

RoadWorks

The Immense Cost of Deficient Roadway Conditions

More than half of U.S. highway fatalities are related to deficient roadway conditions. These conditions are in fact a substantially more lethal factor than drunk driving, speeding or non-use of safety belts according to a startling new study.

Ten roadway-related crashes occur every minute (5.3 million a year). Crashes involving deficient road conditions contribute to more than 22,000 fatalities and cost \$217 billion a year. These substandard conditions also contribute to 38 percent of non-fatal injuries, the report found.

The work was done by the Pacific Institute for Research & Evaluation (PIRE) on behalf of the Transportation Construction Coalition, which is made up of 28 national associations and labor unions and co-chaired by the American Road and Transportation Builders Association and the Associated General Contractors of America.

"If we put as much focus on improving road safety conditions as we do in urging people not to drink and drive, we'd save thousands of lives and billions of dollars every year," principal study author Dr. Ted Miller said. Miller, an internationally-recognized safety economist with PIRE added, "Safer drivers and safer cars remain vitally important, but safer roadways are critical to saving lives, preventing injuries and reducing costs."

The report also identifies ways transportation officials can improve road conditions to save lives and reduce injuries. "For example, immediate solutions for problem spots include replacing non-forgiving poles with breakaway poles, using brighter and more durable pavement markings, adding rumble strips to shoulders, mounting more guardrails or safety barriers, and installing better signs with easier-to-read legends." The report also suggested more significant road improvements, including adding or widening shoulders, improving roadway alignment, replacing or widening narrow bridges, reducing pavement edges and abrupt drop offs, and clearing more space adjacent to roadways.

Among the study's key findings:

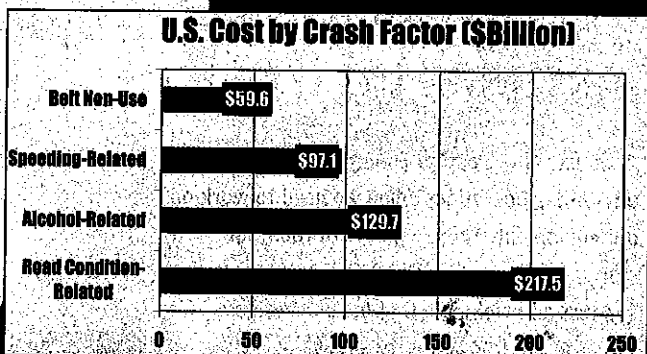
- **Roadway condition** is a contributing factor in more than half—52.7 percent—of the nearly 42,000 American deaths resulting from motor vehicle crashes each year and 38 percent of the non-fatal injuries. In terms of crash outcome severity, it is the single most lethal contributing factor—greater than speeding, alcohol or non-use of seat belts.
- **Motor vehicle crashes** in which roadway condition is a contributing factor cost the U.S. economy more than \$217 billion each year. That is more than three and a half times the amount of money government at all levels is investing annually in roadway capital

improvements (\$59 billion), according to the Federal Highway Administration.

- **Societal cost** includes \$20 billion in medical costs; \$46 billion in productivity costs; \$52 billion in property damage and other resource costs; and \$99 billion in monetized quality of life costs.
- **American businesses are paying** an estimated \$22 billion of the annual economic cost of motor vehicle crashes involving their employees in which roadway condition is a contributing factor. This includes almost \$10 billion a year in health-related fringe benefit expenses for insurance (\$6.0 billion) workers' compensation claims (\$1.2 billion), sick leave (\$1.7 billion) and Social Security (\$920 million).

These crashes cost government (taxpayers) at all levels \$12.3 billion.

See the full report, titled *On a Crash Course*, at www.transportationconstructioncoalition.org.



Due diligence

Specifying a long-lasting alternative to open-cut construction.

The patents on some aspects of some trenchless techniques have expired, opening up these markets to more contractors and giving infrastructure managers more options for less-disruptive utility improvements. With greater opportunity, however, comes greater potential exposure.

"As an industry, we've done a pretty good job educating people about alternatives," says Gerry Muenchmeyer, PE, technical director for the National Association of Sewer Service Companies and principal of Muenchmeyer Associates. "What we haven't done is educate people who are responsible for determining if a quality product has been installed."

If you've successfully specified a particular technique in the past, the task is relatively straightforward. If state rules allow it, you may even be able to offer the bid to a select group of contractors, in effect exercising a pre-screening process. Or you can learn from managers who've learned the hard way.

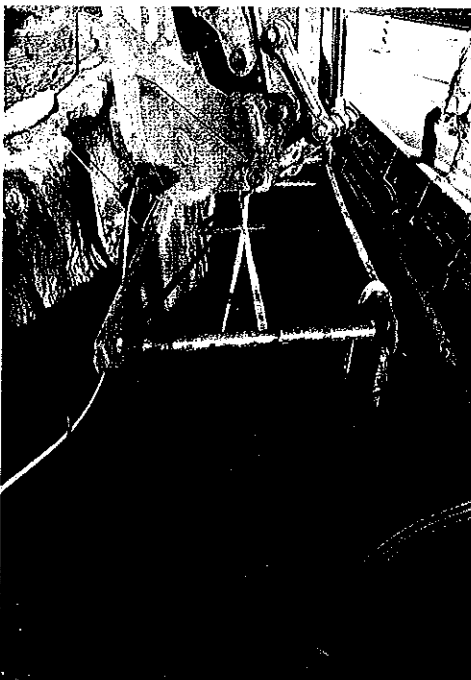
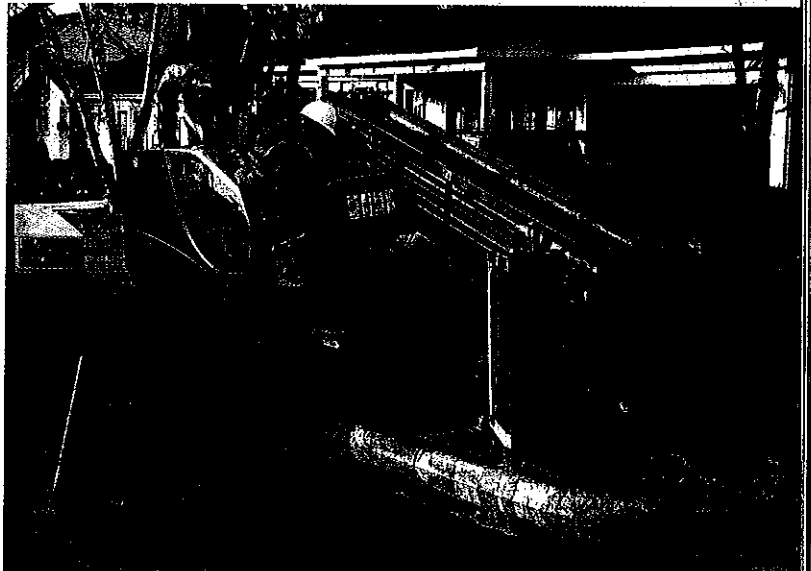
Overland Park, Kan., Right-of-Way Coordinator Murv Morehead says that bids for the city's utility installations sometimes are written on a performance basis in which the bid specifies the expected result of the project but leaves implementation in the contractor's hands.

"We don't force contractors to use a specific method, but we do reserve the right to encourage them to look at alternatives to open-cut, especially if digging up a street is involved," Morehead says. "We can withhold the permit until we're convinced that the contractor has done due diligence and has proved to us why there's no other method available than open-cut."

Some departments write bids specifying only that the project be done "by a means other than open-cut" without actually selecting the technique, according to Ray Sterling, PE, director of the Trenchless Technology Center at Louisiana Tech University.

"If you approach bidding in this way, you must be in

(continued)



▲ More departments are requiring contractors to bid rehab and new infrastructure projects based on using trenchless methods.

◀ Pipe diameter, condition, depth, length, new pipe diameter, soil conditions, and service connections dictate whether pipe bursting is appropriate for rehabilitating a failed line.
Photos: Vermeer Corp.

a position to approve the method that you allow to be used, and you must have a consistent design basis for the various methods approved," he says. The department also must have established quality control procedures and a method for assessing the experience level of contractors.

Quality control was Overland Park's impetus for developing the *Horizontal Directional Drilling Guidelines Handbook* that outlines expectations for items like jobsite safety, calibration of tracking

equipment, and containment of drilling fluid. The International Pipe Bursting Association also offers detailed specification guidelines for classifying project difficulty, assessing contractor experience, and controlling various aspects of the process.

The National Association of Sewer Service Companies' Muenchmeyer recommends writing specifications "at a high level for quality control and inspection in the field." If they're silent regard-

ing inspection and testing, your authority may be significantly impaired.

Large projects may require more than one trenchless method as well as sections of open-cut. While Roselle, Ill., uses horizontal directional drilling (HDD), coupled with other methods, for certain aspects of water-system maintenance and installation of streetlight cable, Public Works Director Rob Burns points out that open cutting is still sometimes the most viable option. The point is to avoid the assumption that a 14-foot backhoe solves every sewer or water problem.

Slip-lining with fold-and-form pipe? Burst, ram, or drill? If you don't have the time or resources to seriously investigate the various methods, consider asking a trusted civil engineering firm to provide an overview. If a particular method seems feasible, suppliers of the appropriate technology will provide more detailed information.

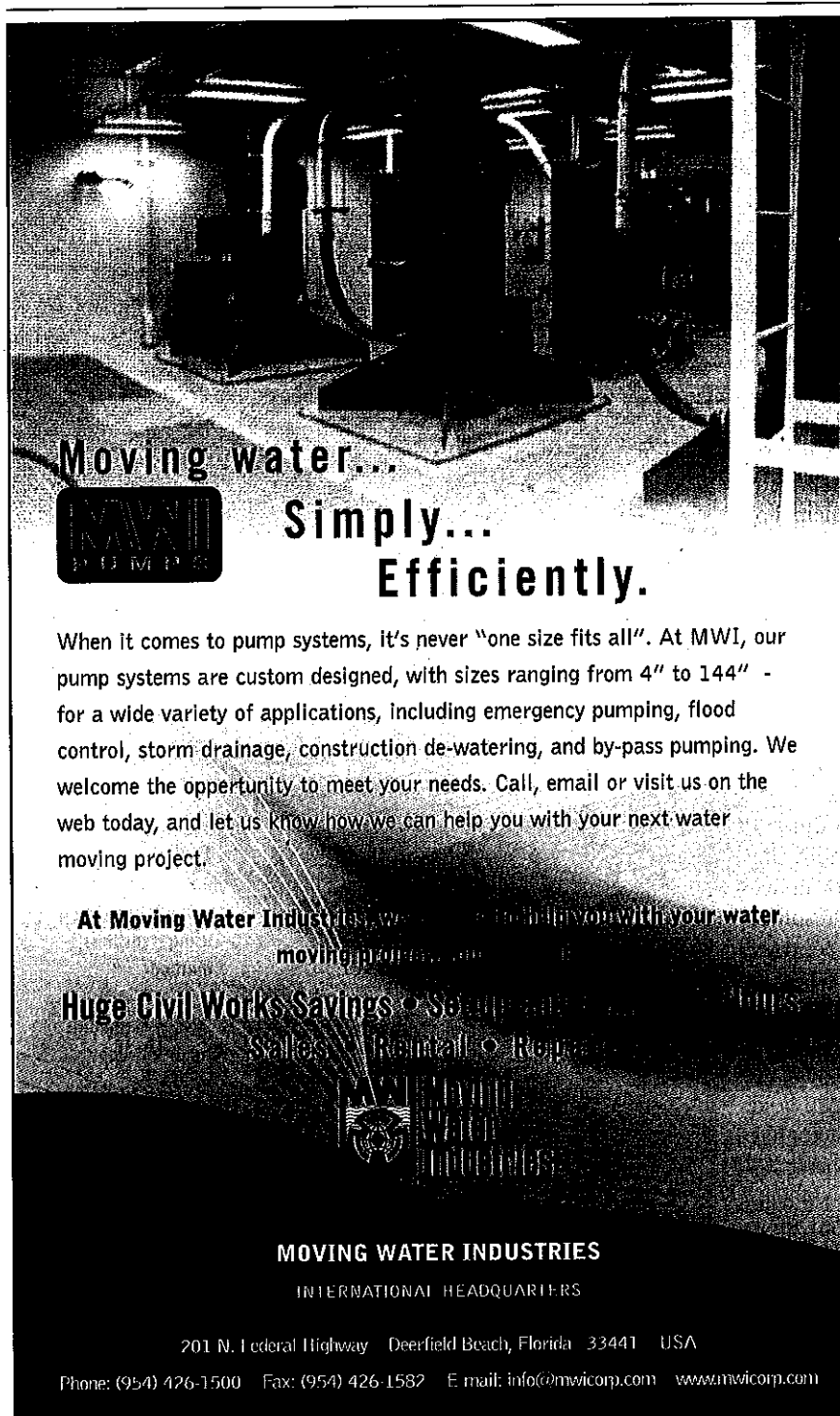
Another resource is the EPA's Capacity, Management, Operations, and Maintenance (CMOM) program, which provides a framework for assessing pipe condition. Video inspection records are invaluable in selecting trenchless alternatives. After assessing system condition and long-term maintenance needs, some departments realize that doing the work in-house ensures access to technology not readily available in their service area, allows for a more flexible operation, and gives them more control over scheduling.

Whatever the motivation, say managers who've made the investment, the decision to purchase should always be based on a hard look at economics and equipment use.

Columbia, S.C., for example, bought several horizontal directional drills to handle smaller jobs and emergencies while continuing to contract for larger projects. The city of Mesquite, Texas, bought a static, 30-ton pipe-bursting system four years ago after calculating the return on investment.

"We've installed more than 10,000 feet of sewer pipe. Our intent is to purchase a larger, 100-ton system to increase our capability, and to start taking on some water-system work," says Wastewater Superintendent Andy Chennault. "The system paid for itself on the first three jobs." **PW**

— Moore is a technical writer for *Two Rivers Marketing, Des Moines, Iowa.*



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Subsurface retention benefits above-ground aesthetics

Underground pipe and stone bed accomodates runoff from a 25-year storm while maintaining upscale image for a luxury auto dealer.

By Toni L. Durliat

Project

Kenny Kent auto dealership
stormwater management,
Evansville, Ind.

Participants

Morley and Associates, Inc. (engineer)
Peyronnin Construction Co., Inc.
(contractor)

Product application

HDPE underground stormwater
retention system preserves valu-
able real estate and meets local
mandate to mitigate flooding.



Commercial property owners today are challenged to find new ways to manage stormwater runoff, due primarily to stringent regulations and skyrocketing land values. Engineering an effective solution can be a high-stakes assignment, particularly when the client is a luxury car dealership located in a floodplain.

Such was the case when the Kenny Kent Toyota Scion Lexus dealership in Evansville, Ind., undertook a major expansion that created a new parking lot and building addition for its sales and service facilities. To be successful, the stormwater management solution had to meet the following four criteria:

- comply with the local stormwater runoff ordinance;
- keep expensive land in use;
- allow for future expansion; and
- maintain aesthetics appropriate for a luxury auto dealership.

Given these requirements, an open stormwater retention system was not an option. "Open retention wastes expensive property and takes regular maintenance to keep it looking good in the spotless dealership environment," explained James Q. Morley, president of Morley and Associates, the civil engineering firm responsible for designing the solution.

With open storage off the table for space and aesthetic reasons, as well as for the safety risks it poses in a public area, the engineering firm considered how best to comply with a local ordinance that requires minimizing the impact of development on the entire

A worker compacts an open-graded stone backfill around the underground pipes to provide stormwater storage capacity as well as structural support for the surface parking lot.

surface water drainage system. Located on the Ohio River, Evansville has an unusually high water table. Flooding has become more common in recent years, so the dealership expansion plans would need to address this concern. "When you have 12 acres that are primarily pavement and roofing, the stormwater runoff would contribute significantly to the flooding problem," said the dealer's director of fixed operations Joe Fredrich.

Fortunately, Morley and Associates previously designed a system to collect stormwater runoff from the parking lot of a big-box retail development in

Evansville. This project had the same strict runoff management requirements the dealership faced, and eight years after installation it was still functioning perfectly. The firm knew it would work for Kenny Kent as well.

Subsurface retention

The solution was a subsurface retention system using high-density polyethylene (HDPE) perforated pipe laid in a bed of aggregate. With this solution, the water evaporates or percolates slowly into the ground, recharging the groundwater instead of causing flooding downstream. By contrast, containment methods such as underground concrete basins and storage tanks convey runoff quickly into streams, aggravating flooding problems. These methods also increase costs because they require deeper excavation than HDPE pipe.

According to Morley, "The water storage area in the pipes plus all the volume in the void areas of the aggregate provide plenty of storage capacity." Combined, the pipe and aggregate beds hold 30,500 cubic feet of water.

Most of the soils in this area of Evansville are silty clays with very low permeability, so the local ordinance required that the system be designed based on the assumption that the water cannot percolate and that it must drain out of the primary discharge pipe. Of course, some water will naturally soak in, but the amount depends on the time of year and annual precipitation, among other factors.

The Evansville and Vanderburgh County Drainage Ordinance requires that the stormwater system accommodate a 25-year storm event, but engineers must also account for what happens to stormwater during a 100-year event. In such an event, stormwater backs up into the system. If runoff exceeds the volume of the storage facility, the water will back up into the parking lot beginning at the lowest area drain. The

parking lot was designed and graded so that when stormwater gets more than about 6 inches deep at the area drain — not deep enough to get into any of the buildings or flood vehicles sitting on the car lot — it spills over into adjacent streets and then into a receiving ditch. Also taken into consideration was that when stormwater backs up into the parking lot, it creates more head pressure in the retention system, thereby pushing more water out the primary



Nyloplast drain basins connect to perforated pipes in the subsurface stormwater retention system. Two workers can place the lightweight HDPE components, eliminating the need for cranes.

discharge pipe.

Morley and Associates specified Hancor's LandMax retention system, a complete HDPE stormwater pipe system with compatible fittings, joints, coupler, and adapters. "The LandMax components were all inventory items, which made constructing the retention system as simple as it was functional," said Hancor regional sales representative Robert Miller.

"Because it was a flat area located in a floodplain, the new buildings and parking lot had to be elevated above the original ground level, with the floor of the buildings at the minimum flood protection level and the parking lot sloping away from the building," said Morley. In addition to having

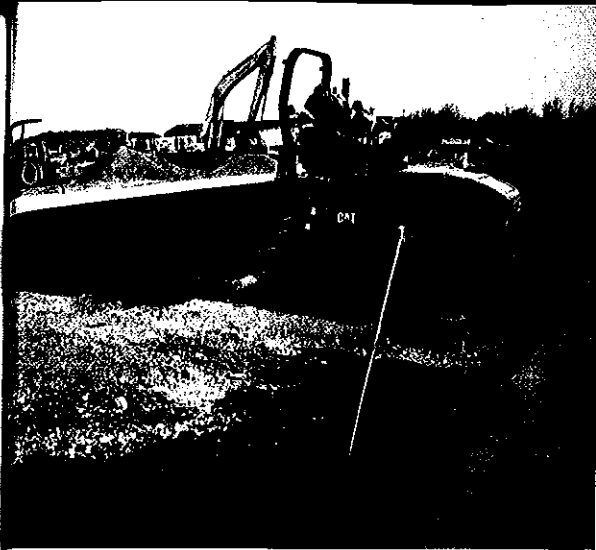
the proper grade, the parking lot had to be smooth and flat. Depressions in the pavement would collect rainwater that would attract birds, which was not acceptable at the car dealership.

The retention system was constructed around an existing parking lot and buildings and tied into an existing storm sewer. Land adjacent to the new parking lot was conserved for future dealership expansion by confining the runs of pipe to the smallest area possible without compromising the storage capacity of the system.

A large retention basin was excavated 6 feet deep and lined with nonwoven geotextile to prevent soil particles from infiltrating into the retention area. Six inches of INDOT No.2 aggregate — an open-graded stone with a high void ratio — were placed over the geotextile to form the base for the LandMax retention system. Runs of SureLok HDPE 15-inch perforated pipe were laid 52 feet wide by 183 feet long. Perpendicular to this area, runs of SureLok HDPE 24-inch perforated pipe were laid 26 feet wide by 156 feet long. In total, nearly 4,500 feet of perforated HDPE pipe were used in the L-shaped retention system.

Hancor's Nyloplast engineered inline surface drains and drain basins, also part of the LandMax retention system, were installed in 21 areas around the parking lot to collect stormwater into the retention system below. The lightweight drains were installed by two workers, eliminating the expense and risk of bringing a crane to the dealership — which remained open during construction — to lift and place heavy drains into the excavated area.

According to Morley, the ability to make connections easily with the lightweight HDPE pipe accelerated the installation process. "Saving time was important to the dealership, since they never closed their doors during the construction," Hancor's Miller noted. "Besides helping get cars out on the



Workers carefully level and compact the final asphalt surface for the auto dealer sales lot around one of the 21 surface drains.

new lot sooner, reducing installation time also made HDPE pipe a cost-effective solution.”

James Hall, project manager for contractor Peyronnin Construction Co., Inc., agreed that HDPE pipe was easy to work with. “It was light-

weight and everything went together quickly.” Before construction began, Miller met with the contractor to explain the correct installation procedures, and he was on the job site to answer questions at critical intervals.

After all the pipes were connected, the area was backfilled to the top of the pipes with aggregate and compacted. Besides providing more storage capacity

for the retention system, the rock adds strength and structural support. A final cover of 25 inches was installed over the backfill and the lot was surfaced with asphalt. While SureLok withstands heavy traffic loads with only 12 inches of cover, the extra cover in this

case ensured that the lot would have the required flat surface.

Morley said he’s an advocate of using perforated pipe, water storage in rock, and groundwater recharge. “We should take every opportunity to get rainfall back into the soil and not into the creeks and rivers to prevent flooding downstream. It’s much better to maintain our groundwater table.”

Upon completion, the parking lot was readied quickly for new vehicle inventory. According to the dealership’s Fredrich, “The system is functioning as expected — out of sight, out of mind.” ■

Tori L. Durliat is director of marketing for Advanced Drainage Systems, Inc. She can be contacted at tori.durliat@ads-pipe.com.

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