Transit CHALLENGES Practical SOLUTIONS

RESEARCH IN ACTION:

A CASE STUDY

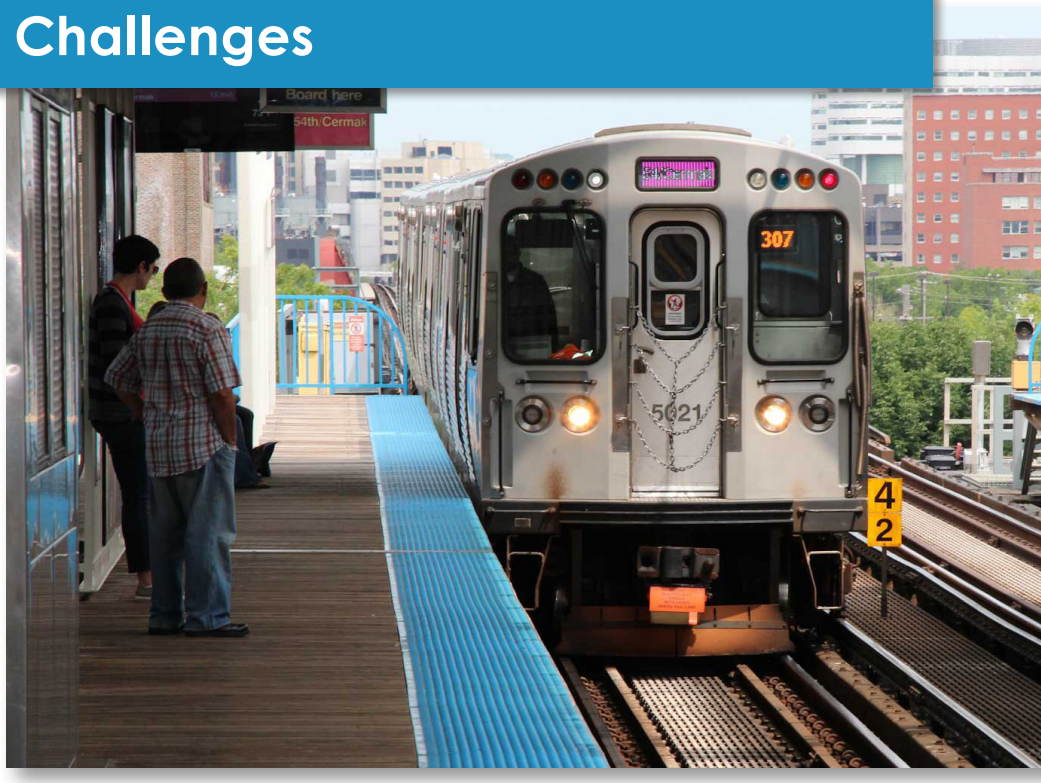
TCRP

TRANSIT COOPERATIVE RESEARCH PROGRAM

Understanding Direct-Fixation Track Design Requirements and Challenges

The Problem

THE WAVE OF RETIREMENTS underway across the transit industry poses challenges for younger employees who do not possess decades of institutional knowledge to help guide decision making. At the Chicago Transit Authority (CTA), for example, many civil engineers have been on the job for a dozen years or less. While CTA is very supportive of continuing education, positions often can only be filled once the opening is vacant, reducing the opportunities new civil engineers have for institutional knowledge transfer. As a result, there are "gaps in our knowledge" that only hard, historical data can fill when mentoring is unavailable, says Matthew T. Gibbs, Civil Engineer IV with CTA. This is especially important with respect to assessing the condition of the agency's tracks and related components as well as designing specifications for new construction.



Baseline Data Provides Context for System Performance

CTA IS AMONG THE transit agencies interviewed for **TCRP Report 71: *Track-Related Research Volume 6: Direct-Fixation Track Design Specifications, Research, and Related Material***. Although the report was issued in 2005, it continues to serve as a valuable source of independently verified knowledge for CTA and other rail transit operators. Gibbs notes the importance of "learning about the past so you can improve and not make the same mistakes" with respect to direct-fixation (DF) track system construction.

The two-part report provides specific, objective guidance on the design and construction of DF track systems. The first part

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describes track-design principles and material-evaluation methods for DF fasteners and track. The second part of the report provides data, evaluations, field reviews, and analyses of DF fasteners from a variety of sources to understand their characteristics and proper application more fully.

The implementation of DF track, which aids in tunnels with restricted clearances, reduces dead load on aerial structures, and contributes to reduced structure costs, has been in widespread use for over 40 years. However, DF track is also problematic, given the fairly widespread functional failures of fastener components.

Gibbs references **TCRP Report 71** as a source of baseline data for understanding common functional failures with, for example, anchor bolts and hold-down bolts, both components of the DF fastener assembly that affixes to the concrete supporting structure. CTA reported DF fastener-related structural problems in 1995; those observations, incorporated into the report, helped Gibbs understand the trajectory of such problems over time.

For example, on CTA's O'Hare Line, the report specifically notes the failure of fasteners in place since 1984, including hold-down bolts, loose bolts, and concrete deterioration with exposed rebar. At the Addison Street Station on the Red Line, the report cites surface elevation problems, grout spalling, and loose shims. Similar details, accompanied by numerous photographs, are documented for nine other large transit agencies, providing a reliable overview of DF problems over many years.

For Gibbs, the historic snapshot of conditions provides important context for future planning. "When we look [at a DF system] now, things look a certain way. But there are problems that started 20 years ago. This [information] wasn't transferred through institutional knowledge."

Independent Testing Informs Construction Specifications

CTA ALSO VALUES THE independentlyconducted functional testing data reported in TCRP Report 71. A total of 16 different DF fasteners and several embedded block components were examined in detail for the report. These samples are representative of the majority of DF fastener designs on the market at the time. Specific physical characteristics were tested. For example, the report states that one of the key parameters used to characterize a DF fastener is the static stiffness. The objective for the fastener static stiffnesses tests was to determine reliable, realistic stiffness measurements for a number of different DF fasteners representing a wide range of design types.

Gibbs says it is important to understand how various products perform in an "independent testing regime" like the one shared in the report. He has relied on the report's testing methods to update CTA's performance-based specifications. This obviates the need to rely on any one manufacturer's own claims of functionality and reliability.

TCRP Report 71 "covers failures during construction so we can write our specs to avoid failures," Gibbs notes. Armed with this information, CTA expects to avoid making costly, unplanned repairs to its DF track systems before the end of their anticipated design service lives. ●