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Quality matters

A PUBLICATION OF THE LADOTD MATERIALS & TESTING SECTION

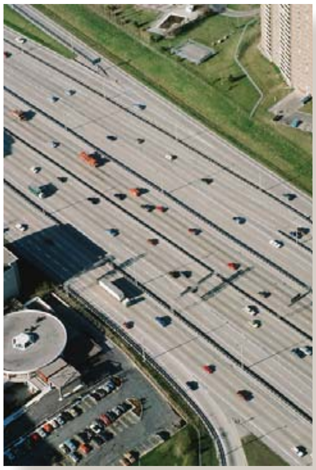
Concrete Variability

Portland cement concrete is an essential material in the domain of road and bridge construction. However, in recent years, the components which make up this wonder stuff have become increasingly hard to get and increasingly more variable.

In this day and age, concrete can have quite a few components including cement, fly ash, ground granulated blast furnace slag, water, admixtures, super-plasticizers, air-entrainers, silica fume, and fibers. Concrete companies often have to change cement suppliers more frequently during a project due to availability. These concrete components have also become more variable. For example, since the implementation of the Clean Air Act in the last decade, coal-fired power plants have had to tighten up on their emissions, resulting in increased variability in fly ash. This increasing variability can then lead to compatibility issues.

Due to the demand for cement, the variability of components, and the complexity of components, Quality Control done by contractors in the field on a daily basis is increasingly important. Sometimes a slight change in the properties of one material can swing the pendulum enough to create a compatibility problem that may be evidenced by a change in concrete's demand for water or variability in slump or air content. This can lead to cracking.

Here are the latest DOTD specifications for concrete: "PORTLAND CEMENT CONCRETE (08/06): Section 901 of the 2006 Standard Specifications and the supplemental specifications thereto is amended as follows. The contractor shall be responsible for monitoring the components (cement, mineral and chemical admixtures, aggregates) in their mix to protect against any changes due to component variations. As component shipments arrive, the contractor shall verify slump, air content, and set time by testing at ambient temperatures. The contractor shall make adjustments to the mix design to rectify any changes which would adversely affect constructability, concrete placement, or the specifications. The contractor shall submit test results to the Department for review each day of paving ..."



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Nuclear Density Gauges: Safety & Compliance

A nuclear density gauge is a vital tool used on Louisiana's highway construction projects. It is one of the most important quality assurance tools an inspector has to ensure that the foundation of the road will perform as designed. The use of any nuclear material requires compliance with the federal Nuclear Regulatory Commission regulations and safety precautions, enforced in our state by DEQ and DOTD. With help from radiation safety officers (RSOs), DOTD has, for the most part, maintained a good record of compliance.

One safety precaution is the emphasis of the As Low As Reasonably Achievable (ALARA) principle. One example of putting the ALARA principle to use is moving an employee's workstation as far from the nuclear storage area as possible or storing the unit in another building. In general, a person's full time workstation should be no less than 15 feet from the nuclear storage area.

To ensure that overexposure to an employee does not occur, DOTD monitors over 450 nuclear gauge operators with dosimeter badges. Dosimeter badges must be worn by any employee handling a gauge or working in the gauge storage area. Additional safety precautions that should be practiced daily to reduce unnecessary expo-

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District 58 received a flawless inspection in the 2007 District Laboratory Accreditation Program.

MatLab Updates

Materials Manager

We are moving along with our SiteManager Materials (SMM) implementation. I would like to welcome a new technical member, Mr. Ray Jones, to our team. Ray is with InfoTech, the developer of the Trns*port suite of software, of which SiteManager is a portion. Ray will be building our testing templates and reports. He is now located in the Materials and Testing Section. Ray has already proven to be a valuable asset to our team, in that he spent a few months assisting Construction with creating Daily Work Report templates and reports.

We are seeing excellent progress in our template development area. J.R. Connors, our InfoTech technical lead, is spending a large amount of his time in each of our laboratories tracking the test methods and working with our technicians to develop test templates for all of our test methods. So far, we have identified 783 templates to be built.

New Products

A trial field installation of "Delpatch Elastomeric Concrete," a polyurethane elastomeric binder with aggregate, was completed October 31, 2007 (see photo at left). This installation is located in the eastbound inside lane on the Sunshine Bridge (LA 70) over the Mississippi River in St. James Parish. Delpatch Elastomeric Concrete was submitted to the NPEC in May of 2007 by manufacturer D.S. Brown Co. as an alternate material for use in pavement patching and is expected to demonstrate ease of installation and much higher performance in a short period of time compared to current standards for patching material. So far, the patched sections have held up very well. The Committee will continue to monitor the performance of this product.

In other business, the committee met on November 13, 2007 and again on February 12, 2008. Nine products were submitted for evaluation; also, nine product evaluations were closed or were deemed to fall under the specifications for a Qualified Products List (QPL) material.

District Accreditation

The District Lab Inspection Program is an integral part of the District Laboratory Accreditation Program, as mandated by the Federal Highway Administration. The inspection program for 2007 concluded on January 17, 2008, when accreditation certificates were mailed to each district laboratory. Congratulations to District 58 for a flawless inspection! No deficiencies were noted during the inspections of apparatus or procedures used in the testing of soils, aggregates, Portland cement concrete, or bituminous laboratories.

Matlab Accreditation

The AASHTO Accreditation Program staff conducts an annual review of the status of every accredited laboratory to ensure the applicable criteria have been met. The Materials Lab was due for an annual review in February. All documents were completed and sent to AMRL. The Directories of AASHTO Accredited Laboratories can be viewed at the AMRL Web site, www.amrl.net, for current status and scope information.

Co-Op

The testing for phase 07-2 of the cooperative testing program has been completed and reported to the Materials and Testing Section. In an effort to improve the Co-Op Program, motor oil was distributed as a substitute for emulsified asphalt to test for viscosity beginning with phase 08-1. This change of material is an attempt to eliminate the variability due to material and sample handling, producing a better indicator of technician proficiency.

NTPEP

The National Transportation Product Evaluation Program provides field performance data to all states. The reports can be accessed online at http://data.ntpep.org. Feel free to take a peek! NTPEP has also begun facility audits for HDPE pipe manufacturers and will publish the reports online as well. Also, our own chief engineer, Mr. William Temple, now chairs the NTPEP meeting group. If you would like additional information regarding, or have suggestions to improve, NTPEP or DataMine, please contact Jason Davis.

Profiler Update

The LA DOTD 2008 Profiler Certification Rodeo was scheduled for April 28 through May 15 of 2008. The only change this year is that operators are required to process data through ProVal. Anyone with questions may contact Lodrick Price at (225) 248-4151 or by email at LodrickPrice@dotd.

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QPL Updates

la.gov.

The January 2008 revisions of the qualified products lists include the addition of the following new sources (updates appear in bold print):

- QPL 02 – Aggregates – ABAJ, Arkansas Gravel Co., Inc. (Wylie Mine – Hampton, AR); ABAN, LaFarge Aggregates (Cave-In-Rock, IL); ABAO, Arkansas Gravel Co., Inc. (Bradshaw Mine – Hampton, AR); ABAP, JJ Ferguson Sand & Gravel Blackhawk Pit (Greenwood, MS)
- QPL 04 – Gasket Materials for Culvert Pipe – 0436, Vertex, Inc. (Mogadore, OH)
- QPL 07 – Portland Cement, Portland-Pozzolan Cement, and Portland Blast-Furnace Slag Cement – 07AK, Giant Cement Company (Harleyville, SC)
- QPL 09 – Raised Pavement Markers – 0987 and 0988, Ray-O-Lite, Division of Pac-Tec, Inc. (Newark, OH)
- QPL 13 – Reflective Sheeting – 13CW, 13CX, and 13CY, 3M Company (St. Paul, MN)
- QPL 39 – Flexible Posts – 3929, Filtrona Extrusion (Tacoma, WA)
- QPL 47 – Non-Shrink Grout – 4761, SpecChem (Kansas City, KS)
- APL 50 – Fly Ash – 5028, Alabama Power (Headwaters Resources, Supplier) (Quinton, AL)
- QPL 58 – Admixtures for Portland Cement Concrete – 58EX, BASF Admixtures, Inc. (Cleveland, OH)
- APL 66 – Plastic Culvert Pipe and Joint Systems – 6614, Diamond Plastics Corporation (Plaquemine, LA)
- QPL 72 – Erosion Control Products – 7245 through 7249, American Excelsior Co. (Rice Lake, WI)
- QPL 75 – High Performance Cold Mix for Patching Materials – 7508, Rapid Road Repair Products (Dallas, TX)

Henry Lacinak Retires

After 36 years of dedicated service to the department, Henry Lacinak retired from his position at the Materials & Testing Section on January 4, 2008. Henry firmly supported quality assurance and will be missed for his extensive knowledge of materials and specifications.

Henry graduated from Louisiana State University in 1971 in chemical engineering and began his career with the department in 1971 as an engineer intern in the Chemical Unit. After being promoted throughout his career at the Materials & Testing Section, he retired as the Materials Testing and Evaluation Engineer over the Special Testing Unit and, once again, the Chemical Unit.

During his career, Henry became involved in numerous regional and national organizations, including AASHTO, ASTM, the National Transportation Product Evaluation Program (NTPEP), and the Southeastern Protective Coatings (SEPCOAT) group. He has chaired various technical committees in each of these organizations, and his involvement has helped the department become recognized as a leader in quality assurance.

Although Henry's retirement plans include traveling, attending LSU sporting events (as many as possible), and gardening, he has also decided to stay active with his work. AASHTO has retained Henry as a consultant on a part time basis with the NTPEP he has worked with since its inception in 1995. His long term association with the program will give a high level of support, and will help to ensure that the program remains a benefit to all involved states, including Louisiana.

Though his journey with the department is over, Henry leaves us with these words of wisdom: "Don't sweat the petty stuff, and don't pet the sweaty stuff."

The revision also includes the following update:

- QPL 07 – Portland Cement, Portland-Pozzolan Cement, and Portland Blast-Furnace Slag Cement 0759, Lehi Portland Cement Company (Leeds, AL), Type I, III.

Also included in this revision are the following product source code deletions:

- QPL 34 – Hydrated Lime and Quicklime – 3425 – Redland Stone Products Co. (San Antonio, TX)
- QPL 40 – Concrete Anchor Systems – 4035, 4039, 4041 – Powers Fasteners (New Rochelle, NY)
- QPL 52 – Adhesive Anchor Systems for Deformed Tie Bars and Dowel Bars – 5228, 5230, 5232 – Powers Fasteners (New Rochelle, NY)
- QPL 69 – Noise Reduction Systems – 6905 – Soundcore, Inc.(Amherst, NY)

Soils Lab Testing Program Adjusts to New AASHTO Design Guide

As a result of NCHRP Project 12-33, entitled "Development of Comprehensive Specification and Commentary," in July of 1988, the Federal Highway Administration (FHWA) mandated a significant change in the design methods used for transportation structures, including their foundations. The mandate was to move from the traditional allowable stress design, or ASD, to a load/resistance factor design, or LRFD. This conversion was to take place over several years following the announcement of the decision.

The major difference between the two methods is that the ASD procedure collectively accounts for the uncertainty of all design loads and resistances in one single factor of safety. The LRFD procedure involves applying a load factor to each load and a resistance factor to each resistance parameter to account for the uncertainty in loads and resistances. By applying conservative factors only to those areas which the designer has limited experience or low confidence in the test data, the remaining factors can be set at a level where the designer has high confidence in his design decisions.

The probability based LRFD specification is advantageous in the following areas:

1. More uniform level of safety throughout the system.
2. Measurement of safety as a function of variability of loads and resistances.
3. Designers will have an estimate of the probability of meeting or exceeding the design criteria during the design life.

LRFD has the following limitations:

1. Requires the availability of statistical data and probabilistic design algorithms
2. Resistance factors vary with design methods
3. Requires the change in design procedure from ASD

ASD has the followings limitations:

1. Does not adequately account for the variability of load and resistance
2. Does not embody a reasonable measure of strength
3. Involves subjective selection of factor of safety

The new analysis and design procedure is projected to more accurately predict the performance of the structures, resulting in less conservative designs, that will significantly reduce costs without exposing the public to any additional risk.

In the geotechnical design process, one of the most significant factors is the reliability of the subsurface investigation results. DOTD still maintains one in-house exploration crew but also utilizes as many as four consulting engineering firms to obtain and test soil samples for bridge projects. For future projects, the Materials and Testing Section and all geotechnical consultants will have to modify their sampling and testing methodologies to meet the requirements of the new AASHTO LRFD guidelines. Some of the changes have already been implemented, and others are still in progress.

In an effort to reduce the disturbance of the samples prior to testing, FHWA directed all DOTs to implement laboratory extrusion of samples. In August of 2007, the soils laboratory began extruding soil samples from the Shelby tubes in the laboratory. This was a major change in operations, both for the lab staff and the Soils Exploration crew. A Shelby tube is a thin-walled steel tube just under three inches in diameter that is pushed with a drill rig into a layer of undisturbed soil. About three feet in length, the tube is usually able to hold the soil inside while it is pulled up and out of the borehole. In previous years, when the Shelby tube with its sample was extracted from the borehole, it was immediately brought to the truck mounted sample extruder. A Technician extruded the sample with a hydraulically driven piston, always pushing the sample in the same direction it was pushed into the barrel. The sample was caught in a tray and then brought to the Squad leader for visual examination and field classification. This information was recorded in the field log book. The squad leader then selected a representative portion approximately a foot long, and it was then wrapped, labeled, and packaged for shipment to the laboratory. A copy of his eld notes was delivered with the samples.

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Soils Lab Testing Program

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With the new requirements, now the sample remains in the Shelby tube until it is delivered to the lab. The field squad leader looks at the material in the end of the tube, and having observed the cuttings being flushed from the hole while drilling, he determines the composition of the soil that has been sampled. He records the information in his log book, along with the sample ID number and the depth from which the sample was taken. Then he seals the tube and places it in a storage rack for shipment to Baton Rouge. The tubes are stored standing up, allowing the sample to remain in the same position it was in prior to being sampled.
At the end of the week, the samples are delivered to the Materials and Testing Section Soils and Aggregates Testing Laboratory with a copy of the field notes, and the lab technician pulls the file for the project to see what testing is required for the particular boring. Once the design request has been reviewed, and the testing plan established, the technician removes the seals on the tube and places the tube in the extruder device. Once properly installed, the sample is extruded from the tube with a hydraulically driven ram. The sample is always extruded in the same direction as the sample was pushed into the tube. This has been found to minimize the disturbance of the sample. The sample is caught in a tray and examined by the lab technician and, if possible, by the soils lab engineer. The field notes are reviewed, and any additional items observed in the lab are noted. The team determines if the chosen testing plan is appropriate for testing for that sample and then begins implementing the testing plan. When the testing is completed on that sample, the next sample goes through the same process.

Yet to be fully implemented are changes in the testing requirements. More precise testing methodologies are planned to give the designers a less conservative prediction of the in situ, or in place, performance of the soils. Some of these tests, such as the triaxial compression test, have been performed for years, but only on a limited basis due to their complexity and the time required to perform the procedures. Others are relatively new, at least to the Materials and Testing Section staff.

Fortunately, with good management of our testing equipment budget, the Materials and Testing Section has, in the last couple of years, purchased some state-of-the-art testing equipment to allow several tests to be automated. Once the sample is prepared and set up in the testing unit, the computer hooked to the unit is programmed to both test the sample and to take the data readings for the duration of the test, even if it takes several hours, or days! The soils lab has just installed a new Load Trac® testing unit that can run unconfined or triaxial compression tests, and when those tests are completed, it can be used to double our capability for determining the one dimensional consolidation properties of soils. These automated units have proven extremely valuable in the amount of time they free up for the technicians to do other tasks.

The Materials and Testing Section's Soils & Aggregate Testing Laboratory staff has worked hard to provide the design sections with the geotechnical foundation information they need to design safe, economical, and durable structures. We will continue to coordinate our efforts with the geotechnical exploration crew to ensure timely and effective processing and reporting of the soil boring logs to design. We will also work closely with the geotechnical and bridge design staffs to ensure that we perform the testing they need accurately and as quickly as practical. Specialized testing will become more commonly needed, and the two sections will have to work together to ensure that the testing plans selected will provide the right kind of results for use in the new LRFD process.

The hope is that the implementation of load/resistance factor design will result in more economical structures that will safely serve the public for many years. The Materials and Testing Section will do its part to ensure that it does.

MatLab Updates

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Environmental

Since the late 1980s, the Environmental Evaluation Unit (EEU) has been responsible for managing the department's UST program as it relates to the removal and closure of fuel tanks located within the right-of-way of construction projects. Just recently, however, the EEU has taken on the new responsibilities of managing the department's active UST program, those tanks in operation and located at our various maintenance yards, etc.

Physical

Congratulations to Alton Booth for obtaining the Level 1 ACI Certification for concrete testing.

Nuclear Density Gauges

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sure involve time and distance. Reducing the time spent near a gauge reduces exposure but is not always practical. The work must be done. In this case, distance is the key. By simply doubling the distance from a gauge, an operator is exposed to only one-fourth of the radiation. Exposure to nuclear radiation is measured in units called rem, Roentgen equivalent man. The exposure limit for a gauge operator is five rem/year. A personal exposure history is kept on file at the Materials and Testing Section and reviewed for each DOTD employee issued a dosimeter badge. A copy is sent quarterly to each district's RSO.

DOTD is also concerned about the public's exposure to radiation from department owned nuclear gauges. To make sure the public is not being exposed to more than 100 rem/year, a biannual survey of the storage area(s) is completed by the district RSO and submitted to the materials lab RSO for review.

Regulations require proper security of gauges within department facilities and on job sites while at a storage facility or while in transit. This includes maintaining two controlled locks, secured doors, and secured transportation cases. Gauges must be secured even in the storage room. All LADOTD gauges must be secured at all times, whether being visually monitored by an operator during actual field use or by chains and locks during transportation and storage. As a reminder, DOTD's radiation program requires that all gauges, when not taking measurements, be returned to the safe position, locked, and placed inside the storage case that, in turn, should be locked and secured to the vehicle.

Numerous forms must be kept with the gauge at all times. These forms are provided by the department/Matlab RSO at the materials and testing section. These forms must be kept up to date and are required by law to be within arm's reach of the driver during transportation. Such forms are: Notice To Employees, a copy of DOTD's Radiation Materials License, and Emergency Response Information and Safety Procedures. Also, a Bill of Lading unique to each manufacturer, an IAEA Certificate of Competent Authority (also known as special form certificate: two per gauge), and a copy of the latest leak test report must be kept up to date and within reach of the driver.

Fines are also issued for incorrect or expired paperwork accompanying the gauge, omission of or damaged/illegible labels on the gauge and transportation case, and failure to maintain a utilization log of each gauge. Regulations require that DOTD knows each gauge's whereabouts at all times. A utilization log is a requirement of DOTD's Radiation Materials License. The LADEQ and DOTD take even the smallest amount of nuclear material as a serious matter and will enforce compliance in any areas failing to meet the standard.

The Materials and Testing Section is currently working on updating the training, manuals, and procedures for using nuclear density gauges. The hope is that this will improve understanding and compliance with the numerous and complex regulations. Ultimately, the goal is to improve the safety of the employees and the public.

Any questions regarding DOTD's nuclear program, safety, and compliance should be referred to the district RSO/district lab engineer or the department/Matlab RSO, Melinda Braud, at the Materials and Testing Section at 225-248-4133.

Concrete Variability

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Contractors can use AASHTO T197 (ASTM C403) for set time determination and DOTD TR 201 for unit weight determination. DOTD personnel are to review the quality control test results daily.

In the future, perhaps the Matlab will be able to check certain combinations of cementitious materials ahead of time to weed out potential troublemakers. However, for now, the field tests for quality control are essential for identifying suspect material combinations before they become a problem.

Quality Matters

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