

DURABILITY ASSESSMENT OF PREFABRICATED BRIDGE ELEMENTS AND SYSTEMS

Problem

Many states have instituted Prefabricated Bridge Elements and Systems (PBES) and Accelerated Bridge Construction (ABC) projects to decrease onsite construction time, work zone and user costs, and increase safety factors; however, the quality and long-term benefit of PBES units produced is of concern to the Maryland State Highway Administration (SHA). Incomplete and noncompliant inspection processes and nonexistent waste management procedures not only affect the quality and durability (long-term performance) of PBES units produced but can also increase costs and waste time.

Objectives

The main objectives for this project were to:

- Compile Maryland State Highway Administration (SHA) inspection sheets and other checklists to develop an inspection framework for product quality control and assurance to determine the acceptability of manufactured PBES.
- Develop a detailed database in Microsoft Excel based on the framework developed to capture production, handling and shipping processes of PBES products.
- Identify practices that potentially limit production performance by critically examining process flow.

Description

This research focused on the collection of critical information for the development of quality control measures. These measures are used to ensure quality processes, monitoring requirements, and the inspection and disqualification criteria of PBES. The durability assessment of the PBES was based on observations made during site visits to two SHA-certified precast concrete plants.

Observations were made during the prestressed beam production process, including concrete material testing that was reconciled with inspection data sheets. Emphasis was also placed on identifying areas for the improvement of quality processes and inspection during production and storage.



Results

A user-friendly database to be used as a clearinghouse tool will aid in the automation process for documenting inspection data. Additionally, this database will track and handle the quality assurance and quality control (QA/QC) process at SHA certified precast plants. SHA inspection sheets and other checklists were compiled to develop the decision framework for QA/QC used in the database. However, the following items were noted as areas where the overall quality and long-term benefit of the prestressed beams and QA/QC processes could be enhanced:

- Thin diagonal hairline cracks were found in most of the beams, notably at the ends of the beam and could have resulted during the concrete curing process and/or when the prestressing strands were released. It is believed these will not affect the structural integrity of the beams but should be noted.
- Major spalling was not noticed in the beams except for little ingress, which has no structural implications and could be easily patched.
- Untidy working conditions based on lean manufacturing indices did not exceed a lean index of 6; however, minimization of waste and having well defined processes to recycle excess concrete and prestressing steel are important for promoting a safe work environment and providing quality products that can ultimately assist in minimizing costs.
- Measured cambers of studied prestressed beams were within estimated (+/- 0.2-in.) and all inspected beams had appropriate profiles according to the specifications in the fabrication drawings.
- However, storage/timing sequencing of beams is longer than what is specified in the initial project documents, and can affect beam camber in the long-term and potentially cause alignment problems on-site that are counterproductive for PBES/ABC.

Report Information

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Links to database and project photos can be found at:
<http://www.moniquehead.com/#!pbes/cwuw>.

Link to final report: http://www.roads.maryland.gov/OPR_Research/MD-13_SP309B4E_Durability-Assessment-of-Prefabricated-Bridge-Elements-and-Systems_Report.pdf