VI. Pre-Cast Components

A. Purpose

The use of new and innovative pre-cast concrete components was implemented on several projects throughout the state. These new systems include pre-cast concrete pavement slabs on TH 62 in the Metro District and pre-cast concrete slab systems on bridges on TH 8 in Chisago County and on TH 72 over the Tamarac River in District 2. The intention of these new systems was to examine ways to reduce construction time and reduce delays to motorists during construction.

B. Pre-Cast Concrete Pavements on TH 62

On Tuesday, June 21, 2005, a test project involving the installation of precast concrete pavement panels was conducted on a pavement rehabilitation project on TH 62 between I-35W and TH 55 in the southeast metro (SP 2775-12). The purpose of this test project was to evaluate the use of precast pavement panels to reduce construction time.

The test segment included installation of 18 precast pavement panels on the outside lane of eastbound TH 62 near 40th Avenue. The repair segment included a continuous 218’ stretch of pavement 12’ wide.

Construction sequences involved removing the old slab, adding a stone-dust aggregate and fine grading with special machinery, placing the new slabs, and grouting the slabs together. Work on replacing the 218’ stretch took approximately 2 days. The costs on this type of repair were approximately 8 times higher compared to a standard D-1 repair.

The use of pre-cast panels has the potential to significantly reduce cure time and reduce lane closure time. If staged correctly, this type of pre-cast system could be used to repair small areas (1 panel) without disrupting peak hour traffic.

A detailed report of this project was compiled by the Office of Construction and Innovative Contracting. The report details the construction procedures, timelines, safety impacts, costs, and provides specifications and plans for the panels. The report can be found at the following website:

http://www.dot.state.mn.us/const/tools/
C. Pre-Cast Concrete Bridge Slab Systems

Two projects were selected for the implementation of pre-cast concrete slab systems. The projects include SP 1301-91 (TH 8 in Chisago County) and on SP 0143-29 (TH 72 over Tamarac River) in District 2. The TH 8 project included a 3-span structure with span lengths of 22'-27'-22'. The project on TH 72 involved replacing the deck on the 3-span voided span structure (45' spans).

The system includes inverted-t structures that act as the deck falsework. The panels are approximately 6 feet wide and 1 to 1-4" tall depending on the span. After the tees are placed, additional reinforcement is added to tie the segments together and the final deck (minimum 4" over the pre-cast panels) is poured.

The project on TH 8 also attempted to utilize pre-cast abutments and pile caps. However, due to the weight of the abutments, the contractor was not able to pre-cast these elements off-site and deliver them to the project site. Instead, these elements were cast on-site, picked by a crane, and placed on the piles.

The benefits of this system include:

- Pre-stressed pre-cast slabs allow for slender sections
- No deck falsework (except sides)
- Limited stream interruption
- Controlled pre-cast environment and higher quality control.
- Simple non-specialized construction methods and equipment
- Decreased field construction time.
- Standardized cross-section shape can be used on multiple projects.

These projects are still currently under construction. For more information, please refer to Mn/DOT Bridge web-site. The web-site offers more details and plans for these projects.

http://www.dot.state.mn.us/bridge/PrecastSlabSystem/PrecastSlabSystem.html
H. CONCLUSIONS

Pre-Cast Concrete Pavement Panels

- Although the costs of pre-fabricated concrete pavement panels are substantially higher than standard DOT repairs, the elimination of cure time can be significantly reduce lane closure time and reduce traffic impacts. User-costs need to be carefully considered when selecting this type of rehabilitation strategy.

- Work zone safety needs to be considered when using this type of rehabilitation. On a project-by-project basis, the project engineer should carefully weigh the safety measures of using barrier versus the time factor involved with opening the lane to traffic.

- The production rates on this project may not necessarily reflect the production rates on projects that require rapid turn around. This operation was not on the critical project path. In addition, the contractor had a learning curve with installing the new system.

- It is possible that on smaller repair areas, a pre-cast repair could be made during the day or night, and re-opened to traffic before the next rush hour. This would involve opening the lane to traffic before the joints were sealed and shoulder repaired. A subsequent “off-peak” lane closure would be required to complete this work.

Pre-Cast Concrete Bridge Slab Systems

- Pre-cast concrete bridge slab systems have the potential to significantly reduce field construction time by eliminating the need for falsework.

- By casting the bridge slab systems in a controlled environment, the quality of construction should significantly increase.

- These systems are relatively expensive compared to standard construction practices due to the start-up costs for the pre-fabricators. Costs are anticipated to decrease as more projects are constructed with this technology.

- Environmental impacts can be reduced by minimizing stream/river impacts during construction. This type of construction can also improve navigation under these bridges during construction.

I. RECOMMENDATIONS

- Continue to monitor the long-rang durability of pre-cast concrete pavement panels and compare the durability to the type C and type D repairs also performed on the TH 62 pavement rehabilitation project.

- Educate designers and construction personnel on the successes and drawbacks of these pre-cast concrete product projects.

- Continue to work with Mn/DOT Bridge Section of assess the cost and construction timeline impacts of the pre-cast bridge slab components and identify future projects for implementation.