

Developing Work for NJDOT in the Area of Concrete Pavements and Transportation Structures

FINAL REPORT
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Introduction

In response to the request of CAIT, representatives of Twining Laboratories visited the New Jersey Department of Transportation (NJDOT) on two separate occasions in September and November 2008. As part of our visits we met with Ms. Eileen Sheehy, PE, and Manager of Bureau of Materials, performed a cursory observation of the facilities, reviewed Standard Specifications of New Jersey DOT for Road and Bridge Construction, and met and discussed prospective work for New Jersey DOT in the area of concrete infrastructure with your faculty and research associates.

The objectives of this effort are:

- To analyze scope of work currently performed by the Bureau of Materials,
- To understand based on facts available, current mission of the Bureau of Materials,
- To understand past and current tasks performed by CAIT for NJDOT and to establish future needs in the area of rigid pavements and structural concrete,
- To develop in collaboration with CAIT a vision proposal for future work with NJDOT, encompassing experience of both organizations, CAIT and Twining Laboratories, in:
 1. Concrete and concrete materials testing and evaluation for quality control and quality assurance purposes,
 2. Methods and equipment for non-destructive testing and monitoring pavements and structures,
 3. Developing and implementing innovative concrete mixtures for building transportation infrastructure, and
 4. Developing and implementing accelerated construction methods.
- To develop in collaboration with CAIT a proposal for integrating into various technical activities of NJDOT in the area of rigid pavements and structural concrete.

Organizational Structure

The Bureau of Materials is a part of the Capital Program Management division of NJDOT. The manager of the Bureau of Materials, Ms. Eileen Sheehy, P.E., reports directly to the Director of Construction Services & Materials. Each department at the Trenton laboratory has a supervisor responsible for day-to-day operations that reports directly to Ms. Sheehy.

It should be noted that while the Bureau of Materials and Bureau of Construction Engineering are both within the Capital Program Management division, the Bureau of Research is within the Planning and Development division.

Mission of Bureau of Materials

During the limited-time site visit we were not able to acquire documents formally disclosing mission of the Bureau of Materials. Information provided to us during the meeting and documents in our possession suggest the following. Bureau of Materials develops procedures for quality assurance and control of materials used for construction of transportation structures and pavements. As a part of the quality assurance program the Bureau issues list of materials subject to approval and develops and implements materials approval procedures. The Bureau also evaluates new materials and products, not incorporated into standard specifications, for their potential use in future design. At the same time the Bureau performs quality control testing of materials according to the scope listed below.

Scope and Volume of Testing for Concrete Transportation Structures and Pavements

Currently the Trenton laboratory is testing aggregates, concrete, grout, mortar, reinforcing steel, chemical admixtures, hydraulic cements, supplementary cementitious materials, and special products, mainly according to AASHTO standards.

Concrete cylinder compression testing and hydraulic cement testing are the only two specific tests where some order of volume was presented to us. Ms. Sheehy informed us that the Trenton laboratory tests on the order of 24,000 to 40,000 concrete cylinders per year. Volume of testing of Portland cement is on the average three samples per week.

Equipment and Facilities

Trenton laboratory has sufficient facilities and equipment needed for the scope of testing performed. In addition to the central laboratory in Trenton NJDOT also operates regional laboratories.

Reporting and Filing Test Results

It is our understanding that all test results are manually recorded on paper and these test results are stored in on-site file cabinets. In addition, sample log-in is also manually performed solely using a paper log-in book. The Interim Report "Laboratory Information Management System" by NJDOT and National Center for Transportation and Industrial Productivity issued in 2002 noted the necessity of replacing paper-based filing system by an intranet-based electronic filing system. According to the Report such system was under development by the NJ Institute of Transportation. Status of the system should be further verified.

Proposed Areas of Collaboration Between Rutgers University and NJDOT

CAIT has a successful history of collaborating with NJDOT. Rutgers Asphalt/Pavement Laboratory (RAPL), accredited by AASHTO, has been performing testing of bitumen binders, aggregates and asphalt concrete for NJDOT. CAIT develops and hosts personnel training and technology transfer courses for asphalt concrete specialists. This sets a model for prospective collaboration between NJDOT and CAIT in the area of concrete transportation structures and pavements.

- Such collaboration is seen as efficient in the following areas:
- Performing outsourced quality control and quality assurance testing of concrete, concrete materials, steel, grouts, mortars, etc.,
- Evaluation of materials and fabricated items as a part of overall quality control system implemented in transportation construction,
- Development of special methods and procedures for evaluating new materials and products,
- Evaluation and transfer of new technologies,
- Development and implementation of methods and equipment for non-destructive testing and monitoring pavements and structures,
- Development and implementation of innovative concrete mixtures and technologies for building transportation infrastructure,
- Development and implementation of accelerated construction methods,
- Training of personnel.

Efficient work in the area of applied materials engineering, production and construction technologies, and testing methods requires partnering not only between CAIT and the Bureau of Materials, but also participation of the Bureau of Structural Engineering, Bureau of Research, and New Products and Technology units of NJDOT.

CAIT with its unique research capabilities and strategic relationships with public and private research firms is well positioned to lead such a partnership. Twining Laboratories is pleased to offer to the partnership our experience and technical expertise in concrete materials engineering, accelerated construction technology, testing and evaluation of concrete materials and concrete, quality control and quality assurance. Examples of advancements that should be readily achievable through a strategic alliance between CAIT and Twining Laboratories are:

- Implementation of mobile laboratories for quality control and assurance testing of rapid strength concrete for full-depth and partial repairs of pavements,
- Implementation of fast track construction technologies,
- Expanding use of industrial by-products and waste materials for production of infrastructure concrete,
- Expanding use of non-destructive quality control methods in production of precast concrete for transportation structures and pavements,
- Developing and implementing protocols for remote monitoring of behavior of bridge decks to prevent early age cracking,
- Expanding use of non-destructive methods of pavement and sub-grade evaluations.

Twining laboratories will be able to assist CAIT in developing a concrete laboratory meeting the needs of NJDOT in the outsourcing of testing. Transferring to CAIT certain volume of quality control and assurance testing, currently performed by the Trenton Laboratory of the Bureau of

Materials, should eliminate “overflow” work and solve problems with hiring personnel by the DOT. It will also allow the Bureau of Materials to be fully concentrated on developing and implementing statewide technical policy in quality control and quality assurance of concrete construction, approval of materials, implementation of new materials and technologies. As an option, during the transition period, we suggest that the Trenton laboratory keep a core group of full-time technicians that is capable of performing the typical quantity of required testing. This core group should be as small as possible without requiring any overtime work to turn-around samples in specified time frames and that CAIT provide additional personnel to the Trenton laboratory when the need arises. The factors of when to request additional personnel should jointly be determined by NJDOT and CAIT to ensure that additional personnel are utilized as efficiently as possible and only when absolutely needed.

Conclusion

Implementation of new technologies and test methods will require training of NJDOT personnel, concrete suppliers and contractors. It is our recommendation that CAIT develops, implements, and oversees such training programs.