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2019

# Build a Better Mousetrap



U.S. Department of Transportation  
**Federal Highway Administration**

OFFICE OF INNOVATIVE PROGRAM DELIVERY





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*All images featured in this publication were provided by the respective competition entrants.*







## Transforming Transportation Through Innovation

The Federal Highway Administration (FHWA) annually recognizes innovation among local agencies and tribes through the Build a Better Mousetrap (BABM) national competition. BABM shines a spotlight on those frontline workers who use their expertise and creativity to solve everyday problems that improve safety, reduce costs, and increase efficiency.

The FHWA Office of Innovative Program Delivery's Center for Local Aid Support administers the Build a Better Mousetrap national competition. Entrants are winners from competitions throughout the country.

This year's winners were selected based on an innovation's cost savings, benefits to the community or agency, ingenuity, and ease of transference to other agencies. FHWA also considered an innovation's effectiveness in three categories: Facilities Improvements, Inspection and Data Collection, and Maintenance Tools and Methods. The competition's fourth category, Asset Management Techniques, had no entrants in 2019.

## Innovation Among Local and Tribal Agencies

Local and tribal agencies are responsible for more than three million miles of roadways and roughly 50 percent of the bridges in the United States. These transportation networks are vitally important to both the economic health of the country and the quality of life for all Americans. These agencies must use limited budgets and resources to serve the needs of their customers. Innovation can be the mission-critical factor that helps bridge that gap. Local and tribal road practitioners continually implement incremental changes in their processes, tools, and services to reflect groundbreaking technologies and best practices. In their roles as innovators, agency staff leverage their considerable creativity, technical expertise, and diverse talent pool to suggest changes that are useful, valuable, and impactful to their local system. Build a Better Mousetrap (BABM) showcases the most clever and creative practices and tools from across the country. By sharing these innovations with one another, local and tribal road departments can adapt these new tools and practices, and deliver more efficient, cost-effective services to their communities.

For additional information about LTAP or the Build a Better Mousetrap national competition, please visit <https://www.fhwa.dot.gov/clas/ltap/>.

# FACILITIES IMPROVEMENTS

These innovations enhance the quality of operation and improve the use of transportation facilities through construction, alteration, and innovative repair.

## WINNER

East Brandywine Township,  
Chester County, Pennsylvania

## Rolling Rack for Salt Spreaders Boosts Safety

"I usually say if you don't find anything to do, you're not looking hard enough," remarked Matthew VanLew. As Roadmaster of East Brandywine Township in Chester County, Pennsylvania, VanLew doesn't believe in idle hands. The former carpenter oversees 38 miles of roads and helps maintain a 19,000-square-foot municipal building. There are endless acres of grass to cut and trees to clear, and always something to repair.

VanLew often reminds his crew of five that if they're faced with a job they don't feel comfortable doing, they shouldn't. Many of the team's morning meetings conclude with him reminding them, "Be safe out there."

This level of support makes public works employees like Derrick Claas and Kyle Mortzfield feel empowered when exercising their problem-solving muscles around the garage. They freely share their practical yet creative ideas, especially when it comes to finding ways to save space. No stranger to the creative process himself, especially when it comes to working with wood, VanLew says "sawdust is in our blood."

East Brandywine Township's facility is filled to capacity with equipment and supplies inside and outside of the building. For most equipment, indoor storage is preferred to protect the investment. However, space is at a premium, and oversized equipment, such as salt spreaders weighing

300 to 500 pounds, pose the biggest storage challenge. Couple that with the need for quick and easy access during the winter and you soon find yourself out of space.

"They would all be spread out on the floor," says Mortzfield. "To get to them, we would have to move a truck and a couple of plows because we don't really use them a whole lot."

Not only were the spreaders tucked away on the front side of the garage, but each also required a backhoe to lift it onto the back of a truck outside—and the help of two to three people. To get the backhoe into the garage, many other pieces of equipment had to be moved out of the way.

Claas and Mortzfield knew there must be a smarter way to organize and move the spreaders, so the duo started brainstorming. Drawing on previous project experience, such as mounting a wheel on a concrete mixer to make it easier to transport, they arrived at the perfect solution: a self-contained unit on wheels that could be operated by a single person.

Realizing they could easily repurpose lumber that had been reclaimed from an old structure, they took dimensions of the spreaders and started building. Casters and hardware were the only items that needed to be purchased for the project, resulting in a total cost of \$50.

The biggest challenge was figuring out how to stack the spreaders so the bottom row had access, but they solved this problem with an ingenious two-piece, double-decker design. Perched on wheels, the first layer holds two spreaders, while the cradle above them holds two more.



At a moment's notice, the new 5 L x 9 W x 4 H foot rack could be wheeled out the door to a chain hoist the township garage salvaged from an old pump station. Once hooked to the spreader, the hoist can raise and lower it so it lines up perfectly with a dump truck. The same person who wheeled the rack out can then position the four pins necessary to finish mounting the spreader into place.

"It makes it a one-man operation and safer than using the backhoe," says VanLew of the project's benefits. And not only is it safer but it's also more efficient.

According to Claas, "You can get a spreader onto a truck on your own probably in 10 to 15 minutes. It would probably take the same amount of time using the backhoe, but that was also with two or three people doing it. You save 20 minutes per spreader because those other two employees could be doing something else [like loading the truck with salt]."

"Plus," VanLew continues, "during snow or bad weather, we have to pre-salt the roads as quickly as we can—or maybe we're called in the middle of the night and it takes about a half-hour to get to the township garage... By putting the spreader on one truck within 10 minutes, that driver does not have to wait to help with the other trucks. It saves a lot of time and it gets us on the road a lot quicker."

This time- and space-saving innovation led Claas and Mortzfield to receive recognition at an East Brandywine Township Board of Supervisors meeting, and they've started to share their idea with public works colleagues in the area.

VanLew is proud of their innovation. "To see what they did and what they accomplished, and how it's really benefited the township and our crew, is pretty amazing."

Asked what's next for the duo, VanLew laughs and says, "I can see their wheels spinning right now."



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Town of Parker Engineering & Public Works, Colorado

## Street Sweeping Goes Solo With Modified Trailer

The Town of Parker Department of Public Works is responsible for street sweeping on arterials and collectors with posted speed limits in excess of 45 mph. These conditions dictate the use of a crash attenuator to provide a safe work zone for road crews and motorists. Parker's sweepers were not designed to allow for towed crash attenuators, so the Town utilized an attenuator truck to follow the sweeper, increasing labor costs and reducing the availability of staff resources available to perform other maintenance tasks. After researching solutions, the Department ordered, modified, and attached a crash attenuator trailer to the street sweeper, eliminating the need for a second vehicle and reducing costs. From a total cost of \$33,000 for the trailer and tow hitch modifications, Parker anticipates an annual savings of roughly 300 staff hours. This equates to an annual labor savings of \$9,360, so the town will realize a full return on its investment in just under four years, and continue to reap that benefit over the anticipated 12-year life span of the attenuator trailer.



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Public Works and Water Resources, City of Newark, Delaware

## Street Sweeper Gets a Second Chance to Serve

The Public Works and Water Resources Department in Newark, Delaware, wanted to repurpose the city's inoperative street sweeper. While the back engine that powered the sweeping machine no longer worked, the truck's front engine and chassis were fully functional. By installing a flatbed for moving materials and adding a removable brine tank for pretreating roadways before winter storms, the remodeled truck allowed Newark to add two capabilities to the city's fleet while simultaneously reducing waste by keeping a functioning vehicle out of the landfill. In addition, the team added emergency lighting as well as new electric valves and PVC piping for brine application that perform exceptionally well at accepted brine application rates. Creating the entire project for the "new" truck in-house for \$2,795—far less than the cost of purchasing a new one—demonstrated how an old street sweeper can live on with a few innovative modifications.

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Schuyler County Highway Department, Illinois

## Recycled Oil Cuts Energy Costs

The Schuyler County Highway Department wanted to reduce energy costs for its shop spaces. After implementing a few energy-saving upgrades, they decided to tackle their most costly consumption expense: heating the four bays for the County's snowplow trucks as well as their front office space. For \$6,985, the Department acquired a used oil burner for heating the bays, and for the first few years, supplied and stored its own oil in a self-fabricated, 500-gallon tank at a cost of \$1,500. Wanting to make the system even more economical and efficient, Schuyler partnered with local mechanics to repurpose used oil from their shops into heating oil for the system, supplying the burner through a rotation of recycled 275-gallon intermediate bulk totes. Today, the facility meets 90 percent of its heating needs using recycled oil, dramatically reducing energy costs. Before implementation, the annual utility budget ranged from \$12,000 to \$14,000; with the new system, the annual budget for the last three years has ranged from \$2,000 to \$3,000, resulting in a savings of roughly \$10,000 each year.



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Lancaster County Engineering, Nebraska

## Mobile Command Center Streamlines Engineering Services

Like many local road agencies, Lancaster County Engineering faces the challenge of having its staff dispersed broadly across 850 square miles. This results in significant time lost when traveling to a central location for training, transporting samples to the laboratory for testing, and other countywide tasks. When the health department de-commissioned a mobile dental clinic, the County decided to set aside the vehicle as surplus. Engineering obtained the unit and transformed it into a mobile coordination, command, training, and testing center for the County's roadways. The unit came equipped with running water, a bathroom, laboratory sink, and small offices that road crews could repurpose into workspaces and training rooms. The Engineering staff then restocked the lab with tools and added a Wi-Fi repeater to integrate with the County communication system, work order system, and other online resources. Now, the County roads team uses the repurposed command center to test materials on-site, verify specifications, and hold small group trainings at locations countywide. This innovative use of an existing vehicle cost just \$850 and helps Lancaster County Engineering provide quality services more quickly and efficiently.

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Lancaster County Engineering, Nebraska

## Truck Platform Steps Up Maintenance Safety

Lancaster County employees used various inefficient methods to reach overhead work while performing sign maintenance, brush trimming, and other tasks in the field. Over a two-day period, an Engineering staff member created a portable work platform that mounts to the side of a pickup truck. The platform sits over the wheel well and easily folds up during transport. When in use, safety rails and chains prevent falls from the platform. The device, which cost \$945 to design, assemble, and test, instantly improved safety and sign maintenance tasks. In addition, the specially equipped truck allowed the one sign technician to focus on all significant sign maintenance in the county, such as rapid response to sign replacements and repairs, while others handled lower priority tasks such as brush trimming. The first platform worked so well that the crew built additional platforms for each of the County's four districts. Lancaster County now saves at least \$500 each month because the sign technician no longer needs to respond to every request.



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Steele County Highway Department, North Dakota

## Roadside Wetland Management

Roadside wetlands provide necessary drainage and prevent dangerous flooding. Highway departments work hard to preserve roadside wetland areas, and must carefully manage visibility issues caused by wetland vegetation. Overgrown sedge grasses, such as cattails on Steele County roadsides, caused visibility issues for travelers and potential liability issues for the county. To balance preservation and safety priorities, Steele County Highway Department staff members invented a hydraulic-motor-belt driven sickle mower. The mower safely manages roadside vegetation, such as cattails and small trees, without damaging wetland integrity. The mower sickle can be raised and lowered to a 45-degree angle and attaches via a three-point mount. The bar can navigate uneven terrain with pulleys and hydraulics, and has reinforced tubing to prevent bowing. This cost-efficient innovation improved safety for motorists and saves the county time, money, and manpower.

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# INSPECTION AND DATA COLLECTION

This category recognizes modernization and use of new technology to retool the way agencies approach inspections, capture information, and increase efficiency and productivity.



© 2019 Olmsted County Public Works, Minnesota.

**WINNER:** Olmsted County  
Public Works, Minnesota

## 360-Degree Camera Sled Transforms Culvert Inspections

Imagine you're a public works inspector whose job is to check on the condition of culverts. The only way to see inside those culverts is to crawl in with a flashlight. If you're lucky, the diameter is large enough to get through on your knees. Otherwise, you're forced to slide in on your belly and roll onto your back. The bottom is wet and often covered in layers of mud.

Senior transportation specialist Jeff Busch doesn't have to imagine any of that because it's his reality—at least it was before his resourcefulness led him to a brilliant new solution. Until recently, every time Busch and his fellow Olmsted County, Minnesota, inspectors checked one of 1,600 culverts after a flooding event or before a repair project, they were confronted with uncomfortable, unsanitary, and potentially unsafe conditions.

"If something goes wrong, you're stuck in that confined space," says Busch. "It's an emergency situation."

The possibility of coming face to face with a rodent or snake provided even more motivation to find an alternative inspection method.

For about two years, the five Olmsted inspectors and their supervisor, Scott Holmes, talked about how they could create a remote inspection system. Busch knew he wanted to design a system without complex wiring, servos (a power-driven mechanism that supplements the primary control), or the need to maintain a Wi-Fi signal. While the team members originally considered using a remote-control car to move a camera through the culvert, Busch ultimately led them to the original concept of a camera on a sled.

As a lifelong tinkerer with a childhood habit of taking toys apart to "make them better," innovative thinking comes naturally to Busch. Presented with this challenge, his gears couldn't help but turn: If they integrated a 360-degree action camera in their design, they could easily view a culvert from every angle. Plus, he realized most of the models available were waterproof—perfect for their purposes. Applying additional criteria of short focal length, small size, large memory, and viewing and editing software to his search, he found the ideal 360-degree action camera and a tablet that enables the remote use of a live feed.

Busch, however, prefers to review footage back in the office later, finding that immediate answers are not essential, and recordings can be saved as part of the inspection.

To make a model of the sled platform he envisioned for the action camera, he headed for his son's creative construction set for kids—and it was that prototype composed of little plastic rods and connectors that Busch pitched to Olmsted's county engineer, Kaye Bieniek, getting her support.

Next, he needed to find a way to move the camera through the culvert. The perfect ingredient came in the form of 4 mm fiberglass fish tape, typically used by electricians to route new wiring, which could be pushed through the pipe and locked into the sled when it got to the other side. A toilet tank float was ideal at the end of the fish tape to help it skip through the pipe without getting stuck.

Busch has been stopped only twice after sending his sled through roughly 120 culverts. And despite pulling his sled over rocks, rusted metal, and even a deer skull, there hasn't been a single flip-over or wreck. Pretty impressive for something composed of a PVC pipe sled, pool noodle side arms for buoyancy, rechargeable bike lights to illuminate the action camera, a flashing pet collar for visual location, a toilet tank float, and a kite reel that operates as a "positioning yo-yo" or recovery line.

"I've never built anything like this," Busch says. "I just kind of looked for objects that would fit my needs and saw what would work best."

Before his innovation, the smallest culvert inspectors could enter was 24 inches—and they couldn't get quality visual documentation for their evaluations. Now, inspectors can obtain clear images in culverts as small as 15 inches. The new system has already provided maintenance crews with better data; in one instance, preventing a road from being torn up when Busch's video revealed that only a patch was required.

"You can look at video multiple times and get a different view every time," Busch reports. He was initially concerned about the lens being too close to the pipe for clear images, but that hasn't been an issue. He does slow videos down to half speed for better resolution, however.



© 2019 Olmsted County Public Works, Minnesota.

Holmes is impressed with how the 360-degree action camera on skids has transformed their work, not to mention Busch's ingenuity. "It's nice having an innovator like Jeff," he says. "You can go back and look at all these still pictures around the whole culvert—around the top, around the sides, around the bottom. You can spend a half-hour looking at it in the office, and he only ran it through there for a minute."

Busch says he was going for "cheap but effective," which he accomplished with his final tally of \$1,240, compared to commercial pipe inspection crawler robots that can cost as much as \$10,000. The bulk of that cost went toward the 360-degree action camera (\$600) and tablet (\$360).

Busch has already modified his original design and is now using a third, more compact version featuring even greater stability and flotation capabilities. He also plans to use the 360-degree action camera to get a better view of trouble spots in other areas of his work, including construction and bridge inspections. Culverts are only the beginning.

"I'm definitely inspired to do more," he says.

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Larimer County Engineering Department, Colorado

## Cameras See Road Activity and Efficiencies

Two technicians and one engineer of Larimer County's Traffic Section oversee operations on nearly 900 miles of county-maintained roadways. As physically stationing the staff in the field is not feasible, the Section needed an efficient method of recording turning movement counts on all major collectors, arterials, and state highway intersections throughout the County. They used a bungee cord to attach a time-lapse camera in weather-resistant housing to a sign or utility pole. After 24 hours, the crews picked up the camera. Through trial and error, staff found that placing the camera 200 to 500 feet from the intersection and recording frames at one-second intervals gave the best results. While the cameras can be set to record at any user-defined period, traffic patterns are typically recorded from 5:45 a.m. to 7:15 p.m. to determine peak-hour turning movement counts and support warrant studies for signalization. After the camera is brought back to the Section office, a technician views the time-stamped video and tallies the turning movements in 15-minute increments for the a.m. and p.m. peak hours. The remote camera system reduces the time required to produce counts by 30 to 50 percent, allows tabulation when convenient, and eliminates safety issues associated with placing employees and vehicles near busy intersections.



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## Transportable Unit Brings Safety to Bridge Inspections

Navigating steep, rock-reinforced slopes, trying to reach high overhead structures, and avoiding fast rushing water are all risks faced by bridge inspectors. When flooded waterways made bridge inspections even more of a challenge in Lancaster County, officials needed to immediately address inspector safety. Using snoopers trucks to safely access these areas is common but rental rates for a truck and operator can cost thousands of dollars per week and require multiple staff to operate. This is a steep investment for a local public agency, and the County needed an affordable option for inspecting its 285 bridges. To meet this challenge, staff created a hitch-mounted crane unit with a remote-controlled motorized winch for installation on the back of a standard County SUV. The easily transportable unit features a 1,000-pound capacity and includes a secondary rope and belay system for added safety. The entire unit cost \$1,328 to build, including labor, and allows crews to safely inspect bridges even in the most challenging conditions.

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City of Asheville Public Works, North Carolina

## Sidewalk Assessment App Prioritizes Projects

The citizens of Asheville demanded to know why certain sidewalk projects have priority over others. Asheville Public Works staff needed to justify sidewalk maintenance decisions with an objective rating system like the one used for street projects. Public Works staff needed a tool that would identify sidewalks in need of repair based on pavement condition surveys but off-the-shelf software and apps did not completely meet their needs. Loading the existing inventory dataset of sidewalks into geographic information system software that works with online maps started the process of customizing the app. Inspectors used the web map on their mobile devices to capture and edit sidewalk data. The streets division manager and streets operation manager performed quality checks on data, which now assigns priority based on condition severity. The app helps minimize mobilization costs by grouping nearby projects together and informs planning for larger capital improvements. Using data to estimate preventive maintenance funding needs, increase general awareness of sidewalk upkeep and accessibility needs, and respond to citizen inquiries and grant opportunities is a win for everyone.



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Burke County Highway Department, North Dakota

## Testing Tool Shines Light on Safety and Savings

Burke County officials needed an efficient, cost-effective way to complete sign inspections. It is challenging to inspect 1,500 road signs—especially during daylight hours. Two staff members developed a possible daytime alternative by mounting high-powered LED lights to the rack of a pick-up truck. The pickup is parked 50 to 75 feet from the sign. A “before” picture is taken and then the bright LED lights are turned on and an “after” picture is taken of the sign. The lights were angled toward the signs for better assessment, and an in-line switch was installed for in-cab manipulation. The two pictures are compared to determine the reflectivity. If there is any doubt about the sign’s reflectivity, a comparison sign can be used at the same sign post and the pictures can be retaken to determine if the existing sign is in need of replacement. All of the images are stored to maintain an accurate inventory.

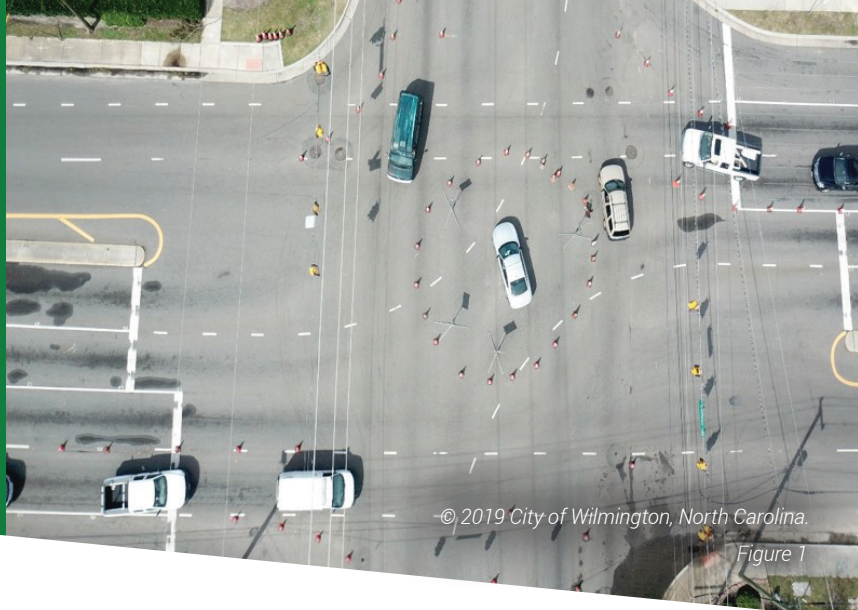
A recently completed research project has been submitted to gain approval of Burke County’s method as an acceptable way to test sign retroreflectivity. At this time, this process does not meet the retroreflectivity requirements implemented on December 21, 2007, and set forth in Section 2A.08 and Table 2A–3 of the 2009 *Manual on Uniform Traffic Control Devices*.

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# MAINTENANCE TOOLS AND METHODS

From the traditional to the unique, the physical improvements of conventional tools and methods to increase productivity, improve efficiency, or augment safety are recognized.



© 2019 City of Wilmington, North Carolina.

Figure 1

**WINNER:** City of Wilmington, North Carolina

## Temporary Roundabouts Protect Officers and Drivers

Natural disasters have a way of bringing out the best in people. For Eric Lippert, a police officer assigned to the traffic unit in Wilmington, North Carolina during Hurricane Florence, that meant quick thinking and the courage to advocate for an unprecedented idea.

Wilmington Police knew resources would be spread thin as Hurricane Florence approached in 2018. Fortunately, warnings of a category four led about 40 percent of the population of New Hanover County to evacuate before the hurricane made landfall as a category one on Sept. 14. While the catastrophic wind speeds predicted never materialized, the large, slow-moving storm produced record-breaking rainfall. More than 30 inches fell in some locations, and record river flooding occurred as rain continued over the next several days.

With many roads and streets impassable and power outages widespread, authorities urged those who didn't evacuate to stay home, and most complied. Traffic throughout the city remained light until the storm passed, but residents who did venture out during the day (the city enacted a nighttime curfew) were reminded to treat the dark intersections like four-way stops.

During the briefing the morning after the storm first hit, the Wilmington Police Department assigned eight officers, including Lippert, to direct traffic at South College Road and Oleander Drive, the juncture of the city's main thoroughfare for northbound/southbound traffic and one of two main thoroughfares for eastbound/westbound

traffic. Two rotating teams of four officers were tasked to simultaneously direct traffic until the city restored power to the signals.

Although rotations meant frequent breaks from the wind and rain, officers were still exposed to the elements and there was a significant drain on police resources. Lippert proposed the construction of a temporary roundabout at the intersection. Lippert knew this solution could dramatically reduce manpower and officers could stay dry and out of harm's way.

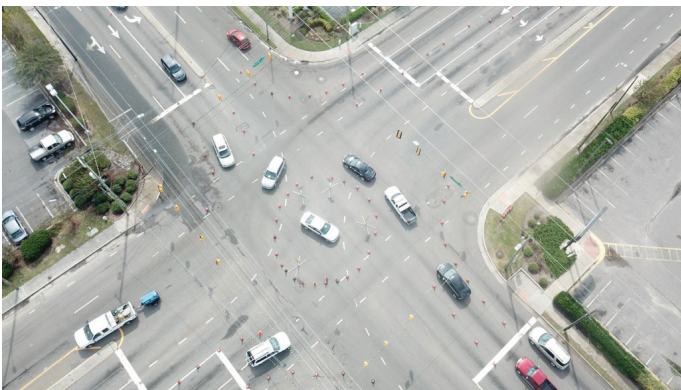
While waiting for the official green light from the Traffic Engineering Division and Department of Transportation (DOT), the traffic unit brought 300 traffic cones typically used to set up DWI checkpoints to the intersection. In less than 30 minutes, the cones were in place—each positioned close enough to the next (3 to 4 feet) to prevent a car from driving between. Officers “eyeballed” the center circle for size and, after observing various types of vehicles navigating it, adjusted the circle to allow a full mix of traffic to proceed safely, including cars, buses, and tractor trailers. (At subsequent intersections, after officers determined a rough center radius, the process included an officer standing in the middle holding one end of a rope, while another officer walked around in a circle at the other end, occasionally spray-painting marks on the road to indicate where cones should be placed.)

Officers strategically positioned cones to indicate a right-hand traffic pattern, with only right turns allowed upon entering and at all four corners (Fig. 1, above). With extensive flooding in some of the outer lanes, officers could not create an even path through all sections of the roundabout. Instead, they adapted the design to allow traffic to shift inward in spots and create wide turns into certain lanes.

Once the roundabout was in place, officers began directing each car until the steady rain accelerated into a full-on assault. The sergeant directed officers to wait out the downpour in their cars. Lippert and the others waited—and watched. Would drivers be able to navigate the circle on their own?

With drivers no longer slowing down to receive direction, traffic started flowing more smoothly. City Traffic Engineer Don Bennett quickly created temporary roundabout signs and pop-up stands, and with the signage in place, a single police car flashing blue lights in the center of the circle was all that was necessary to maintain the intersection. Additional officers were released to attend the numerous other priorities a natural disaster brings, enabling the department to use their resources more efficiently across the community.

Lippert enlisted help from the Wrightsville Beach Fire Department, which uses drones for water rescues. With their overhead footage of the successful traffic flow through the roundabout (Fig. 2, below), the traffic unit was given the thumbs-up for three other critical intersections across the city.



© 2019 City of Wilmington, North Carolina.

Figure 2

Getting their hands on a large quantity of cones would become their biggest challenge, but Traffic Engineering secured enough for these main thoroughfares from their contractor. Planning to scale up this solution in the future, Lippert has already reached out to Cape Fear Community College to enlist the Basic Law Enforcement Training program's 1,000 cones.

Lippert was confident his idea would facilitate safer traffic flow while making more efficient use of manpower, but its success exceeded even his expectations. Other than a driver hitting one of the signs, causing it to fall on the car, no crashes or property damage occurred at any of the intersections while the roundabouts were in place.

And as with so much these days, news traveled quickly after locals posted videos to social media. Officials from DOT in Raleigh came to inspect the roundabouts and record video. Highway Patrol even asked for help constructing a roundabout outside city limits. And discussion about Lippert's idea didn't subside with the rain.

"I've heard that it's been talked about in Florida as an evacuation plan next time there's a hurricane coming," says Lippert. "It's been talked about in Alabama, West Virginia, and South Dakota [for weather events]. The traffic engineers that have heard about this have really spread the word."

Recently, traffic unit supervisors across North Carolina attended a presentation by Lippert to plan for the implementation of roundabouts when they experience a long-term power outage—be it from a natural disaster or construction work temporarily knocking out traffic signals. The concept can be applied in all circumstances, to all multi-lane intersections, provided enough room exists to position a police car in the center circle and allow vehicles of all types to navigate through.

"It's funny, people are always telling me I'm the guy who thinks out of the box—I don't hesitate for a second bringing up an idea," he says.

Lippert admits initially, he wanted to avoid being out in the rain for 12 hours. But his motivation runs far deeper. Lippert routinely checks the Officer Down Memorial Page website and is affected by the number of officers killed nationwide each year directing traffic. Transforming unmarked four-way stops into roundabouts shields both officers and the public from the very real possibility of a driver recklessly blowing through the intersection.

Lippert explains, "My ultimate goal is to protect lives, and I think this simple idea accomplished this mission."

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Arapahoe County Road and Bridge, Colorado

## Slab Saw Cradle Boosts Efficiency

Arapahoe County couldn't keep using a dedicated pickup and trailer to move its slab saw to the job site. The ramp on the truck that hauled all of the other equipment was too steep to load the saw, and waiting for another truck to be available delayed maintenance projects. The Road and Bridge Staff collaborated with the Fleet Department and built a metal cradle to securely hold the saw on the truck. The cradle has a skid steer quick attachment so the saw can be safely lifted and attached. Crew members now use the saw for unplanned and emergency work.



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Arapahoe County Road and Bridge, Colorado  
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El Paso County Department of Public Works, Colorado

## Portable Platform Raises the Bar on Bridge Safety

The El Paso County Department of Public Works (DPW) faced the challenge of providing alternative fall protection when working on bridge deck replacements that are high enough to require fall protection, but not high enough to utilize fall nets. For most bridges in the county, access to setting up scaffolding is limited. Underlying soil and waterway conditions pose stability concerns, and multiple safety lines to support multiple tasks present trip hazards for crews. Working together, the bridge foreman, work crews, and a welder with the DPW Fleet Department developed a lightweight, adaptable, sectionalized platform placed on structural I-beams that reduces the fall zone to within protection guidelines. The new platform also incorporates significant safety features, such as support locks and rollers, to ensure the platform remains in place or can be easily moved. This innovative solution prioritizes worker safety and helps to create an efficient workflow. By collaborating on an in-house project rather than seeking a system from an outside source, El Paso County delivered a specifically tailored platform at a significant cost savings that both meets the needs of their bridge deck replacement work sites and mitigates the risk of injury.

El Paso County Department of Public Works, Colorado  
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Town of South Windsor, Connecticut

## Undercarriage Washing Makes Winter Manageable

Harsh snow-fighting chemicals collecting on South Windsor Public Works Department's vehicles caused corrosion that put the trucks out of service for repairs and limited the life of the equipment. Washing the vehicles helped, but fully cleaning their undercarriages proved a challenge. To solve this, Public Works designed a low-pressure, high-volume, "drive-over" flushing system to effectively rinse these hard-to-reach areas. Once in place, fleet vehicles simply drive over and flush the chlorides away. Costing the department less than \$400, the undercarriage washing system has completed more than 1,000 cycles of cleaning the 30+ vehicles in South Windsor's winter operations fleet. Keeping these mission-critical vehicles clean means less breakdowns and worn out parts, leading to fewer maintenance calls and an extended service life that saves the department money year after year.



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© 2019 Delaware River and Bay Authority, Delaware Memorial Bridge, Delaware.

Delaware River and Bay Authority,  
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## Delaware River and Bay Authority, Delaware Memorial Bridge, Delaware Clean Victory for Salt Spreaders

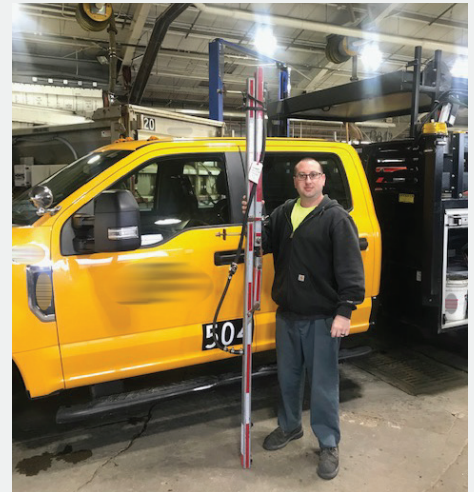
The Delaware River and Bay Authority found it labor-intensive and time-consuming to maintain the V-box salt spreaders used to treat road surfaces. The spreaders required annual maintenance that includes multiple steps to clean the conveyer chains, remove material and rust, and apply a lubricating encapsulant. To improve on this process, agency staff designed and built a manifold that automates the process of cleaning the conveyor chains. The manifold reduces the overall time and effort to properly maintain the conveyer chains by utilizing two different spray patterns spaced at specific intervals. These patterns and spacing are intended to focus the high-pressure water jet into areas where it is most needed. The 25-degree nozzles on the outside provide a focused spray to concentrate on the moving linkages and pins, while the two 40-degree inner nozzles provide a wide spray pattern designed to clear debris and material from the conveyer bars. The manifold, which cost less than \$100 to make, both reduces the time and manpower required to service the V-box salt spreaders and increases their effectiveness in adverse conditions.



Illinois Tollway, Illinois

## Safety Sprayer Minimizes Pesticide Exposure and Increases Efficiency

Recognizing the growing research on the toxic effects of pesticides, roadway maintenance personnel at the Illinois Tollway sought to reduce pesticide exposure to workers, customers, and the environment from its spraying operations. The Tollway's pesticide applications typically require two trucks, one with an attenuator and one with the spray system, and three workers, including two drivers and one operator. To mitigate exposure, frontline workers from the Tollway's Arlington Heights maintenance site created the Safety Sprayer. Costing less than \$20 and built from 85 percent "found" or recycled materials, the sprayer is mounted to the side of the attenuator truck, eliminating the need for the spray operator and the additional driver. A single driver operates the sprayer safely from inside the cab, and the new tool's four nozzles ensure consistent application and zero exposure. The equipment weighs less than 20 lbs., does not extend past the truck's mirrors, and can be attached or removed in the field in under 15 minutes. This innovative solution minimizes exposure to pesticides for employees, customers, and the environment, while also reducing the staff and equipment needed to complete the application.



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Appanoose County Secondary Roads, Iowa

## Portable Alarm Makes All Vehicles Safer

Appanoose County Secondary Roads management and office vehicles lacked back-up alarms, a safety enhancement needed when visiting work sites. To solve this problem, County employees customized an effective and portable alarm that costs only \$35: \$25 for the alarm, \$10 for a trailer plug, and nothing for scrap perforated square tubing. This back-up alert can be plugged into the trailer outlet of most vehicles and removed when it's not needed, allowing Appanoose County to get the most out of each \$35 investment because multiple vehicles can share a single alarm. Through this low-cost improvement, the Secondary Roads team avoided costlier alternatives while also decreasing the potential for injury in the field.

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Jasper County Highway Department, Iowa

## Double-Handle Design Makes Bridge Deck Texturing a Breeze

When using a bull float broom and handles, the Jasper County Highway Department found it difficult to achieve an adequate finish on freshly placed concrete bridge decks. Maneuvering 30 feet of handle over the bridge catwalk made it almost impossible to keep even pressure across the entire width of the bridge deck. To address this challenge, the department bought two 16-inch barn brooms and cut one handle in half and added the two handles to one broom head. This created a "v" on the top of the broom head that allowed 30 feet of rope to be installed through a hole in each handle. With a crew member on each side of the bridge, one person pulls the broom while the person on the opposite side holds back tension to control the angle of the broom and the amount of pressure. For a total cost of less than \$100, Jasper County is laying a better-wearing surface on its bridge decks.



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Secondary Roads, Iowa.

Clayton County Secondary Roads, Iowa

## Custom Motor Grader Roller Wipes Out Washboards

Unpaved roads develop washboards quickly when freshly bladed gravel is left uncompacted, especially on steep hills. Knowing this, Clayton County would blade their roads and then make multiple passes up and down the hills with the motor grader to compact the gravel. This was an inefficient process that staff wanted to improve. In their shop, they built a custom roller using tube steel, round and solid stock, wall pipe, and pillow-block bearings. The new equipment attaches to the back of the motor grader. The desired road surface is achieved more quickly and stays smoother longer which stretches the department's financial resources.

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City of Clive Public Works, Iowa

## Custom Rivet Press Drives Safety

Street sign assembly in the city of Clive is a tedious, inefficient task. The manual seating process was repetitive, noisy and carried a high risk of missed hammer strikes resulting in a potential for injuries and reduced reflectivity. Staff designed and built a custom rivet press to make this job safer and easier. The new press cost under \$130 to create and is made of flat steel, round solid stock, square tube, and other parts fashioned with a wire welder and plasma cutter. The new press reduces noise levels, decreases sign assembly time, and provides a lower, more ergonomic work surface. The chance of injury is reduced because the new press can be stopped at any point in its path, requires less force, and has a counterweighted handle to protect passersby.



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Ouachita Parish Public Works Department, Louisiana

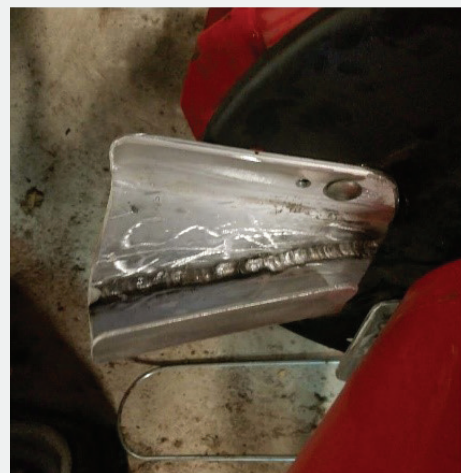
## Getting a Handle on Catch Basin Lids

The Ouachita Parish Public Works Department needed a lightweight, mechanical means to lift and lower catch basin lids for inspection purposes. Electro-magnetic dollies can address the problem, but they cost \$1,000 or more, and the Department needed a more lightweight, portable, and economical solution. To address this challenge, shop employees used steel bar stock to create a simple, mechanical lid-assist tool. The device helps workers pry a basin lid open and then clamps to it like a handle, helping to lift the lid up and over. When an inspection is complete, the tool helps guide the lid back into place. Crew members no longer need to use brute force to lift and lower catch basin lids, increasing overall worker safety and decreasing the incidences of finger- and toe-pinch injuries. At a cost of less than \$100, including labor and materials, the lid-assist tool can be easily reproduced if lost, damaged, or stolen.

Terrebonne Parish Consolidated Government, Louisiana

## From Seed to Salt: Spreaders Repurposed “In a Pinch”

Terrebonne Parish Consolidated Government (TPCG) experienced a record string of sub-freezing temperatures and didn't own the proper de-icing equipment. The agency had an abundance of calcium chloride (CaCl<sub>2</sub>), normally used for dust control, that could be used as a de-icing agent; however, they did not have a method to dispense the pellets. To overcome this challenge, TPCG modified a grass-seed spreader to dispense CaCl<sub>2</sub> at the correct distribution rate for effective de-icing. The team fabricated a modified caster that increased the distribution radius from 20 to 40 degrees; they also restricted the original feeder plate to allow for fewer pellets per rotation. Fortunately, the modified casters and the original casters bolt on, so the team can switch them out easily when the need arises. The process to reimagine the spreaders for de-icing use is both efficient and economical; the project took only four hours of labor to complete and cost just \$250. This innovative solution allowed Terrebonne to reopen area roads and bridges faster than anticipated.



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Ottawa County Road Commission, Michigan

## Tailgate Extension Gets Drivers Out of a Jam

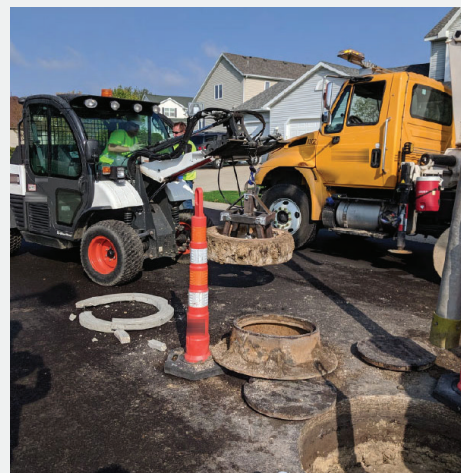
When Ottawa County Road Commission employees unload the road debris they collect—such as brush, tree branches, and broken concrete—the material often gets caught in the truck's tailgate chains. This causes multiple problems for County operators, including additional labor time, significant safety concerns, and the possibility of both damage to equipment and unintended debris on roadways. To address this problem, a county mechanic devised a solid box side plate that attaches to the tailgate pins and tailgate lock. This eliminates the need for the chains and creates smooth sides so debris can easily slide out. Adding a tailgate lock as an additional safety feature prevents the driver from accidentally opening the tailgate and it being opened while someone is driving. The extension cost approximately \$400 and promises to cut the need for repairs significantly while keeping road crews safe and roadways clear.

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Public Works, City of Rochester, Minnesota

## Manhole Ring Lifter Makes Concrete Improvements

Manhole repair projects in Rochester, Minnesota are a heavy lift for public works employees, who spend hours jackhammering the inner concrete rings of each manhole cover into smaller pieces that are then lifted out by hand. Determined to reduce the physical and time burden required to remove the rings, staff from the City of Rochester Public Works Department spent 40 hours creating a mechanical manhole ring lifter. The hydraulic lifting device attaches to a small crane on a four-wheeler and is lowered into the manhole to a depth where its wings are at the bottom of the concrete ring. The wings then extend to dislodge the concrete from the infrastructure beneath it, allowing the crane to lift the device and the concrete ring to the surface which eliminates the need for jackhammering and manual lifting. Though Rochester officials spent \$1,968 to create the device, they estimate a total annual savings of over \$48,000 in labor and equipment costs.



© 2019 Public Works, City of Rochester, Minnesota.

Public Works, City of Rochester, Minnesota  
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Lancaster County Engineering, Nebraska

## Slick Brine System Speeds Snow Removal

Lancaster County Engineering wanted a cost-effective, efficient way to pretreat pavements during the winter. After researching methods of mixing and distributing brine solution using readily available supplies, County crews mounted a spray bar on the rear bumper of a pickup truck using pipe, hosing, and nozzles common to agricultural sprayers that they found at a local farm store. The spray bar is then fed with a transfer pump from a tote of brine in the bed of the truck. They first tested their solution on the parking lot at their facility and, once perfected, extended its use to treat paved roads countywide. The initial system cost \$2,220 to make, though the team estimates that additional units will cost roughly \$500 less. For that initial investment, Lancaster County reduced snow and ice removal times from untreated pavements by 50 percent, with an added benefit of eliminating ice-related slips, falls, or accidents in their parking lots.

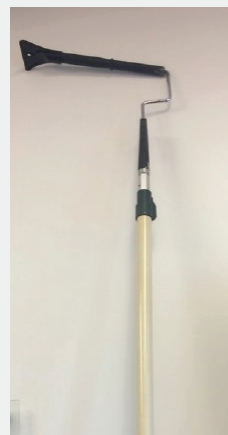
Lancaster County Engineering, Nebraska  
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City of Papillion Public Works, Nebraska

## LED Signal Scraper Provides Bright Way to Remove Snow and Ice

Each winter, the City of Papillion Public Works encounters heavy, wet snow that sticks to LED traffic signals during storms. The snow blocks out the signal because, unlike older incandescent versions, LED lights do not produce enough heat to melt snow. Public Works wanted to find a way to remove this snow and ice without forcing road crews to spend long periods of time in harsh winter weather. Staff mated an ice scraper to a paint roller and mounted both atop an adjustable extension pole. This allowed crews to reach the tool into a hooded light to clear the lens, either from the ground or from inside a pick-up cab. Completing the entire project in-house using basic hand tools meant a cost of only \$50 per scraper. Armed with this low-cost solution, Papillion crews effectively cleared traffic signals throughout the winter, ensuring signal visibility for the driving public while also exposing crews to less snow, ice, and cold during their workday.



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City of Papillion Public  
Works, Nebraska.

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Town of Thurston Highway Department, New York

## Department “Wings” Snow Removal Solution

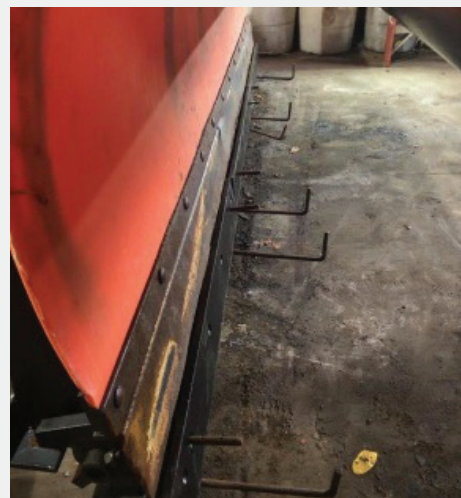
The Town of Thurston Highway Department is very familiar with snow removal, but towering snowdrifts on some of its roadways presented another challenge altogether. Their existing trucks and plows are poorly matched against the 15- to 20-foot-high snowdrifts that can accumulate during significant storms and often reform right after plowing due to high winds. To overcome this challenge, three employees designed a quick-connect system to remove the bucket from an excavator and add a snowplow wing. After some testing, the team realized adding a plate at the top of the wing would help minimize overflowing snow, so they welded one onto the blade using steel the Department had in stock. The updated equipment now allows road crews to easily push snow 15 to 20 feet away from the plowed surface, ensuring the drifts reform in the fields and not on the roadway.

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Rockland Highway Department, New York

## Safer Solution for Snowplow Blade Installation

For the Rockland Highway Department, attaching a two-blade system to a snowplow is a labor-intensive process. At least two people are needed to work the bolts through the blade and plow mounting holes while also supporting the blades. To reduce the labor needed for this job, department employees devised a system that used long metal pins to keep the blade in place while it is secured to the plow. The Department's welder turned scrap metal into customized, half-inch circumference pins for crews to slide through the plow's moldboard mounting holes during installation. This innovation provides enough support to align and bolt the two blades to the plow as the pins hold them in place. This new blade guide and carrier tool requires only one person to mount plow blades, lowering both labor costs and staff fatigue levels.



© 2019 Rockland Highway Department, New York.

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Town of Ramapo Highway Department, New York

## Salt Brine System Prevents Slick Sidewalks

The Town of Ramapo Highway Department relies on snow blowers and plows to clear snow and ice from pedestrian paths. These sidewalks are heavily used and the Department receives numerous complaints about icy conditions from citizens following winter storms. Two mechanics from the Parks Department set out to solve this problem by devising a fast and convenient way to apply a salt brine solution to prevent ice forming on sidewalks. Using only materials from the shop, they constructed a gravity feed system from hosing, valves, PVC piping, and a water tank, then mounted the device onto the bed of a small utility vehicle. Ramapo now can deploy the vehicle to treat sidewalks with the salt solution before winter storms arrive to prevent snow from accumulating and ice from forming. The added mobility of the applicator allows road crews to cover more ground in less time, making sidewalks safer for all.

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Village of Baldwinsville Highway Department, New York

## Wing Cart Improves Snow Removal Safety

The Village of Baldwinsville receives significant snowfall each winter and its Highway Department crews know their way around a snowplow. However, the job of removing and installing the 11-foot-wide, 1,200-pound metal snowplow wings using an overhead hoist or a fork truck is cumbersome. An alert Highway Department employee found a solution when he spotted a wing transport cart in the background of a photograph from a public works department in Nevada. Inspired by the image, he designed and fabricated a wheeled cart onto which a snowplow wing can be lowered, disconnected from the plow truck, and then easily moved into storage. The 2.5-foot-wide by 5-foot-long cart ensures the wing is never free to fall; it is fastened to the cart before being removed from the truck and remains fastened to the cart until it is securely reinstalled. At a cost of less than \$80 per cart, this innovative solution makes a problematic, burdensome task faster and easier, significantly increasing staff safety and improving operational efficiency.



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City of Dickinson, Public Works Department, North Dakota

## Automated Material Spreader Seals Streets With Less Stress

Manually leveling sealer into pavement cracks is labor-intensive work when a crew member pushes a heavy steel box to level the hot mastic material. To make pavement sealing go more quickly and easily, road crews for the City of Dickinson developed an innovative solution. They mechanized the operation by mounting a push frame and steel box to the undercarriage of a 4-wheeler. For less than \$100, the new process expedites the sealing process. This keeps the mastic smoother, reduces the number of days crews need to complete the work, and mitigates crew injuries and the need for work breaks.

City of Dickinson, Public Works Department, North Dakota  
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City of Easton Public Works Department, Pennsylvania

## Quick and Easy Pick-Me-Up for Sewer Inlet Covers

The City of Easton wanted to make it more efficient and less costly to inspect and clean the city's storm sewer inlet covers. Before, the task of removing and returning the heavy covers required a backhoe, which the Public Works Department towed to each site and staffed with an operator and crew. Seeking a less cumbersome process, two City employees designed and fabricated a custom tool with materials supplied in-house. They repurposed the post of an old stop sign, a car jack, and a chain with a hook into a portable device for removing storm covers. Now a small crew can place the new tool over a sewer grate, set the angle iron against the curb, and attach the hook to the grate. They can then easily crank the device by hand and lift the grate from its position.

This simple, user-friendly solution significantly increases efficiency and helps Easton make better use of its resources. The backhoe can now be reserved for larger tasks.



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City of Easton Public Works  
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© 2019 James O'Brien, City of Williamsport Public Works Department, Pennsylvania.

City of Williamsport Public Works Department, Pennsylvania

## Paver Patches More Potholes in Less Time

The City of Williamsport developed a more efficient way to pave small sections of compromised roadways and repair potholes. The Public Works Department had sold its traditional paver because that paver required a crew of six to eight to operate. The Department worked together to come up with the idea of a simplified paver. Paving material is deposited into a drag box and attached to a large truck that spreads the material to eliminate the tedious task of hand shoveling. The driver of the truck moves slowly over the area, allowing the paver to put down a matte layer of pavement. A smaller, two-person team is now able to put down 10 tons of material in 10 minutes. Costing only \$600, the new paver also saves money and labor. It more efficiently repairs potholes and repaves small sections of roads. It also eliminates the need to haul large, traditional pavers to smaller jobs.

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Department Foreman  
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Swatara Township Highway Department, Pennsylvania

## Steel Guard Keeps Salt Spreader Out of Harm's Way

When hitched to the back of a utility vehicle, Swatara Township's tailgate salt spreader seemed like nearly the perfect tool to distribute ice melt throughout the community. Tight spaces near sidewalks and walkways often caused accidental damage to the unit. One bumped or scraped spinner could cost \$400 to replace; and more extensive damage could require replacing the entire spreader, doubling the expense. To protect the Township's investment, employees designed and built a guard that bolts to the tow hitch on the utility vehicle. The guard was fabricated by welding scrap rolled steel together. The cost was only \$200, including labor, and the guard shields the spreader from accidental damage. With this simple solution, the Township continues to serve the community during winter weather without interruption, and potentially saves hundreds of dollars each year in spreader replacements.



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Swatara Township Highway  
Department, Pennsylvania  
Todd Webb, Highway Superintendent  
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twebb@swataratwp.com

# LIST OF LTAP CENTERS

State	Center Name	Address	Phone Number	Website
Alabama	Alabama Technology Transfer Center	202 Ramsay Hall Auburn, AL 36849	800-446-0382	<a href="http://eng.auburn.edu/atap/">http://eng.auburn.edu/atap/</a>
Alaska	Alaska Research, Development, & Technology Transfer	2301 Peger Road Fairbanks, AK 99709-5316	907-269-6208	<a href="http://www.dot.state.ak.us/stwddes/research/">http://www.dot.state.ak.us/stwddes/research/</a>
Arizona	Arizona LTAP	1130 North 22nd Avenue Phoenix, AZ 85009	602-712-4050	<a href="https://www.azltap.org/">https://www.azltap.org/</a>
Arkansas	Arkansas Technology Transfer Center	1 University of Arkansas Fayetteville, AR 72701	501-569-2380	<a href="http://www.arkansashighways.com/t2/t2.aspx">http://www.arkansashighways.com/t2/t2.aspx</a>
California	California LTAP Center	3000 State University Drive Sacramento, CA 95819-6103	916-278-4433	<a href="http://www.californialtap.org/">http://www.californialtap.org/</a>
Colorado	Colorado LTAP	15285 S. Golden Road Building 47 Golden, CO 80401	303-735-3530	<a href="https://www.coloradoltap.org/ltap/default.asp">https://www.coloradoltap.org/ltap/default.asp</a>
Connecticut	Connecticut Technology Transfer Center	270 Middle Turnpike Unit 5202 Storrs, CT 06269-5202	860-486-5400	<a href="https://t2center.uconn.edu/">https://t2center.uconn.edu/</a>
Delaware	Delaware T2 / LTAP Center	355A DuPont Hall University of Delaware Newark, DE 19716	302-831-6241	<a href="https://sites.udel.edu/dct/t2-center/">https://sites.udel.edu/dct/t2-center/</a>
Florida	Florida Transportation Technology Transfer Center	2100 NE Waldo Road Building 1604, Suite 106 Gainesville, FL 32609	352-273-1670	<a href="https://www.techtransfer.ce.ufl.edu/t2ctt/Contact.asp">https://www.techtransfer.ce.ufl.edu/t2ctt/Contact.asp</a>
Georgia	Georgia Department of Transportation LTAP Center	3993 Aviation Circle Atlanta, GA 30336	404-507-3437	<a href="http://www.dot.ga.gov/PartnerSmart/Local/Pages/LTAP.aspx">http://www.dot.ga.gov/PartnerSmart/Local/Pages/LTAP.aspx</a>
Hawaii	State of Hawaii Department of Transportation	2530 Likelike Highway Honolulu, HI 96819	808-832-3405 Ext 105	<a href="http://hidot.hawaii.gov/highways/other/hawaii-local-technical-assistance-program/">http://hidot.hawaii.gov/highways/other/hawaii-local-technical-assistance-program/</a>
Idaho	LHTAC T2 Center	3330 W. Grace Street Boise, ID 83703	208-344-0565	<a href="https://lhtac.org/">https://lhtac.org/</a>
Illinois	Illinois Technology Transfer Center	2300 S. Dirksen Parkway Springfield, IL 62764	217-782-7820	<a href="http://idot.illinois.gov/transportation-system/local-transportation-partners/county-engineers-and-local-public-agencies/technology-transfer-center/index">http://idot.illinois.gov/transportation-system/local-transportation-partners/county-engineers-and-local-public-agencies/technology-transfer-center/index</a>
Indiana	Indiana LTAP	504 West State Street West Lafayette, IN 47907-2058	765-494-2900	<a href="https://docs.lib.purdue.edu/inltap/">https://docs.lib.purdue.edu/inltap/</a>



<b>State</b>	<b>Center Name</b>	<b>Address</b>	<b>Phone Number</b>	<b>Website</b>
<b>Iowa</b>	<i>Iowa LTAP</i>	2711 South Loop Drive Suite 4700 Ames, IA 50010-8664	515-294-8103	<a href="https://iowaltap.iastate.edu/">https://iowaltap.iastate.edu/</a>
<b>Kansas</b>	<i>Kansas University Transportation Center</i>	1536 W 15th Street Suite G 520 Lawrence, KS 66045	785-864-5658	<a href="http://kutc.ku.edu/ltap">http://kutc.ku.edu/ltap</a>
<b>Kentucky</b>	<i>Kentucky Transportation Center</i>	176 Raymond Building Lexington, KY 40506-0281	800-432-0719	<a href="https://www.kyt2.com/">https://www.kyt2.com/</a>
<b>Louisiana</b>	<i>Louisiana LTAP Technology Transfer Center</i>	4101 Gourrier Avenue Baton Rouge, LA 70808	225-767-9131	<a href="http://www.ltrc.lsu.edu/ltap/">http://www.ltrc.lsu.edu/ltap/</a>
<b>Maine</b>	<i>Maine Local Roads Center</i>	24 Child Street Augusta, ME 04330	800-498-9133	<a href="https://www.maine.gov/mdot/mlrc/">https://www.maine.gov/mdot/mlrc/</a>
<b>Maryland</b>	<i>Center for Advanced Transportation Technology and Maryland T2 Center</i>	5000 College Avenue 2200 Technology Ventures Bldg., College Park, MD 20740	301-403-4623	<a href="http://www.mdt2center.umd.edu/">http://www.mdt2center.umd.edu/</a>
<b>Massachusetts</b>	<i>Massachusetts LTAP - Baystate Roads</i>	214 Marston Hall Amherst, MA 01003	413-545-2604	<a href="https://www.umasstransportationcenter.org/umtc/Baystate_Roads.asp">https://www.umasstransportationcenter.org/umtc/Baystate_Roads.asp</a>
<b>Michigan</b>	<i>Michigan Local Technical Assistance Program</i>	309 Dillman Hall 1400 Townsend Drive Houghton, MI 49931	906-487-2102	<a href="http://www.michiganltap.org/">http://www.michiganltap.org/</a>
<b>Minnesota</b>	<i>Minnesota LTAP</i>	University Office Plaza, Suite 440 2221 University Avenue, SE Minneapolis, MN 55414	612-626-1077	<a href="http://www.mnltap.umn.edu/">http://www.mnltap.umn.edu/</a>
<b>Mississippi</b>	<i>Mississippi LTAP</i>	401 North West Street Jackson, MS 39201	601-359-7685	<a href="https://mdot.ms.gov/portal/LTAP/">https://mdot.ms.gov/portal/LTAP/</a>
<b>Missouri</b>	<i>Missouri LTAP</i>	710 University Drive Suite 121 Rolla, MO 65409-1340	573-341-7200	<a href="https://mltrc.mst.edu/moltap/home/">https://mltrc.mst.edu/moltap/home/</a>
<b>Montana</b>	<i>Montana Local Technical Assistance Program</i>	2327 University Way Room 230 Bozeman, MT 59715	406-994-6100	<a href="http://www.montana.edu/ltap/">http://www.montana.edu/ltap/</a>
<b>Nebraska</b>	<i>Nebraska Local Technical Assistance Program</i>	650 J Street, Suite 215 A Lincoln, NE 68508	402-472-5748	<a href="https://www.ltap.unl.edu/neltap/default.asp">https://www.ltap.unl.edu/neltap/default.asp</a>
<b>Nevada</b>	<i>Nevada LTAP Center</i>	1755 E. Plumb Lane Suite 264 Reno, NV 89502	775-420-4811	<a href="https://nvltap.com/">https://nvltap.com/</a>
<b>New Hampshire</b>	<i>UNH - Technology Transfer Center</i>	33 Academic Way Durham, NH 03824	603-862-0030	<a href="https://t2.unh.edu/contact-us">https://t2.unh.edu/contact-us</a>
<b>New Jersey</b>	<i>New Jersey Local Technical Assistance Program</i>	100 Brett Road Piscataway, NJ 08854-8058	848-445-0579	<a href="https://cait.rutgers.edu/njltap/">https://cait.rutgers.edu/njltap/</a>

<b>State</b>	<b>Center Name</b>	<b>Address</b>	<b>Phone Number</b>	<b>Website</b>
<b>New Mexico</b>	<i>New Mexico LTAP</i>	1 University of New Mexico Albuquerque, NM 87131	505-277-0767	<a href="http://ltap.unm.edu/">http://ltap.unm.edu/</a>
<b>New York</b>	<i>Cornell Local Roads Program</i>	106 Riley Robb Hall Ithaca, NY 14853	607-255-8033	<a href="https://www.clrp.cornell.edu/clrp/about.html">https://www.clrp.cornell.edu/clrp/about.html</a>
<b>North Carolina</b>	<i>North Carolina LTAP</i>	909 Capability Drive Research Building IV Raleigh, NC 27606	919-515-8899	<a href="https://itre.ncsu.edu/focus/ltap/">https://itre.ncsu.edu/focus/ltap/</a>
<b>North Dakota</b>	<i>North Dakota LTAP</i>	515 ½ E. Broadway Suite 101 Bismarck, ND 58501	701-328-9855	<a href="https://www.ndltap.org/">https://www.ndltap.org/</a>
<b>Ohio</b>	<i>Ohio LTAP Center</i>	1980 West Broad Street Columbus, OH 43223	614-466-7170	<a href="http://www.dot.state.oh.us/Divisions/Planning/LocalPrograms/LTAP/Pages/default.aspx">http://www.dot.state.oh.us/Divisions/Planning/LocalPrograms/LTAP/Pages/default.aspx</a>
<b>Oklahoma</b>	<i>Oklahoma Local Technical Assistance Program</i>	5202 N Richmond Hill Drive Stillwater, OK 74075	405-744-7496	<a href="http://ltap.okstate.edu/">http://ltap.okstate.edu/</a>
<b>Oregon</b>	<i>Oregon Technology Transfer Center</i>	355 Capitol Street NE, MS 11 Salem, OR 97301-3871	888-275-6368	<a href="https://www.oregon.gov/odot/programs/t2/Pages/default.aspx">https://www.oregon.gov/odot/programs/t2/Pages/default.aspx</a>
<b>Pennsylvania</b>	<i>PennDOT LTAP</i>	400 North Street 6th Floor Harrisburg, PA 17120	800-367-5827	<a href="https://gis.penndot.gov/ltap/">https://gis.penndot.gov/ltap/</a>
<b>Rhode Island</b>	<i>Rhode Island Department of Transportation RILTAP</i>	2 Capitol Hill, #119 Providence, RI 02903	401-222-2450	<a href="http://www.dot.ri.gov/about/RILTAP.php">http://www.dot.ri.gov/about/RILTAP.php</a>
<b>South Carolina</b>	<i>South Carolina Transportation Technology Transfer Service</i>	202 Hugo Drive Clemson, SC 29634	864-656-4183	<a href="https://www.scltap.org/">https://www.scltap.org/</a>
<b>South Dakota</b>	<i>South Dakota Local Transportation Assistance Program</i>	1175 Medary Avenue Brookings, SD 57006	605-688-4121	<a href="https://www.sdstate.edu/jerome-j-lohr-engineering/sd-local-transportation-assistance-program">https://www.sdstate.edu/jerome-j-lohr-engineering/sd-local-transportation-assistance-program</a>
<b>Tennessee</b>	<i>Tennessee Transportation Assistance Program</i>	309 Conference Center Building Knoxville, TN 37996-4133	865-974-5255	<a href="http://ttap.utk.edu/">http://ttap.utk.edu/</a>
<b>Texas</b>	<i>TxLTAP</i>	140 W. Mitchell Street Arlington, TX 76019	817-272-9617	<a href="http://www.txltap.org/">http://www.txltap.org/</a>
<b>Utah</b>	<i>Utah LTAP Center</i>	4111 Old Main Hill Logan, UT 84322-4111	435-797-2918	<a href="https://www.utahltap.org/">https://www.utahltap.org/</a>
<b>Vermont</b>	<i>Vermont Local Roads Program</i>	1716 US Route 302 Montpelier, VT 05633-5001	802-828-3537	<a href="https://localroads.vermont.gov/">https://localroads.vermont.gov/</a>
<b>Virginia</b>	<i>UVA Transportation Training Academy</i>	351 McCormick Road Thornton Hall, Room B122A Charlottesville, VA 22904-4742	434-982-2897	<a href="http://uva-tta.net/">http://uva-tta.net/</a>

<b>State</b>	<b>Center Name</b>	<b>Address</b>	<b>Phone Number</b>	<b>Website</b>
<b>Washington</b>	<i>Washington State LTAP Center</i>	310 Maple Park Avenue SE Olympia, WA 98504-7300	360-705-7355	<a href="https://www.wsdot.wa.gov/">https://www.wsdot.wa.gov/</a>
<b>West Virginia</b>	<i>West Virginia LTAP</i>	395 Evansdale Drive, Morgantown, WV 26505	304-293-9924	<a href="https://wvltap.wvu.edu/">https://wvltap.wvu.edu/</a>
<b>Wisconsin</b>	<i>Wisconsin Transportation Information Center</i>	432 North Lake Street Madison, WI 53706	800-442-4615	<a href="https://epd.wisc.edu/tic/">https://epd.wisc.edu/tic/</a>
<b>Wyoming</b>	<i>Wyoming Technology Transfer Center (WyT2/LTAP)</i>	1000 E. University Avenue Dept. 3295 Laramie, WY 82071	307-766-6743	<a href="http://www.uwyo.edu/wyt2/">http://www.uwyo.edu/wyt2/</a>