Saving When Repaving:

How to cut manhole raising costs by 81% and extend new pavement lifespan with adjustable manhole risers

A Report Sponsored by American Highway Products Ltd.

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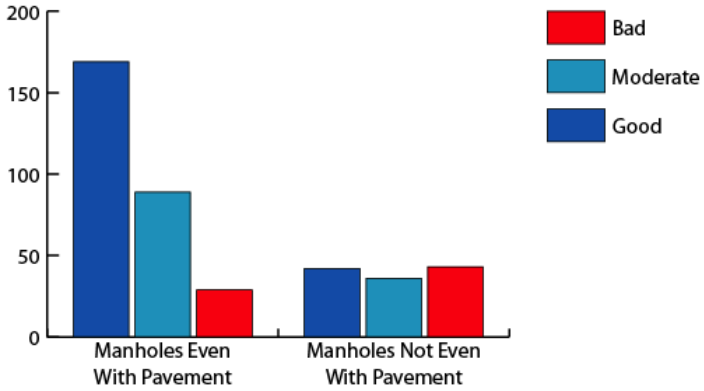
In most cases, adjustable manhole risers are the safest, most efficient, and most cost-effective way to raise manholes to grade after streets are repaved with a lift of new asphalt. By analyzing *all* the costs of raising manholes, **road maintenance supervisors and paving contractors can save significant money and time using adjustable risers**, as compared to other methods.

Road repaving is a substantial portion of any municipality's budget and—since asphalt is an oil refinery byproduct with no acceptable substitute—costs are rising dramatically as oil prices climb. To rein in repaving budgets, maintenance supervisors have to look elsewhere and some have managed to cut costs by taking a closer look at all the labor and costs associated with raising manholes to grade after new paving. Also, raising manholes effectively is an opportunity to improve public perception of street maintenance efforts.

Though seemingly a minor detail, cities can have tens of thousands of manholes and keeping them level and at grade is a difficult and important task even in mid-sized cities. South Bend, Indiana, for example has a population of 107,000 and raises 1,000 manholes annually (*SolidWaste.com, 11/2000*)

When manholes aren't raised to grade, surrounding paving is more likely to be damaged. In Kansas City (per *A Look at the Effect of Manholes on Street Condition*, a 12/2004, report prepared by Steve Rinne) there are 48,000 sewer manholes, 31,000 water valves, and a large, uncounted number of manholes placed by more than 20 private utility companies. 480 representative manholes were surveyed, and 30-percent were found to be substantially above or below grade. The pavement around the observed manholes was assessed. Around manholes at grade, only 11-percent of pavement was rated "bad"; however, **around uneven manholes, 35-percent of pavement was rated bad**. This is good evidence that uneven manholes contribute to pavement wear, which makes intuitive sense as well. In the



Pavement quality around Kansas City manholes, per *A Look at the Effect of Manholes on Street Condition*, a 12/2004 report by Steve Rinne.

…smooth pavement lasts longer.

words of the report, "a sunken manhole is a pothole with a steel bottom," that retains water during freeze-and-thaw cycles. Raised manholes get excessive wear from ordinary traffic, snowplow blades, and other equipment. The National Asphalt Paving Association (NAPA) report, *Thin Asphalt Overlay for Pavement Preservation*, states plainly, "…**smooth pavement lasts longer**."

Assessing all costs of raising manholes to grade

It's difficult to accurately assess the costs of raising manholes because the issues involved are easy to overlook or minimize. Sometimes this is because the amount of work involved seems trivial compared to the overall task of repaving a section of road, and sometimes it's because the costs of faulty manhole raising are deferred for months or years, or are speculative (such as liability for damaged vehicles) and hard to quantify. The following list of costs associated with manhole raising is compiled from interviews with more than 30 paving maintenance supervisors or paving contractors.

- **Materials:** Material costs are not the most significant factor in manhole raising expenses, mainly because it is pointless to consider material costs without also considering the labor of installation. Precast concrete risers, also known as 'donuts' or grade rings, are relatively inexpensive, for example, but are easily the most labor-intensive manhole raising solution.
- **Labor:** By analyzing time logs and maintenance reports, some road maintenance supervisors have been able to quantify the labor costs of raising manholes. In Shoreline, Washington (near Seattle) for example, the wastewater district maintenance manager analyzed three years of maintenance records and determined that raising manholes was costing about $500 per manhole for labor and materials. In this case, the district was covering the manhole at time of paving, then jackhammering new pavement at a later date, and digging out the manhole frame and raising with precast grade rings. In a similar scenario, the Southern California city of Ontario found that labor costs were $360 per manhole when using precast grade rings.
- **Liability Claims:** Where manhole rims with sharp edges are left proud of the roadway surface, or where manholes have not been raised and create distinct potholes, cities and contractors can be liable for resulting damage to cars. Common claims include broken rims and damaged tires. Similarly, manhole covers that bounce or rattle out of loose risers can lead to expensive claims.
- **Pavement Damage:** As shown in the Kansas City study cited above, uneven manholes are strongly associated with pavement damage. But even where the manhole is raised correctly, some methods require that existing pavement be chipped out around the new manhole so

that enough material can be removed to allow access to the utility frame. Where this is the case, the pavement is usually patched with hot mix which may not bond well with existing pavement. Worse, the new material sometimes rests on new infill that is not compacted to the same extent as existing fill, and subsidence causes pavement cracks and uneven manholes.

- **'Green' Costs:** Digging up and resetting utility frames usually unearths 500-1,000 pounds of material, possibly contaminated, which must be hauled to an appropriate facility. Jackhammering and hauling have substantial energy costs, and infilling with new asphalt consumes yet more material. Precast grade rings can weigh a hundred pounds or more, and the energy costs costs of shipping and hauling should be considered, especially when serving populations that place a high priority on sustainable business practices.
- **Lane Closures:** Any manhole raising procedure that extends lane closure duration, or calls for new lane closures at a later date, increases expense and inconveniences the public. And, since contractors usually provide traffic control on repaving projects, city maintenance departments may be taking on paperwork and expense needlessly when digging up and repaving manholes after repaving has been completed.
- **Inflow and Infiltration:** Manholes, of course, are a common culprit when dealing with excess I&I, especially when they are below grade. Leaks during active rainfall are one source of excessive I&I, but are usually insignificant compared to water inflow caused by groundwater release in the days after a rain. Where concrete grade rings, shimmed and leveled by thin layers of grout, are used to raise manholes, cracks in the rings and grout layers are prime sources of excess I&I.
- **Safety Issues:** Safety concerns for employees raising manholes arise from two sources: exposure to traffic, and exposure to lifting and pinching injuries. During repaving, roads are usually closed entirely and/or traffic is controlled by flaggers. Closures that take place after repaving, solely to raise manholes, are often single lane closures, with traffic still moving near crews. Also, flaggers with radios are sometimes replaced with signage alone. Therefore, if manholes can be raised during the original repaving operation, crews are exposed to less traffic and risk. The actual weight of the manhole raising technology is also a factor. Heavy precast grade rings can cause lifting, crushing, or pinching injuries when delivered, racked for storage, loaded into trucks, and when carried to the utility frame and set into place.

Some costs listed above will not apply to all regions: for example, snowplow damage is not a factor in warmer cities. But **most costs listed apply to most repaving projects**, and should be considered seriously when looking for ways to raise manholes in efficient ways that are **cost-effective for the entire project life cycle**.

Pros and cons of various manhole raising techniques

Pave Over and Ignore. Simply paving over manholes is certainly expedient, and not always a bad idea—some manholes serve outmoded or inactive systems, and some are so rarely accessed that jackhammering up as needed is relatively efficient. The downside, of course, is that manhole locations can be hard to recover when needed and the manhole might stay 'lost'. Also, emergency access is impeded, and sealed manholes are more likely to generate explosive gas and water pressures.

Pave Over and Dig Up Later. Especially in areas with short paving seasons, paving over manholes at time of repaving is common. They are then relocated in fall or spring, jackhammered up, and raised. This does avoid slowing down repaving projects. However, the disadvantages are numerous: new pavement is always damaged, soil compaction is usually disturbed, traffic is disrupted a second time, etc.

Raise Manholes with Precast Grade Rings or Brick. This is a very common method of raising manholes. Manholes are excavated until the cone is exposed, and the top of the cone is raised with precast grade rings, or sometimes brick. Grade rings, or donuts, come in relatively few standard sizes, and must be at least two inches thick to avoid cracking. This can be an effective, durable method in some circumstances. But, if the grade rings are subject to a freeze-thaw cycle they are very likely to crack. They can also crack from ordinary traffic pressures. Asphalt lift thickness may vary from spot to spot, or may not match standard brick or precast grade ring thicknesses. When this happens, the manhole must either be raised to grade with thin layers of grout, or left slightly above or below grade. Neither alternative is good—grout layers are very likely to crack and allow I&I, and uneven manholes lead to pavement damage. On top of these problems, one must consider the labor, time, and safety costs detailed above.

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Raising Manholes with Rubber or Plastic Rings. The main advantage of rubber or plastic rings is that they won't crack or leak, and they can be readily produced in incremental sizes that can be matched to lift thicknesses. Rubber rings, in particular, lessen vibration and noise and are good choices for manholes directly on tire paths. They are also lighter, reasonably priced, and some are tapered so that manholes can match sloped roadways. On the downside, setting rubber or plastic rings is nearly as labor and time intensive as setting precast rings or brick, and pavement and compaction is still disturbed. Still, they are good options in many situations, and are almost always better choices than brick or precast donuts.

Raise Manholes with Rigid Steel or Cast Iron Risers. Rigid metal risers are

set directly into existing utility frames. Ideally, they're as thick as the paving lift and provide a new rim for the old manhole cover at the correct height. They avoid the labor of digging manhole cones, can usually be set at the time of repaving, are reasonably priced, and are quick to set. The most significant downside is unreliability. Rigid risers cannot be adjusted to match old frames, which are often worn or out of round. If the fit isn't snug, they rely on gravity and asphalt compaction to stay in place. Similarly, the manhole cover may sit loosely in the rigid riser. Loose covers and rims can rattle and pop free abruptly, with serious consequences. Not only is this unsafe, it can lead to expensive claims. **Due to negative past experiences with rigid risers, some cities and departments have ruled out the use of any risers that can be set into existing frames.** A less significant downside of cast iron risers is that they can crack or break, and then leak or fail.

Adjustable Manhole Risers. Like rigid risers, adjustable risers are designed to be set directly into existing rims and provide a new rim at the proper height for manhole covers. But unlike rigid risers, adjustable risers have some mechanism that allows the riser to expand or contract as needed to match the old rim. **Adjustability is a game changer in the manhole raising arena.** The reasons why are explored in the following section.

Adjustable risers are potentially an ideal manhole raising technology

Because they avoid most of the disadvantages of other manhole raising technologies, adjustable riser rings are potentially an ideal solution for maintenance departments and paving contractors that raise large numbers of manholes annually. Because they don't require excavation of the manhole cone, they don't disturb new pavement or compaction. Because material doesn't need to be dug up, hauled, or replaced, there are no objections on sustainability grounds. They can be set at the same time as repaving projects, so that no new traffic closures take place—this means the public is not inconvenienced and maintenance crews aren't exposed to additional risks. Because they're adjustable, they can be set into rims loosely and expanded to fit tightly, even when rims are worn or out of round. They're light, so crews don't risk back injuries or crushing accidents. And they can be very quick to install, reinforcing all the advantages listed.

…there are certainly potential pitfalls.

Still, there are certainly potential pitfalls. Because adjustable risers are necessarily made of flexible materials, they might not be able to stand up to heavy traffic. Because they have moving parts, they might be complicated to install, or require special tools or training. Because they are made of metal, they might be subject to rust. They could be expensive. They're a new technology compared to precast grade rings, and their track record over time is a legitimate concern. In fact, any new technology should be considered carefully before used in roadways, as public safety must always come first. With this in mind, what should supervisors and contractors look for in an

adjustable manhole riser?

Features to look for in an ideal adjustable manhole riser

- **Sturdiness and Durability:** Despite it's flexibility, an adjustable riser should easily stand up to heavy traffic. Also, since they should be installed during repaving projects, they should also stand up to construction traffic—that is, during the period after riser installation and before asphalt is placed, the riser and cover (which may be two inches or so above grade) should stand up to heavy trucks and graders.
- **Reasonably priced:** Despite the moving parts and convenience, an adjustable riser is still a commodity and shouldn't be prohibitively priced.
- **Rustproof:** Risers that can rust and fail are unacceptable for roadway use, even if they are exceptionally cheap and convenient. Galvanized risers, for example, are a better choice than painted risers.
- **Easy and Quick to Install:** Maintenance crews will be setting hundreds of risers annually. The technology involved should not be complicated, and should not require specialized tools or power tools. They should also be quick to set, preferably in minutes.
- **Easily Tightened:** To take full advantage of adjustability, the adjustment mechanism should be able to apply significant force. When this is the case, the fit with the existing rim will be snug and exact, so that the riser stays put and the manhole cover fits as well as it did in its original frame.
- **Lightweight:** If adjustable risers are lightweight and compact, they can be easily stored and transported. Ideal risers should also be light enough for one man to handle alone.
- **Readily Available:** Because manholes for different purposes and utilities vary considerably in size, and because pavement lifts are of varying thicknesses, adjustable manhole risers should be available in many sizes and thicknesses, preferably in increments of less than half an inch. They should also be available on short notice, so that crews aren't caught short during a repaving project.
- **Good Track Record:** Because they are an important part of critical infrastructure, risers should be a known quantity. Ideally, the particular riser chosen will have a large installed base, with some risers in place for decades.

Three brief case studies

The Ronald Wastewater District, near Seattle, Washington, has been using adjustable manhole risers since 2005. The district maintenance manager used maintenance records to show that, when using precast grade rings, buying and setting the precast rings cost $500 in materials and labor. Using the same records after using adjustable risers for three years, he determined that buying and setting adjustable risers cost just $95 in materials and labor, **a savings of 81 percent**. As a result of the time savings, the district was also able to do more maintenance on other wastewater infrastructure.

In the Southern California city of Ontario, the street maintenance supervisor used similar records and determined that setting precast rings was costing a total of $360. After switching to adjustable risers, he found that total costs were just $80, **a savings of 78 percent**. Because Ontario is a litigious environment, the adjustable risers chosen were also subjected to rigorous testing: for example, heavy trucks were repeatedly driven over raised manholes, before new asphalt was laid. As of early 2009, almost 2,000 risers have been set, with no failures. In some cases, the city has stacked two risers to accommodate multiple lifts.

…no risers have failed in more than 20 years of use.

The city of Tampa Bay has been using adjustable manhole risers since 1986, installing as many as 600 annually. The transportation operations chief says that **no risers have failed in more than 20 years of use** (*Roads & Bridges*, 12/2006).

One specific solution: the American Highway Products Pivoted Turnbuckle Manhole Riser

This white paper was commissioned by American Highway Products Ltd., makers of the Pivoted Turnbuckle Manhole Riser, the Flex-o-Ring rubber grade ring, and several other manhole related products. American Highway Products has been making adjustable manhole risers since 1978, and has the largest installed base of any active firm.

The Pivoted Turnbuckle Manhole Riser weighs about 25 pounds, and is made of rustproof, galvanized steel. The patented turnbuckle exerts 1,000s of pounds of force to seat the riser, and can be installed in less than five minutes using just a screwdriver. They are made to order in exact sizes, and one day service—an industry exclusive—is available. They are reasonably priced.

For more information, or to see a video of the installation procedure, go to www.ahp1.com, or call 888.272.2397. Onsite demonstrations are also available.