INNOVATION SNAPSHOTS

Outside-the-Box Thinking from Michigan DOT Employees

Data Access

Mapping traffic volumes now takes far less time thanks to Web-based tools. page 2

Sign Maintenance

Mobile data collection and online mapping bolster MDOT's graffiti cleanup strategy. page 3

Winter Road Maintenance

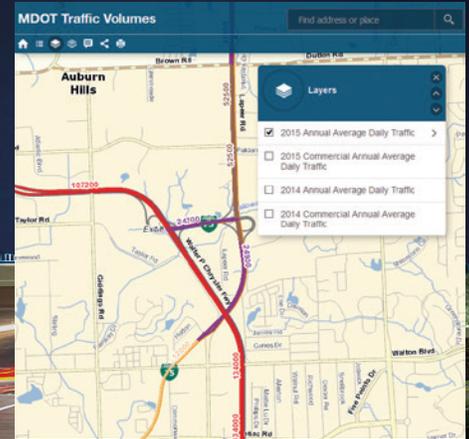MDOT uses snowplow location and sensor data to clear roads faster using less salt. page 3

Bridge Repair

MDOT employees' floating invention helps the Bay Region make big repairs in small spaces under bridges and culverts. page 4

MDOT

WEB TRAFFIC

GIS puts traffic volume maps at your fingertips

New geographic information system (GIS) mapping tools draw from MDOT's databases to produce interactive, on-demand traffic volume maps — all for minimum effort and maximum impact.

ARE THE MAPS READY YET?

Every year, MDOT works hard to collect and compile annual daily average traffic counts for all road segments under the department's authority. "This information is crucial to MDOT for planning and engineering," says Lawrence Whiteside, supervisor of MDOT's Travel Information Unit and Electronic Services Unit. "It's in high demand as well by external customers like consultants and the public."

The digital age has thankfully meant the end of MDOT's desk-sized printed traffic volume maps, replaced in 2004 with PDF maps. However, the PDFs were a challenge to produce,

See current GIS traffic maps at michigan.gov/adtmaps, and explore the Open Data portal at gis.mdot.opendata.arcgis.com.

using up considerable labor hours and calendar days. MDOT was also compiling the traffic information in geo-coded GIS databases back then, but the technology sorely lacked a user-friendly interface at the time.
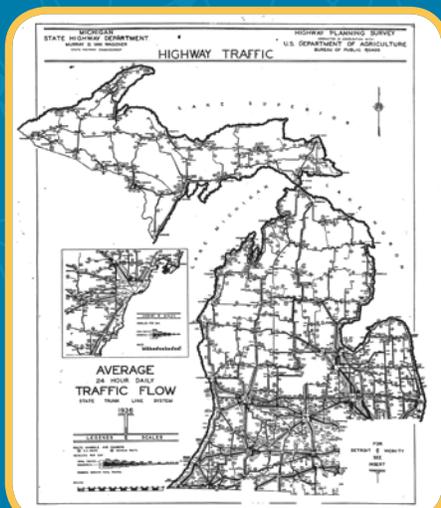
GIS FOR THE MASSES

"Web-based apps eventually came of age to display GIS information," says Matt Robinson, transportation planner with MDOT's Data Oversight

Deep archive: No data was lost with the new GIS approach. MDOT archived PDFs and scanned paper maps dating back to 1936 (mdotcf.state.mi.us/public/maps_adtmaparchive).

and Geospatial Management Section. With close and coordinated efforts between MDOT's traffic and data offices, the department launched its online Traffic Volumes Map in 2013.

Powered by Esri's ArcGIS software, the system displays traffic maps for both the most recent year and previous years. "Thanks to websites like Google Maps, nontechnical users can feel their way around the system fairly easily," Robinson says. MDOT still makes traditional GIS data sets available online for GIS power users.

The program is an unqualified success. "It's no exaggeration to say we cut our effort down by more than 90 percent," says Kevin Krzeminski, MDOT transportation planner specialist. "After finalizing a year's data set, our office used to spend upwards of 400 hours and several months on the PDF maps. Now we spend less than 40 hours."

Traffic counts are one of several GIS-based data sets available in MDOT's Open Data portal, along with a variety of asset and survey data. As new annual traffic counts go live, the older GIS sets find a home in the Open Data portal, with traffic counts dating back to 2006.

Mobile Apps Help Coordinate Graffiti Cleanup

A rash of unsightly and dangerous graffiti "tags" on overhead freeway signs hit the Detroit area in 2012. MDOT's coordinated defense depended on tracking the tags across the metro area, and mobile data collection tools and digital mapping made it possible.

MDOT's secret weapon was a graffiti tracking tool that used Esri's geographic information system (GIS) software product ArcGIS and its Collector app for gathering field data. The user-friendly app lets maintenance workers use tablets and smartphones to capture key data about each tag (including geo-coded location and a photo) to populate an online database.

"The system helped us be strategic and efficient with our cleanup efforts," says Joe Bartus, field operation specialist for MDOT. "In addition, the online dashboard kept management informed on our progress."

MDOT's efforts paid off, with 76 signs cleaned over a total of 35 cleaning days. The whole time, staff remained on the lookout for new tags and kept the system up-to-date. The enterprise ultimately led to a dropoff in new tags.

MDOT's efforts also provided a benefit to law enforcement. MDOT's where-and-when data, along with photos of distinct graffiti signatures, helped police and prosecutors make their case against taggers.

"The system was so effective," says MDOT Transportation Planner Matt Robinson, "that a number of other areas of MDOT were eager to try it." MDOT is now implementing similar GIS field collection systems for invasive species, catch basin conditions, construction permits, and billboard inventory — and the list is still growing.

More than just a nuisance: Tagged overhead freeway signs create unsafe and distracting driving conditions, and cleaning them often requires closing lanes.

Plow Data Powers Faster Snow and Ice Removal

Connected vehicle technology is helping MDOT make winter a bit easier for drivers by clearing snow and ice faster — and saving money in the process.

MDOT started installing GPS-powered automatic vehicle location (AVL) devices on its winter road maintenance equipment in 2013. These systems report where each truck is, and they also gather data from other sensors to report details like atmospheric conditions, camera images, and speed and salt application rates for each vehicle.

MDOT uses that information, plus additional pavement and weather data and forecasts, in its maintenance decision support system (MDSS), which it uses to better plan for winter storms.

It's a powerful combination for managing plowing and salting operations. "Monitoring snowplow speeds and material application helps us apply efficient salting practices," says Melissa Howe, region support engineer for MDOT's Maintenance Field Services Section. "Maintenance supervisors can also easily adjust shifts based on the timing of a storm so we have plows on the streets precisely when they're needed, adding people proactively rather than reactively."

AVL and MDSS have helped MDOT reduce salt consumption by 2.2 percent. MDOT
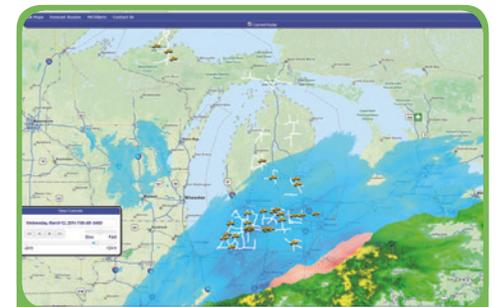
Information applied: MDOT's MDSS is a powerful weather service and monitoring tool that helps the department make informed decisions in planning for winter storms.

spends about $30 million on salt in an average year, so even modest reductions in salt usage save a lot of money. And there's more to come: Steve Cook, MDOT engineer of operations and maintenance, expects even greater efficiencies as MDOT gains experience with the system and finds new ways to apply the data.

In position: After lifting the float with a crane truck, workers use a rip cord to drop the riprap into place.

FLOATING AN IDEA

A new repair tool for small bridges creates big savings

Beneath their seemingly tranquil surfaces, Michigan's streams can hide a threat to the bridges that cross them. That's because running water can create scour — erosion of the soil and rocks around bridge or culvert supports — which reduces the stability of the entire structure.

Traditionally, MDOT engineers have repaired scour in small culverts or bridges by retrofitting the streambed with articulated concrete blocks, held together by steel rods, cables or interlocking geometry. But that can cost about $75,000 for a typical small bridge. It's also not always a suitable approach, so sometimes a complete bridge replacement (costing about $750,000) is the only option.

In 2014, transportation maintenance workers at MDOT invented a better way. Using parts purchased online and a bit of fabrication know-how, they created a float to help them install loose but heavy rocks, known as riprap, around bridge or culvert footings to minimize erosion and add stability.

The float consists of a dump box attached to two buoyant pontoons. Maintenance workers use a skid loader to fill the box with riprap on land, and then use a crane truck to lift the float into the water. Once it's in position, they pull a rip cord to open the bottom of the box and drop the rocks through to the streambed.

BIG SAVINGS WITH LITTLE HASSLE

Maintenance staff can use the float to make repairs without interfering with traffic. "Typically, we only need to close a shoulder to use the float," says Gregg Brunner, associate region engineer for operations in the Bay Region. Most repairs can be made in only a few days.

In an average year, the float saves the Bay Region from having to install two articulated concrete block floors and make one full bridge replacement — projects that would cost about $900,000 total. By contrast, the float method can get the job done for about $4,000 per project ($12,000 total).

The float also provides an example of how MDOT's regions build on each other's work. "MDOT's Southwest Region developed the original float to deliver and place riprap inside a culvert, and then we modified its design," Brunner says.

FAST FACTS

New technique saves Bay Region nearly $900,000 per year

Bridge repairs don't affect traffic

MDOT regions invented the equipment

For more information about any of these innovations, contact mdot-research@michigan.gov.