Why Cities Are the Frontline Defense Against Climate Change.

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July 14th, 2019

Cities and other urban areas consume more than two-thirds of global energy and emit more than 80 percent of the world's total greenhouse gases, and many, because of their location, are expected to suffer the most significant consequences of climate change. As such, they appear to be the most appropriate vehicle to address the causes of climate change.

Today, local and regional governments (LRGs) accommodate within their borders the highest concentration of vital energy, water, wastewater, and communications, infrastructure and own the vast majority of the paved roads under which most of that infrastructure is buried.

They also deliver most of the essential services like health care, education, public transportation, housing, electricity, water, and sanitation, as well as a variety of social welfare and economic development programs, that ensure the well-being of their citizens. For these reasons, they are better able to meet this challenge more efficiently, cost-effectively, and with less environmental damage, than any other form of government.

Finally, cities also exercise the legislative and fiscal levers that affect more than 85 percent of the population of the United States and have a much closer relationship with their businesses, residents, and institutions than state and national governments. This enables them to implement new programs more quickly and decisively.

But cities themselves cannot undertake major programs needed to decarbonize the grid. Privately owned, regulated utilities that own and operate the vast majority of this generation capacity, together with their Public Utility regulators, will need to play a significant role in managing the billions of dollars in investment needed to build-out renewables at the system or regional level. Similarly, new energy efficient building codes will require a massive shift in public opinion and the cooperation of those affected, like landlords and residents of those buildings.

And these major programs will take years to plan and implement. So, while they are working on reducing reliance on fossil fuels, or converting public transit and taxis to electric vehicles, or optimizing energy-efficient buildings, there are other, more discrete, actions that cities can undertake on their own at little or no cost. These include simple local matters like improving the way public works are initiated and how pavement excavation and repair is performed in their streets.

Because it is in cities where most utility companies operate, and because those cities own and control the public Right of Way – the sidewalks and streets – under which most of that utility infrastructure is buried, cities can on their own, "with a stroke of the pen", and with no additional taxes, grants, investment or cost, encourage more cost-effective and convenient public works processes that reduce GHG emissions, by simply revising their local Ordinance on how utility cuts in pavement are made and repaired.

One of those methods is keyhole coring and reinstatement. This process, first developed in Toronto, Canada, more than 25 years ago, cuts a small circular core or 'keyhole' through the pavement (from which the technology derives its name) that enables vacuum excavation to expose the buried infrastructure so that it can be accurately located or worked on using specially-designed, long-handled tools, from the surface of the road.

Even though the process cannot be used for every utility cut, it has been found to be a very significant improvement over traditional excavation and repair methods.

Not only is the 18 or 24-inch diameter pavement cut smaller and more precise than conventional excavations, causing less distress to the pavement and its sub-base, but once the underground work has been completed, that

very same core of pavement that was originally cut from the roadway, can now be bonded-back into it as a permanent pavement repair.

The result is a strong, waterproof, mechanical joint that reunites the reinstated core with the remaining slab of pavement in a way that restores the load transfer capacity of the pavement system to its pre-excavation level, and allows the road to be safely reopened to traffic again within 30 minutes of the repair, thereby minimizing traffic congestion and public inconvenience.

Not only can the road be reopened sooner, but because it is a permanent repair, it is no longer necessary to shut down traffic again several months later to make permanent pavement repairs. In this way, keyhole technology can reduce the duration of a typical utility cut repair by an average of five to six hours per excavation and reduce road-closures nationwide by millions of hours.

The Gas Technology Institute, a non-profit research and technology development organization, based in Des Plaines, Illinois, estimates that of the more than 40 million pavement utility cuts performed every year in the nation's roads, at least 25 percent are of the small hole variety that could be accomplished using keyhole technology.

Based on comparative GHG emissions from an excavation and repair using keyhole technology (69 lbs) and those from a similar sized conventional excavation and repair (845 lbs), GTI predicts that if all of those one million small hole utility cuts had been performed with keyhole technology, GHG emissions nationwide would have been reduced by more than 380,000 tonnes. That is equal to the average annual CO_2 emissions from one of the country's 8,000 power generation plants.

In addition, the precise, circular saw-cutting action creates no overcuts and causes no disturbance to the sub-base or adjacent pavement structures. And because there are no corners in which to form pressure-cracks, no groundwater can penetrate into the sub-base to cause potholes in the future.

Finally, because it was cut from the very same pavement slab, the reinstated core is a perfect match in appearance, profile, and performance to the rest of the pavement.

In these ways, minimally-invasive, keyhole coring and reinstatement has been able to solve many of the issues affecting the ongoing performance of the road system and, at the same time, accommodate utilities needing to gain access to their infrastructure buried beneath it.

Although not relevant to improved pavement or environmental performance, the process is also cost-effective and has been credited with reducing both the pavement excavation and restoration costs of those utilities that use the process by up to 87 percent, when compared to conventional excavation and repair methods.

It is also much safer for the workers. Because the infrastructure repairs are performed from the surface of the road using long-handled tools, there is no need for workers to get down into a trench or to use jackhammers that can cause stress injuries to the back, shoulders, elbows, arms, and hands of the operator.

It also reuses or recycles the very same pavement in its repair as was initially used to build the road in the first place, avoiding the consumption of millions of tons of new asphalt and concrete paving materials and the transportation and disposal of vast amounts of asphalt and concrete spoil. All of this contributes to a carbon footprint of a keyhole cut that is one-twelfth the size of conventional excavations.

The first such Ordinance was issued by the City of Toronto in November 2007 when it promulgated *TS 4.70: Standard Construction Specification for Keyhole Excavation and Permanent Reinstatement of Keyhole Cores.* This standard recognized keyhole coring and reinstatement as a permanent repair that requires no further

restoration procedure such as cut-backs, chip-seals or milling-and-overlay if the process is performed in accordance with the standard.

Since then, the keyhole process has been recognized by the FHWA and a number of State DOTs (e.g. Pennsylvania DOT, Illinois DOT and Utah DOT) as a *best practice* and has been formally approved by a number of major municipalities including Maricopa County (Phoenix), Las Vegas, Montgomery County Maryland, Overland Park Kansas, Lincoln Nebraska, Chicago, and St. Louis County, with informal municipal approvals in Dallas-Fort Worth, New York City, Boston, Denver, Colorado Springs, Washington DC, Spokane, Oakland and Sacramento, as well as hundreds more municipalities across the nation.

Yes, the adoption of keyhole technology may seem like a small step, but small steps taken now can help reduce the need to take more extensive and potentially more expensive actions later on. And it is something that cities and municipalities can implement on their own, at no cost, that can help to improve the road system and the environment at the same time.

Seems like a win-win-win for everyone.

About the Author: *E. Marshall Pollock, Q.C., is the President and CEO of Utilicor Technologies Inc., the manufacturer and distributor of a field-proven, keyhole coring and pavement reinstatement system that is the subject matter of this article.* *Some of this material was first published in 2010 in the* ***Journal of Town & City Management,*** *Vol 1,2 pp 197-210, by Henry Stewart Publications.*