



CHEMISTRY RESEARCH FACILITY FACT SHEET

Research that is Essential, Indispensable, and Connected to our Customers.

PURPOSE

The Turner Fairbank Highway Research Center Chemistry Research Facility (CRF) conducts fundamental studies of highway materials from a chemical point of view. Investigations into the chemical mechanisms involved in well-known distress modes in concrete and asphalt pavements helps to generate new testing methods and foster the development of new materials. CRF validates Federal Highway Administration sponsored off-site research, offers unbiased support for State agencies and industry partners, and assists with the forensic evaluation of pavement failures.

DESCRIPTION

Research projects conducted within the CRF support both the goals of the Federal Highway Administration and provide assistance to State agencies and industry partners.

MAJOR COMPONENTS

CRF is composed of the following three laboratories:

The Chemistry Laboratory synthesizes and characterizes highway materials and evaluates their susceptibility to in-service damage. This synthesis includes evaluating the susceptibility of highway materials to weathering, moisture damage, oxidation, deleterious aggregates, and ASR gel formation, as well as studying the harmful effects of deicing chemicals on the materials.

The Analytical Laboratory uses highly specialized equipment for the identification

and chemical analysis of materials used in paving structures and for the development of standard test methods for the paving industry.

Instrumentation includes the following:

- The Infrared Spectrometer is used for the identification of coatings and asphalt binders and the rapid determination of the type and quantity of additives in binders as well as their degree of aging.
- The uses for the Ion Exchange Chromatograph include the quantitative determination of additives for forensic tests in paving systems and the effects of additives on the environment surrounding highway systems.
- The Atomic Absorption Spectrometer is used in forensic studies to determine the amounts of trace metals present in paving systems such as lime in hot mix asphalt.
- The Elemental Analyzer determines the amount of carbon, hydrogen, nitrogen, oxygen, and sulfur present in organic systems. It is used to study the structure and aging of asphalt binders.
- The solvent separation of asphalt binders into their component Saturates Aromatics, Resins, and Asphaltenes (SARA analysis) by thin layer chromatography is accomplished using the Iatroscan Spectrometer. This technique is very useful in determining how the structures of asphalt binders are affected by additives and aging.

- The Raman microscope is used to study the structure of aggregates, fly ash, and other materials used in concrete production. It is also used to study the formation of ASR (Alkali Silica Reaction) gels in concrete.
- The X-Ray Fluorescence spectrometer is used to measure the elemental composition of materials, in particular aggregates, fly ash, and concrete.

The Materials Characterization Laboratory

contains several microscopes including a scanning electron microscope with an Energy Dispersive X-ray Microanalysis (EDAX-ray) fluorescence spectrometer. These microscopes enable researchers to identify the compositions of highway related materials and study the morphological properties of polymer modified asphalt binders.

RECENT ACCOMPLISHMENTS

- Developed a test method to detect and measure the presence of lime in hot mix asphalt. This method is being adopted by American Association of State Highway and Transportation Officials (AASHTO) as a standard procedure.
- Developed a simple test method to demonstrate the presence of phosphoric acid in asphalt binders.
- Provided technical assistance to a number of State agencies in forensic investigations. These investigations included the

The Turner-Fairbank Highway Research Center (TFHRC) has more than 24 laboratories for research in the following areas: safety; operations, including intelligent transportation systems; materials technology; pavements; structures; and human centered systems. The expertise of TFHRC scientists and engineers

covers more than 20 transportation-related disciplines. These laboratories are a vital resource for advancing this body of knowledge created and nurtured by our researchers. The Federal Highway Administration's Office of Research, Development, and Technology operates and manages TFHRC to conduct innovative research

to provide solutions to transportation problems both nationwide and internationally. TFHRC is located in McLean, Virginia. Information on TFHRC is available on the Web at www.tfhrc.gov.

use of lime as an antistrip additive, the use of phosphoric acid as an asphalt modifier, and various cases of contaminated binders and aggregates.

CURRENT RESEARCH

- Development of industry guidelines for the use of phosphoric acid as an asphalt modifier.
- Development of mitigation strategies for aggregates containing deleterious clays.
- Development of rapid and accurate techniques to identify aggregates likely to form ASR gels in concrete structures.
- Development of mitigation strategies to prevent the formation of ASR gels in

concrete by the use of appropriate quantities of additives such as fly ash and ground blast furnace slag.

- Evaluating highway materials to determine their susceptibility to moisture damage.
- Investigating the mechanisms of oxidation and age hardening of asphalt binders.

PARTNERSHIPS

Laboratory personnel provide technical representation for the Federal Highway Administration on panels for the National Cooperative Highway Research Program, the National Science Foundation, and the Transportation Research Board task groups. Staff members also serve on oversight work

groups and review papers for the Association of Asphalt Paving Technologists and the Transportation Research Board. CRF collaborates with the Western Research Institute in Laramie, Wyoming; the European Bitumen Association, Eurobitume, based in Belgium; and Technische Universiteit Delft, the technical university based in the Netherlands, as well as several universities in the United States.

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