Customer Services

The MCL accomplishes its goal of technology deployment through project participation, demonstrations, training, and equipment loan. In an effort to reach a maximum number of transportation personnel with significant project findings, evaluation results, and innovative concrete technologies, the MCL provides project reports and published papers in journals and symposia proceedings. Presentations at industry conferences and showcases, such as ACI, PCI, ACPA, and TRB are utilized to further the transfer of these new technologies. MCL staff can also provide speakers, put on specialized workshops, and provide technical assistance.

Tensile bond strength testing of a bonded over asphalt overlay

NHI training course

Contacts

If your are interested in one or more of the services provided by the Mobile Concrete Laboratory, you can contact your FHWA Resource Center, Division Office, or the MCL staff directly:

- **Gary Crawford**, Project Manager , FHWA, (202) 366-1286.
- **Jagan Gudimettla**, MCL Project Engineer, Global Consulting, Inc., (202) 366-1335.
- **Jim Grove**, Senior Project Engineer, Global Consulting, Inc., (515) 294-5988.

U.S. Department of Transportation
Federal Highway Administration
Office of Pavement Technology
1200 New Jersey Avenue, SE
Washington, DC 20590

FHWA Administrator Victor Mendez being briefed in the Mobile Concrete Laboratory

MCL at a workshop in California.

Publication No. FHWA-IF-12-048

U.S. Department of Transportation
Federal Highway Administration

MOBILE CONCRETE LABORATORY

Transferring Advanced Concrete Technology To Our Partners

Mission

Federal Highway Administration's Mobile Concrete Laboratory (MCL) introduces Federal, State, and local transportation personnel to the state-of-the-art concrete technology in materials selection, mixture design, field and laboratory testing, and pavement evaluation. In an effort to bridge the gap between research and the field, the MCL accomplishes this technology transfer in several ways:

- By conducting on-site field testing at construction projects to supplement State highway agency (SHA) testing and to demonstrate new innovative equipment / construction practices.
- By training SHA personnel through "hands-on" experience with new technologies.
- By showcasing equipment and technology at industry conferences, symposia, and SHA facilities to familiarize transportation personnel with state-of-the-art technology.
- By providing an equipment loan program where SHA personnel can borrow equipment for various lengths of time after having been trained in their use by MCL staff.

The current focus of the MCL includes assisting SHA's implementation of the mechanistic- empirical pavement design guide (MEPDG) and nondestructive testing, performance-related specifications (PRS), long life pavements, durability, and sustainability. An active partnership with manufacturers, contractors, industry associations, and academia is central to all of the MCL's activities.

Setup for nondestructive pavement thickness measurement on US30 in Iowa.

Technology

Field demonstrations are performed using a fully equipped mobile concrete testing laboratory that can perform a wide range of concrete tests. These include conventional destructive tests as well as new and innovative nondestructive tests.

Examples of these capabilities are:

Conventional QC Tests:

- Temperature, slump, air content, unit weight
- Strength (compression, flexural, splitting tensile)
- Elastic Modulus and Poisson's Ratio

Nondestructive and In Situ Tests:

- Dowel Bar Alignment
- Pavement Thickness
- Tensile Bond Strength
- Impact Echo
- Ultrasonic Tomography
- Pull Out Strength
- Maturity Testing
- Match Curing

Device to nondestructively measure dowel bar alignment.

Ultrasonic tomography detects reinforcement and internal defects in concrete.

Device to nondestructively measure pavement thickness.

Durability Related Tests:

- Microwave Water Content
- Coefficient of Thermal Expansion
- Rapid Chloride Permeability
- Surface Resistivity
- Calorimetry
- Air Void Analyzer
- HIPERPAV Software
- Aggregate Gradation Software

Air Void Analyzer measures air content, specific surface, and spacing factor in fresh concrete.

Electrical resistivity measurement of concrete.

Coefficient of thermal expansion measurement.

FHWA Mobile Concrete Laboratory (MCL)

Testing Capabilities

STANDARD TESTS
Fresh Concrete Properties (slump, air, unit weight, temperature, etc.)
Strength Tests (Compression, Flexure and Splitting Tension)

ADVANCED TESTS
Microwave Water Content
Microwave oven water content method is a simple, and effective way of monitoring water content of concrete at the construction site. The water content can be determined in less than 15 minutes. The water-cementitious materials (w/cm) ratio has a significant effect on the strength and permeability of a pavement. Monitoring the test results may provide an early flag of potentially low-strength concrete, allowing the contractor to adjust operations sooner than conventional strength testing might indicate. Concrete strength varies inversely with the amount of water in the mixture. For a given mixture with a constant amount of cement, the w/cm ratio has the greatest impact on strength.

AVA
AVA is a portable device that measures the entrained air void structure of fresh concrete in about 30 minutes. AVA can be used to measure the air content, specific surface, and spacing factor of fresh Portland cement concrete. Freeze-thaw resistance of concrete is primarily controlled by an air-void system with closely spaced small bubbles. The AVA test should be used for quality control, not acceptance.

Maturity
Measuring the maturity of concrete pavements is a nondestructive test method for estimating in-place concrete strength. Maturity may be used as a criterion for opening a pavement to traffic and for quality control purposes. The degree of hydration (leading to strength) of a given mixture design can be measured as a function of time and temperature. Correlation curves can be developed for a mixture design that estimate concrete strength based on its maturity. The in-place strength of a pavement can be estimated by monitoring the temperature of the slab over time and using the correlation curve that was developed for that mixture to relate it back to strength. A maturity curve (strength estimate based on maturity) is only applicable to a specific mixture design.

Coefficient of Thermal Expansion
CTE is one of the important parameters that can affect the performance of concrete pavements. The expansion and contraction of concrete due to temperature changes can impact the durability of joints and the risk of cracking in concrete pavements. It is also one of the level 1 inputs in the new Mechanistic and Empirical Pavement Design Guide software

MIT SCAN T2
MIT SCAN T2 allows precise non destructive measurement of thickness of concrete pavements. Aluminum or zinc coated steel plates are placed at random or regular locations before concrete is poured. Thickness of pavement can be determined at locations of the aluminum or zinc coated plates. This device can only be used on the Jointed Plain Concrete Pavement.

MIT SCAN 2
Dowel bars that are not aligned properly may not be effective in load transfer. MITSCAN uses magnetic imaging technology to determine the alignment of dowel bars. This device can only be used on the Jointed Plain Concrete Pavement.

Modulus of Elasticity and Poisson's Ratio

This test covers the determination of modulus of elasticity of hardened cylindrical concrete specimens when subjected to longitudinal compressive stress. These values are a key input for designing pavements using the new Mechanistic-Empirical Pavement Design Guide.

Rapid Chloride Permeability Test (RCPT)

The RCPT is a test method that allows rapid assessment of the chloride permeability of concretes. The test defines to what extent different concretes can effectively protect reinforcing steel from corrosion. The rapid-test method has been adopted as AASHTO T277, Electrical Indication of Concrete's Ability to Resist Chloride and ASTM C 1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

Surface Resistivity Meter (SR Meter)

This test can be used to evaluate the electrical resistivity of water saturated concrete to provide a rapid indication of its resistance to chloride ion penetration. Measurements from this test have shown good correlations with other electrical indication tests, such as the Rapid Chloride Permeability Test (RCPT) (AASHTO T 277 /ASTM C 1202). The primary advantage of this test is that it is fast (less than five minutes) and does not require any sample preparation unlike the RCPT test method.

Calorimetry

The hydration of cementitious materials results in a number of exothermic chemical reactions. These processes can be monitored by measuring the total heat liberated over time (heat signature). The heat generated during early hydration reactions of cementitious materials can be measured using a calorimeter. Changes in the heat signature of a concrete mixture can impact construction issues related to strength development and proper saw timing. They are also an indicator of some change in the materials or proportioning and thereby can be a red flag to indicate a need for investigation of the process.

HIPERPAV

HIPERPAV is a software tool that predicts the strength of concrete pavement as well as the internal stresses that a concrete pavement may experience in the first 72 hours of its life. When stresses exceed the strength, cracks will occur. HIPERPAV does not prevent cracks, but it provides the user with information about the likely risk of early cracking in the pavement, allowing preventative actions to be taken. Using HIPERPAV is analogous to driving at night with headlights. We are able to see potential dangers sooner than if we were driving by the light of the night sky.

Ultra Sonic Pulse Echo (MIRA)

The Ultrasonic Shear-wave Tomography technique (MIRA) represents a revolutionary approach to concrete ultrasonics. MIRA is a low frequency (20 to 100 kHz) multifunctional phased array ultrasonic system designed to detect and evaluate internal reinforced concrete defects such as honeycombs or voids. This system represents one of the most advanced techniques available in nondestructive testing (NDT) of concrete. Unlike traditional ultrasonic methods, which typically produce one pair of waves per measurement, using the MIRA, 45 pairs can be collected per measurement. The MIRA can be used for a variety of non-destructive applications including detecting honeycombing, mud balls, poorly grouted prestressing ducts, determining the condition of construction joints, pavement thickness, etc.