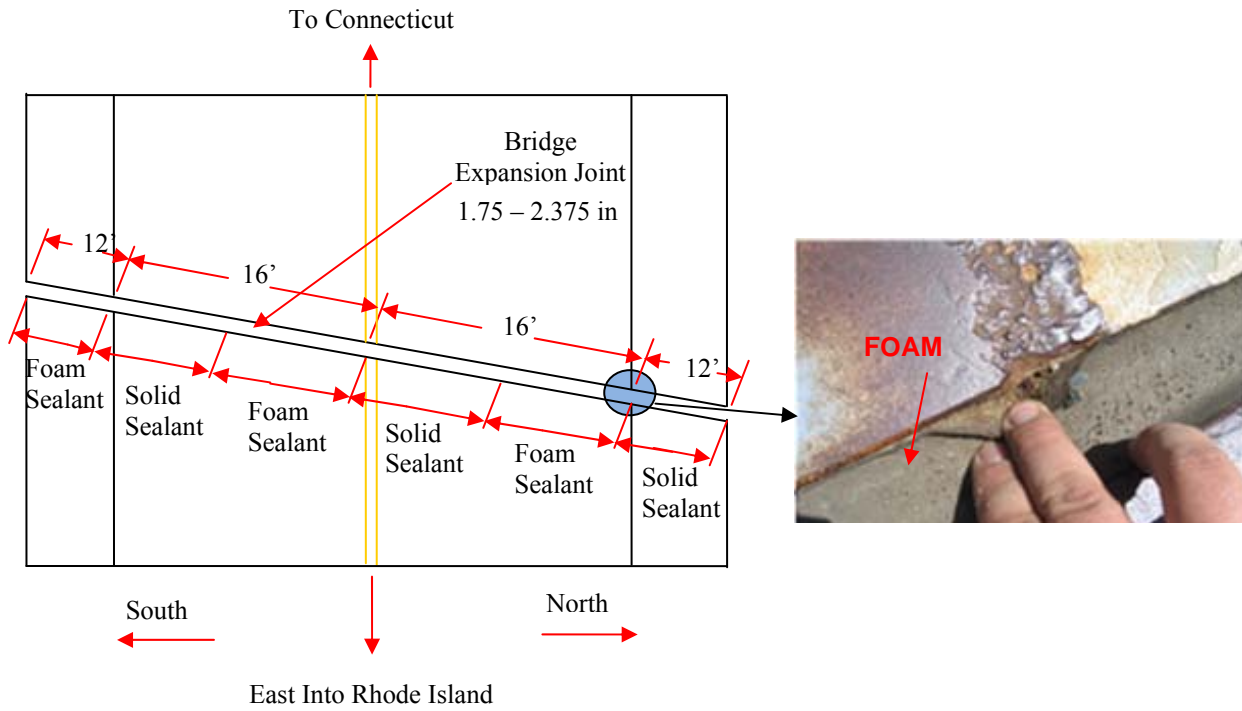


Figure 26. Damage to Foam Sealant in Rhode Island, May 7, 2010

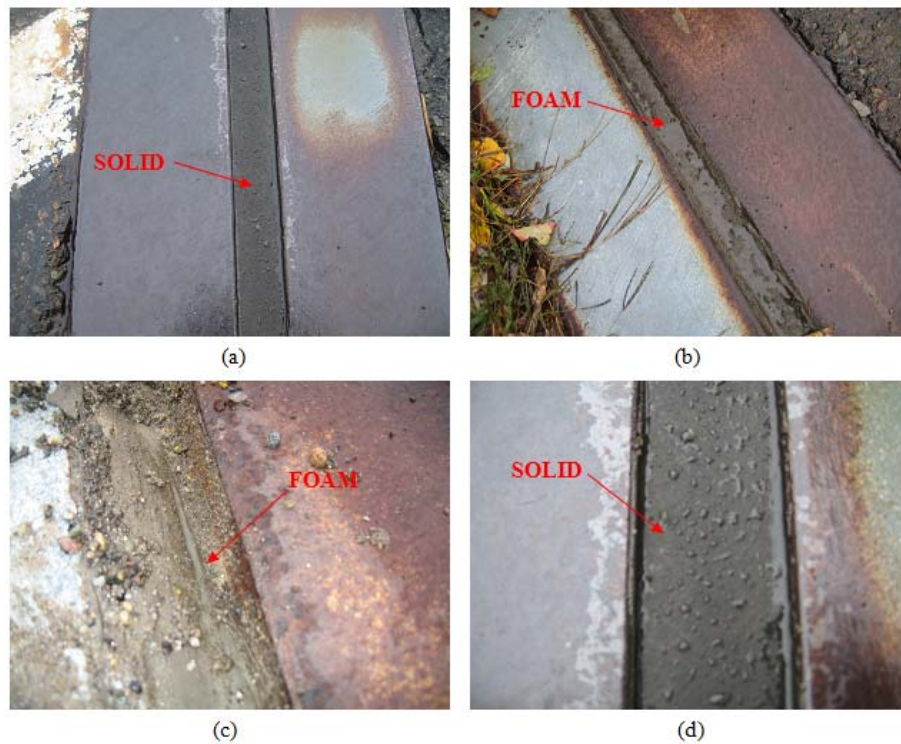
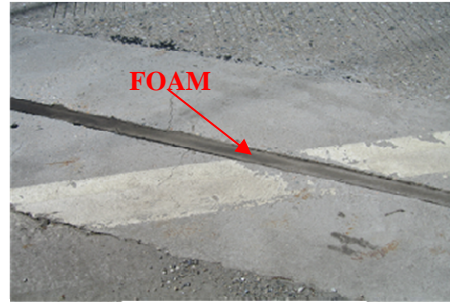


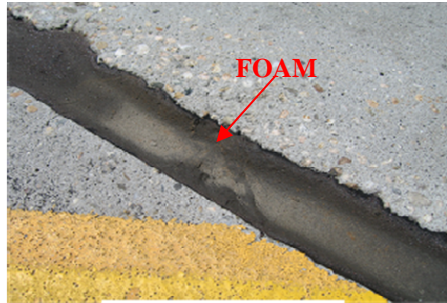
Figure 27. Foam and Solid Sealant on Rhode Island Bridge, October 1, 2010



(a)



(b)



(c)



(d)

Figure 28. Foam and Solid Sealants on New York Bridge, May 11, 2010



(a)



(b)



(c)



(d)

Figure 29. Foam and Solid Sealants on New York Bridge, October 6, 2010

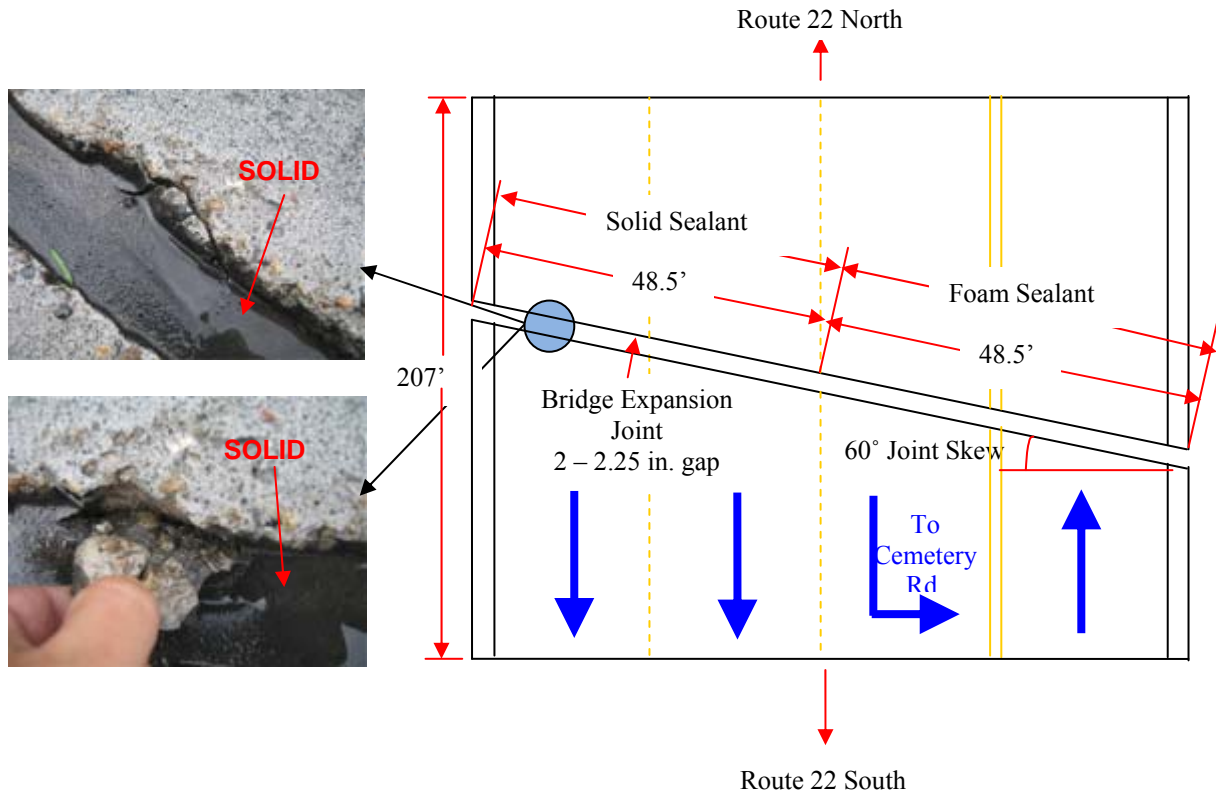


Figure 30. Damage to the Solid Sealant in New York Bridge, October 6, 2010

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Laboratory Evaluation of a Silicone Foam Sealant for Field Application of Bridge Expansion Joints,” Malla, R.B., Swanson, B., and Shaw M.T., Proceedings of the 2010 SEM Annual Conference & Exposition, SEM, Bethel, CT, 12 pages, June 2010.

"Development and Installation of Foam Sealant for Small Movement Bridge Expansion Joints," Malla, R.B., Swanson, B., and Shaw M.T., Poster presentation to the Proceedings, 27th Annual International Bridge Conference, Pittsburgh, PA, June 6-9, 2010.

“Laboratory Evaluation of a Silicone Foam Sealant Bonded to Various Expansion Joint Header Materials,” Malla, R.B., Swanson, B., and Shaw M.T. (2010), Construction and Building Materials - An Internet Journal, Submitted for publication, September 19, 2010.

“Laboratory Evaluation, Field Application, and Monitoring of a Silicone Foam Sealant Bonded to Various Bridge Expansion Joint Headers,” Swanson, Brian, M.S. Thesis, University of Connecticut, Storrs, CT., December 29, 2010, 127 Pages.

PROJECT NUMBER: 03-6

PROJECT TITLE: Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Walaa S. Mogawer, PI, UMass Dartmouth; Jo Sias Daniel, Co-PI, University of New Hampshire

STATUS: Continuing

AGREEMENT TERM: 10/1/2009 – 9/30/2011

ANTICIPATED COMPLETION: 9/30/2011

PROJECT OBJECTIVES:

- Define and compare thin lift overlay maintenance mixes and surface treatments currently used in the New England States.
- Evaluate the thin lift overlay maintenance mixes and surface treatments currently used in the New England States and compare to those currently used worldwide.
- Determine the current New England DOT procedures for picking rehabilitation methodologies.
- Perform and evaluate non-destructive testing to better determine the optimum time to apply surface treatments or thin lift overlay mixes to the existing pavements in order to properly prioritize rehabilitation projects.
- Evaluate the benefits and drawbacks of using PMA thin lift mixes versus surface treatments with lab testing.
- Evaluate the cost comparisons between PMA thin lift mixes and surface treatments.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

1. Thin lift mixtures prepared with six binders (modified and unmodified) using two sources of aggregates (crushed stone and gravel) were fabricated and delivered to UNH for evaluating the thermal cracking characteristics of the mixtures.
2. The low temperature cracking of the aforementioned mixtures were measured using the Asphalt Concrete Cracking Device (ACCD) at UMass Dartmouth.
3. The University of New Hampshire (UNH) began evaluating the thermal cracking characteristics of the thin lift mixtures prepared with six binders (unmodified and polymer modified) using two sources of aggregates. UNH is testing these mixtures in accordance with AASHTO T322 “Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device” and the low temperature cracking properties of the mixtures are being determined from an analysis program (LTStress).

4. Commenced evaluation of the cracking characteristics of the thin lift mixtures using the Texas Overlay tester in accordance with Texas Specification Tex-248-F.

**REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO
THIS PROJECT FROM THE START OF THE PROJECT THROUGH
DECEMBER 31, 2010: None**

PROJECT NUMBER: 04-1 (Phase 2)

PROJECT TITLE: Recycling Asphalt Pavements Containing Modified Binders - Phase 2

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): James Mahoney, Connecticut Transportation Institute, University of Connecticut

STATUS: Continuing

AGREEMENT TERM: 8/23/2007 – 9/30/2009

ANTICIPATED COMPLETION: 3/31/2011

PROJECT OBJECTIVES:

Phase 2

The objectives of the second Phase of this project will attempt to address incompatibilities that may arise when RAP is used in a new HMA pavement that contains a virgin modified asphalt binder. This Phase of the project will also provide guidance as to the proper amount of RAP that can be added to the HMA without causing problems. In addition, the interaction of polyphosphoric acid modified virgin asphalts and the aggregates in the RAP will also be tested to determine if there is a negative impact on the HMA mixes performance.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

The research team completed the testing and data analysis for this project.

A draft final report was submitted to the technical committee in October.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Laboratory Evaluation of HMA Containing RAP and PMB,” Zofka A., Bernier A., Mahoney J., and Zinke S., presented at NEAUPG Annual Meeting Poster Session, October 6-7, 2010, Saratoga, New York.

“Laboratory Evaluation of HMA Containing RAP and PMB,” Zofka A., Bernier A., Mahoney J., and Zinke S., presented at ASCE 1st T&DI Green Streets & Highways Conference Poster Session, November 14-17, 2010, Denver, Colorado.

PROJECT NUMBER: 04-3

PROJECT TITLE: Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jennifer Jacobs, PI, Thomas Ballestero, Co-PI, University of New Hampshire and Richard Vogel, Co-PI, Tufts University

STATUS: Completed

AGREEMENT TERM: 10/1/2009 – 9/30/2010

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

The main objective of this research is to develop a set of regional regression relationships to predict flood flows for steep slope watersheds from basin characteristics. The regression relationships will be developed using standard USGS regional hydrologic methods. We propose to identify target watersheds in the New England region and to develop a database of physical basin parameters and historical streamflow necessary for the statistical analysis. Regression analyses will be conducted to identify explanatory variables and to develop regression relationships for average daily flow and 2-, 10-, 25-, 50-, and 100-year peak flow recurrence interval events. As appropriate, the New England states will be divided into subregions.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

The contract extension request was approved. The final regression analysis and documentation was completed. Major accomplishment was the development of peak flow regression equations for New England steep watersheds (Table 1). The final report was submitted, reviewed, and published.

Table 1. Regression equations and their accuracy for estimating peak flows for steep, ungaged, unregulated drainage basins in New England. Steep is defined as a main channel slope that exceeds 50 ft per mile. [Q is peak flow, in cubic feet per second; A is drainage area, in square miles; P is mean annual precipitation in inches]

Peak-flow regression equation by recurrence interval	Standard Error of the Estimate (percent)		(PRESS/n) ^{1/2} (percent)		Average Prediction Error (percent)		Average Equivalent Yrs of Record
$Q_2=0.01601A^{0.889}P^{2.12}$	47.1%	-32.0%	46.9%	-31.9%	48.1%	-32.5%	2.09
$Q_5=0.01965A^{0.889}P^{2.19}$	45.1%	-31.1%	44.8%	-30.9%	46.1%	-31.6%	3.03
$Q_{10}=0.02430A^{0.891}P^{2.21}$	46.5%	-31.7%	46.4%	-31.7%	47.5%	-32.2%	3.89
$Q_{25}=0.03387A^{0.893}P^{2.20}$	50.4%	-33.5%	50.7%	-33.7%	51.5%	-34.0%	4.73
$Q_{50}=0.04372A^{0.895}P^{2.18}$	54.5%	-35.3%	55.2%	-30.9%	55.8%	-35.8%	5.10
$Q_{100}=0.05765A^{0.897}P^{2.15}$	59.4%	-37.3%	60.5%	-37.7%	60.8%	-37.8%	5.29
$Q_{500}=0.111A^{0.903}P^{2.08}$	73.4%	-42.3%	75.3%	-43.0%	75.1%	-42.9%	

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

2006 Maine Water Conference, Augusta, ME, March 22, 2006, Poster presentation.

“Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England,” Jacobs, J., November 17, 2010, NETCR81.

PROJECT NUMBER: 04-4

PROJECT TITLE: Determining the Effective PG Grade of Binder in RAP Mixes

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): PI: Jo Daniel, University of New Hampshire; Co-PI: Walaa Mogawer, UMass Dartmouth

STATUS: Completed

AGREEMENT TERM: 10/1/2004 – 3/31/2008

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

The main objective of this research is to develop a method to determine or estimate the binder grade in mixtures designed with RAP from the properties of the mixture itself.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

This project was completed and the final report submitted in 2010.

The objective of this research project was to develop a method to determine or estimate the binder grade in mixtures designed with RAP from the properties of the mixture itself. Three different RAP percentages (10%, 25%, 40%) were evaluated for a 12.5 mm Superpave mixture. A PG 64-28 virgin binder was used. Additionally, testing was done on virgin mixtures with PG 58-28, PG 70-22, and PG 76-22 binders. Dynamic modulus, creep compliance, and strength tests were run in the indirect tensile mode for the various mixtures. The Hirsch model was used to back calculate the binder $|G^*|$ values from the measured mixture dynamic modulus values. Partial $|G^*|$ master curves were measured on the extracted binder from each mixture and the recovered binder was also PG graded.

Several methods of estimating the effective PG grade of the binder were evaluated. Empirically based methods of interpolating values of measured mixture properties are straightforward, but require an extensive amount of testing in the laboratory. The relationship between material properties and PG grade must be established for each type of mixture (gradation, asphalt content).

The most promising methods for determining the effective PG grade of the mixture use the Hirsch model to back calculate binder $|G^*|$ from the measured mixture dynamic modulus. Some difficulties exist in determining the high temperature PG grade because of the large difference in temperatures between the dynamic modulus testing and PG grading temperatures. However, recovered and virgin binder information can be used to compare with the back calculated $|G^*|$ from the mix to estimate the effective high temperature PG grade. The low temperature PG grade can be estimated from mixture testing only because the range of temperatures for PG grading corresponds to the dynamic modulus testing temperatures.

Recommended Procedure for Estimating PG Grade

Based on the results of the research conducted in this project, the research team

recommends the following procedure for estimating the PG grade of mixtures containing RAP:

1. Perform complex modulus testing on at least three replicate specimens.
Recommend that temperatures from -20°C to 30°C be used to develop master curves and obtain desired shift factors. This may require modification of current AMPT devices to test at lower temperatures.
2. To estimate high temperature PG grade:
 - a. Obtain $|G^*|$ master curve for virgin binder
 - b. Obtain $|G^*|$ master curve for extracted and recovered mixture binder
 - c. Back calculate $|G^*|$ using the measured dynamic modulus and the Hirsch model
 - d. Compare back calculated $|G^*|$ to virgin and recovered values to estimate the effective high temperature PG grade
3. To estimate low temperature PG grade for fatigue:
 - a. Back calculate $|G^*|$ using the measured dynamic modulus and the Hirsch model
 - b. Use the Rowe method to determine the phase angles from the back calculated $|G^*|$ master curve
 - c. Shift master curves to determine temperature at which $|G^*| \sin \delta = 5000$ kPa
4. To estimate low temperature PG grade for thermal cracking:
 - a. Use linear viscoelastic theory to convert complex modulus to creep compliance
 - b. Calculate creep stiffness of mixture
 - c. Use Hirsch relationship to calculate creep stiffness of binder
 - d. Calculate S-value and m-value for each mixture as a function of temperature
 - e. Calculate temperature at which $S=300$ MPa and $m=0.300$
 - f. Determine effective low temperature PG grade

Recommendations for Further Research

Further research is required on different types of RAP mixtures and different virgin PG grades to verify and refine the procedures developed as part of this research project. In particular, it is important to perform testing on plant produced mixtures to capture what truly happens to these mixtures in the field. Future testing should focus on the low to intermediate temperature testing as this is the biggest concern with the addition of aged RAP binder in the mix.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“The Impact of RAP on the Volumetric, Stiffness, Strength and Low Temperature Properties of HMA,” Krishna Swamy, A., Mitchell, L.F., Hall, S.J., and Daniel, J.S., submitted for publication to the Journal of Materials in Civil Engineering.

“Determining the Effective PG Grade of Binder in RAP Mixes,” Daniel, J.S. and Mogawer, W.S., January 2010, NETCR78.

PROJECT NUMBER: 05-1

PROJECT TITLE: Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Thomas C. Sanford,
University of Maine

STATUS: Continuing

AGREEMENT TERM: 1/1/2010 – 3/31/2011

ANTICIPATED COMPLETION: 3/31/2011

PROJECT OBJECTIVES:

The objective of this study is to produce a drilled shaft design method for evaluating the now unused side shear or end bearing to supplement the AASHTO allowable load. The magnitude of unused side shear or end bearing corresponding to the AASHTO allowable load will be the magnitude that occurs at the same shaft movement as the allowable load. This method should reflect different rock socket geometry and different rock properties typical of New England. The method should be based on past load tests and be robust and easy-to-use.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

A finite element model was developed for a drilled shaft in hard rock. The model had the capacity to simulate an Osterberg test. This model was calibrated against six Osterberg tests that had been screened from a large pool of tests. The screened tests were in hard rock in the Northeast (primarily in New England) and had supporting data available. After the model was calibrated, then the displacement response to loading was conducted on a range of shaft depths, diameters, and rock quality. A design method to include both side shear and end bearing for a given displacement of the shaft was developed for both an analytic approach and for an Osterberg test. The draft report documenting the method and findings has been essentially completed.

The rock quality (discontinuities) in hard rock has a significant effect on the end bearing displacement under loading and thus affects the end bearing capacity to be used for design. Also the dimensions of the socket have a large effect on the relative percentage of end bearing mobilized in the design load for a given displacement. The tolerable displacement of the shaft at the top of rock has been typically designed in the past for 3 to 4 mm but has ranged up to 11 mm. Most of the displacement occurs during construction. Concrete shaft capacity above the rock in overburden can be a limiting factor for shafts founded in hard rock. The compression of concrete in deeply drilled shafts can be a significant factor in the overall displacement of the top of the shaft during loading. With poor quality hard rock (many fractures), bearing capacity limits for the end can still be an issue.

**REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO
THIS PROJECT FROM THE START OF THE PROJECT THROUGH
DECEMBER 31, 2010: None**

PROJECT NUMBER: 05-5

PROJECT TITLE: Measurement of Adhesion Properties Between Topcoat Paint and Metallized/Galvanized Steel with Surface Energy Measurement Equipment

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Sze C. Yang, PI, and K. Wayne Lee, Co-PI, University of Rhode Island

STATUS: Continuing

AGREEMENT TERM: 4/22/2010 – 8/22/2011

ANTICIPATED COMPLETION: 8/22/2011

PROJECT OBJECTIVES:

1. Compare the adhesion properties of NEPCOAT-approved topcoat paint over metallizing to topcoat paint over galvanizing using specialized “surface-energy” measuring lab methods. As a control the adhesion properties of topcoat paint over zinc primer painted steel substrates will also be measured.
2. Investigate various factors affecting the adhesion of topcoat paint over galvanizing.
3. Report and recommend practices which produce the best adhesion of NEPCOAT-approved topcoat paints over metalized and particularly galvanized steel surfaces.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

Summary:

We completed the pull-off strength adhesion tests (ASTM D 4541) and the tape test (ASTM D 3359) for previously prepared 52 composite test panels according to the work plan for this project.

The contact angle data of the liquid paints on an additional 13 test panels without organic coatings were analyzed. We observed 4 different types of paint droplet/surface interactions based on the initial droplet shape and the change of the liquid/solid contact angle as a function of time. These data inform us of the propensity of wetting and the spreading/absorption of a particular liquid primer by a roughened zinc surface. When we compare the wetting and spreading tendencies of a liquid primer/surface with the measured pull-off strength of the cured paint/surface a systematic correlation has emerged. The data shows that the better wetting and the faster spreading of the primer liquid droplet, the stronger is the adhesion of the dried coating on the zinc surface.

1. **Completed the adhesive strength tests of the coated test panels prepared in the last quarter of work:**

A total of 104 pull off tests were performed on 52 painted test panels according to ASTM D4541 standard. A total of 104 tape tests were done

according to ASTM D 3359. The results were tabulated and the photographs of the pull-off spot on the painted test panels were studied.

2. **Surface contact angle analysis:**

We performed statistical analysis of the contact angle data obtained in the last working quarter (May to Aug, 2010). We found systematic trends within the data set. An analysis of these data is attached to this report as **Appendix A** to document and to analyze the measured contact angles of the liquid primer as a function of time after a droplet of the freshly formulated epoxy primer is touching the roughened zinc surfaces.

3. **Correlations between the trends observed in the contact angle analysis and the pull-off strength data.**

We compared the trends found in the contact angle data and the trends in the pull-off strength data found for the same primer/substrate pairs. There is a significant correlation that supports the following two hypotheses: (1) A better wetting of the substrate (evidenced by low initial contact angles) leads to a stronger primer-to-zinc surface bonding. (2) A faster spreading of the liquid paint on the roughened surface leads to a stronger paint bonding to the substrate. The data, the analyses, and the implications of this result are described in the attached Appendix A.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Measurement of Adhesion Properties Between Topcoat Paint and Metalized / Galvanized Steel With Surface Energy Measurement Equipment,” Paper # CET-25, Yang, S.C., Lee, K.W., Lu, C., and Mirville, M., Presented at the US-Korea Conference on Science, Technology, and Entrepreneurship (UKC2010), Seattle, Washington, August 14, 2010.

PROJECT NUMBER: 05-6

PROJECT TITLE: Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): J. H. Wang, University of Rhode Island

STATUS: Completed

AGREEMENT TERM: 10/1/2009 - 9/30/2010

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

- Review and evaluate existing research and literature related to the use of graphic-aided DMSs and the effects of such uses on elder drivers.
- Examine the feasibility of employing graphics in DMS messaging to assist drivers' comprehension of the message with a particular focus on elder drivers.
- Compile and or develop a library of graphic-aided text messages if such use were determined to be both feasible and beneficial.
- Make recommendations to identify, re-design, or create elderly friendly dynamic message signs that are effective for the driving population as a whole.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

- The final report of this project was submitted to NETC in October 2010. Seventy hard copies of the approved report were sent to NETC in January 2011.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

A presentation was given to the Rhode Island DOT on November 16, 2006.

"Improving Elder Drivers Comprehension of Dynamic Message through a Human Factors Study," Clark, A., Wang, J.H., Maier-Sperdelozzi, V., and Collyer, C., Proceedings of the 12th International Conference on Industrial Engineering – Theory, Application, and Practice, p.747-753, 2007.

"Assisting Elder Drivers' Comprehension of Dynamic Message Signs," Clark, A.T., Wang, J.H., Maier-Sperdelozzi, V., and Collyer, C.E., Proceedings of the 87th Annual Meeting of Transportation Research Board, Paper No. 08-2276, p.1-16, CD-ROM, 2008.

"Age Effect on Driver Comprehension of Messages Displayed on Dynamic Message Signs," Wang, J.H., Clark, A. Y., and Maier-Sperdelozzi, V., Proceedings of IIE Research Conference, Paper No. 307, p.1-6, CD-ROM, 2008.

“Employing Graphic-Aided DMS to Assist Elder Drivers’ Message Comprehension,”
Wang, J.H. and Clark, A. Y., December 30, 2010, NETCR82.

PROJECT NUMBER: 05-8

PROJECT TITLE: Evaluation and Implementation of Traffic Simulation Models for Work Zones

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): John Collura, University of Massachusetts Amherst

STATUS: Completed

AGREEMENT TERM: 9/22/2009 – 3/21/2010

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES:

1) assess the strengths and limitations of readily available computer based simulation models designed to evaluate the impacts of alternative work zone strategies; 2) make recommendations for the use of such simulation models on roadway reconstruction and rehabilitation projects in New England and New York State; and 3) conduct the necessary technology transfer activities in order to ensure that the results of this project are disseminated and provided directly to potential simulation model users, including transportation engineers and planners in New England and New York State.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

All tasks were completed.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies: Case Studies Along Interstate Highways in Massachusetts and Rhode Island,” Moriarty, K.D., Collura, J., Knodler Jr., M.A., Daiheng, N., and Heaslip, K., Paper presented at the TRB Annual Meeting in January 2008.

“Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies,” Collura, J., Heaslip, K., Moriarty, K., Wu, F., Khanta, R., and Berthaume, A., Paper presented at the TRB Annual Meeting in January 2010.

“Evaluation and Implementation of Traffic Simulation Models for Work Zones,” Collura, J., June 18, 2010, NETCR80.

PROJECT NUMBER: 06-1

PROJECT TITLE: New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Jo Sias Daniel, PI, University of New Hampshire; Ghassan R. Chehab, Co-PI, Pennsylvania State University

STATUS: Continuing

AGREEMENT TERM: 10/1/2009 - 9/30/2011

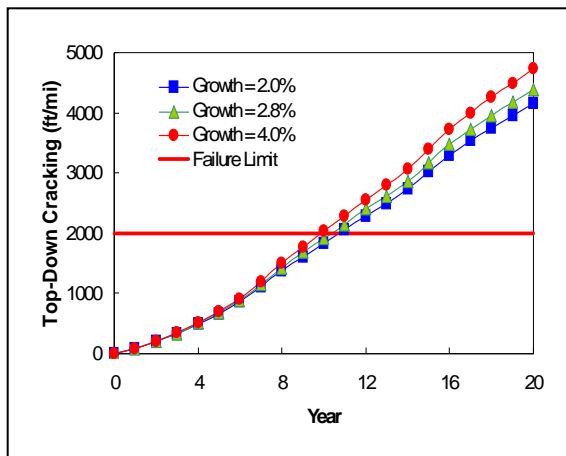
ANTICIPATED COMPLETION: 9/30/2011

PROJECT OBJECTIVES:

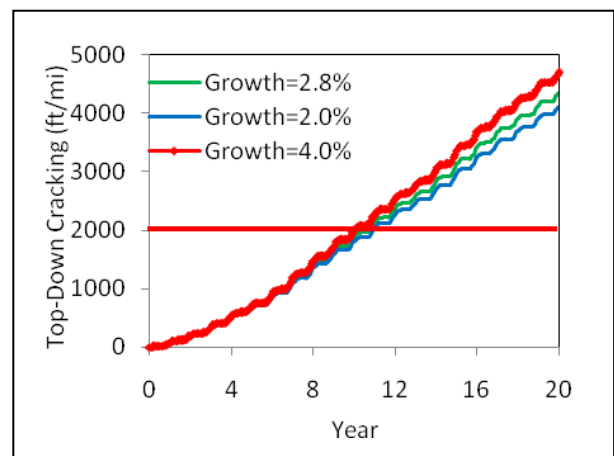
- Determine the design and data collection methods, material tests, and testing equipment currently in use by each state.
- Identify the Level 2 and Level 3 design guide inputs for which regional or local values are required.
- Provide state specific recommendations on implementation of the MEPDG including changes in data collection & measurement, equipment needs, training, and anticipated benefits.
- Provide specific recommendations for regional and local calibration of the MEPDG by identifying appropriate field test & monitoring sites, data to be collected, and perform local calibrations if appropriate field data is available.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

- Comparisons of sensitivity analysis using M-E PDG ver. 1.0 and ver. 1.1 software (level 3 and 2) for NH and CT



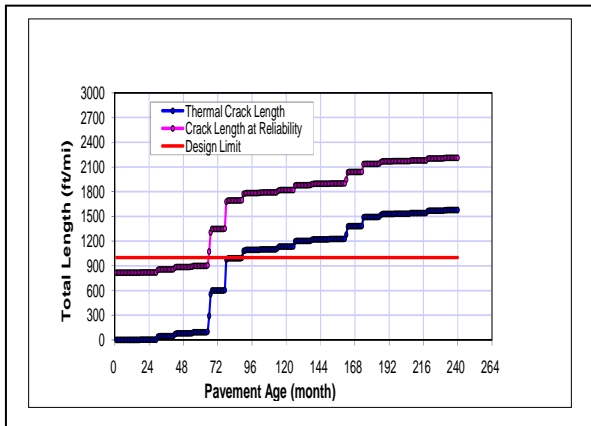
Ver. 1.0



Ver. 1.1

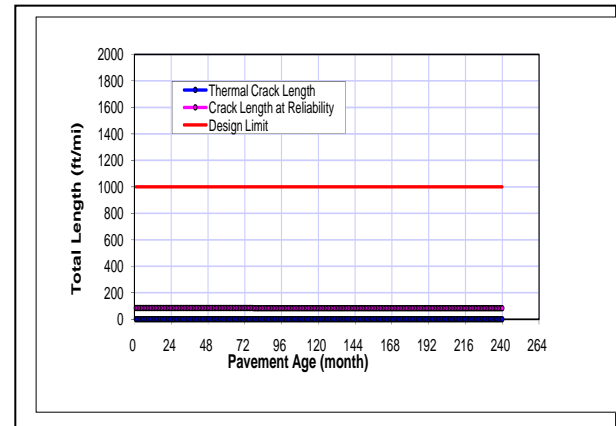
Figure 1. Effect of Traffic Growth Rate on Top-Down Cracking in NH

- Thermal Cracking comparisons using M-E PDG ver. 0.91 and ver. 1.1 software for NH, ME and CT



Ver. 1.0

Figure 2. Thermal Cracking in NH



Ver. 1.1

- Completed Vermont M-EPDG sensitivity analysis for Level 2 and Level 3 to determine the impact of all key inputs on predicted pavement performance like: alligator fatigue cracking, rutting, transverse cracking distresses and smoothness IRI, and the effects of:
 - AADTT's
 - Traffic growth rates
 - Traffic operational speeds
 - Traffic truck class distributions
 - HMA layer thickness
 - HMA binder grades
 - HMA 3/8" and 3/4" mix gradations
 - HMA effective binder contents
 - HMA air voids contents
 - Mix and Aggregate coefficient of thermal contraction (CTC's) values
 - Base types/ modulus
 - Subgrade types/modulus
 - Climate
 - Ground water table levels

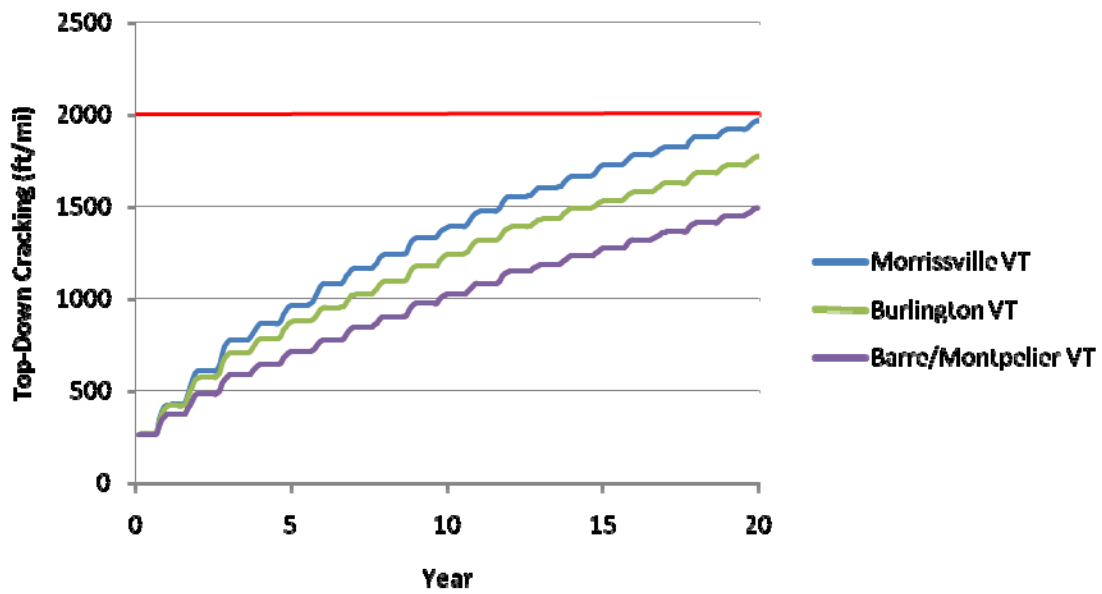


Figure 3. Effect of Climate on Top-Down Cracking in VT

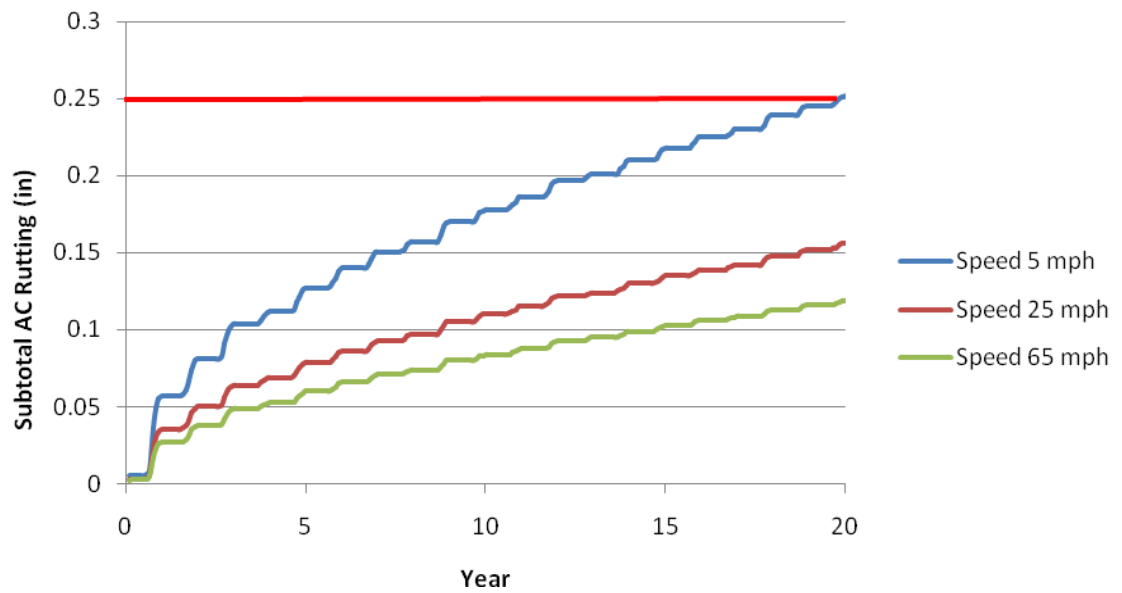


Figure 4. Effect of Operational Speed on Subtotal AC Rutting in VT

Table 1. VT Sensitivity Analysis Results Level 3

Bottom-Up	Top-Down	AC Rutting	Total Rutting	IRI
HMA Thickness	HMA Thickness	Operational Speed	Operational Speed	Initial IRI
HMA Air Voids	Subgrade Type/ Modulus	AADTT	Subgrade Type/ Modulus	Subgrade Type/ Modulus
AADTT	HMA Air Voids	HMA Mix Gradation	AADTT	Operational Speed
Operational Speed	Operational Speed	Traffic Distribution	HMA Thickness	HMA Thickness
Traffic Distribution	AADTT	HMA Binder Grade	HMA Mix Gradation	AADTT
HMA Effective Binder Content	Traffic Distribution	Climate	Traffic Distribution	HMA Mix Gradation

- Initial meeting with the VT AOT officials and discussion about the M-E PDG implementation plans for Vermont – August, 2010
- Initial meeting with Eric Thibodeau – NH DOT and discussion about the M-E PDG implementation in NH State – August, 2010
- Initial contact and a phone conference with the ME DOT officials regarding their issues and future plans for the M-E PDG implementation – September, 2010
- Initial contact with Rick Bennett and Wes Yang from the NYS DOT regarding their issues and future plans for the M-E PDG implementation – October, 2010
- Completed NY State M-E PDG sensitivity analysis for Level 3
 - NY State DOT doesn't want to participate in the project
- Initial contact and a phone conference with Kate Wilson-Hoffman – RI DOT regarding their issues and future plans for the M-E PDG implementation – November, 2010
- Initial contact with Edmund Naras – MA DOT to discuss the implementation plan – December, 2010
- Sensitivity Analysis of pavement performance using M-E PDG and JMP Graphical ANOVA software.

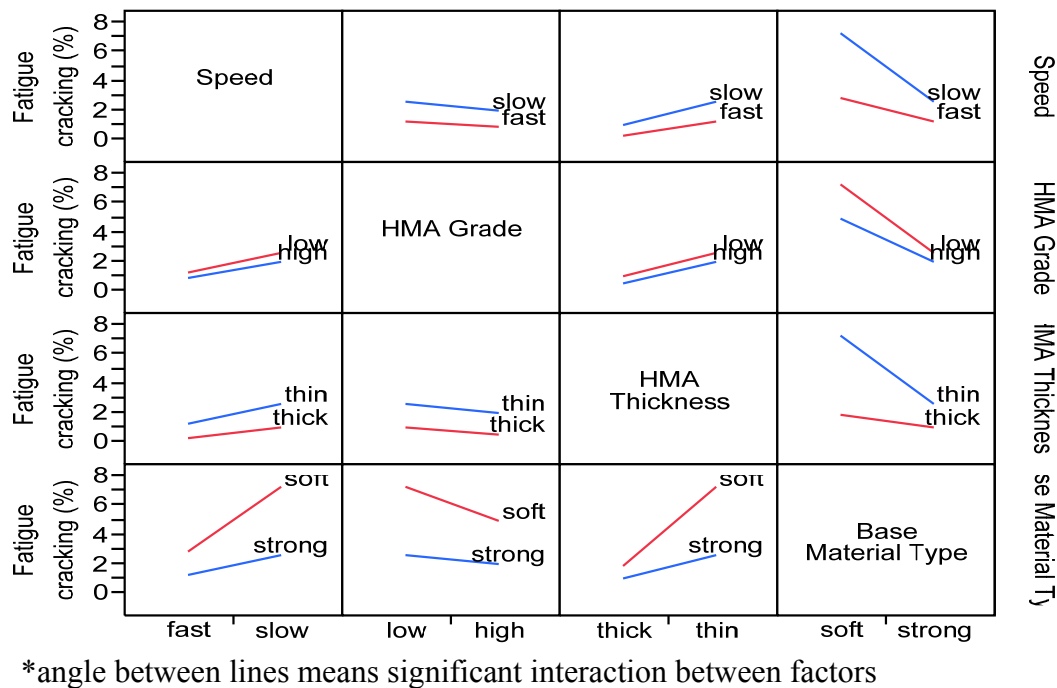


Figure 5. Interaction Profile example for Fatigue (alligator) cracking

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Sensitivity of MEPDG Level 2 and 3 Inputs Using Statistical Analysis Techniques for New England States,” Ayyala, D., Chehab, G. R., and Daniel, J. S., accepted for publication in the Transportation Research Record 2010.

“Sensitivity of RAP Binder Grade on Performance Predictions in the MEPDG,” Daniel, J. S., Cehab, G. R., and Ayyala, D., Journal of the Association of Asphalt Pavement Technologists, Vol. 78, 2009, pp. 352-376.

“Sensitivity of RAP Binder Grade on Performance Predictions in the MEPDG,” Presentation by Jo Sias Daniel to the Association of Asphalt Paving Technologists Annual Meeting, March 2009.

PROJECT NUMBER: 06-3

PROJECT TITLE: Establishing Default Dynamic Modulus Values for New England

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): James Mahoney, PI,
University of Connecticut

STATUS: Continuing

INITIAL AGREEMENT DATE: 7/1/2008 – 4/30/2010

ANTICIPATED COMPLETION: 3/31/2011

PROJECT OBJECTIVES: RESEARCH OBJECTIVE:

The objective of this research is to test commonly used HMA mixtures throughout New England to determine their respective moduli. The results of this testing will be:

- Used to determine if there is a significant difference between dynamic modulus values for materials from throughout the region.
- Used to compare the dynamic modulus of lab produced mixes and plant produced mixes.
- Compared against the master curves derived by performing the reduced testing as outlined by Bonaquist and Christensen. This will reduce the number of temperatures as well as the number of frequencies tested. If this process correlates well with the full set testing master curves, it will reduce the amount of time required to conduct the testing.
- Compared against the predicted moduli obtained by using the Witczak Predictive Model and the Hirsh Model. If there is a strong correlation between the tested and predicted values then this would provide a reasonable value for the dynamic modulus for most HMA designs in the 2002 Pavement Design Guide.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:

The research team has completed the testing and data analysis.

The research team has submitted a draft final report to the technical committee.

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

“Evaluation of dynamic modulus of typical asphalt mixtures in Northeast U.S Region,” Zofka A., Bernier A., Mahoney J., and Zinke S., Paper submitted to the International Journal of Road Materials and Pavement Design.

PROJECT NUMBER: 06-5

PROJECT TITLE: The New England Winter Severity Index

PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S): Samuel Miller, PI, Plymouth State University; Brendon Hoch, Co-PI, Plymouth State University

STATUS: Terminated

AGREEMENT TERM: N/A

ANTICIPATED COMPLETION: N/A

PROJECT OBJECTIVES: RESEARCH OBJECTIVE: The objective of this study is to develop winter severity indices for the New England region. Anticipated tasks include identifying appropriate and manageable number of weather regions within New England, developing winter severity indices using statistical concepts, developing standard methods to utilize the indices and provide recommendations on maintaining and improving indices.

PROGRESS/ACCOMPLISHMENTS THROUGH DECEMBER 31, 2010:
N/A

REPORTS/PAPERS PUBLISHED, PRESENTATIONS MADE RELATING TO THIS PROJECT FROM THE START OF THE PROJECT THROUGH DECEMBER 31, 2010:

Final Report on file - not distributed.

D. FINANCIAL STATUS OF PROJECTS ACTIVE DURING 2010

D.1 FINANCIAL STATUS OF ACTIVE PROJECTS:
Table 1: Financial Status of Projects Active During 2010
(As of December 31, 2010)

NO.	PROJECT TITLE, PI, UNIVERSITY	APPROVED BUDGET	INVOICES APPROVED FOR PAYMENT	PROJECT BALANCE
02-1	Relating Hot Mix Asphalt Pavement Density to Performance, <i>W. Mogawer, University of Massachusetts, Dartmouth, R. Mallick, Worcester Polytechnic Institute, J. Daniels, University of New Hampshire</i>	\$103,524.00	\$103,260.73	\$263.27
02-6 Phase 2	Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring, <i>R. Malla, M. Shaw, University of Connecticut</i>	\$75,000.00	\$60,909.66	\$14,090.34
03-6	Fix It First: Utilizing the Seismic Property Analyzer and MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments, <i>W. Mogawer, University of Massachusetts Dartmouth, J. Daniel, University of New Hampshire</i> (under FHWA agreement)	\$45,842.00	(see FHWA)	(see FHWA)
04-1 Phase 2	Recycling Asphalt Pavements Containing Modified Binders - Phase 2, <i>J. Mahoney, University of Connecticut</i>	\$82,751.00	\$78,613.45	\$4,137.55
04-3	Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England, <i>J. Jacobs, T. Ballesterio, University of New Hampshire, R. Vogel, Tufts University</i> (under FHWA agreement)	\$21,978.00	\$21,978.00	\$0.00
04-4	Determining the Effective PG Grade of Binder in RAP Mixes, <i>J. Daniel, University of New Hampshire, W. Mogawer, University of Massachusetts Dartmouth</i>	\$130,876.00	\$130,876.00	\$0.00
05-1	Development of Supplemental Resistance Method for the Design of Drilled Shaft Rock Sockets, <i>T. Sandford, University of Maine</i> (under FHWA agreement)	\$47,755.00	(see FHWA)	(see FHWA)
05-5	Measurement of Adhesion Properties Between Topcoat Paint and Metallized/Galvanized Steel with Surface Energy Measurement Equipment, <i>S. Yang, K. W. Lee, University of Rhode Island</i> (under FHWA agreement)	\$20,012.00	(see FHWA)	(see FHWA)
05-6	Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension, <i>J. H. Wang, University of Rhode Island</i> (under FHWA agreement)	\$13,278.00	\$13,278.00	\$0.00

D.1 FINANCIAL STATUS OF ACTIVE PROJECTS:
Table 1: Financial Status of Projects Active During 2010
(As of December 31, 2010)

NO.	PROJECT TITLE, PI, UNIVERSITY	APPROVED BUDGET	INVOICES APPROVED FOR PAYMENT	PROJECT BALANCE
05-8	Evaluation and Implementation of Traffic Simulation Models for Work Zones, <i>J. Collura, University of Massachusetts</i> (under FHWA agreement)	\$5,035.00	\$5,035.00	\$0.00
06-1	New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs, <i>J. Daniel, University of New Hampshire</i> (under FHWA agreement)	\$68,085.00	(see FHWA)	(see FHWA)
06-3	Establishing Default Dynamic Modulus Values for New England, <i>J. Mahoney, University of Connecticut</i>	\$109,787.00	\$103,816.46	\$5,970.54
06-5	The New England Winter Severity Index, <i>S. Miller, Plymouth State University</i>	\$100,000.00	\$73,639.62	\$26,360.38

D.2 NETC FUND BALANCE				
As of December 31, 2010				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
Unexpended Balance of NETC funds from AASHTO				
as of 6/5/95 (Per AASHTO memo 12/4/95)				132,777.07
Member Obligations 1994 = 6 X \$75,000	450,000.00			582,777.07
Coord./Admin. of NETC: Calendar Year 1995 Bdgt. = \$73042		58,761.32	FINAL	524,015.75
Continued Projects:				
- Construction Costs of New England Bridges-Phase II		39,500.00	FINAL/CLOSED	484,515.75
- Tire Chips as Lightweight Backfill-Phase II: Full-Scale Testing (Supplemental Funding)		16,000.00	FINAL/CLOSED	468,515.75
- Bridge Rail Crash Test - Phase II: Sidewalk-Mounted Rail		134,127.00	FINAL/CLOSED	334,388.75
- New England Vehicle Classification and Truck Weight Program		6,752.57	FINAL/CLOSED	327,636.18
Member Obligations 1995 = 7 X \$75,000	525,000.00			852,636.18
"95" Project Series:				
95-1: Use of Tire Chips/Soil Mixtures to Limit Pavement Damage of Paved Roads		75,000.00	FINAL/CLOSED	777,636.18
95-2: Suitability of Non-Hydric Soils for Wetland Mitigation		39,867.70	FINAL/CLOSED	737,768.48
95-3: Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Mixes		120,812.12	FINAL/CLOSED	616,956.36
95-5: Buried Joints in Short Span Bridges		61,705.61	FINAL/TERM.	555,250.75
95-6: Guidelines for Ride Quality Acceptance of Pavements		106,124.00	FINAL/CLOSED	449,126.75
"94" Project Series:				
94-1: Structural Analysis of New England Subbase Materials and Structures		110,057.38	FINAL/CLOSED	339,069.37
94-2: Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques		224,901.80	FINAL/CLOSED	114,167.57
Member Obligations 1996 = 6 X \$75,000	450,000.00			564,167.57
Coord./Admin. of NETC: Calendar Year 1996; Bdgt. = \$75,000		69,123.85	FINAL	495,043.72
Member Allocations 1997 = 6 X \$75,000	450,000.00			945,043.72
Coord./Admin. of NETC: Calendar Year 1997; Bdgt. = \$82,494		77,244.35	FINAL	867,799.37
"94" Project Series:				
94-3: Procedures for The Evaluation of Sheet Membrane Waterproofing Note: Project administered by VAOT under TPF Project No. SPR-3		67,002.00	FINAL/CLOSED	800,797.37
94-4: Durability of Concrete Crack Repair Systems		72,036.04	FINAL/TERM.	728,761.33
"96" Project Series:				
96-1: SUPERPAVE Implementation		60,139.25	FINAL/CLOSED	668,622.08
96-2: Optimizing GPS Use in Transportation Projects		27,008.81	FINAL/TERM.	641,613.27
96-3: Effectiveness of Fiber Reinforced Composites as Protective Coverings for Bridge Elements, etc.		135,000.00	FINAL/CLOSED	506,613.27
T2 (per 12/2/97 Adv. Committee Mtg.) for 1998 = \$10,000		9,551.06	FINAL	497,062.21
Coord./Admin. of NETC: Calendar Year 1998; Bdgt = \$73,021		80,422.65	FINAL	416,639.56
Refund Check (No. 15-663337), for CY '98 Management of NETC, from UConn OSP; Ref. 7/19/00 letter to J. Sime from J. Devereux, UConn OSP	336.00			416,975.56
Member Obligations 1998 = 6 X \$75,000	450,000.00			866,975.56
"97" Project Series:				
97-1: A Portable Method for Determining Chloride Concentration on Roadway Pavements	Phase 1	96,669.50	FINAL/CLOSED	770,306.06
	Phase 2	90,667.79	FINAL/CLOSED	679,638.27
97-2: Performance Evaluation & Economic Analysis of Durability Enhancing Admixtures, etc.		108,318.73	FINAL/CLOSED	571,319.54
97-3: Determining Properties, Standards & Performance of Wood Waste Compost, etc.:	Phase 1	27,779.64	FINAL/CLOSED	543,539.90
	Phase 2	16,074.30	FINAL/CLOSED	527,465.60
Alloc. to ConnDOT for Constr. Costs of Test Site (Approved 1/21/99 Ballot)		10,700.00		516,765.60
97-4: Early Distress of Open-Graded Friction Course		57,495.71	FINAL/CLOSED	459,269.89
Travel Tech. Comm. (Aug. 98 tel. poll) for 1998 = \$5,000		0.00		459,269.89

D.2 NETC FUND BALANCE				
As of December 31, 2010				
(Cont'd)				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
Member Obligations 1999 = 6 X \$75,000	450,000.00			909,269.89
Coord./Admin. of NETC: Calendar Year 1999:				909,269.89
- Administration = \$77,666				
-Technology Transfer & Technical Committee				
Travel = \$20,400				
-Total = \$98,066		79,101.20	FINAL	830,168.69
"99" Project Series:				
99-1: Bridge Rail Transitions		240,000.00	FINAL/CLOSED	590,168.69
99-2: Evaluation of Asphaltic Expansion Joints		62,234.76	FINAL/CLOSED	527,933.93
99-3: Bridge Scour Monitoring Systems		78,523.32	FINAL/CLOSED	449,410.61
99-4: Quantifying Roadside Rest Area Usage		44,857.00	FINAL/CLOSED	404,553.61
99-6: The Effects of Concrete Removal Operations on Adjacent Concrete That Is to Remain		96,008.36	FINAL/CLOSED	308,545.25
Member Obligations 2000 = 6 X \$100,000	600,000.00			908,545.25
Coord./Admin. of NETC: Calendar Year 2000:		91,899.37	FINAL	816,645.88
- Administration = \$ 85,788				
- Technology Transfer & Technical Committee				
Travel = \$ 16,800				
- Total = \$102,588				
"00" Project Series:				816,645.88
00-1: Ground-Based Imaging and Data Acquisition Systems for Roadway Inventories in New England - A Synthesis of Practice		31,251.92	FINAL/CLOSED	785,393.96
00-2: Evaluation of Permeability of Superpave Mixes		95,499.16	FINAL/CLOSED	689,894.80
00-3: Composite Reinforced Timber Guard Rail - Phase I: Design, Fabrication and Testing		81,989.38	FINAL/CLOSED	607,905.42
00-4: Falling Weight Deflectometer Study		100,000.00	FINAL/CLOSED	507,905.42
00-5: Guard Rail Testing - Modified eccentric Loading Terminal at NCHRP 350 TL2		61,287.00	FINAL/CLOSED	446,618.42
00-6: Implementation of Visualization Technologies to Create Simplified Presentations Within Highway agencies to be Used at Public Hearings		74,914.49	FINAL/CLOSED	371,703.93
00-7: A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn't		45,369.45	FINAL/CLOSED	326,334.48
00-8: Performance and Effectiveness of A Thin Pavement Section Using Geogrids and Drainage geocomposites in A Cold Region		150,000.00	FINAL/CLOSED	176,334.48
Member Obligations 2001 = 6 X \$100,000	600,000.00			776,334.48
Coord./Admin. of NETC: Calendar Year 2001:		104,385.35	FINAL	671,949.13
- Administration = \$89,448				
- Technology Transfer & Technical Committee				
Travel = \$16,800				
- Total = \$106,248				
"01" Project Series:				
01-1: Advanced Composite Materials for New England's Transportation Infrastructure		47,559.27	FINAL/CLOSED	624,389.86
01-1: Advanced Composite Materials for New England's Transportation Infrastructure - Technology Transfer Phase I		25,286.18	FINAL/CLOSED	599,103.68
01-2: Development of A Testing Protocol for Quality Control/Quality Assurance of Hot Mix Asphalt		80,000.00	FINAL/CLOSED	519,103.68
01-3: Design of Superpave HMA for Low Volume Roads		120,324.15	FINAL/CLOSED	398,779.53
01-6: Field Evaluation of A New Compaction Device		49,944.50	FINAL/CLOSED	348,835.03
Member Obligations 2002 = 6 X \$100,000	600,000.00			948,835.03
NY DOT Obligation = \$52,500	52,500.00			1,001,335.03
Coord./Admin. Of NETC: Calendar Year 2002		109,207.12	FINAL	892,127.91

D.2 NETC FUND BALANCE				
As of December 31, 2010				
(Cont'd)				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
"02" Project Series:				
02-1: Relating Hot Mix Asphalt Pavement Density to Performance		103,260.73	FINAL/CLOSED	788,867.18
02-2: Formulate Approach for 511 Implementation in New England Phase 1		48,158.19	FINAL/CLOSED	740,708.99
02-2: Formulate Approach for 511 Implementation in New England Phase 2		32,813.16	FINAL/CLOSED	707,895.83
02-3: Establish Subgrade Support Values (Mr) for Typical Soils in New England		79,936.86	FINAL/CLOSED	627,958.97
02-5: Determination of Moisture Content of De-Icing Salt at Point of Delivery		19,679.99	FINAL ² /CLOSED	608,278.98
02-6 : Sealing of Expansion Joints - Phase 1		74,982.81	FINAL/CLOSED	533,296.17
02-7: Calibrating Traffic Simulation Models to Inclement Weather Conditions with Applications to Arterial Coordinated Signal Systems		74,037.57	FINAL/CLOSED	459,258.60
02-8: Intelligent Transportation Systems Applications to Ski Resorts in New England		54,724.71	FINAL/CLOSED	404,533.89
Member Obligations 2003 = 6 X \$100,000	600,000.00			1,004,533.89
NY DOT Obligation = \$40,000	40,000.00			1,044,533.89
Coord./Admin. Of NETC Calendar Year 2003 = \$124,258		118,855.19	FINAL	925,678.70
"03" Project Series:				
03-1: Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff		70,690.16	FINAL/CLOSED	854,988.54
03-2: Field Studies of Concrete Containing Salts of An Alkenyl-Substituted Succinic Acid		133,385.33	FINAL/CLOSED	721,603.21
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New England		20,682.70	FINAL/CLOSED	700,920.51
03-3: Feasibility Study and Design of An Erosion Control Laboratory in New England Phase 2		13,135.80	FINAL/CLOSED	687,784.71
03-4: Measuring Pollutant Removal Efficiencies of Storm Water Treatment Units		80,000.00	FINAL/CLOSED	607,784.71
03-5: Evaluation of Field Permeameter As A Longitudinal Joint Quality Control Indicator		77,318.43	FINAL/CLOSED	530,466.28
03-6: Fix It First: Utilizing the Seismic Property Analyzer & MMLS to Develop Guidelines for the Use of Polymer Modified Thin Lift HMA vs. Surface Treatments		99,927.00		430,539.28
03-7 (Alt.): Basalt Fiber Reinforced Polymer Composites		64,092.29	FINAL/CLOSED	366,446.99
Member Obligations 2004 = 6 X \$100,000	600,000.00			966,446.99
NY DOT Obligation = \$52,000	52,000.00			1,018,446.99
Coord./Admin. Of NETC Calendar Year 2004 = \$126,559		113,012.87	FINAL	905,434.12
"04" Project Series:				
04-1: Recycling Asphalt Pavements Containing Modified Binders - Phase I		27,166.58	FINAL	878,267.54
04-1: Recycling Asphalt Pavements Containing Modified Binders - Phase II		82,751.00		795,516.54
04-2: Driver-Eye-Movement-Based Investigation for Improving Work Zone Safety		70,387.66	FINAL/CLOSED	725,128.88
04-3: Estimating the Magnitude of Peak Flows For Steep Gradient Streams in New England		120,003.49	FINAL	605,125.39
04-4: Determining the Effective PG Grade of Binder in RAP Mixes		130,876.00	FINAL/CLOSED	474,249.39
04-5: Network-Based Highway Crash Prediction Using Geographic Information Systems		129,020.04	FINAL/CLOSED	345,229.35
Member Obligations 2005 = 6 x \$100,000	600,000.00			945,229.35
NY DOT Obligation = \$50,000	50,000.00			995,229.35
Coord./Admin. Of NETC Calendar Year 2005 = \$130,528		128,934.25	FINAL	866,295.10
"05" Project Series:				
05-1: Develop Base Resistance Load-Displacement Curves for The Design of Drilled Shaft Rock Sockets		100,000.00		766,295.10
05-2 Enhancing the Reflectivity of Concrete Barriers Phase 1		48,090.00		718,205.10
05-2: Enhancing the Reflectivity of Concrete Barriers, Phase 2: Full-Scale Barrier Selection & Evaluation		72,000.00		646,205.10
05-3: Analysis of Roundabout Operational Characteristics Utilizing Microscopic Simulation Modeling		75,000.00		571,205.10
05-5: Measurement of Work of Adhesion Between Paint and Metalized/Galvanized Steel		125,000.00		446,205.10

D.2 NETC FUND BALANCE				
As of December 31, 2010				
(Cont'd)				
ITEM	OBLIGATION	ENCUMB/ EXPEND.	INVOICE	CUM. BALANCE
05-6: Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension		59,990.74	FINAL	386,214.36
05-7: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways Phase I		92,000.36	FINAL	294,214.00
05-7: Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways Phase II		7,431.26	FINAL/CLOSED	286,782.74
05-8: Evaluation of Alternative Traffic Simulation Models, Including CA4PRS for Analysis of Traffic Impacts of Highway Construction, Reconstruction and Rehabilitation		99,677.22	FINAL/CLOSED	187,105.52
Member Obligations 2006 = 5 x \$100,000 (no ME DOT allocation)	500,000.00			687,105.52
Note: Maine 2006 Obligation as of 11/06/06 per Peabody 11/30/06 email	100,000.00			787,105.52
Coord./Admin. Of NETC Calendar Year 2006 = 131,814		100,718.92	FINAL	686,386.60
"06" Project Series:				
06-1: New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide With Level 2 & 3 Input		150,295.00		536,091.60
06-2: Infrastructure Management Systems Enhancement and Integration to Support True Integrated Management Decision-Making				536,091.60
<i>Note : Project dropped at June 30 2010 Adv. Comm. Mtg.</i>				
06-3 Establish Default Dynamic Modulus Values for New England		110,000.00		426,091.60
06-4 Preventative Maintenance and Timing of Applications		200,000.00		226,091.60
06-5 Winter Severity Indices for New England		73,639.62	FINAL/CLOSED	152,451.98
<i>Note : Project terminated at June 30 Adv. Comm. Mtg.</i>				
Member Obligations 2007 = 600,000	600,000.00			752,451.98
Coord./Admin. Of NETC Calendar Year 2007 = 136,061		122,644.79	FINAL	629,807.19
"07" Project Series:				
07-1 In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations		150,000.00		479,807.19
07-2 Exploring the Potential of Intelligent Intersections Deployment in New England		100,000.00		379,807.19
07-3 Determining Optimum Distance for a Lane Drop Downstream from a Signalized Intersection		100,000.00		279,807.19
07-4 Reliable Travel Time Estimation to Support Real-Time System Management Information. <i>Note : Project dropped at June 30, 2010 Adv. Comm. Mtg.</i>				279,807.19
Member Obligations 2008 = 600,000	600,000.00			879,807.19
NY DOT Obligation (72,000+8,000)	80,000.00			959,807.19
Coord./Admin. Of NETC Calendar Year 2008 = 134,998		131,509.90	FINAL	828,297.29
08-2 Evacuation Modeling to Assist Hazard Management and Response in Urban and Rural Areas of New England		160,000.00		668,297.29
08-3 Best Management Practices for the Invasive Polygonum Cuspidatum (Japanese Knotweed) Along Transportation Corridors		140,000.00		528,297.29
08-4 NETC Research Implementation Survey & Synthesis (Rev. from \$35,000 to \$60,000 NETC Adv. Comm. Mtg 5/21/09)		60,000.00		468,297.29
08-5 NETC/UVM-UTC Transportation Research Challenge: Commute Rideshare, etc.		50,000.00		418,297.29
02-6 Phase II Sealing of Small Mvmt Bridge Expan Joints - Field Inst. & Mntrng		75,000.00		343,297.29
08-6 (Alt.) Interaction Between Salinity, Soil Quality and Amendments in Roadside Plantings		75,000.00		268,297.29
Member Obligations 2009 = 600,000	600,000.00			868,297.29
NYSDOT Obligation	50,000.00			918,297.29
Coord./Admin. Of NETC Calendar Year 2009 (Approved) = 139,309		131,157.45	FINAL	787,139.84
08-1 Applying the Highway Safety Manual in New England		120,000.00		667,139.84
09-1 Active Structural Control of Cantilevered Support Structures:				
Phase 1		150,000.00		517,139.84
Phase 2		100,000.00		417,139.84
09-2 Effective Establishment of Native Grasses on Roadsides		90,000.00		327,139.84
09-3 Advanced Composite Materials: Prototype Development and Demonstration		48,847.00	See Note 3	278,292.84

D.2 NETC FUND BALANCE				
As of December 31, 2010				
(Cont'd)				
		ENCUMB/		CUM.
ITEM	OBLIGATION	EXPEND.	INVOICE	BALANCE
Member Obligations 2010 = 600,000	600,000.00			878,292.84
NYSDOT Obligation	50,000.00			928,292.84
Coord./Admin. Of NETC Calendar Year 2010 (Approved) = 134,809		134,809.00		793,483.84
10-1 A Field Evaluation of SuperPave Hot Mix Asphalt Pavement Containing 30% RAP		180,000.00		613,483.84
10-2 Synthesis of Practice: Electronic Bridge Inspection Document Management Systems		70,000.00		543,483.84
10-3 Field Evaluation of Corrosion Protection on Bridges with A Spray Application of Disodium Tetrapropenyl Succinate (DSS)		100,000.00		443,483.84
10-4 Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology		150,000.00		293,483.84
Notes:				
1 = Member FFY allocations are obligated between October 1 and December 31				
2 = A credit of \$6,599.70 for NETC's overpayment to UConn for CY 2004 NETC Management was applied, by UConn, to the 'Indirect Cost' for project 02-5. Therefore although the total expenditures of the project were \$26,279.69 the amount paid by NETC was \$19,679.99				
3 = Per minutes of NETC Adv. Comm. Mtg. 5/12/08: "It was agreed that since the encumbered amount for NETC 05-7 was incorrectly shown in the Fund Balance Report (April 30, 2008) as \$70,000 and the correct amount is \$100,000, the amount of funding to be allocated for the third ranked problem statement for the FFY 09 research program (NETC 09-3) would be set at the amount of the revised unencumbered fund balance remaining (at that time) after the allocation of funds for NETC 09-1 and NETC 09-2, i.e., \$48,847."				

E. REPORTS, PAPERS AND PRESENTATIONS

E.1 POLICIES AND PROCEDURES:

- “Policies and Procedures, New England Transportation Consortium,” July 1995.
- “Policies and Procedures, New England Transportation Consortium,” April 2002.

E.2 ANNUAL REPORTS:

- “Annual Report For Calendar Year 1995,” March 1996, NETCR3
- “Annual Report For Calendar Year 1996,” January 1997, NETCR4
- “Annual Report For Calendar Year 1997,” January 1998, NETCR9
- “Annual Report For Calendar Year 1998,” January 1999, NETCR10
- “Annual Report For Calendar Year 1999,” January 2000, NETCR21
- “Annual Report For Calendar Year 2000,” August 2001, NETCR27
- “Annual Report For Calendar Year 2001,” December 2002, NETCR40
- “Annual Report For Calendar Year 2002,” November 2003, NETCR41
- “Annual Report For Calendar Year 2003,” September 2005, NETCR55
- “Annual Report For Calendar Year 2004,” December 2005, NETCR59
- “Annual Report For Calendar Year 2005,” August 2006, NETCR61
- “Annual Report For Calendar Year 2006,” April 2007, NETCR68
- “Annual Report For Calendar Year 2007,” February 2008, NETCR70
- “Annual Report For Calendar Year 2008,” April 2009, NETCR75
- “Annual Report For Calendar Year 2009,” April 2009, NETCR79

E.3 REPORTS, PAPERS, AND PRESENTATIONS 1988-1994:

- “The Development of a Common Regional System for Issuing Permits for Oversize and Overweight Trucks Engaged in Interstate Travel,” Humphrey, T.F., May 1986.
- “Agreement to Implement a Common Set of Procedures for Issuing Permits for Nondivisible Oversize and Overweight Trucks Engaged in Interstate Travel,” The New England Transportation Consortium, October 1988.
- “The New England Transportation Consortium, Round One Activities,” Humphrey, T.F., and Maser, K.R., MIT, December 1988.
- “New Technology for Bridge Deck Assessment - Phase I Final Report,” Vols. I and II, Maser, Kenneth R., MIT Center for Transportation Studies, October 1989.
- “Handbook for Use by the Trucking Industry to Implement The NETC Common Truck Permit Procedures for Certain Nondivisible Oversize/Overweight Vehicles Traveling on State Highways,” MIT Center for Transportation Studies, January 1989.
- “Bridge Rail Design and Crash Worthiness - Final Report,” Elgaaly, M., Dagher, H., and Kulendran, S., University of Maine, May 1989.

E.3 NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1994 (cont'd):

“New England Transportation Consortium, Operational Procedures,” Humphrey, T.F., November 1991.

“Wetlands: Problem & Issues,” Shuldiner, P.W., University of Massachusetts, August 1990.

“Development of a Uniform Truck Management System,” Vols. I and II, Lee, K.W., and McEwen, E.E., University of Rhode Island. July 1990.

“A Study of STAA Truck Safety In New England - Phases I & II,” MIT, November 1991.

“New Technology for Bridge Deck Assessment - Phase II Final Report,” MIT, May 1990.

“Rail Service In New England,” Martland, C.P. Little, and Alvaro, A.E., MIT Center for Transportation Studies, April 1992.

“CMA Degradation and Trace Metals in Roadside Soil,” Ostendorf, D.W., Palaia, T.A., and Zutell, C.A., University of Massachusetts, March 1993.

“Tire Chips as Lightweight Backfill for Retaining Walls - Phase I,” Humphrey, D., Sandford, T.C., Cribbs, M.M., Gharegrat, H.G., and Manion, W.P., University of Maine, August 1992.

“Cooperative Regional Transportation Research Programs Underway in New England,” Humphrey, T.F., and Sussman, J.M., International Congress on Technology and Technology Exchange, June 1989.

“Uniformity Efforts in Oversize/Overweight Permits,” Humphrey, T.F., NCHRP Synthesis, No. 143, Transportation Research Board, 1988.

“Implementation of a Uniform Truck Permit System by the New England Transportation Consortium,” Humphrey, T.F., AASHTO 1987 Annual Meeting Proceedings, pp. 84-90, 1987.

“Advantages of Oversize/Overweight Truck Permit Uniformity,” AASHTO 1990 Annual Meeting Proceedings, pp. 83-85, 1990.

“Crash Worthiness of Bridge Rails,” Dagher, H., Elgaaly, M., and Kulendran, S., Proceedings, Fourth Rail Bridge Centenary Conference, Heriot-Watt University, Edinburgh, Scotland, August 1990.

E.3 NETC REPORTS, PAPERS, AND PRESENTATIONS 1988-1994 (cont'd):

“Principles of Radar and Thermography for Bridge Deck Assessment,” Maser, R., and Roddis, W.M.K., ASCE Journal of Transportation Engineering, Vol. 116, No. 5, Sept./Oct. 1990.

“Regional Rail Planning In New England,” Martland, C.P. Little, and Alvaro, A.E., MIT, August 1993. (Accepted for publication 1994)

“CMA Degradation in Roadside Soil: Acetate Microcosms,” Ostendorf, D.W., Pollock, S.J., De Cheke, M.E., and Palaia, T.A., Transportation Research Record, No. 1366, pp. 41-43, 1992.

“Aerobic Degradation of CMA in Roadside Soils: Field Simulations from Soil Microcosms,” Ostendorf, D.W., Pollock, S.J., De Cheke, M.E., and Palaia, T.A., Journal of Environmental Quality, Vol. 22, pp. 229-304, 1993.

“Shear Strength and Compressibility of Tire Chips for Use as Retaining Wall Backfill,” Humphrey, D.N., Sandford, T.C., Cribbs, M.M., and Manion, W.P., Transportation Research Record No. 1422, pp. 29-35, Transportation Research Board, National Research Council Washington, D.C., 1993.

“Tire Chips as Lightweight Subgrade Fill and Retaining Wall Backfill,” Humphrey, D.N., and Sandford, T.C., Proceedings of the Symposium on Recovery and Effective Reuse of Discarded Materials and By-Products for Construction of Highway Facilities, pp. 5-87 to 5-99, Federal Highway Administration, Washington, D.C., 1993.

E.4 REPORTS, PAPERS AND PRESENTATIONS 1995-2010:

Project No. Title

N/A Construction Costs Of New England Bridges

Reports:

“Construction Costs of New England Bridges,” Alexander, J.A., Dagher, H. and James, S., November 1996, NETCR1.

Papers and Presentations:

“Construction Costs of New England Bridges,” Alexander, J., Dagher, H. and James, S. Presented at the Annual Maine Transportation Conference, December 7, 1995.

**N/A Tire Chips As Lightweight Backfill For Retaining Walls, Phase II:
Full-Scale Testing**

Reports:

“Tire Chips As Lightweight Backfill For Retaining Walls - Phase II,” Tweedie, Jeffrey J., Humphrey, Dana N., and Sandford, T.C., March 11, 1998, NETCR8.

Papers and Presentations:

“Tire Shreds as Lightweight Retaining Wall Backfill-Active Conditions,” Humphrey, D. Submitted for publication in the ASCE Journal of Geotechnical and Geoenvironmental Engineering.

“Civil Engineering Uses for Tire Chips,” Humphrey D.N. A six-hour short course presented to the Nebraska Department of Environmental Quality, the Maine Dept. of Transportation, the Texas Engineering Extension Service, the Manitoba Tire Stewardship Board, the Alberta Tire Recycling Management Board, and the Arkansas Department of Pollution Control and Ecology.

“Tire Chips as Lightweight Subgrade and Retaining Wall Backfill,” by Humphrey, D.N. and Sandford, T.C. Symposium on Recovery and Effective Reuse of Discarded Materials and By-Products for Construction of Highway Facilities, FHWA, Denver, Colorado, October 19-22, 1993.

“Use of Tire Chips as Subgrade Insulation and as Lightweight Fill for Highway Construction,” Humphrey, D.N. Presented at the 18th Annual Meeting of the Asphalt Recycling and Reclaiming Association, Pompano Beach, Florida, February 23-26, 1994.

“Use of Tire Chips in Highway Construction,” Humphrey, D.N. Presented to the New England Environmental Expo, Boston, Massachusetts, May 9, 1995.

N/A

**Tire Chips As Lightweight Backfill For Retaining Walls, Phase II:
Full-Scale Testing (cont'd):**

Papers and Presentations (cont'd):

“Use of Tire Chips in Highway Construction,” Humphrey, D.N. Presented to the AASHTO Region 1 RAC Meeting, Portland, Maine, May 23, 1995.

“Tire Chips for Highway Construction,” Humphrey, D.N. Presented to the Northeast Recycling Council in Sturbridge, Massachusetts on December 8, 1995.

“Tire Chips: A New Road Building Geomaterial,” Humphrey, D. Presented at the Conference on Waste and Recycled Materials in the Transportation Infrastructure, held in conjunction with the 75th Annual Meeting of the Transportation Research Board, January 7, 1996.

“Use of Tire Chips in Civil Engineering.” Presented at the 76th Annual Meeting of the Rubber Association of Canada, March 7, 1996.

“Civil Engineering Uses for Scrap Tires,” Humphrey, D. Presented at Scrap Tire '96 held in Chicago, Illinois on August 16, 1996.

“Full Scale Field Trials of Tire Chips as Lightweight Retaining Wall Backfill-At Rest Conditions,” Tweedie, J.J., Humphrey, D.N., and Sandford, T.C., Transportation Research Board No. 1619, Transportation Research Board, Washington, D.C., p. 64-71, 1998.

“Tire Shreds as Retaining Wall Backfill, Active Conditions,” Tweedie, J.J., Humphrey, D.N., and Sandford, T.C, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 124, No. 11, Nov., pp.1061-1070, 1998.

“Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short course presented in each of the six New England States, 1998.

“Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short course presented to the RI DOT, April 1999.

N/A

**New England Vehicle Classification And Truck Weight Program,
Phase I**

Reports:

“New England Vehicle Classification and Truck Weight Program, Technical Report No. 1: Toward the Development of a Vehicle Classification Program for New England,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T., and Shuldiner, P., April 1996.

N/A

**New England Vehicle Classification And Truck Weight Program,
Phase I (cont'd):**

Reports (cont'd):

“New England Vehicle Classification and Truck Weight Program, Technical Report No. 2: Toward the Development of a Truck Weight Program for New England,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T., and Shuldiner, P., April 1996.

“New England Vehicle Classification and Truck Weight Program, Technical Report No. 3: Supplemental Analysis of Truck Weight Data Collection at SHRP Continuous Count Stations,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T., and Shuldiner, P., April 1996.

“New England Vehicle Classification and Truck Weight Program, Phase I,” Collura, J., Chan, D., Evans, E., Kelly, S., Hosmer, T. and Shuldiner, P., April 1996, NETCR2.

“An Analysis of Vehicle Class and Truck Weight Patterns in New England,” Collura, J. and Orloski, F. Presented at the 1994 National Traffic Data Acquisition Conference, Rocky Hill, Connecticut, September 18-22, 1994.

“New England Vehicle Classification and Truck Weight Program,” Collura, J. and Orloski, F. Presented to the Transportation Research Board's Highway Traffic Monitoring Committee, Annual Meeting of the Transportation Research Board, Washington, D.C., January 1995.

Papers and Presentations: None

N/A

Bridge Rail Crash Test, Phase II: Sidewalk-Mounted Rail

Reports:

“NETC 2-Bar Curb-Mounted Bridge Rail Design - Plans and Specifications.” Revised January 1997.

“NETC 4-Bar Sidewalk-Mounted Bridge Rail Design - Plans and Specifications.” January 1997.

“Crash Testing and Evaluation of the NETC 2-Bar Curb-Mounted Bridge Rail,” Mak, K.K., and Menges, W.L., February 1998, NETCR10.

“Full-Scale Crash Evaluation of the NETC 4-Bar Sidewalk Steel Bridge Railing,” Kimball, C.E., and Mayer, J.B., March 1999, NETCR14.

Papers and Presentations: None

Structural Analysis Of New England Subbase Materials And StructuresReports:

“Structural Analysis of New England Subbase Materials and Structures,”
Lee, K.W., Huston, M.T., Davis, J., Vajjhalla, S., June 30, 2001,
NETCR26.

Papers and Presentations:

“Structural Analysis of New England Subbase Materials and Structures,”
Davis, J. Presented at the Rhode Island Transportation and Civil
Engineering Forum, Kingston, Rhode Island, October 23, 1996.

“Structural Analysis of New England Subbase Materials and Structures.”
Presented at the Northeast Graduate Student Symposium on Applied
Mechanics, University of Rhode Island, April 26, 1997.

“Structural Analysis of New England Subbase Materials and Structures.”
Presented at the Rhode Island Transportation and Civil Engineering
Forum, University of Rhode Island, October 15, 1997.

“Structural Analysis of New England Subbase Materials and Structures,”
Davis, J., Huston, M., and Lee, K.W. Presented at the 1998 Annual
Transportation Research Board Meeting.

“Structural Properties of New England Subbase Materials of Flexible
Pavements.” Presented at the 5th International Conference on the Bearing
Capacity of Roads and Airfields, July 8, 1998.

“Structural Properties of New England Subbase Materials of Flexible
Pavements.” Presented at the 5th International Conference on the Bearing
Capacity of Roads and Airfields on July 8, 1998.

“Characterization of Subbase Materials of Flexible Pavements With and
Without Reclaimed Asphalt Pavement,” Lee, K.W., Davis, J., and
Vajjhalla, S. Presented at the 1999 World Congress for Korean Scientists
and Engineers, July 7, 1999.

“Characterization of Subbase Materials of Flexible Pavements With and
Without Reclaimed Asphalt Pavement,” Lee, K.W., Davis, J. and
Vajjhalla, S. Presented at the 12th Rhode Island Transportation Forum,
University of Rhode Island, October 15, 1999.

94-2 Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques

Reports:

“Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques,” Huston, D., Fuhr, P., Maser, K. and Weedon, W., July 1, 2002, NETCR 19.

Papers and Presentations:

“Bridge Deck Structural Monitoring Techniques,” Huston, D. Presented at the New England State Materials Engineer Association Conference, Burlington, Vermont, October 9, 1996.

“Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Maser, K., Weedon, W., Fuhr, P.L., and Adam, C., Structural Health Monitoring, Chang F., Editor, Technomic Publishing, pp. 91-109, Proceedings of the International Workshop on Structural Health Monitoring, Stanford, California, September 1997.

“Ground Penetrating Radar for Nondestructive Evaluation of Concrete Bridge Decks,” Adam, C., M.S. Thesis, Department of Mechanical Engineering University of Vermont, September 1997.

“Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Master, K., Hu, J.Q., Weedon, W., and Adam, C., Proceedings of the GPR '98 7th International Conference on Ground-Penetrating Radar, The University of Kansas, Lawrence, KS, May 27-30, 1998.

“Bridge Deck Evaluation with Ground Penetrating Radar,” Huston, D., Hu, J.Q, Pelczarski, N, and Esser, B., Proceedings Second International Conference on Structural Health Monitoring, Stanford University, September 1999.

“GIMA Antenna Design for Ground Penetrating Radar in Concrete NDE Application,” Hu J.Q., Huston, D. and Fuhr, P. SPIE paper 3670-63, SPIE Conference On Sensory Phenomena and Measurement Instrumentation for Smart Structures and Materials, Newport Beach, CA, March 1999.

“Ground Penetrating Radar for Concrete Bridge Health Monitoring Applications,” Huston, D, Hu, J.Q., Maser, K., Weedon, W., and Adam, C. SPIE 3587-23, Proceedings SPIE NDE Techniques for Aging Infrastructure and Manufacturing, Newport Beach, CA, March 1999.

“Electromagnetic Interrogation of Structures,” Huston, D. Fourth Army Research Office on Smart Structures, State College, PA, August 1999.

Nondestructive Testing of Reinforced Concrete Bridges Using Radar Imaging Techniques (cont'd):Papers and Presentations (cont'd):

“GIMA Ground Penetrating Radar System For Infrastructure Health Monitoring,” Huston, D.R., Hu, J.Q, Maser, K., Weedon, W., and Adam, C. Journal of Applied Geophysics 43, 2000, pp. 39-146.

“Good Impedance Match Antenna (GIMA) Design and Its Applications for Ground Penetrating Radar In Concrete Structures NDE Applications,” Hu, J. M.S. Thesis, Department of Mechanical Engineering, University of Vermont, March, 2000.

“Damage Assessment in Roadways with Ground Penetrating Radar,” Huston, D., Pelczarski, N., Esser, B., Maser, K., and Weedon, W. SPIE Conference on Nondestructive Evaluation and Health Monitoring of Aging Infrastructure, 3995A-55, Newport Beach CA, March 2000.

“Damage Detection in Roadways with Ground Penetrating Radar,” Huston, D.R., Pelczarski, N., Esser, B., and Master, K. GPR 2000, 8th International Conference on Ground Penetrating Radar," Gold Coast, Australia, May 2000.

“Wireless Inspection of Structures Aided by Robots,” Huston D.R., Pelczarski N., Esser B., Gaida G., Arms S. and Townsend C. SPIE Symposium on NDE for Health Monitoring and Diagnostics, 4337-24, Newport Beach CA, March 2001.

“Inspection of Bridge Columns and Retaining Walls with Electromagnetic Waves,” Huston D.R., Pelczarski N., and Key C. SPIE Symposium on Smart Systems for Bridges, Structures, and Highways, 4330-09, Newport Beach, CA, March 2001.

“Wireless Electromagnetic Interrogation of Structures,” Huston D., Pelczarski N., Fuhr P., Arms S., and Esser B. (Tentatively accepted) Smart Materials and Structures, April 2001.

“Adaptive Sensors and Sensor Networks for Structural Health Monitoring,” Huston D. SPIE 4512-24, Symposium on Complex Adaptive Structures, Hutchinson Island, FL, June 2001.

- 94-3 Procedures For The Evaluation Of Sheet Membrane Waterproofing:**
Reports:
“Procedures for the Evaluation Sheet Membrane Waterproofing,”
Korhonen, C.J., Buska, J.S., Cortez, Edel R., and Greatorex, Alan R.,
August 1999, NETCR13.
- Papers and Presentations: None
- 94-4 Durability Of Concrete Crack Repair Systems:**
Reports: None
- Papers and Presentations:
“Durability of Concrete Crack Repair, Projects,” Robinson, J. Presented at
the University of Rhode Island Graduate Seminar Series, Kingston, RI,
November 19, 1997.
- “Durability of Concrete Crack Repair System,” Tsiatas, G. and Robinson,
J. Presentation to representatives of the Chemical Grouting Division of
Kajima Corporation (Japan), University of Rhode Island, College of
Engineering, October 26, 1999.
- 95-1 Use Of Tire Chip/Soil Mixtures To Limit Frost Heave And Pavement
Damage Of Paved Road**
Reports:
“Use of Tire Chip/Soil Mixtures to Limit Frost Heave and Pavement
Damage of Paved Roads,” Brian, K.L., and Humphrey, D. N., June 2000,
NETCR12.
- Papers and Presentations:
“Laboratory and Field Measurement of the Thermal Conductivity of Tire
Chips for Use as Subgrade Insulation,” Humphrey, D., Chen, L.H. and
Eaton, R. A paper submitted to the Transportation Research Board for
presentation at the session on “Properties of Unconventional Aggregates”
at the Annual Meeting of the Transportation Research Board, Washington,
D.C., January 1997.
- “Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short
course presented in each of the six New England States, 1998.
- “Highway Applications of Tire Shreds,” Humphrey, D. A 7-hour short
course presented to the RI DOT, April 1999.
- “Field Trial of Tire Shreds as Insulation for Paved Roads,” Humphrey, D.,
Chen, L.H., Lawrence, B. A paper presented at the 10th International
Conference on Cold Regions Engineering: Putting Research into Practice,
held in Hanover, NH, August 16-19, 1999.

- 95-2 Suitability Of Non-Hydric Soils For Wetland Mitigation**
Reports:
“Suitability of Non-Hydric Soils for Wetland Mitigation,” Brannaka, L.K. and Evans, C.V., February 28, 1997, NETCR5.

Papers and Presentations: None
- 95-3 Implementation And Evaluation Of Traffic Marking Recesses For Application of Thermo-Plastic Markings On Modified Open Graded Mixes**
Reports:
“Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Friction Course,” Lee, K.W., Cardi, S.A., and Corrigan, S., July 2000, NETCR23.

Papers and Presentations:
“Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open Graded Mixes,” Lee, K.W. Presented at the Rhode Island Transportation and Civil Engineering Forum, Kingston, Rhode Island, October 23, 1996.

“Implementation and Evaluation of Traffic Marking Recesses for Application of Thermoplastic Pavement Markings on Modified Open-Graded Mixes,” Lee, K.W. Presented at the Rhode Island Transportation and Civil Engineering Forum, University of Rhode Island, October 15, 1997.
- 95-5 Buried Joints In Short Span Bridges**
Reports: None

Papers and Presentations:
“State of the Art Study of Bridge Joint Systems in New England,” Tsiatas, and Chandrasekaran, S. Submitted for presentation at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1997.
- 95-6 Guidelines For Ride Quality Acceptance Of Pavements**
Reports:
“Guidelines for Ride Quality Acceptance of Pavements,” Collura, J., El-Korchi, T., Black K., Chase, M. and Li, J., April 1997, NETCR 6.

Papers and Presentations: None

96-1

Implementation of Superpave

Reports:

“Superpave Implementation,” Mahoney, James, Stephens, Jack E., September 1999, NETCR18.

96-3

Effectiveness Of Fiber Reinforced Composite As Structural And Protective Coverings For Bridge Elements Exposed To Deicing Salt Chlorides

Reports:

“Effectiveness of High Strength Composites as Structural and Protective Coatings for Structural Elements,” Balaguru, P., and Lee, K.W., May 2001, NETCR28.

Papers and Presentations:

“Inorganic Matrices for Composites,” NSF Workshop on Composites, Hanover, NH, March 15, 1998.

“Behavior of Geopolymer Reinforced with Various Types of Fabrics,” SAMPE 1998, Anaheim, CA, May 1998.

“Use of Ferrocement Theory for Analysis of High Strength Composites,” Ferrocement VI, Ann Arbor, MI, June 1998.

“Advances in Composites,” National University of Singapore, July 19, 1998.

“Effectiveness of Fiber Reinforced Composites as Structural and Protective Covering Bridge Elements Exposed to Deicing-Salt Chlorides,” Visiting Scholar Lecture, Transportation Forum, University of Rhode Island, October 15, 1999.

“Advanced High Strength Fiber Composites,” U.S.-Germany Workshop, Maiz, Germany, May 16-19, 1999.

“Recent Advances in Fiber Composites,” Seminar Series, University Catalauna, Spain, June 28, 1999.

“Inorganic Coatings for Transportation Infrastructures,” Geopolymer Conference, St. Quentin, France, July 2, 1999.

“State-of-the-Art: Fiber Reinforced Concrete,” NSF Faculty Workshop, Northwestern University, Evanston, IL, July 21, 1999.

“Recent Advances in High Strength Composites and Applications for Repair and Rehabilitation,” 6th International Conference on Structural Failure, Durability, and Retrofitting, Singapore, September 15, 2000.

- 96-3 Effectiveness Of Fiber Reinforced Composite As Structural And Protective Coverings For Bridge Elements Exposed To Deicing Salt Chlorides (cont'd):**
Papers and Presentations (cont'd):
“Durability of Carbon Composites Made With Inorganic Matrix,” Garon, R., and Balaguru, P., "SAMPE", November 2000, pp. 34-43.

“Inorganic Matrix - High Strength Fiber Composites,” University of Missouri, Rolla, July 27, 2000.

“Comparison of Inorganic and Organic Matrices for Strengthening of Reinforced Concrete Beams,” Kurtz, S., and Balaguru, P., Journal of Structural Engineering ASCE, V 127, January 2001, pp. 35-42.

“Durability of High Strength Composite Repairs under Scaling Conditions,” Garon, R., and Balaguru, P., Proceedings of Third International Conference on Concrete Under Severe Conditions, Vancouver, Canada, June 2001.
- 97-1 A Portable Method To Determine Chloride Concentration On Roadway Pavements**
Reports:
“A Portable Method to Determine Chloride Concentration on Roadway Pavements,” Garrick, N., Nikolaidis, N., P. and Luo, J, September 2002, NETCR17.

Papers and Presentations: None
- 97-2 Performance Evaluation And Economic Analysis Of Combinations Of Durability Enhancing Admixtures (Mineral And Chemical) In Structural Concrete For The Northeast U.S.A**
Reports:
“Performance Evaluation and Economic Analysis of Combinations of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete for the Northeast U.S.A.,” Civjan, S.A., LaFave, J.M., Lovett, D., Sund, D.J., Trybulski, J., February 2003, NETCR 36.

Papers and Presentations:
“Performance Evaluation of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete,” Sund, D., Report in Partial Fulfillment of Master of Science in Civil Engineering Degree, Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, September, 1999.

97-2 Performance Evaluation And Economic Analysis Of Combinations Of Durability Enhancing Admixtures (Mineral And Chemical) In Structural Concrete For The Northeast U.S.A (cont'd):

Papers and Presentations:

“On the Use of Combinations of Durability Enhancing Admixtures (Mineral and Chemical) in Structural Concrete,” Lafave, J.M., Lovett, D., and Civjan, S.A., ACI Fall Convention, Toronto, Ontario, Canada, October 15-21, 2000.

“Performance Evaluation of Combinations of Durability Enhancing Admixtures in Concrete - Review and Experimental Program,” Report in Partial Fulfillment of Master of Science in Civil Engineering Degree, Lovette, D., Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, February, 2001.

97-3 Determining Properties, Standards And Performance Of Wood Material As An Erosion Control Mulch And As A Filter Berm

Reports:

“Performance Specifications for Wood Waste Materials as an Erosion Control Mulch and as a Filter Berm,” Demars, K.R., Long, R.P., Ives, J.R. April 2000, NETCR20.

Papers and Presentations:

“Compost Applications for Erosion Control: New and Improved Methods,” K. Demars. Presented at the Conference on ‘Putting Compost in the Specs: Practical Applications for Erosion Control’, Wrentham Development Center, Wrentham, MA, October 8, 2002.

97-4 Early Distress Of Open-Graded Friction Course (OGFC)

Reports:

“Early Distress in Open-Graded Friction Course,” Stephens, J.E., Mahoney, J., Dougan, C.E., July 1999, NETCR16.

Papers and Presentations: None

99-1 Bridge Rail Transitions – Development and Crash Testing

Reports:

Design documents for the NETC 2-Bar Curb-Mounted and 4-Bar Sidewalk-Mounted Bridge Rail Transitions are available from the NETC Coordinator.

“NCHRP Report 350 Testing and Evaluation of NETC Bridge Rail Transitions,” Dean C. Alberson, C. Eugene Buth, Wanda L. Menges, and Rebecca R. Haug, Texas Transportation Institute, Texas A&M University, January 2006, NETCR 53.

- 99-1 Bridge Rail Transitions – Development and Crash Testing (cont’d):**
Papers and Presentations:
“NETC Bridge Rail Transitions,” by Dean C. Alberson and Wanda L. Menges, Concord, New Hampshire, December 13, 2005.

“Summary of NCHRP Report 350,” by Dean C. Alberson, Concord, New Hampshire, December 13, 2005.
- 99-2 Evaluation of Asphaltic Expansion Joints**
Reports:
“Evaluation of Asphaltic Expansion Joints,” Mogawer, W.S., November 2004, NETCR 50.

Papers and Presentations: None
- 99-3 Development Of Priority Based Statewide Scour Monitoring Systems In New England**
Reports:
“Development of Priority Based Statewide Scour Monitoring Systems in New England,” Ho, C.T., Di Stasi, J.M., August 2, 2001, NETCR24.

“Real-Time Bridge Scour Assessment and Warning,” Di Stasi, J.M. and Ho, C.L., Proceedings of International Symposium: Technical Committee No. 33 on Scour of Foundations. Melbourne, Australia, pp. 337-352.

Papers and Presentations: None
- 99-4 Quantifying Roadside Rest Area Usage**
Reports:
“Quantifying Roadside Rest Area Usage,” Garder, P. and Bosonetto, N., November 27, 2002, NETCR 38.

Papers and Presentations:
Results from the rest-area research were included in a presentation by the PI: “The Efficacy and Use of Continuous Shoulder Rumble Strips: Engineering a Solution,” presented at the November 20-21, 2002 National Summit to Prevent Drowsy Driving, National Academy of Sciences, Washington, DC, November 21, 2002 (taped by C-SPAN. Summit also covered by CNN Live Today, CNN Live on Location, CBS Early Show, National Public Radio’s Market Place, and national radio network coverage by ABC, CBS, and AP as well as two stories by nationally syndicated health columnist Jane Brody of The New York Times).

- 99-6 Analytical and Experimental Investigation Of The Effects Of Concrete Removal Operations On Adjacent Concrete That Is To Remain**
- Reports:
 “Analytical and Experimental Investigation of the Effects of Concrete Removal Operations on Adjacent Concrete That is to Remain,” Masih, R., Wang, T. and Forbes, A., January 15, 2002, NETCR 29.
- Papers and Presentations:
 “Enhancing the Students' Learning Process Through Interaction Project Between Academia and Industry.” Presented and published in the Abstract of ASEE 2000 at the University of Massachusetts, Lowell, April 2000.
- “The Effect of Powerful Demolition Equipment on the Remaining Part of the Concrete Bridge,” Masih, R. Presented and published in the proceedings of the Second International Conference on Computational Methods for Smart Structures and Material. Madrid, June 2000.
- “Effect of Demolition on Remaining Part of Concrete Bridge, Numerical Analysis Vs. Experimental Results.” Presented and published in the proceedings of Internationales Kolloquium uber die Anwedungen der Informatik in Architektur und Bauwesen, Germany, June 2000
- “The Effect of Bridge Rehabilitation on the Remaining Structural Parts.” Presented and published in the proceedings of the ASCE conference at Stanford University, August 2000.
- 00-1 Ground-Based Imaging And Data Acquisition Systems For Roadway Inventories In New England - A Synthesis Of Practice**
- Reports:
 “Ground-Based Image and Data Acquisition Systems for Roadway Inventories in New England – A Synthesis of Highway Practice,” Hancock, K. and Degray, J., August 2002, NETCR 30.
- Papers and Presentations: None

- 00-2 Evaluation Of Permeability Of Superpave Mixes**
Reports:
“Evaluation of Permeability of Superpave Mixes,” Mogawer, W., Mallick, R., Teto, M. and Crockford, C., July 3, 2002, NETCR34.
- Papers and Presentations:
“An Alternative Approach to Determination of Bulk Specific Gravity and Permeability of Hot Mix Asphalt (HMA),” Bhattacharjee, S., Mallick, R. and Mogawer, W. Submitted to International Journal of Pavement Engineering.
- A Presentation, by W. Mogawer, to the Northeast Asphalt User Producer Group Meeting, October 18, 2001, Albany, New York.
- 00-3 Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail**
Reports:
“Design, Fabrication and Preliminary Testing of a Composite Reinforced Timber Guardrail,” Davids, W., Botting, J., March 31, 2004, NETCR 39.
- Papers and Presentations: None
- 00-4 Portable Falling Weight Deflectometer Study**
Reports:
“Portable Falling Weight Deflectometer Study,” Steinert, B., Humphrey, D., Kestler, M., March 11, 2005, NETCR52.
- Papers and Presentations: None
- 00-5 Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2**
Reports:
“Guardrail Testing Modified Eccentric Loader Terminal (MELT) at NCHRP 350 TL-2,” Alberson, D., Menges, W. and Haug, R., July 2002, NETCR35.
- Papers and Presentations:
Dean Alberson, Texas Transportation Institute, Principal Investigator presented the results of the crash tests conducted on the MELT guardrail terminal to the Association of General Contractors/American Road Transportation Builders Association/American Association of State Highway Transportation Officials Task Force 13 meeting in Seattle, Washington, April 2002.

- 00-6 Effective Visualization Techniques for the Public Presentation of Transportation**
Reports:
“Effective Visualization Techniques for the Public Presentation of Transportation Projects,” Luo, J., MS Thesis, University of Connecticut, August 2002.

“Effective Visualization Techniques for the Public Presentation of Transportation Projects,” Garrick, N.W., Minutti, P., Westa, M., Luo, J., Bishop, M., July 2005, NETCR 48.

Papers and Presentations: None
- 00-7 A Complete Review of Incident Detection Algorithms and Their Deployment: What Works and What Doesn’t**
Reports:
“A Complete Review of Incident Detection Algorithms & Their Deployment: What Works and What Doesn’t,” Parkany, E., Xie C., February 7, 2005, NETCR 37.

Papers and Presentations:
“Use of Driver-Based Data for Incident Detection,” Parkany, Emily, Submitted to the 7th International Conference on Applications of Advanced Technologies in Transportation Engineering (AATT), Boston, August 2002.
- 00-8 Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region**
Reports:
“Performance and Effectiveness of a Thin Pavement Section Using Geogrids and Drainage Geocomposites in a Cold Region,” Helstrom, C.L., Humphrey, D.N., and Labbe, J.M., August 2007, NETCR60.

Papers and Presentations:
“Geogrid Reinforced Pavement Structure in a Cold Region,” Helstrom, C.L., Humphrey, D.N., and Hayden, S.A., Proceedings of the 13th International Conference on Cold Regions Engineering, ASCE, Orono, Maine, 12 pp., 2006

- 01-1 Advanced Composite Materials for New England’s Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice**
Reports:
“Advanced Composite Materials for New England’s Transportation Infrastructure: A Study for Implementation and Synthesis of Technology and Practice,” Breña, S.F., Civjan, S.A., and Goodchild, M., May 2006, NETCR62.

Papers and Presentations: None
- 01-1 Advanced Composite Materials in New England's Transportation T2 Phase I Infrastructure - Technology Transfer Phase 1: Selection of Prototype**
Reports:
“Advanced Composite Materials in New England’s Transportation Infrastructure – Technology Transfer Phase 1: Selection of Prototype,” Breña, S.F., and Civjan, S.A., November 1, 2009, NETCR77.

Papers and Presentations: None
- 01-2 Development of a Testing Protocol for QC/QA of Hot Mix Asphalt**
Reports:
“Development of a Testing Protocol for QC/QA of Hot Mix Asphalt (HMA),” Mogawer, W.S., Mallick, R., February 5, 2004, NETCR 43.

Papers and Presentations:
“An Evaluation of Use of Rapid Triaxial Test In Quality Control of Hot Mix Asphalt (HMA),” Mogawer, W. S., Presented at the 82nd Annual Meeting of the Transportation Research Board, January 12-16, 2003, Washington DC.
- 01-3 Design of Superpave HMA for Low Volume Roads**
Reports:
“Design of Superpave HMA for Low Volume Roads,” Mogawer, W.S., Mallick, R., December 31, 2004, NETCR 51.

Papers and Presentations:
“Development of Mix Design Criteria for Low Traffic Volume Hot Mix Asphalt Roads,” Nanagiri, Y.V., Mallick, R., Mogawer, W.S. Proceedings of the Annual Meeting of the Canadian Technical Asphalt Association, November 2003.

- 01-6 Field Evaluation of a New Compaction Monitoring Device**
Reports:
“Field Evaluations of A New Compaction Monitoring Device,” Miller, H.J., June 26, 2003, NETCR 42.

Papers and Presentations: None
- 02-1 Relating Hot Mix Asphalt Pavement Density to Performance**
Reports:
“Relating Hot Mix Asphalt Pavement Density to Performance,” Mogawer, W.S., Daniel, J.S., and Austerman, A.J., April 1, 2010, NETCR76.

Papers and Presentations:
“Evaluation of the Effects of HMA Density on Mixture Fatigue and Rutting Performance,” Mogawer, W.S., Northeast Asphalt User/Producer Group (NEAUPG) Annual Meeting, South Portland, Maine, October 8, 2009.

“Evaluation of the Effects of Hot Mix Asphalt Density on Mixture Fatigue Performance, Rutting Performance and MEPDG Distress Predictions,” Mogawer, W.S., Austerman, A.J., Daniel, J.S., Fujie, Z., and Bennert, T., International Journal of Pavement Engineering, 2011.
- 02-2 Formulate Approach for 511 Implementation in New England**
Reports:
“Formulate Approach for 511 Implementation in New England,” Shuldiner, P., Loane, G., and Knapick, R., October 2005, NETCR44.

Papers and Presentations: None
- 02-3 Establish Subgrade Support Values for Typical Soils in New England**
Reports:
“Establish Subgrade Support Values for Typical Subs in New England,” Malla, R. B., and Joshi, S., April 2006, NETCR57.

Papers and Presentations:
“Resilient Modulus Prediction Models for Some New England Subgrade Soils,” Malla, R. and Joshi, S., Electronic Proceedings of the 2005 Joint ASCE/ASME/SES Conference on Mechanics and Materials (McMat 2005), Baton Rouge, LA, June 1-3, 2005.

“Resilient Modulus of Subgrade Soils A-1-b, A-3, and A-7-6 using LTPP Data: Prediction Models with Experimental Verification,” Joshi, Shraddha, and Malla, R., Proceedings, ASCE GeoCongress 2006, (Atlanta, GA, Feb. 26-March 01, 2006), ASCE, Reston, VA; Feb. 2006, 6p (CD ROM).

02-5

Determination of Moisture Content of Deicing Salt at Point of Delivery

Reports:

“Determination of Moisture Content of Deicing Salt at Point of Delivery,” Long, R., Demars, K., March 2004, NETCR 45.

Papers and Presentations: None

02-6

Sealing of Small Movement Bridge Expansion Joints

Reports:

“Sealing of Small Movement Bridge Expansion Joints,” Malla, R.B., Shaw, M.T., Shrestha, M.R. and Boob, S., June 2006, NETCR58.

Papers and Presentations:

“Silicone Foam Sealant for Bridge Expansion Joints,” Malla R. B., Shaw M. T., Shrestha M. R., Boob S., McMat 2005 Mechanics and Materials Conference Baton Rouge, Louisiana, June 1-3, 2005.

“Experimental Evaluation of Mechanical characteristics of Silicone Foam Sealant for Bridge Expansion Joints,” Malla R. B., Shaw M. T., Shrestha M. R., Boob S., 2005 Society for Experimental Mechanics Annual Conference Portland, Oregon, June 7-9, 2005.

“Development and Experimental Evaluation of Silicone Foam Sealant For Small Bridge Expansion Joints,” Matu Shrestha, M.S. Thesis, Dept. of Civil & Environmental Engineering, University of Connecticut, Storrs, CT, September 2005.

“Laboratory Evaluation of Weathering and Freeze-Thaw Effects on Silicone Foam Bridge Joint Sealant,” Shrestha, M.R., Malla, R.B., Boob, S. and Shaw, M.T., Paper #369, Proceedings, SEM 2006 Annual Conference and Exposition (St. Louis, MO, June 04-07, 2006), SEM, Bethel, CT, June 2006, 8p (CD ROM).

“Development and Laboratory Analysis of Silicone Foam Sealant for Bridge Expansion Joints,” Malla, R., Shaw, M., Shrestha, M., and Brijmohan, S., Journal of Bridge Engineering, ASCE, Reston, VA, July 2006.

02-6 Phase 2 Sealing of Small Movement Bridge Expansion Joints - Phase II: Field Demonstration and Monitoring

Reports: None

Papers and Presentations:

“Laboratory Evaluation of a Silicone Foam Sealant for Field Application of Bridge Expansion Joints,” Malla, R.B., Swanson, B., and Shaw M.T., Proceedings of the 2010 SEM Annual Conference & Exposition, SEM, Bethel, CT, 12 pages, June 2010.

"Development and Installation of Foam Sealant for Small Movement Bridge Expansion Joints,” Malla, R.B., Swanson, B., and Shaw M.T., Poster presentation to the Proceedings, 27th Annual International Bridge Conference, Pittsburgh, PA, June 6-9, 2010.

“Laboratory Evaluation, Field Application, and Monitoring of a Silicone Foam Sealant Bonded to Various Bridge Expansion Joint Headers,” Swanson, Brian, M.S. Thesis, University of Connecticut, Storrs, CT., December 29, 2010, 127 Pages.

02-7 Validating Traffic Simulation Models to Inclement Weather Travel Conditions with Applications to Arterial Coordinated Signal Systems

Reports:

“Validating Traffic Simulation Models to Inclement Weather Travel Conditions with Applications to Arterial Coordinated Signal Systems,” Sadek, A., El-Dessouki, W., November 2004, NETCR 47.

Papers and Presentations:

“Inclement Weather and Traffic Flow at Signalized Intersections: A Case Study from Northern New England,” Agbolosu-Amison, S.J., Sadek, A.W., and El-Dessouki, W., (2003). Tentatively accepted for publication in the Journal of the Transportation Research Board.

“Impact of Inclement Weather on Traffic Signal Operations in New England,” Agbolosu-Amison, S.J., Sadek, A.W., (2003). Presented to the Vermont Chapter of the Institute of Transportation Engineers, Montpelier, Vermont.

“Inclement Weather and Traffic Flow at Signalized Intersections: A Case Study from Northern New England,” Agbolosu-Amison, S.J., Sadek, A.W., and El-Dessouki, W., (2003). Presented at the 83rd Annual Transportation Research Board Meeting, Washington, D.C.

02-8 Intelligent Transportation Systems Applications to Ski Resorts in New England

Reports:

“Intelligent Transportation Systems Applications to Ski Resorts in New England,” Sadek, A., March 2004, NETCR 46.

Papers and Presentations:

“Addressing Ski Resort Transportation Problems with Intelligent Transportation Systems Applications,” Knapick, R.J., and Sadek, A.W., (2003). Abstract submitted to the Institute of Transportation Engineers District One Meeting, Burlington, VT.

03-1 Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff

Reports:

“Ability of Wood Fiber Materials to Attenuate Heavy Metals Associated with Highway Runoff”, MacKay, A.A., July 16, 2008, NETCR65.

Papers and Presentations: None

03-2 Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid

Reports:

“Field Studies of Concrete Containing Salts of an Alkenyl-Substituted Succinic Acid,” Civjan, Scott A., and Crellin, Benjamin, June 30, 2008, NETCR73.

Papers and Presentations:

“Hycrete – DSS An Innovative Admixture for Concrete: An Update on NETC 03-2,” Civjan, Scott A., and Crellin, Benjamin, 16th Annual NE Materials and Research Meeting Concord, NH. June 7, 2005.

“Hycrete Concretes: An Update on NETC 03-2,” Civjan, Scott A., and Crellin, Benjamin, Connecticut DOT, November 2, 2005.

“A New Admixture to Mitigate Corrosion Problems,” Civjan, S.A., and Crellin, B.J., Concrete International, Volume 28, No. 8, Pp. 78-82.

03-3 Phase 1 Feasibility Study of an Erosion Control Laboratory in New England

Reports:

“Feasibility Study of an Erosion Control Laboratory in New England,” Long, R.P., and Demars, K.R., December 2004, NETCR 49.

Papers and Presentations: None

03-3 Phase 2 Design Considerations for a Prototype Erosion Control Laboratory in New England

Reports:

“Design Considerations for a Prototype Erosion Control Testing Plot,” Long, R.P., and Demars, K.R., December 2005, NETCR 56.

Papers and Presentations: None

03-4 Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units

Reports:

“Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units,” Zhang, X., September 27, 2005, NETCR54.

Papers and Presentations:

“Evaluation of Pathogenic Indicator Bacteria in Structural BMPs,” Zhang, X. and Lulla, M., to be published in the Journal of Environmental Science and Health, Volume A41 (November 2006).

“Distribution of Pathogenic Indicator Bacteria in Structural BMPs,” Zhang, X. and Lulla, M. to be published in the Journal of Environmental Science and Health, Volume A41 (August 2006).

03-5 Evaluation of a Field Permeameter as a Longitudinal Joint Quality Indicator

Reports:

“Evaluation of a Field Permeameter as a Longitudinal Joint Quality Indicator”, Daniel, J.S., Mallick, R.B., and Mogawer, W.S., April 20, 2007, NETCR64.

Papers and Presentations:

“Development of a Longitudinal Joint Permeameter as a QC/QA Tool for HMA Pavements,” Daniel, J.S., a Presentation to the Petersen Asphalt Research Conference, Cheyenne, WY, June 2005.

“Longitudinal Joint Permeameter: New Non-Destructive Pavement Joint Test,” Daniel, J.S., a Presentation to the North East Asphalt User/Producer Group Meeting, Burlington, VT, October 2005.

“Longitudinal Joint Permeameter: Non-Destructive Test for QC,” Daniel, J.S., a presentation to PennDOT Bituminous Technician Certification Program, March 14, 2006.

“Development and Evaluation of a Field Permeameter as a Longitudinal Joint Quality Indicator,” Mallick, R.B., and Daniel, J.S., International Journal of Pavement Engineering, Vol. 7, No. 1, March 2006. pp. 11-21.

03-7**Basalt Fiber Reinforced Polymer Composites**Reports:

“Basalt Fiber Reinforced Polymer Composites,” Parnas, R., Shaw, M., and Liu, Q., August 2007, NETCR63.

Papers and Presentations:

“Preliminary Investigation of Basalt Fiber Composite Properties for Applications in Transportation,” Liu, Q., Shaw, M.T., Parnas, R.S., McDonnell, A., Transportation Research Board Annual Meeting, January 2005, Washington, D.C., Paper 05-1117, Session 487.

“Investigation of Basalt Fiber Composite Mechanical Properties for Applications in Transportation,” Q. Liu, M.T. Shaw, R.S. Parnas and A.M. McDonnell, Polymer Composites, 27(1), 41-48, 2006.

“Investigation of Basalt Fiber Composite Aging Behavior for Applications in Transportation,” Q. Liu, M. T. Shaw, R. S. Parnas, A.M. McDonnell, Polymer Composites.

“Basalt Fiber Reinforced Polymer Composites,” Q. Liu, R.S. Parnas, M.T. Shaw, A.M. McDonnell, SAMPE, Seattle, WA, November 2005.

“New Set-up for Permeability Measurement,” Q. Liu, R.S. Parnas, SAMPE, Seattle, WA, November 2005.

04-1 Phase2 Recycling Asphalt Pavements Containing Modified Binders - Phase 2Reports: NonePapers and Presentations:

“Laboratory Evaluation of HMA Containing RAP and PMB,” Zofka A., Bernier A., Mahoney J., and Zinke S., presented at NEAUPG Annual Meeting Poster Session, October 6-7, 2010, Saratoga, New York.

“Laboratory Evaluation of HMA Containing RAP and PMB,” Zofka A., Bernier A., Mahoney J., and Zinke S., presented at ASCE 1st T&DI Green Streets & Highways Conference Poster Session, November 14-17, 2010, Denver, Colorado.

Driver-Eye-Movement-Based Investigation for Improving Work-Zone SafetyReports:

“Driver-Eye-Movement-Based Investigation for Improving Work-Zone Safety,” Fisher, D.L., Knodler, M., and Muttart, J., January 28, 2009, NETCR71.

Papers and Presentations:

“Human Factors: Understanding & Evaluating Driver Response,” Muttart, J.W., Anne Arundel County Police Special Operations Building, Sponsored by the Maryland Association of Traffic Accident Investigators, Hanover, MD. March 20 - 23, 2006.

“Understanding and Quantifying Driver Response,” Muttart, J.W., Texas Association of Accident Reconstructionist Specials, Houston, TX, February 17 & 18, 2006.

“Using Event Data Recorder Information for Driver Response Research and Intelligent Transportation Systems in Rear End Collision,” Muttart, J.W., CDR Users Conference, Dallas, TX. February 13, 2006.

“Human Factors: Understanding & Evaluating Driver Response,” Muttart, J.W., Canadian Association of Traffic Accident Investigators & Reconstructionists, Fredericton, NB, Canada. July 10 - 13, 2006.

“Driving Simulator Evaluation of Situational Awareness during Hands-Free Communication,” Muttart, J.W., New England Institute of Transportation Engineers Technology Day, Amherst, MA. July 20, 2006.

“Accounting for Moderate Driver Distractions in Work Zones,” Muttart, J.W., Factors, Formulae, Forensic, Technology, & Training Conference, Houston, TX. September 17, 2006.

“Driving Simulator Evaluation of Driver Performance during Hands-Free Cell Phone Operation in a Work Zone: Driving without a Clue,” Muttart, J., Fisher, D. L., and Pollatsek, A., (January 2007), Presentation given at the 86th Transportation Research Board Annual Meeting, TRB, National Research Council, Washington, D.C.

“Driving Simulator Evaluation of Driver Performance during Hands-Free Cell Phone Operation in a Work Zone: Driving without a Clue”, Muttart, J., Fisher, D. L., Knodler, M. and Pollatsek, A., (2007), Transportation Research Record, 2018, pp 9-14.

04-3 Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England

Reports:

“Estimating the Magnitude of Peak Flows for Steep Gradient Streams in New England,” Jacobs, J., November 17, 2010, NETCR81.

Papers and Presentations:

2006 Maine Water Conference, Augusta, ME, March 22, 2006, Poster presentation.

04-4 Determining the Effective PG Grade of Binder in RAP Mixes

Reports:

“Determining the Effective PG Grade of Binder in RAP Mixes,” Daniel, J.S. and Mogawer, W.S., January 2010, NETCR78.

Papers and Presentations: None

04-5 Network-Based Highway Crash Prediction Using Geographic Information Systems

Reports:

“Network-Based Highway Crash Prediction Using Geographic Information Systems,” Ivan, J.N., Gårder, P.E., Bindra, S., Jonsson, B.T., Shin, H., Deng, Z., June 2007, NETCR67.

Papers and Presentations:

“A Procedure for Allocating Zonal Attributes to a Link Network in a GIS Environment,” Jonsson, T., Deng, Z., Ivan, J.N., presented at 85th TRB Annual meeting, Jan. 2006, Paper No.: 06-2561.

“Using Land Use Data to Estimate Exposure for Improving Road Accident Prediction,” Jonsson, T., Ivan, J.N., Zhang, C., presented at 32nd Annual Traffic Records Forum, Palm Desert CA, Aug. 3, 2006.

05-5 Measurement of Adhesion Properties Between Topcoat Paint and Metalized/Galvanized Steel with Surface Energy Measurement Equipment

Reports: None

Papers and Presentations:

“Measurement of Adhesion Properties Between Topcoat Paint and Metalized / Galvanized Steel With Surface Energy Measurement Equipment,” Paper # CET-25, Yang, S.C., Lee, K.W., Lu, C., and Mirville, M., Presented at the US-Korea Conference on Science, Technology, and Entrepreneurship (UKC2010), Seattle, Washington, August 14, 2010.

05-6 Employing Graphic-Aided Dynamic Message Signs to Assist Elder Drivers' Message Comprehension

Reports:

“Employing Graphic-Aided DMS to Assist Elder Drivers' Message Comprehension,” Wang, J.H. and Clark, A. Y., December 30, 2010, NETCR82.

Papers and Presentations:

“Improving Elder Drivers Comprehension of Dynamic Message through a Human Factors Study,” Clark, A., Wang, J.H., Maier-Sperdelozzi, V., and Collyer, C., Proceedings of the 12th International Conference on Industrial Engineering – Theory, Application, and Practice, p.747-753, 2007.

“Assisting Elder Drivers' Comprehension of Dynamic Message Signs,” Clark, A.T., Wang, J.H., Maier-Sperdelozzi, V., and Collyer, C.E., Proceedings of the 87th Annual Meeting of Transportation Research Board, Paper No. 08-2276, p.1-16, CD-ROM, 2008.

“Age Effect on Driver Comprehension of Messages Displayed on Dynamic Message Signs,” Wang, J.H., Clark, A. Y., and Maier-Sperdelozzi, V., Proceedings of IIE Research Conference, Paper No. 307, p.1-6, CD-ROM, 2008.

05-7 Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways

Reports:

“Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways,” Ivan, J.N., Sadek, A.W., Hongmei, Z., and Surang, R., February 12, 2009, NETCR72.

Papers and Presentations:

“A Decision Support System for Predicting the likely Benefits of Left-turn Lane Installation,” Ranade, S., Sadek, A.W. and Ivan, J., 2007, TRB Annual meeting, Paper No. 07-0992; January 2007; Transportation Research Record, 2023:28-36, 2007. This paper received the Best Paper Award from the Committee on Operational Effects of Geometrics at the 2008 Annual Meeting.

“Safety Effects of Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways,” Zhou, H., Ivan, J. and Sadek, A., Transportation Research Board Annual Meeting; Paper No. 09-2000, Washington, DC, Jan. 2009.

05-8 Evaluation and Implementation of Traffic Simulation Models for Work Zones

Reports:

“Evaluation and Implementation of Traffic Simulation Models for Work Zones,” Collura, J., June 18, 2010, NETCR80.

Papers and Presentations:

“Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies: Case Studies Along Interstate Highways in Massachusetts and Rhode Island,” Moriarty, K.D., Collura, J., Knodler Jr., M.A., Daiheng, N., and Heaslip, K., Paper presented at the TRB Annual Meeting in January 2008.

“Using Simulation Models to Assess the Impacts of Highway Work Zone Strategies,” Collura, J., Heaslip, K., Moriarty, K., Wu, F., Khanta, R., and Berthaume, A., Paper presented at the TRB Annual Meeting in January 2010.

06-1 New England Verification of NCHRP 1-37A Mechanistic-Empirical Pavement Design Guide with Level 2 & 3 Inputs

Reports: None

Papers and Presentations:

“Sensitivity of MEPDG Level 2 and 3 Inputs using Statistical Analysis Techniques for New England States,” Ayyala, D., Chehab, G. R., and Daniel, J. S., accepted for publication in the Transportation Research Record 2010.

“Sensitivity of RAP Binder Grade on Performance Predictions in the MEPDG,” Daniel, J. S., Cehab, G. R., and Ayyala, D., Journal of the Association of Asphalt Pavement Technologists, Vol. 78, 2009, pp. 352-376.

“Sensitivity of RAP Binder Grade on Performance Predictions in the MEPDG,” Presentation by Jo Sias Daniel to the Association of Asphalt Paving Technologists Annual Meeting, March 2009.