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The Bridge



A quarterly newsletter from Michigan's Local Technical Assistance Program



Texas Underseal: Cracking Up to Be a Good Treatment for Michigan Roads

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Photo courtesy of M. Worden

Agencies in Michigan have been employing a new approach to preventive maintenance: the Texas underseal. Michigan's county engineers are following the long-term results of the underseal's effective crack-relief layer along with the adaptability of the materials and methods that can be used.

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Michigan's Local Technical Assistance Program

With the annual freeze-thaw cycles and the heavy traffic loads to which Michigan roads are subjected, having no reflective cracking in the surface of an old concrete road overlaid with asphalt (i.e., a composite pavement) after two years of exposure would seem like a sensational claim. But, some local roads in Michigan have experienced this as a result of an innovative approach to overlays.

Here in Michigan, the overlay treatment attaining these results is typically one or two layers of hot-mix asphalt (HMA) with a chip seal layer under it. Karl Hanson, a highway engineer at the Wexford County Road Commission (CRC), had a local road that was slated to become a detour during road work on M-115 in 2012. But, Hanson said the detour's road was "really too narrow, the edges were all broken off. It was in a heavy 'ag' area—so it would receive heavy agricultural traffic, and the 'ag' traffic had beat down the road." Furthermore, he remembered the road had "alligator cracking along the outside edges, going in to the quarter-crown point and to the center of the road" as well as "some transverse cracking".

Faced with the prospect of having 20,000-30,000 cars a day on this road, Hanson feared the road was "going to blow up underneath all that traffic". So, he chip sealed the road the year prior to the detour to improve its ride temporarily; then, he had detour traffic drive on the chip seal surface. After completion of the M-115 project, Hanson paved the county's road and added shoulders. Impressively, Hanson said, "I just put a crack seal on it last year [2016], but I think it had been four years and I think it's performed a

lot better than a conventional overlay." Hanson's technique—as he later came to discover—is a classic Texas underseal.

The Texas underseal is proving to be effective in delaying reflective cracking, or distresses in the original pavement that transmit up through an overlay. A Texas underseal, which is a sealcoat or microsurface, works by providing a buffer between road layers since it is applied to the uppermost layer of the roadway's original surface before placing a hot-mix overlay. It functions like a "bond breaker", according to Mark Worden, project superintendent at the Road Commission of Kalamazoo County (RCKC). "It's a relief layer between the old pavement and the new pavement we are putting on top... it gives [the layers beneath] an area to [move] without reflecting or pulling apart the new asphalt surface."

Moreover, a Texas underseal can subsequently act as a moisture barrier. When the top pavement layer cracks, water on the surface can move into the base layer, which then destabilizes. With a weakened base layer, a road is susceptible to further damage, like alligator cracking or shear cracking, when heavy vehicles drive on it, and the road's usable lifetime is reduced. Thus, a Texas underseal retards or prevents surface water infiltration when the overlay becomes distressed.

Texas Undersealing with a Michigan Twist

The RCKC modified the Texas underseal for their Portage Road project, making their road less likely to succumb to reflective cracking any time soon. They repaired a 1.5-mile section of Portage Road in Schoolcraft Township in the summer of 2015

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MDOT Category F Applications for FY2019

The Michigan Department of Transportation (MDOT) Office of Economic Development is currently accepting Transportation Economic Development Fund Category F applications for Fiscal Year 2019. Eligible applicants include cities, villages and county road commissions. Proposed projects must be on federal-aid designated routes within federal-aid urban areas located in a county with a population of 400,000 or fewer. Higher consideration is given to applications that propose improving all-season capabilities on routes having high commercial traffic or those that improve access to state trunklines.

Category F grant requests are capped at a maximum of \$375,000. A minimum 20 percent local match is required. Overmatch is encouraged and will be considered when evaluating grant requests. Engineering, utility, and right-of-way acquisition costs are not eligible for Category F funding, nor are they eligible to serve as local match.

As a reminder, Preventative Maintenance (PM) projects are ineligible for Category F funding. Only Resurfacing (3R) and Reconstruction (4R) projects are eligible for Category F funding. For the definitions regarding PM, 3R, and 4R, please refer to the *MDOT Local Agency Programs Guidelines for Geometrics on Local Agency Projects*, 2014 Edition.

The application deadline for Category F grants is **Friday, May 5, 2017**. The application and instructions can be accessed at <http://www.michigan.gov/tedf>. For questions, please contact Matt Wiitala, at 517-241-2152 or wiitalam@michigan.gov. ■



Photo: Pxabay, CC0 Public Domain

Letter from the Editor

Driving on M-28 last Sunday, I saw numerous little groundhogs in the grassy areas along the sides of the road. *Maybe*, I said to one of my colleagues, *they're out in droves to signal that spring has finally come to the Upper Peninsula of Michigan?*

If it is finally spring, then it can be a very exciting time, as the lingering snow—now darkened by sand used to maintain winter roads—melts into fresh green grass and as trees bud and early flowers blossom. But, working on a university campus makes one keenly aware of a phenomenon that accompanies spring's new life: change. In the spring, students graduate and go on to make their way in the world or they temporarily leave to gain on-the-job experiences at major corporations or hometown businesses.

For us here at the Michigan LTAP, we see our student intern team both shrink and grow as some of our students graduate and move on to a life full of new challenges and adventures while other students join us for up-to-full-time summer internship experiences. That kind of change is a constant around here, and so we can expect that each spring we will undergo some losses and will also have some new additions to the LTAP team.

Change has been called the 'inevitable' by notables ranging from British politician Benjamin Disraeli and American businessman/philanthropist Tony Robbins to American biochemistry professor/sci-fi writer Isaac Asimov and Irish singer/songwriter Enya. If we can be sure of change, then we should be able to prepare for it at least at some level. Not immune from the inevitability of change—as many of us probably know all too well—is our road-and-bridge network.

No sooner is the construction of a new road or bridge complete that its path to deterioration is under way. That means we know there will come a time when we must intervene to preserve a pavement, for example, or allow it to completely fail. This trajectory is relatively predictable to the point that we now have tools—like Roadsoft's Extended Service Life Calculator—to model when a pavement can be expected to fail and how many years of additional service life a treatment can provide to a deteriorating pavement.

This issue of *The Bridge* addresses the inevitability of change over the course of an asset's life and suggests strategies to imbue new life into failing infrastructure. We begin this issue with a glimpse at the Texas underseal, which is now relieving Michigan roads from early onset of reflective cracking. This issue continues that discussion more broadly by gaining insights from Rob Green, Michigan Department of Transportation's CPM engineer. He details a broader set of tools and ideas for both implementing and gaining support for pavement preservation efforts. To cap off this discussion, we look at what the State of Michigan is planning to do in order to advance Michigan's infrastructure—including its transportation assets—into the 21st century.

We also introduce our readership to Paul Spitzley in this issue. Under Spitzley's guidance, Ionia County has found innovative ways to do their rehabilitation work while saving money, and Spitzley shares that story with us. He also reveals his plans for this summer's preventive maintenance work on Ionia County's road network.

Finally, we provide tips and tricks for working with Excel's PivotTables. Using Excel can be a helpful way to store and analyze asset data. Its PivotTable feature allows users to organize and manipulate data more effectively.

If we fail to prepare for inevitable changes, Benjamin Franklin warns us that we are setting ourselves up to fail. This issue of *The Bridge* is about the robust, diverse set of tools that can prepare Michigan's transportation agencies to meet those changes.

Victoria

The fourth round of Every Day Counts begins this spring and, with it, comes a renewed focus on Pavement Preservation. We spoke with Rob Green, capital preventive maintenance engineer for the Michigan Department of Transportation, to learn what Michigan is doing to advance preventive maintenance and pavement preservation.

Editor: In Michigan, state and local agencies have been using a technique of preventive maintenance for pavements commonly referred to as the “mix of fixes”—the *right fix at the right time in the right place*. Can you explain what is meant by the “mix of fixes” technique?

Green: The “mix of fixes”, at least how we see it, is in reference to having a toolbox full of options or operations to maintain and preserve pavements throughout the course of its service life. The idea is not to rely on the old paradigm of only reconstructing bad pavements first while not doing anything to maintain the rest of the system or network. Rather, the idea is that, having a “mix of fixes” allows you the ability to apply a lesser-cost fix to preserve and extend the pavement life. It dovetails into right place, right time. It implies that you should have a feel for your pavement system (your network) and its condition (how it’s rating over time), combined with the understanding of how

each fix works and how each fix can preserve or extend the pavement life.

Editor: How long has Michigan been using this technique?

Green: The technique of “mix of fixes” can be considered “capital preventive maintenance”—we commonly call that “CPM” or we also referred to it as “preventive maintenance” or “PM”. The Michigan Department of Transportation had had a road CPM program since the early '90s. The program started around 1992 with a budget of approximately \$6 million. Fast forward to present day: the program has grown to roughly \$100 million. A budget like that shows the priority and dedication MDOT has for roads that we maintain and for utilizing this “mix of fixes” to help better preserve our roadways.

Editor’s note: The CPM program budget is approximately 1/8th of MDOT’s capital outlay for roads and bridges which, in 2016, was \$858,672,000.

Editor: How widespread is its use among Michigan’s agencies? Can you share any specific examples of local agencies’ use of a “mix of fixes” approach to preventive maintenance of pavements?

Green: A large number of Michigan’s local

agencies—its county road commissions, its cities, and its villages—have adopted the “mix of fixes” approach to preventive maintenance. Some agencies have been utilizing this technique longer than others. And, Michigan’s Transportation Asset Management Council is doing an excellent job at highlighting the success stories of these agencies. As agencies continue to see a benefit from it, I’m sure more will begin to adopt the technique as well. Prior to coming to the Department, I had worked with a handful of agencies on performing pavement evaluations and assisting the development of their asset management plans.

Editor: What tools and resources are available for local agencies to guide them in making pavement preservation decisions based on a “mix of fixes”?

Green: There are a number of tools and resources available for local agencies to use. For agencies that are just starting to look at a “mix of fixes”, MDOT’s *Capital Preventive Maintenance Manual* is a good starting point to get feel for the number of fixes available

Access the CPM Manual on MDOT’s website:
http://www.michigan.gov/documents/mdot/MDOT_CapitalPreventiveMaintenanceManual_322973_7.pdf



Photo courtesy of K. Hanson



Q&A on Preventive Maintenance with CPM Engineer Rob Green

Allegan County road with a fog seal treatment applied

Q&A with Rob Green (continued from Page 3)

► for both asphalt and concrete pavements. The manual is available on our public website.

One thing to note when going through the manual, you'll see that it provides "trigger" values on when best to utilize a particular fix. These "trigger" values are based on pavement management data (pavement condition) collected on the pavement. The manual also provides a short description of what the existing pavement condition would be for a potential candidate project using the particular fix. So, that's a resource that agencies can use. One final comment regarding the *CPM Manual* is that it is a little dated. I'm currently in the process of revising the manual to reflect current fixes and standards. I hope to get the revised edition out by the end of the third quarter.

Editor: How does Michigan's preventive maintenance efforts for pavements compare to pavement preservation efforts in other states?

Green: Pavement preservation is a "hot topic" for Michigan and other states. We all know that the pavement infrastructure is aging or in many cases beyond its service life.

However, the money available is limited. So, that's why pavement preservation is a collaborative effort. For example, MDOT is an active participant in the Midwest Pavement Partnership and the National Road Research Alliance. Both of these are multi-state groups conducting research on different fixes and looking to improve their quality or their impact on service life. Road agencies understand that we're all in this together. Our good and bad experiences get shared regarding new technologies or innovation or new types of material.

Editor: What unique challenges do Michigan agencies face in their pavement maintenance efforts? How might we better combat these challenges?

Green: I think it's easy to throw out the easy answers such as freeze-thaw cycles, traffic volumes, weight limits, and the obvious one budgets. But, I think the most unique

challenge, in my opinion, that agencies face is community education. It can be hard for the public to understand what the differences are between the types of fixes we do. They see that a road is closed or there are

construction crews working on it, but their expectation of the fix may be different from reality. When the road work is done, they're thinking that the road is smooth and looks brand new. But, it's a pavement preservation fix, so the public may see the road cracking or crews back working on it sooner than they thought and they get frustrated about that. They often don't know the difference between 'Did you just completely reconstruct this?' or 'Was it just a mill and resurface?' or even what these fixes mean in regard to the service life of that pavement. The public education piece is important to help them understand. So, for example: Yes, we were here working on a road five years ago and now we are back on the same section again. Meanwhile, three blocks over that section of road may seem like it's falling apart. But, it may be a more financially responsible to perform another preservation fix to preserve a good pavement than to spend all of the agency's budget on reconstructing a single block and not be able to touch any of the other pavements in the community.

How do you overcome a challenge like this? I think that local leaders need to be open and transparent with the community members. Help to educate your local leaders on pavement preservation and help them understand that pavement maintenance fixes are only intended for three to five years. But, during that three to five-year period, because

Rob Green on Implementing Preventive Maintenance Strategies

Stick with it. Publicly it can be an uphill battle to fight, but the long-term payoff will be there. Pavement preservation is the key to restoring your pavement network. And, that's a significant paradigm shift. Also, don't be afraid of trying different fixes your agency hasn't used in the past or that you've had a bad experience with. There's lots of other fixes out there, like hot-in-place recycling or chip seals that give you a crack relief layer, for example. Materials and techniques are always changing. Stick with it!

these fixes are a lower cost, an agency can touch that many more lane-miles within a community thus improving and maintaining the overall health of the pavement network.

The Michigan LTAP offers Transportation Asset Management for Local Officials, a course that equips local, elected officials to communicate effectively with the public about transportation infrastructure projects. Contact ctt@mtu.edu for information on hosting or attending the course.

Editor: Do you foresee any forthcoming innovative technologies or techniques that might enhance pavement preservation around the state of Michigan?

Green: As I mentioned earlier, MDOT is part of a collaborative effort that is performing continual research. The CPM program does have an Emerging Technology Treatments program. These treatments are different fixes utilizing different materials or techniques than the standard fixes, for example a “scrub seal.” We are going to be testing a “scrub seal”, which is similar to a chip seal but with a slight modification: as the polymer-modified rejuvenating asphalt emulsion is being applied to the existing pavement surface, there are physical “brooms” on the back of the paver that scrub the emulsion into all of the cracks before the aggregate is applied (similar to a chip and seal process).

This gives a more solid surface and seals the surface. We’re going to have a pilot of the project in Newaygo and Oceana Counties, and we’re going to be reviewing how the construction of that goes and evaluating whether it’s truly worth the investment in this new type of fix. So, we’ll be evaluating that before we roll it out for a broader use, if we do see that it’s beneficial.

Editor: The fourth round of Every Day Counts (EDC-4), which begins this year, is highlighting the *when*, *where*, and *how* elements in its Pavement Preservation initiative. By this, EDC-4 suggests focusing on “applying specific project treatments at specific locations”, the “timing” of treatment application, and “quality construction materials and practices”. Can you tell us how Michigan’s “mix-of-fixes” approach to preventive maintenance of pavements may relate to EDC-4 Pavement Preservation?

Green: EDC-4 Pavement Preservation can be boiled down to pavement asset management: knowing what you have, the current condition, and then having a toolbox of fixes available. MDOT and other agencies, we’re continually reviewing and evaluating the conditions of the pavements in their respective networks. This continual condition evaluation allows for a better understanding of how the pavement is deteriorating. This is where the *right place*

and *right time* pieces come into play. The goal of pavement preservation is trying to keep good pavements in good condition with a more cost-effective fix. In regards to quality of construction materials and practices, MDOT is constantly reviewing specifications and material performance. So, we work with industry to make the modifications to our specifications to ensure a high-quality fix utilizing the best materials on construction practices. ■

Did you know?

Roadsoft has a built-in extended service life (ESL) calculator to help you evaluate your “mix-of-fixes” approach. The calculator models the asset data that you have stored in Roadsoft to illustrate the ESL gained by applying capital preventive maintenance treatments to asphalt pavements.



How to Access the ESL Calculator

1. Select **Asset Management** from the main menu.
2. Select **Pavement Management** from the *Asset Management* menu.
3. Select **Extended Service Life Calculator** from the fly-out menu.

For more information, visit ctt.mtu.edu or roadsoft.org/help.



Crack sealing



A Texas underseal on Kalamazoo County's Portage Road: spreading aggregate for the chip seal (left) and paving with an HMA over the chip seal (right)

using the Texas underseal technique, which the RCKC learned from Tom Wood, now-retired, during a peer exchange with the Minnesota Department of Transportation. Worden noted that the road—with an underlying layer of deteriorating 6- to 8-inch-thick concrete and multiple courses of hot-mix asphalt overlay—was part of the old US-131 route before US-131 was diverted, in the 1960s, to where it is today. According to Worden and Travis Bartholomew, the operations director at the RCKC, the lower layers were creating reflective cracks, which propagate up from the concrete and break the road's upper layers. This cracking can happen to such a degree that Bartholomew said they expected open cracks after the first winter following the Portage Road repair. "We were thinking we were going to have to go out there and crack fill year-old asphalt." Only, the road didn't crack. Now, two years later, the RCKC has yet to perform any maintenance on the roadway or see any cracks appear in its surface.

Preparing for and laying the underseal on Portage Road was a 20-day process. Worden explained that they "milled off 4 inches of asphalt and put down our typical chip seal, which is a high-float, rapid set 2M emulsion and a 3/8-inch crushed stone for our aggregate... [directly] on top of the milled surface". They followed this chip seal by "two lifts of HMA". To keep the first course of HMA "as rich as possible" and to minimize reflective cracking, Worden said that they used a 36A asphalt, which is a fine gradation mix, along with additional bituminous binder to "[reduce] the air voids in the mixture". They also used asphalt cement (binder) grade 58-28 in the 36A to allow for more flexibility in the first lift. For the second course, they used Superpave™ mix for the surface with a polymer-modified binder in order to accommodate the road's average daily traffic count of 6,000-8,000

cars while giving the pavement resistance to rutting.

According to both Worden and Bartholomew, the RCKC saw no cracking on this section of road a year after the project was completed, at which point they

laid down a precautionary chip seal and fog seal to seal the top surface of the pavement from water and sunlight in hopes of preventing the new HMA's asphalt binder from becoming brittle due to age hardening. Bartholomew described these precautionary seal treatments, which waterproof the road from the top, as creating a "sandwich seal" of sorts in conjunction with the Texas underseal, which protects the road from the bottom.

When laying the HMA layers over the underseal, different approaches have been met with equal success. Wexford County gave the underseal months to cure fully before the HMA paving process whereas Kalamazoo County only allowed hours to transpire between undersealing and HMA paving. Tom Wood was known to have theorized* that, so long as no reflective cracking had broken through a chip seal surface, using it as an underseal could still be effective regardless of when the HMA paving occurs.

* Listen to Tom Wood's update on Texas underseal from the 2015 Transportation Asset Management Conference: <http://ctt.nonprofitsoapbox.com/upcoming-events/event/155>

Only Time Will Tell

While Texas undersealing has been known

to exhibit underseal binder bleeding up to the road surface when exposed to heat from the HMA layer, this has not been observed in Michigan's projects. But, when it comes down to deciding whether to use Texas undersealing treatments, Bartholomew points out, "We don't have a lot of experience under our belt. That's a problem with road projects and road research: the advantages, a lot of times, aren't seen for years. In [the Portage Road] project, we're already seeing some advantages [with the underseal]. The question is, for how long?"

Because underseal treatments are relatively new in Michigan, it is difficult to anticipate long-term effects. Nonetheless, Wexford CRC evaluated undersealed sections of their county roads last year and found almost no cracking in comparison to sections without underseal on the same projects, which are exhibiting hairline transverse cracking. Hanson's successful experience with Texas underseal means he's going to "push the limits of it and how effectively we can do it." He suggested that road agencies "use [underseals] as one tool". Hanson emphasized that Texas underseal is not a "universal treatment", noting that it can "add substantial cost to each project; that may or may not be the right choice". But, he encouraged agencies to "build [their] confidence and level of experience with it... Just experiment with it: you can do a quarter mile [of chip seal]; then, you can overlay the whole mile [of road to be improved] and see if that quarter mile performs better than the remaining three quarters." Hanson pointed out that the only way agencies will determine best practices for using Texas underseal in Michigan is by "build[ing] experience using it in a lot of different circumstances across the state."

For now, though, Hanson, Worden, and Bartholomew feel fortunate that their Texas undersealed roads have been experiencing a few years of relief from reflective cracking. ■



Left: Undersealed section of Wexford County's South 45-Mile Road with no edge cracking; Right: Undersealed travel lane preventing rainfall from permeating underlying layers compared to shoulder without underseal

RESOURCES

1. Pavement Design Guide: <http://onlinemanuals.txdot.gov/txdotmanuals/pdm/index.htm>
2. MnDOT Special Provisions 2016 Boiler Plates: <http://www.dot.state.mn.us/stateaid/pavement.html>

NEED MORE GUIDANCE?

Karl Hanson (engineer@wexfordcrc.org | 231-775-9731) can provide guidance for agencies planning to implement Texas underseal.



Moving Michigan's Infrastructure into the 21st Century

Administration, Communication, and Education (ACE) Committee
Michigan Transportation Asset Management Council

Michigan's economic future hinges on its transportation infrastructure. That premise is a point that Eric DeLong, Grand Rapids deputy city manager, would underscore. "The quality of our infrastructure drives both quality of life and prosperity in neighborhoods and business districts," he explained. "Our experience shows that strategic investments in infrastructure make a significant difference for our community. The same would be true for Michigan."

DeLong was a member of the recent 21st Century Infrastructure Commission, which published a report on December 5, 2016, outlining 110 cost-effective recommendations for safe, reliable, and efficient 21st century infrastructure systems. The Commission—created by Governor Rick Snyder and comprised of 27 members from the business, government, nonprofit, and academic communities—put forward recommendations to improve Michigan's infrastructure; essential to this improvement is an integrated statewide asset management system that would include transportation infrastructure data as well as drinking-water, storm-water, sanitary-sewer, energy, and communication systems data.

A statewide asset management database and better coordination in planning, construction, and maintenance emerged as needs for all infrastructure types from public

concerns that were voiced during an online forum and at both public and stakeholder meetings around the state. Local agencies will be able to use a forthcoming statewide asset management database to store condition information for assets beyond their roads and bridges. This data will enable the modelling of more utility right-of-way projects at the local, regional, and state levels. Avoiding the multiple road surface disruptions following a paving project due to underground utility work, for example, would reduce costs, reduce disruptions, and improve the public perception of transportation and utility providers.

Creation of this statewide asset management system will begin in fiscal year 2018 with a pilot program. The pilot's goals are to develop a database of infrastructure elements and measurements that are commonly used in the state and to determine incentives for data collection. On April 3, 2017, Governor Snyder's office announced that the prosperity regions in the southeast and west of Michigan will be collaborators in this development effort.

To support this effort, the Michigan Legislature will be establishing a Michigan Infrastructure Council, making the Michigan Transportation Asset Management Council's (TAMC) assistance potentially valuable as the process moves forward. "The TAMC has nearly 15 years of experience improving

cooperation, collaboration, and sharing best practices among large and small transportation agencies" says TAMC Chair, Joanna Johnson. "Being involved and supporting the critical initiatives of 21st Century Infrastructure Commission's recommendations continues these efforts that we find vital at the TAMC."

Local agencies and consultants who attend the 2017 Spring Transportation Asset Management Conference can have their questions answered or concerns addressed at a coffee conversation with representative agencies selected for the pilot program. The conversation will also reveal developing details about the creation of the statewide asset management database, who is paying for it, and who is collecting the data. This year's spring conference will be held on May 25th in Mount Pleasant. The conference gives local agencies and consultants a venue to learn innovative road and bridge asset management techniques used by the State and by other local agencies. ■

Elisha DeFrain, MDOT Intermodal Policy Section, contributed to the authorship of this article.

RESOURCES

1. 21st Century Infrastructure Commission report, Dec. 5, 2016: www.mlinfrastructurecommission.com
2. April 3, 2017 memo from Gov. Snyder's office: <http://tinyurl.com/govsnyder-memo20170403>
3. Michigan Transportation Asset Management Council: www.michigan.gov/tamc

2017
Transportation Asset Management Conference

Spring Conference
 May 25, 2017 – 8:00 a.m. - 4:00 p.m.
 Mount Pleasant, Michigan



For more information, visit: michigan.gov/tamc

Register at:
<http://ctt.nonprofitsoapbox.com/2017tamc-spring-conference>

Excel PivotTables, Easy as 1-2-3

Chad Banka, PE – TranSystems
Reprinted from *Kansas LTAP Newsletter*, Winter 2015, with permission



In public works professions we develop data spreadsheets containing many types of information. We track crashes, monitor traffic data, keep maintenance records and quantify product consumption during winter storms, to name a few. The information collected is invaluable, but we need to efficiently organize the data into something useful.

PivotTables are a versatile feature of Excel, offering a powerful way to organize and quickly manipulate a lot of information without cumbersome, headache-inducing formulas. They are easy to update and they allow data to be summed, counted, or averaged quickly by dragging and dropping with a few clicks of the mouse.

At WICHway, KDOT's Intelligent Transportation System in Wichita, PivotTables help make sense of the massive amount of collected data. The information generated from PivotTables is used to create traffic incident and congestion index reports for Wichita's major highways. Once created, these graphs and reports may be easily updated each month.

When information is requested by a council member, commission member, or the public, it is helpful to create a table in minutes showing how many signs were struck in a particular month or the average amount of product used in a winter storm. When comparing monthly data, yearly trends or analyzing traffic count data, PivotTables help us communicate by streamlining the data into meaningful information that is easy to visualize and understand.

Making these reports is easy. Let's walk through some simple steps to get you started in just minutes.

Step One. Organize your spreadsheet data.

The data in your Excel spreadsheet must be organized in columns and include appropriately-named headings. Eliminate empty rows and columns and clean up any bad data. For this example, we have several

thousand rows of crash/incident data over the course of one year.

Step Two. Create the PivotTable.

In the insert ribbon at the top of the screen, choose Tables, then PivotTable. Excel will automatically select all of the data in your spreadsheet, outlined by the "marching ants" border; or you may custom-select the data you want from the activated dialog box. Next, select where you want to place the PivotTable (typically into a new worksheet) and hit "OK." Once selected, a new worksheet and PivotTable box appears.

Step Three. Build the PivotTable report.

Step Three. Build the PivotTable report. To build your table, simply drag and drop the fields (the column headings of your spreadsheet) you want to summarize into the row, column and values area of the PivotTable Field List.

In our example, we want to count the total incidents on four major highways in Wichita and filter out unwanted information. To accomplish this, we drag the highway field to "Row Labels," and incident type to the "Values" area. The "Values" area identifies and controls the type of calculation summarizing your data. By default, the counting value is used, but other functions, including averages, sums, and basic statistics, are available by double-clicking the field button (or right click the field button) and selecting "Value Field Settings." Lastly, the incident type field is placed into the "Report Filter," filtering out unwanted data.

At this point, the PivotTable begins to automatically generate. From here, we may want to add additional fields to our PivotTable, make comparisons, or separate our data by month. It's exciting to try different fields and functions and then watch the PivotTable

A powerful, easy-to-use feature you can't live without

PivotTables help you communicate meaningful information generated from your spreadsheets—information people can understand and use.

Inc Id	Link Name	Highway	Direction	Link Id	Longitude	Latitude	Start Date	Start Time	Incident Type
180	14224 US-54 WB at Armour	US-54	W	54022140	-97.247492	37.680117	1/3/2014	7:55:00	ACCIDENT-INJ/FAT
181	27584 US54 at Woodlawn-WB	US-54	W	54219640	-97.2639	37.6797	12/30/2014	9:21:00	ACCIDENT-PDO
182	27469 I-135 at Pawnee-SB	I-135	S	13500402	-97.312004	37.650135	12/23/2014	17:07:00	ACCIDENT-PDO

A PivotTable starts with an Excel spreadsheet with cleaned up, well-organized data.

Photo: Pixabay, CC0 Public Domain

Image courtesy of C. Banka

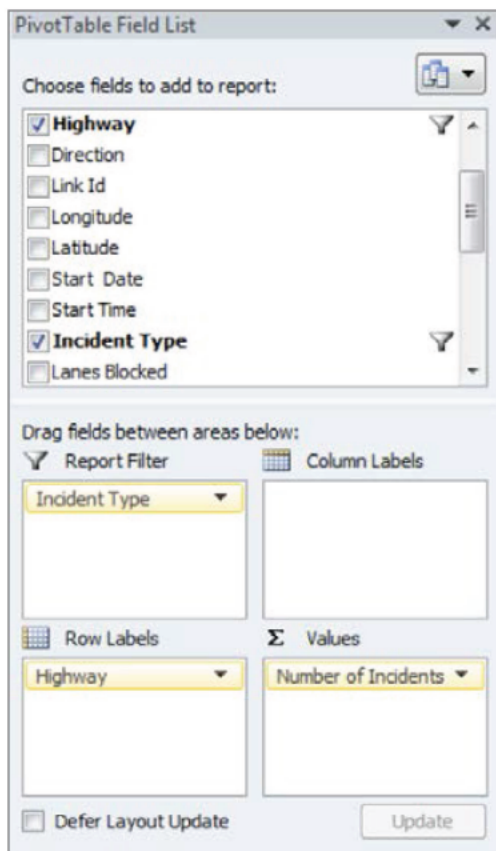


Image courtesy of C. Banka

When creating the PivotTable, you simply draft the fields you want in your report into the Report Filter area.

dynamically update. PivotTables can be as complicated or simple as you need them to be.

A step further...

The three steps above are just the beginning. Many of the basic Excel functions you're already familiar with can be used to sort, arrange and format the data to your satisfaction. PivotCharts are a great way to illustrate the data from the PivotTables. PivotCharts include bar and pie charts as shown here, but line charts, scatter plots, and numerous other charts are also available.

Want to add more raw data to the spreadsheet? No problem! Individual or multiple PivotTables and charts in the workbook are easy to update after adding new data to the spreadsheet by using the standard refresh or refresh-all button. If you're looking for more information on PivotTables or have questions, videos and interactive tutorials can be found through a simple search on the internet. To see some examples of how TranSystems uses PivotTables, check out the "Reports" section at <http://www.WICHway.org/wichway/Reports>. ■

USING SLICERS

Slicers, new in Microsoft Excel 2010, are similar to traditional filters, but are easier to understand and visualize. Slicers are available for both PivotTables and PivotCharts and interactively filter the data using buttons that allow the user to quickly control the displayed data. To insert a Slicer, select the intended PivotTable, click "Options" from the PivotTable Tools ribbon, and select "Insert Slicer."

In our example, instead of looking at the data for the entire city, we may want to look at a specific highway or compare a couple of options instead of using all the spreadsheet data. Using Slicers and a click of the mouse on the intended highways, the table updates instantly. Multiple Slicers may be used on a single table or chart, allowing the user to look at or analyze specific information with a click of the mouse, such as filtering to look at injury or animal crashes on just one highway. – *Chad Banka*

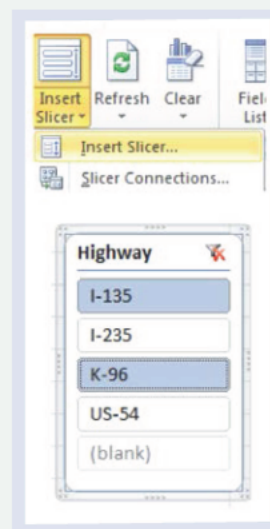


Image courtesy of C. Banka

ALL VALUES OF THE SAME TYPE SHOULD BE IN ONE COLUMN

To create a good pivot table, columns should be categorical. So, for example, columns might be labelled "Project Type", "Contractor", "Quarter", "Month", "Cost", and so forth. Then, each data point (or record set) should populate one row. Below is an example of data not arranged categorically; that is, the date/time values in columns B, C, and D do not reflect the column header, incident type. To make this data suitable for a pivot table, one column should be dedicated to incident type while another column should be dedicated to incident date/time (see example with article, left). – *Editor of The Bridge*

Highway	Accident-INV/FAT	Accident-PDO	Accident-PDO
US-54	1/3/2014 - 7:55:00	12/30/2014 - 9:21:00	0
I-135	0	0	12/23/2014 - 17:07:00

NEED ASSISTANCE?

The Michigan LTAP team can guide you in using advanced features in Microsoft Excel. Call 906-487-2102 and ask for Excel help.

ADDITIONAL RESOURCES

Microsoft Support "Create a PivotTable to analyze worksheet data":
<https://support.office.com/en-us/article/Create-a-PivotTable-to-analyze-worksheet-data-A9A84538-BFE9-40A9-A8E9-F99134456576>

Excelcampus.com "How to Structure Source Data for a Pivot Table & Unpivot":
<https://www.excelcampus.com/modeling/structure-pivot-table-source-data/>

Reprinted from *Kansas LTAP Newsletter*, Winter 2015, with permission. Chad Banka is a transportation engineer in TranSystems' Wichita office and is the operations support engineer for WICHway, Wichita's Intelligent Transportation System. WICHway is owned and operated by the Kansas Department of Transportation and is located in downtown Wichita. Banka may be reached at (316) 303-3000 or at ccbanka@transystems.com



‘The Guy that’s Making an Improvement’: Paul Spitzley

Kelsey Fournier – Engineering Intern
Center for Technology & Training

Paul Spitzley, left, at the Cleveland Street Bridge opening

Photo courtesy of P. Spitzley

Ionia County, comfortably situated between Grand Rapids and Lansing, faces a common challenge of being able to fund the maintenance costs of their transportation systems. This challenge has another complexity: additional traffic on their rural roads due to the growth of surrounding areas. But, Ionia County Road Commission (CRC) has locally born and raised Paul Spitzley as its county highway engineer. Spitzley is guiding the CRC with creative solutions to their transportation engineering problems.

Spitzley knew, while growing up in Ionia County, that he wanted to do something proactive, as he “liked working with people” and “trying to improve our community”. Spitzley recognized that he’s “always been interested in building things”; he explained, “Ever since I was young, I liked playing with Legos and Lincoln Logs...”. That interest was kindled by his responsibilities on the family farm: at first, picking up stones and washing the equipment, then operating equipment for tilling, planting, and harvesting. His interest evolved into a goal of “making things easier and better” and, to fulfill this aspiration, Spitzley attended Michigan State University and attained a degree in civil engineering in 2009.

After working briefly for the Road Commission of Kalamazoo County, Spitzley

made his way back to the place where he plants soybeans and monitors a grain elevator and, whenever he can, enjoys being in the outdoors golfing, running, playing pickleball, or hiking with his wife Emily: Ionia County. The county’s hometown feel and knowing its residents and their personalities makes the job gratifying, according to Spitzley. He acknowledges that he’s sometimes faced with “folks you just can’t please—that is part of the job and it can be difficult”. Nonetheless, there’s a sense “satisfaction that comes from completing a project [that pleases] everyone... as much as possible” and a sense of pride from “improving the community around you” that help him overcome those difficulties. Spitzley said, “I think the reason that I got into it is: I want to be the guy that helps to make that improvement.”

Making Improvements, One Road at a Time

One of Spitzley’s first projects at Ionia CRC was to bring a geosynthetic-reinforced soil with an integrated bridge system (GRS-IBS) project—the first of its kind in Michigan—to completion. His predecessor planned and designed the project, which would use a polymeric geosynthetic material with compacted granular fill for the abutments and a jointless interface that compensates for differential settlement for the bridge approach (detailed in *The Bridge* 27.4: <http://michiganltap.org/TheBridge>). It’s a more affordable alternative, having a 25 to 60 percent lower cost than the traditional form of construction, according to the Federal Highway Administration. “So far,” said Spitzley, who oversaw the construction and completion of the project, “it has worked really well, and we’re really happy with it.”

Since then, Spitzley has been improving Ionia County through a “broad range” of

projects. For instance, Spitzley served as project engineer for the Cleveland Street Bridge project, which brought four local entities—the County Board of Commissioners, the City of Ionia, Ionia Township, and the CRC—together to fund it collectively. The project included both a reconstruction of the bridge, which is one of two bridges that crosses Grand River in Ionia County, and a re-design of the intersection located there to incorporate safety improvements. The intersection work also consisted of leveling the grade and improving both intersection and stopping sight distances, which essentially meant reworking the intersection in its entirety. Spitzley was the road commission’s “eyes and ears”, doing everything from approving designs and tracking the budget to monitoring the project and updating the public. Spitzley feels that the scale of the project and the cooperation of agencies has had a positive impact on Ionia County.

Considering Possibilities

Spitzley learned early on in his career that “it is okay to say ‘I don’t know’” when presented with a question. He’s noted that it’s often “worse to assume or to guess” and taking a “longer period to get someone an answer and to make sure that it is the right answer” is a better way of handling a situation. Moreover, he advises others to take the time to look past the obvious and to consider possibilities because the initial option isn’t always the best option.

As a county highway engineer, Spitzley must balance limited funding to do construction work with using “[the best possible] option that’s going to get you through to the next day.” According to Spitzley, Ionia CRC’s maintenance department is “very versatile”, which meant they were an optimal option for the prime contractor on last year’s reconstruction of a



Photo courtesy of P. Spitzley

Cleveland Street Bridge during reconstruction project, which also included a redesign of the intersection to implement safety improvements

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About LTAP

The Local Technical Assistance Program (LTAP) is a nationwide effort funded by the Federal Highway Administration and individual state departments of transportation. The goal of the LTAP effort is to foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers.

Steering Committee

The LTAP Steering Committee makes recommendations on, and evaluations of, the activities of Michigan's LTAP.

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“Spitzley oversaw the CRC maintenance department’s excavation, drainage improvements, removal of trees, and reconstruction preparatory work, which they did with their own equipment, before having the contractor take over with the pulverizing and re-paving.”



Divine Highway
 Ionia CRC Maintenance Department

Photo courtesy of P. Spitzley

2-mile stretch on Divine Highway. Rather than bidding out the entire project to a contractor like most agencies do, Spitzley oversaw his CRC maintenance department’s excavation, drainage improvements, removal of trees, and reconstruction preparatory work, which they did with their own equipment, before involving a contractor with the pulverizing and re-paving. “It’s something that’s not done too often,” Spitzley said. The CRC believes that their ability to prepare the site before the contractor’s reconstruction work yielded cost savings, something that allowed the CRC’s available funding to be used more effectively.

Looking to the Future

In 2017, Ionia County’s roads will be seeing several preventive maintenance efforts—crack sealing, drainage work, chip sealing, and resurfacing. Spitzley says the county is anticipating increased funding from the state and plans to apply it to their paved road system, which is behind on maintenance due to the concerted effort to keep the local gravel roads open. “The future is to look at that, and to look at our county as a system and to try to get through our entire system and make improvements throughout the county,” he explained. Spitzley foresees taking on the role of project engineer during the preventive maintenance work, a role that will allow him to continue his efforts to improve Ionia County’s roads and bridges and to set apart Ionia County as having one of Michigan’s innovative road commissions. ■



Divine Highway

Photo courtesy of P. Spitzley



Michigan's
 Local Technical
 Assistance Program

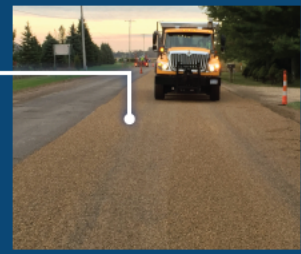
The Center for Technology & Training (CTT) is a part of the Department of Civil & Environmental Engineering at Michigan Technological University in Houghton, Michigan. The mission of the CTT is to develop technology and software, coordinate training and conduct research to support the agencies that manage public infrastructure. In support of this mission, the CTT houses Michigan’s Local Technical Assistance Program, which is part of a national effort sponsored by the Federal Highway Administration to help local road agencies manage their roads and bridges. For more information, visit www.ctt.mtu.edu.

The Bridge

Bridging the gap between research and practice since 1986

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- ▶ Q&A on Preventive Maintenance with CPM Engineer Rob Green
- ▶ Moving Michigan's Infrastructure into the 21st Century
- ▶ 'The Guy that's Making an Improvement': Paul Spitzley



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Upcoming Events

Register at ctt.mtu.edu/training

2017 Traffic Safety Training for Local Officials

May 10 – Kalamazoo

2017 Bridge Load Rating Workshop & Webinar Series

April 27 (webinar), May 11 (webinar), May 18 (workshop: Dimondale), June 8 (webinar) June 22 (webinar)

2017 FHWA & MDOT Construction Focus Areas Webinar

May 11

2017 Transportation Asset Management Conference

May 25 – Mount Pleasant

2017 PASER Training Webinar

June 1

2017 PASER Training Comprehensive Course

June 7 – West Branch

SAVE THE DATE: 2017 Winter Operations Conference

October 17-18, 2017 – Bellaire

SAVE THE DATE: 2017 Intro to Roadsoft (Hands-on) Training

October 31 – Lansing

SAVE THE DATE: 2017 Roadsoft User Conference (RUCUS)

November 1 – Lansing

2017 Bridge Load Rating Workshop & Webinar Series

Register at:

loadrating.michiganltap.org

Bridge Load Rating Workshops

Horatio S. Earle Learning Ctr • 7575 Crowner Drive • Dimondale, MI 48821

May 18, 7:30 AM – 4:30 PM or Sept. 12, 7:30 AM – 4:30 PM

Bridge Load Rating Webinars

The Basics - From Plans to Load Rating

April 27, 9:00 AM – 11:00 AM or Aug. 22, 1:00 PM – 3:00 PM

Load Rating Theory & Policy

May 11, 9:00 AM – 11:00 AM or Aug. 29, 1:00 PM – 3:00 PM

AASHTOWare Bridge Rating™ Output Reports

June 8, 9:00 AM – 11:00 AM or Oct. 24, 1:00 PM – 3:00 PM

Advanced Topics in Bridge Load Rating

June 22, 9:00 AM – 11:00 AM or Dec. 5, 1:00 PM – 3:00 PM

