Updates from the States: Georgia (October 2014)

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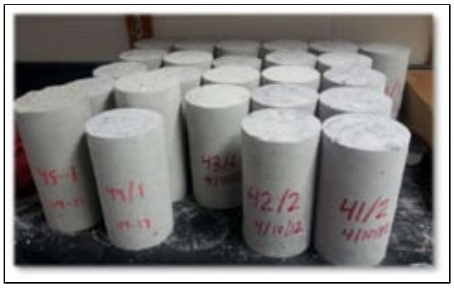
GDOT's research program is aligned with our strategic goals and is a needs-based internally driven program. The program is developed and implemented through the Research Technical Advisory Group (RTAG) process with the assistance and guidance of the Office of Research. GDOT Research Advisory Committee (RAC) sets the direction and priorities for the research program. GDOT RAC is headed by the Chief Engineer as Chair and the Director of Organizational Performance Management as Vice Chair. The State Research Engineer is the Secretary. Division Directors from across the department are members.

GDOT's four Research Technical Advisory Groups are Policy/Workforce, Safety, Asset Management, and Mobility. The RTAGs are composed of a cross-section of members appointed by the office heads or division directors in GDOT, along with a number of GDOT friends that are interested in research. Each RTAG has a secretary from the Office of Research.

RTAG members develop and select the research to be performed by GDOT. The Office of Research facilitates this effort by assisting the chairs of the RTAGs in conducting two meetings a year (May/June and Nov/Dec) and coordinating efforts with the Georgia Transportation Institute or a private consultant selected to perform the work. Research Engineers (RE) in the Office of Research are the Research Project Managers for all research projects, and can also act as the principal investigators on smaller internal research projects.

Recently Completed Research

Determination of Coefficient of Thermal Expansion for Portland Cement Concrete Pavements for MEPDG Implementation



The Coefficient of Thermal Expansion (CTE) is an important parameter in PCC pavement design and is an extremely sensitive input in the Mechanistic-Empirical Pavement Design Guide (MEPDG). Because of this, Georgia DOT undertook a study to measure the CTE for concrete pavements using locally available materials and mix designs used in Georgia.

The study investigated the effect of aggregate and sand types, aggregate content, fly ash types, and air entraining admixture. The study found that increasing the volume of coarse aggregate in the concrete mixture significantly decreases the CTE of the concrete. Concrete samples made with granite or dolomite as the coarse aggregate showed significantly higher CTE values than those with limestone as the coarse aggregate. The study also demonstrated that sand type significantly affects the CTE of concrete and that an increase of natural (siliceous) sand increases the CTE of the concrete. Fly ash type, fly ash content, and water-cement ratio were observed to have an effect on CTE; however, the impact was much less significant than the selection of fine or coarse aggregate.

This project was completed by Sung-Hee Kim at Southern Polytechnic State University for the Georgia Department of Transportation. Click here to read the full report.

This project is contributing to research objectives identified in CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements. For additional information on this project, please contact Georgene Geary with the Georgia DOT.

Georgia Concrete Pavement Performance and Longevity

Due to funding shortages and the increasing reconstruction needs of its aging road network, GDOT has become increasingly interested in conducting life-cycle cost analysis (LCCA) on pavement-type selection to make the best investment in pavements. To support a reliable LCCA on pavement design, the number one question to address is how long the pavements in Georgia last. Pavement longevity varies widely depending on the design, construction quality, environment (e.g., weather and moisture), rehabilitation strategies, etc. Therefore, actual pavement longevity can be best studied by carefully evaluating the historical pavement condition data. The objective of this project was to analyze the longevity of concrete pavements in Georgia using more than 30 years of concrete pavement condition data collected by GDOT.

Since 1971, Georgia has conducted an annual Concrete Pavement Condition Evaluation System (CPACES) survey of its JPCP. The CPACES data along with pavement design, construction time, and traffic data, were utilized to perform a statistical analysis based upon pavements that had reached the end of their service life (defined as the time to reach a major rehabilitation).

The study breaks down the results by pavement category. The categories are: 1) non-doweled JPCP on a soil or soil cement base, 2) non-doweled JPCP on an improved base, and 3) doweled JPCP on an improved base. The average service life of the original pavements was 17 years for Category 1 and 21 years for Category 2. None of the pavements studied in Category 3 has had a major rehabilitation. Category 3 pavements ranged in age from 25 to 33 years; therefore the service life for Category 3 pavements is expected to be longer than 25 years. These results show the improvements in design features corresponding to a longer service life.

This project was completed by James Tsai et al. the Georgia Institute of Technology for the Georgia Department of Transportation. Click here to read the full report.

This project is contributing to research objectives identified in CP Road Map Track 11: Concrete Pavement Economics and Business Management. For additional information on this project, please contact Georgene Geary with the Georgia DOT.

Critical Assessment of Transverse Crack Patterns of CRCP Pavements on I-85 and I-20 Using Sensing Technologies

The newly reconstructed I-85 has developed transverse cracks in the continuously reinforced concrete pavement (CRCP). Though transverse cracks are normal for a CRCP, an abnormal pattern may indicate the potential of developing undesirable distresses such as punchouts and spalling.

The objective of this project was to study the transverse crack spacing patterns on I-85 and compare them to the recommendations in CRCP design guides and to the Mean Crack Spacing (MCS) on I-20, which was constructed more than 40 years ago and is still has good performance. Doing so will help determine whether or not the I-85 CRCP crack pattern is normal or of significant concern and in need of further maintenance. In addition, the project studied the MCS changes over time to determine if pavement cracking is stable or increasing.

The study found that average crack spacings on I-85 are shorter than those on I-20, but the MCSs are still within the ranges recommended by the MEPDG and AASHTO design guides. The study also found that from May 2012 to May 2013, the average MCS on I-85 North changed from 4.0 ft to 3.7 ft while MCSs on I-85 South changed from 3.9 ft to 3.8 ft. Based upon this change, the study recommends additional monitoring to determine if this change in MCS will continue or if it has stabilized.

This project was completed by James Tsai at the Georgia Institute of Technology for the Georgia Department of Transportation.

This project is contributing to research objectives identified in CP Road Map Track 9: Evaluation, Monitoring, and Strategies for Long Life Concrete Pavement. For additional information on this project, please contact Yusuf Ahmed with the Georgia DOT.

Laboratory Evaluation of Polymer-Modified Pervious Concrete (PMPC)

Portland cement pervious concrete (PCPC) has been increasingly used to reduce the amount of runoff water and improve the water quality near pavements and parking lots, but it has seldom been used in highway pavements due to poor performance. The high porosity and interconnected voids between aggregate particles in PCPC cause a significant reduction in strength and abrasion resistance. These properties can potentially be improved through polymer modification.

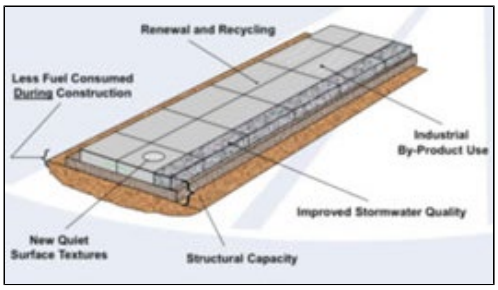
The objectives of this study were to evaluate the behavior and performance of polymer-modified pervious concrete (PMPC), focusing on the benefits of latex polymer on abrasion and freeze-thaw resistance. Various laboratory tests were conducted to evaluate the physical properties (air voids, permeability), mechanical properties (compressive and split tensile strengths), and durability performance (abrasion and freeze-thaw resistance) of pervious concrete mixtures.

The test results show that latex desirably improved strength and abrasion resistance of PCPC, whereas fiber did not have a significant effect on the mechanical properties of PCPC. Even for pervious concrete, air-entraining admixture was helpful for improvement of freeze-thaw durability. A small-sized field project validated the mix design obtained from the laboratory experiments. A relatively large field project is recommended to verify the abrasion and durability performance of pervious concrete pavements in a future study.

This project was completed by Baoshan Huang et al. at the University of Tennessee for the Georgia Department of Transportation. Click here to read the full report.

This project is contributing to research objectives identified in CP Road Map Track 12: Concrete Pavement Sustainability. For additional information on this project, please contact Georgene Geary with the Georgia DOT.

Analysis of Green Road Rating Systems (RP 10-01)



As sustainability increasingly becomes a concern to society, state transportation agencies are looking to adopt initiatives that will both educate their employees and the communities they serve on how transportation systems and system operations can be viewed within such a context. One of the strategies some state departments of transportation (SDOTs) have adopted for providing a more sustainable approach to highway design is a "green streets and highways rating system." Adopting a strategy such as the one proposed in this report for the Georgia Department of Transportation will enable an agency to compare projects based on sustainability goals and outcomes. Such a rating system can provide several benefits to a state department of transportation. As a public relations tool, publishing the sustainability rating results of completed projects can promote an "environmentally friendly" image of the agency. In some cases, this could be used to garner increased support for an agency's program. Comparing the ratings of proposed projects during the early programming process may also help in the selection of more sustainably effective and efficient projects. Additionally, a project in the project planning phase could use the green rating criteria to identify those areas where changes in design could result in more environmentally sensitive designs. A green streets and highways rating tool is an important means of fostering an environmental ethic in a transportation agency, one that could become more important in years to come.

The two objectives of this project are: (1) evaluate emerging transportation sustainability rating systems to

determine best practices and methods that might be applied in the Georgia Department of Transportation (GDOT); and (2) propose a straightforward Georgia-specific rating system that would enable uniform consideration of sustainability characteristics for state DOT projects. This report proposes a rating system that is specific to the GDOT, but which bears some semblance to operational systems that have been used in other states.

This project was completed by Michael D. Meyer and Ana Eisenman at the Georgia Institute of Technology for the Georgia Department of Transportation. Click here to read the full report.

This project is contributing to research objectives identified in CP Road Map Track 12: Concrete Pavement Sustainability. For additional information on this project, please contact Habte Kassa with the Georgia DOT.

Research in Progress

In addition to the completed research described above, the Georgia DOT is in the process of completing the following research projects.

Assessment of Limestone Blended Cements for Transportation Applications

This project is comparing the performance of limestone blended cements to conventional Portland cements in concretes designed to meet GDOT specifications for various types of concrete. This work is being completed by Dr. Kim Kurtis at the Georgia Institute of Technology.

Enhancing GDOT's Concrete Pavement Restoration Program Using Emerging 3D Sensing Technology and Historical Concrete Condition Survey Data (RP 13-19)

This project aims to enhance Georgia DOT's jointed plain concrete pavement rehabilitation by using historical pavement condition evaluation data and distress information extracted from 3D sensing data. This work is being completed by Dr. James Tsai at the Georgia Institute of Technology.

AASHTO MEPDG Validation and Calibration for Georgia Pavements (RP 11-17)

Georgia DOT continues to work on adoption and implementation of the Mechanistic-Empirical Pavement Design Guide (MEPDG) and use of the associated DARWin-ME software. This work in being directed by Georgene Geary at Georgia DOT.

Future Research Needs

Georgia is currently developing a Long-Term Pavement Performance (LTPP) program to monitor and maintain, over time, research-type pavement test sections that have been placed in Georgia. This includes asphalt and concrete pavements. This will also include modeling the pavements using the MEPDG and comparing the measured and predicted distresses over time. Examples of concrete pavements yet to be included in the LTPP program include a PCC lane placed over ¼ inch thick fabric on I-16, 100% recycled PCC shoulders placed on I-16, several sections of RCC shoulders (I-285, 1-75, 1-16), and thin concrete overlays.

About the CP Road Map E-News

The ***CP Road Map E-News*** is the newsletter of the Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map), a national research plan developed and jointly implemented by the concrete pavement stakeholder community. To find out more about the CP Road Map, or to get involved, contact Steve Klocke, 515-964-2020.

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