



Non-Destructive Testing in Pavements, Bridges, and Geotechnical Engineering Seminar

January 21, 2010

In attendance

Herbert Wiggenhauser, *BAM (Federal Institute for Materials Research and Testing)*
William Lohr, *Team Leader, FHWA Minnesota Division Office*
Thomas Yu, *FHWA Office of Pavement Technology, Pavement Programs Engineer*
Lev Khazonovich, *University of Minnesota Department of Civil Engineering*
Kyle Hoegh, *University of Minnesota Department of Civil Engineering*
Dan Dorgan, *Director, Mn/DOT Office of Bridges and Structures*
Keith Shannon, *Director, Mn/DOT Office of Materials and Road Research*
Tim Worke, *Association of General Contractors of Minnesota*
Todd Neimann, *Mn/DOT Office of Bridges and Structures*
Joe Labuz, *University of Minnesota Department of Civil Engineering*
Roberto Ballerini, *University of Minnesota Department of Civil Engineering*
Derrell Turner, *Division Administrator, FHWA Minnesota Division Office*
Bernie Arseneau, *Mn/DOT Division Director, Policy, Safety and Strategic Initiatives*
Ben Worel, *Mn/DOT Office of Materials and Road Research, Research*
Shongtao Dai, *Mn/DOT Office of Materials and Road Research, Research*
Beth Lauzon, *Mn/DOT Office of Materials and Road Research, Geology*
Glenn Engstrom, *Mn/DOT Office of Materials and Road Research, Geotech*
Duane Green, *Mn/DOT Metro, Bridge Maintenance*

NDT Program at BAM

Presented by Dr. Wiggenhauser

- Bridge Testing
- Tendon Ducts, Concrete
- Impulse Echo, Ultrasonic, Radar
- Bridge Under mount Scanner
- Developing Robotic device
 - Measure moisture, corrosion, thickness, bar locations, cover, delamination using ultrasonic, radar, microwave, electro-chemical potential
 - Full scale investigations before and after repair
 - Changing scope for use on bridge decks
 - Developed by a partnership with research institutes and private companies
- Software for data interpretation, fusion, visualization. Challenge has been how to handle the data from various technologies. They are making great progress. Demonstrated their ability to fuse data to provide users a more informative picture of the results. Are working to make this a web application.
- BAM is part of the SHRP2 project (R06A) for nondestructive testing to identify concrete bridge deterioration <http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2558>. BAM has an older bridge that was dismantled and moved to their facility (for use in testing various technologies).
- Additional information on other BAM initiatives can be found on the website http://www.bam.de/en/kompetenzen/fachabteilungen/abteilung_8/fg81/index.htm

FHWA Activities in NDT

Presented by Thomas Yu

- Pavement perspective
- NDT group at Turner-Fairbanks focuses on Structures
- Implementing existing market-ready technology
 - Surface Characteristics – Bob Orthmeyer
 - Pavement structure evaluation – Tom
 - Rehab Design
 - Construction QA
 - Performance monitoring
 - Step frequency GPR
 - Mira 2000
 - Rolling Deflection
- Next Steps – areas for further development:
 - Collaborate with states to test SF GPR
 - Warp and Curl study (MnROAD potential)
 - Evaluate Bridge Deck Delaminations

University of Minnesota NDT Activities

Presented by Dr. Lev Khazanovich

Have been focusing on techniques/technologies that are feasible for implementation but need field verification.

- MIT scan
 - Dowel location and orientation
 - QA for construction
- MIRA
 - Automated data analysis developed for reinforcement cover in concrete pavements
 - Evaluating use on asphalt pavements for air voids, debonding, joint density, and thickness
 - Other potential uses for bridge decks
- Acoustic Emission
- Seismic Wave – for underground cavities
- University of Minnesota Department of Mechanical Engineering – developing sensors that run on vibration (no batteries)
- Area of Need/ Future development
 - Coordinate and create focus on NDT
 - Data Fusion
 - Verification of results – potentially add bridges to MnROAD

Structural Metals

Presented by Todd Neimann, Mn/DOT Bridges Office

- Use visual inspection for welds on steel
- Fabrication plant use radiography, ultrasonic
 - Trained and certified in ultrasonic, not simple.
 - Section loss, corrosion, anchorages (lighting poles), pins
- Looking at medical industry developments: digital radiography
- National effort- phased array ultrasonic
 - Some states are evaluating
- Ultrasonic impact treatment (Russian technology)
 - High frequency for fatigue
 - Letting a contract to evaluate ability to smooth impact of weld defects
 - Loss of thickness in gusset plates (don't have to remove paint)
- U of Mn report on bridge monitoring
 - Will be installing on a target fracture critical tied arch bridge using acoustic emission technology
- Eddy current technologies for crack detection
 - Do not use because most are able to be seen
 - Mag. Particle to supplement, easy to transport

Bridge Maintenance

Presented by Duane Green, Mn/DOT Metro District

Major focus on bridge deck delamination

- Chain drag decks now
 - Traffic control is major issue and cost to public
 - Perform on one lane and extrapolate
- Request for proposals for GPR and IR
 - Top and bottom of deck
 - 45 mph for GPR
 - 5-10 mph for IR
 - 12' width

Issues and Needs

- Top and Bottom of deck delamination, corrosion
 - University of Missouri has a IR with handheld camera
 - Is weather sensitive
 - Want something quick for less traffic disruption and from the top (some bridges high and difficult to get to underside)
- Deck Construction
 - Pavers move steel
 - Cover not adequate
 - Shortens life of deck

Mn/DOT use of GPR and FWD

Presented by Dr. Shongtao Dai, Mn/DOT Road Research

Issues and Needs

- Ability to quickly and more thoroughly evaluate pavements as they are being constructed (i.e. QC and QA) to prevent problems, and for evaluation of existing pavements for identifying problem areas and best solutions. We currently use the following for performance measures on construction contracts for pavements:
 - HMA: density, air voids, thickness, percent AC/film thickness
 - PCC: thickness, air voids, strength, water/cement ratio
 - Unbound: stiffness, moisture, density, gradation
 - Long term performance measures/issues
 - HMA: cracking, raveling, stripping, rutting
 - PCC: cracking, joint deterioration,
 - Aggregate base: moisture,
- Improved data visualization
- Integration of data (GPR, FWD, pavement management)
- Electro Resistivity
 - Refinement of models
 - Combine ER, Sonic and GPR data