

Chicago Tribune



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GETTING AROUND

Strength testing

How safe are Chicago's aging and deteriorating train bridges? Northwestern University helps the CTA monitor the strength of its structures with

SENSORS. PAGE 6

CHRIS WALKER/TRIBUNE PHOTO

FINDING THEIR GROOVE



Bears all alone in 1st, look to be among elite after topping Eagles

CHICAGO SPORTS

Bears wide receiver Rashied Davis, left, and quarterback Jay Cutler celebrate a first-quarter touchdown by Johnny Knox. The Bears beat the Eagles 31-26. BRIAN CASSELLA/TRIBUNE PHOTO

Ailea Miller Metalsmith



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CTA puts its viaducts to the test

Northwestern University helps measure strength of aging bridges

A deteriorated CTA bridge on the Red Line has an important story to tell about the health of the rail system's viaducts.

Each day, thousands of CTA elevated trains operate across 564 bridges, many nearing 100 years old.

The crumbling bridges, some inspected monthly and others every two years, pose a potential danger to CTA passengers as well as to motorists and pedestrians who pass under the viaducts. But the CTA, saddled with a backlog totaling \$7 billion in unfunded capital-improvement needs, can't afford to replace bridges.

The antiquated bridges have exceeded their useful life, experts say. They remain open due, in part, to luck. The bridges were built to carry steam locomotives, which generate approximately four times the load of a moving CTA rail car, said CTA chief engineer James Harper.

"We are kind of benefiting from that a century later," Harper said. "One hundred years is beyond anyone's expectation for a bridge structure."

The bridge at **Devon Avenue and Sheridan Road** on the Red Line is one of the most deteriorated crossings in the CTA system. Its arch design columns have lost significant amounts of concrete, exposing — and in some spots shedding — the reinforced steel below, CTA engineers observed. Braces providing additional shoring were installed near the bridge piers late last year to help the structure support the weight of trains and to withstand a possible hit by errant vehicles on the street.

But CTA officials had little idea how much strain, if any, the braces were taking off the bridge.

Then CTA president Richard Rodriguez picked up a newsletter published by the **Infrastructure Technology Institute at Northwestern University**. The newsletter carried a story about Northwestern researchers monitoring concrete highway bridges in Wisconsin using an automated system that collects and analyzes data.

Rodriguez then surprised Northwestern officials with a phone call.

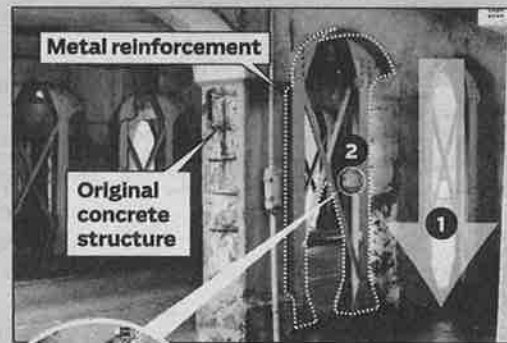
"It was unusual for someone to respond to the newsletter," said Joseph Schofer, associate dean of Northwestern's **Robert R. McCormick School of Engineering and Applied Science**. "But Rodriguez was particularly concerned about the reinforced

An aging system of bridges

The CTA system has more than 500 bridges and viaducts, many of which are nearing 100 years old. Data show that many of these bridges, especially the concrete structures on the north leg of the Red Line, are crumbling and past their useful life. Recently, the Northwestern University Infrastructure Technology Institute is developing a system for monitoring these viaducts.

A pressing issue

To monitor the steel reinforcement of the viaduct at Devon and Sheridan, Northwestern researchers are using strain gauges. These small devices have been around for more than a century, but are being used in a relatively new way to continuously collect information. Since mid-July, the project has monitored more than 52,000 train crossings to find the best method to monitor the entire system.



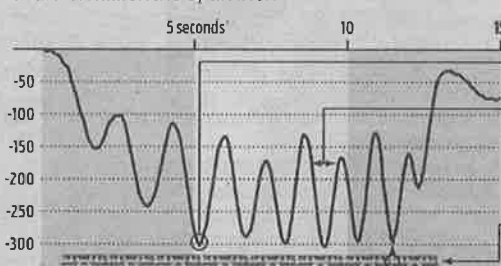
Strain gauges are made up of flexible, electrically conductive material that can measure the external forces affecting the viaducts.

- 1 The weight of trains crossing the viaduct compresses the original structure and metal supports equally.
- 2 The gauge, affixed to the metal, is similarly affected.
- 3 When the gauge's shape changes, so does its electrically conductive property, which is measured.

THE RESULT: These changes are recorded by an on-site computer and used to measure the stress on the bridge.

COMPRESSION MEASUREMENTS

Scale in millionths of an inch



Under the most strain, the gauges show compression of about 305 millionths of an inch, which is about 1/10 the diameter of a human hair.

As the train speeds up, the troughs get closer.

Each depression represents wheels moving weight along the bridge.

STRUCTURE RATING KEY

- Station only
- Past useful life/poor condition
- Viaduct only (thin border)
- Station and viaduct (thick border)

1/2 MILE





Research Engineer Mat Kotowsky finishes work on a wireless transmitter, which is part of a system of stress sensors on the CTA viaduct over Sheridan Road near Devon Avenue. CHRIS WALKER/TRIBUNE PHOTO

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concrete structures on the Red Line and he said, 'Come on down and meet with us.'

In July, the Northwestern team embedded sensors in the Devon-Sheridan bridge to measure how much the structure bends when trains pass over. That information is automatically stored, analyzed and transmitted to a Web site that Northwestern and CTA officials monitor.

The data collected from the gauges will tell more of a story over time, but officials have learned the yellow steel supports that were added are not doing a lot of work — a good sign that means the original structure is tolerating the strain of train traffic.

But given the CTA's budget constraints, the "temporary shoring" at Devon-Sheridan and other locations likely will be in place for many years, officials said. Replacement dates for the bridges remain indefinite, officials said.

The Infrastructure Technology Institute's around-the-clock monitoring of the Devon-Sheridan bridge will provide an early warning to changes that could

compromise the bridge's integrity, Harper said. The monitoring will also provide good clues about the condition of other similarly constructed bridges and any retrofits installed there as shoring.

"Given that we don't have a lot of money to install sensors everywhere, the Devon project is a great predictive tool that helps us predict how much life we have left on our bridges," Harper said.

CTA officials hope over time to expand the monitoring to at least some other bridges and to add Web cameras to create a visual record, including the common problem of trucks hitting viaduct support columns and taking out pieces of concrete, or getting wedged under the crossing, which has a clearance of only 12 feet 10 inches.

"The broader purpose for the monitors is not to tell that a failure is imminent, but to focus on parts of the structure that are most vulnerable in order to identify developing problems," said David Kosnik, a researcher at the institute, which has installed monitoring devices at more than 80 U.S. locations.

Widespread use of monitoring equipment will depend in part on keeping the cost low, said

Daniel Marron, chief research engineer at the institute.

"We try to use off-the-shelf components," said Marron, who estimated the Devon-Sheridan cost about \$35,000.

The researchers learned that a tall truck recently struck the Devon-Sheridan bridge. The truck damaged instrument wires, knocking out one of the sensors.

Harper said CTA officials plan to install cameras at the bridge to chronicle such mishaps. The next step would be to deploy sensors and cameras at other viaducts across the system.

The Infrastructure Technology Institute recently received a \$3.3 million federal grant to monitor transit bridges for the CTA and New York's Metro North Railroad.

"At this and other locations, we can help a public agency that has serious budget constraints to safely extend the service life of its infrastructure," Schofer said.

Contact Getting Around at jhilkevitch@tribune.com or c/o the Chicago Tribune, 435 N. Michigan Ave., Chicago, IL 60611. Read recent columns at www.chicagotribune.com/gettingaround.

RACE FOR MAYOR

Chico supports bill allowing civil unions

Mayoral candidate urges legislators to act in veto session

By Kristen Mack
TRIBUNE REPORTER

Mayoral candidate Gery Chico said Sunday he supports civil unions for same-sex couples and will urge state lawmakers to legalize them when the General Assembly meets this week.

"To me, it's a matter of basic fairness and decency, and it ought to pass," Chico said during a meeting held by a dozen members of the lesbian, gay, bisexual and transgender community at a North Side restaurant, Ann Sather.

Chicago's mayor, however, has little ability to recognize same-sex couples with civil unions. Chico acknowledged that if state legislation does not pass, it's unlikely he would push for a Chicago-only measure should he become mayor.

"I'm not much for drama and hollow actions," Chico said. "We don't want to mislead people and give them the false impression that they have protections if it may not hold up."

Other mayoral candidates, including former U.S. Sen. Carol Moseley Braun and former White House Chief of Staff Rahm Emanuel, support passage of the civil unions bill, which could get a vote during the legislature's veto session.

If elected, Chico said he would extend domestic-partner benefits to city contractors and work to implement mandatory LGBT diversity training for all members of the Chicago police and fire departments.

Chico, a longtime trouble-

shooter for Mayor Richard Daley, has a history of advocating for gay rights.

Rick Garcia, director of public policy for the gay-rights organization Equality Illinois, had words of praise for Chico at Sunday's event.

His presence, however, should not be seen as an endorsement, Garcia said.

"It's too early to make an endorsement. My job is to talk to mayoral candidates and make sure they take into consideration gay issues," Garcia said. "We want to make sure the next mayor follows in Daley's footsteps."

State Sen. James T. Meeks, who is running for mayor, has met with Garcia and LGBT leaders three times, Garcia said. Meeks faces two challenges in winning over the gay community: his conservative legislative record on gay issues and his words from the pulpit of his South Side church.

Some LGBT leaders have said they don't distinguish between Meeks as a pastor and a politician.

Emanuel, meanwhile, released his second television campaign commercial, a one-minute spot his campaign said would start on cable news stations Monday.

It touts his help as a Chicago congressman in keeping a small manufacturing company from relocating to Wisconsin.

kmack@tribune.com

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Read about the campaigning and all the latest news on the run-up to the 2011 Chicago mayor's election.