THE PRECAST, PRESTRESSED PANEL SOLUTION AND PROJECTS TO DATE

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Precast concrete has long been a proven solution for rapid construction of building and bridge structures. In addition to providing a durable, high-performance product, precast concrete greatly reduces construction time by eliminating on-site forming, concrete placement, and curing time. Despite these benefits and the desperate need for expedited construction solutions within the paving industry, precast concrete has yet to see widespread usage for pavements.

To facilitate the development of solutions for expediting pavement construction, the Federal Highway Administration (FHWA) initiated a feasibility study which was completed by the Center for Transportation Research (CTR) at The University of Texas at Austin in 2000. This study proposed a solution for expedited pavement construction which utilizes full-depth prestressed precast concrete panels. With a viable concept developed through the feasibility study, the FHWA initiated a series of pilot projects to evaluate the precast pavement concept in the "real world."

Installation of precast panels for the Georgetown, Texas pilot project.

The first pilot project was constructed on the frontage road of Interstate 35 near Georgetown, Texas in 2001-2002. The project consisted of 2,300 ft of precast concrete pavement spanning the width of the frontage road, including two traffic lanes and inside and outside shoulders. The precast panels were 8 inches thick and 10 ft wide. Half of the project was constructed with "full width" panels, which spanned the full 36 ft roadway width with a single panel, while the other half was constructed with "partial-width" panels wherein 16 ft and 20 ft panels were installed next to each other and post-tensioned together to achieve the full 36 ft width. The panels were installed over a 2-inch hot-mix asphalt leveling course with a single layer of polyethylene sheeting placed between the leveling course and precast panels to reduce the friction between the panels and leveling course. The panels were post-tensioned together in the longitudinal direction in 250-ft sections (25 panels per section). Each section of 25 panels was installed in roughly 6-8 hours. After installation of the panels and completion of longitudinal post-tensioning, the monostrand tendons were grouted to provide a fully-bonded post-tensioning system.

A total of 339 precast panels were fabricated and installed for this initial pilot project. The speed with which the panels could be installed and resulting pavement section proved the viability of the FHWA precast pavement concept. Based on the success of this project, a second demonstration project was developed for the California Department of Transportation (Caltrans) and constructed in 2004.

The second precast prestressed pavement demonstration project was constructed on Interstate 10 near El Monte, California as part of a project to widen the interstate by adding 27 ft of traffic lanes and 10 ft of shoulder. Similar to the pilot project in Texas, the pavement consisted of full-depth precast prestressed panels pretensioned in the transverse direction and post-tensioned longitudinally with monostrand tendons. The panels were installed over a lean concrete base (Caltrans standard) with a single layer of polyethylene between the panels and the base. Additional underslab grout ports were cast into the panels for filling any voids beneath the finished slab.

One of the unique aspects of this demonstration project was the incorporation of a change in cross slope into the surface of the precast panels. A cross-slope of 1.5% was required for the traffic lanes and 5% for the shoulder. To achieve this, while also maintaining a flat bottom surface on the panels, the thickness of the panels was varied from

Fabrication of panels for the California demonstration project showing the unique cross-section required to achieve the change in cross-slope in the finished surface.

Installation of precast panels for the California demonstration project.

10 inches at the ends to 13 inches at the edge of the traffic lanes. The precast panels were all 8 ft wide by 37 ft long. The panels were post-tensioned together in 124 ft sections for a total of 248 ft of pavement. A total of 31 precast panels were fabricated and installed. The first 16 panels were installed in roughly 5 hours and the remaining 15 panels were installed in roughly 3 hours, both during consecutive overnight operations.

While still relatively new, both projects are in excellent condition to date. They have both demonstrated the viability of precast prestressed concrete for expedited pavement construction, leading to additional projects in other states. Currently, additional demonstration projects are in development or under construction through FHWA efforts, including:

1. **Missouri**
   - Replacement of jointed reinforced concrete pavement on Interstate 57
   - 1,000 ft of precast prestressed pavement
   - Pavement crown cast into the panels
2. **Texas**
   - Precast prestressed pavement for a weigh-in-motion (WIM) site on US 175
   - 1,000 ft of precast prestressed pavement (2 sections, 500 ft in length each)
   - Blockouts and conduit for WIM system cast into the precast panels
3. **Iowa**
   - Precast prestressed pavement for bridge approach slabs on Iowa 60
   - 400 ft total length (4 approach slabs, 100 ft in length each)
   - Pavement crown and skewed bridge joints cast into the panels
4. **Indiana**
   - Replacement of existing pavement under a bridge overpass which is frequently impacted by trucks exceeding the allowable clearance
   - Precast prestressed pavement utilized for a thinner pavement section to increase clearance beneath the bridge

Precast, prestressed concrete pavement is not just a rapid-construction solution, it is a long-term solution. The demonstration projects described herein are designed for a 30-40 year lifespan, with minimal maintenance anticipated over that lifespan. Precast concrete offers a high degree of quality control over the fabrication process, which is beneficial for preventing some of the problems commonly encountered with cast-in-place pavement construction. Problems such as built-in curl (from temperature and moisture gradients in the slab), surface strength loss (from insufficient curing), and inadequate air entrainment, can be minimized or eliminated with precast concrete. Additionally, prestressing not only permits a significant reduction in slab thickness, but also minimizes cracking in the pavement, significantly reducing maintenance over the life of the pavement. While construction costs are currently significantly higher than cast-in-place pavement construction, the economic benefits realized through expedited construction (minimal disruption to the traveling public) and improved performance (minimal maintenance over the life of the pavement) will far outweigh the higher initial costs. Precast pavement has been demonstrated as yet another tool to allow transportation agencies to "*get in, get out, and stay out*."