Putting Flowable Fill Guidance to Work

National interest in an alternative fill material prompted NCHRP research to establish recommendations for its use. Two state transportation agencies—Texas and Indiana DOTs—describe how they turned those recommendations into state practices.

Addressing Gaps in Knowledge and Practice for Flowable Fill

Flowable fill (also called controlled low-strength material, or CLSM) resembles plastic concrete and shares many of the same components: water, cement, fine aggregate, and fly ash. Flowable fill is something altogether different, though. It is an innovative low-strength building material that can serve as an alternative to compacted granular fill on highway construction projects.

Many state transportation agencies see the advantages of flowable fill compared with traditional fill materials and techniques, including improved performance and marked reductions in labor costs. While some states have used flowable fill to a limited extent, its wide use nationally has been held back by knowledge gaps in design, construction, and expected performance.

Moreover, because flowable fill is not governed by AASHTO specifications, it has been left to each state to determine whether to use it, and if so, how. States shared a common need for better understanding of this construction material.

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This led to NCHRP Project 24-12(01) and the resulting product, *NCHRP Report 597: Development of a Recommended Practice for Use of Controlled Low-Strength Material in Highway Construction* (www.trb.org/Publications/Blurbs/156851.aspx).

The NCHRP recommendations were an important step toward achieving technical uniformity among states. The guidance includes standardized terminology, strain criteria, and performance testing for flowable fill.

However, significant effort was still needed to put the findings into practice among individual DOTs. As valuable as research findings are as a starting point, state agencies cannot simply "copy and paste" them into their specifications.

Flowable fill is self-leveling and self-compacting. It requires less labor than traditional fill materials.

Paths to Practice

From research results to know-how

Tommy Nantung, a panelist for NCHRP 24-12(01) and pavement materials and construction research manager with Indiana DOT, played a role in helping adapt the NCHRP findings for Indiana's use. One of his duties was to serve as an expert practitioner, bridging the gap between the researchers and the Indiana implementers. As both a project panelist and seasoned practitioner, Nantung helped interpret the technical findings and translate them into practical, useful information.

> "We used the NCHRP product as a jumping-off point for our own in-house research and development."

The job involved sharing his expertise with the right people in the state. As an active member on an Indiana DOT technical committee that addresses construction materials, Nantung was able to bring the NCHRP findings to the steering committee and discuss how to incorporate them in Indiana. "Having a process in place to share input and make recommendations really helped move implementation along," Nantung says.

The implementation process in Indiana included trying out a special provision in the field and gaining a comfort level with new procedures and technologies before making specification changes.

In the end, the state specifications were significantly different from the language in the NCHRP report. Those differences are

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Implementation Strategies *AT A GLANCE*

- **Drawing on the Research Team to Apply Findings:** Expert practitioners and the principal investigator helped tailor results to meet DOTs' needs.
- **Ensuring Stakeholder Buy-In:** DOTs collaborated with internal technical committees and supported contractors and regional field staff.
- **Verifying Findings in the Field:** Pilot projects fine-tuned research results and demonstrated benefits.
- **Addressing a Clear Need:** The technology advanced goals for rapid construction and improved fill performance.

all based on real-world field experiences and feedback from practitioners in the state.

Investigators go above and beyond

Another NCHRP project panelist was Texas DOT's Mike Arellano, who was serving in the agency's geotechnical section at the time this research was completed. Arellano points out that Texas DOT, like Indiana, did its own work on the NCHRP findings. "We used the NCHRP product as a jumping-off point for our own in-house research and development," he says.

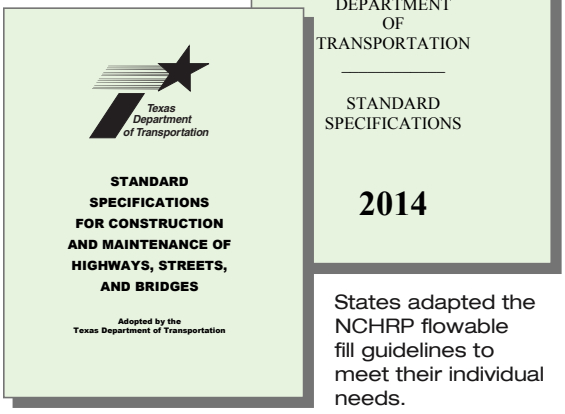
> "In our field trials, we helped suppliers calibrate their gauges and provided the necessary materials."

Texas DOT found the testing guidelines and material designs in the NCHRP report to be particularly helpful. From there, the agency adapted the material properties for the applications it had in mind for rapid set flow fill (Texas' term for flowable fill).

As part of the specifications development process, Arellano pointed out a unique resource that Texas DOT was able to use to its advantage: the principal investigator for the original NCHRP research.

"With many NCHRP projects," Arellano explains, "the researcher's job is done when the report is accepted. In this case, though, we had the good fortune of having the principal investigator, Kevin Folliard of the University of Texas at Austin, right in our backyard."

Folliard and his team provided extensive support to Texas DOT, which was helpful in the early stages of implementation. The investigators sat down with the agency and provided assistance throughout the field investigations.



States adapted the NCHRP flowable fill guidelines to meet their individual needs.

> "We finalized [the standard specification] a few years ago, and we're happy with it now and with the results we're seeing."

Giving stakeholders the support to succeed

State agencies recognize that implementation cannot succeed through the efforts of central office staff alone. Ensuring buy-in from private industry and regional DOT staff alike is critical.

If a DOT were to write new flowable fill specifications but not secure industry support, then those specifications likely would not work. It is critical to reach out to the ready mix concrete industry to explain—and provide a rationale for—new procedures and policies.

At the same time, it is necessary to make sure that materials engineers who oversee fieldwork are fully prepared to meet the requirements of new specifications.

Indiana DOT's Pavement Steering Committee serves as a forum for agency practitioners to evaluate how NCHRP findings may meet the state's needs.

In Texas, Arellano conducted outreach efforts to ensure success in the field. He noted that one potential difficulty involved the supply of rapid set flow fill material. "In our field trials, we helped suppliers calibrate their gauges and provided the necessary materials," Arellano says. At the same time, the agency did quite a bit of testing on its own to validate the results of this construction method.

Implementation Success: A New Tool in the Toolbox

The hard work toward full implementation has paid off. Texas DOT saw the success of a few pilot projects in San Antonio that made use of its new specifications. From that point on, rapid set flow fill became a standard option to repair bridge approaches in Texas. Arellano notes that the alternatives, reconstruction or full-depth repair, are heavy and contribute to consolidation. Flow fill is a lightweight alternative that can still handle the heavy bridge loads.

Arellano also cites the advantages of flow fill for accelerated construction. In one example in the Austin district, the agency had an intersection to rebuild over a weekend, and it used rapid set flow fill as an accelerated method. "It's a very useful tool to have at our disposal," Arellano says.

The technology has become standard procedure in Indiana as well. Nantung describes an iterative process. "We went from a special provision to a standard specification," he says, "and then through 12 versions of the specs, tweaking it every step of the way. We finalized it a few years ago, and we're happy with it now and with the results we're seeing."

Indiana and Texas are two good examples of implementers, but they are not alone. Nantung points out other examples: "Colorado does a lot of flowable fill, as does Ohio. I think across the country, states are using flowable fill—or using it more—thanks to this NCHRP research."

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