

Better City Streets

Do you know what it takes to maintain municipal roadways? Twenty years ago the city of Rochester, New York implemented an innovative street maintenance program that has resulted in some of the best urban roadways in the Northeast. Preliminary studies showed that the condition of water and sewer pipes and other utility lines buried under the roadways had a significant impact on the condition of the road itself. ... READ MORE!

In the early 1980s the city of Rochester acknowledged the unsatisfactory condition of its streets. A cross functional task force was appointed that included representatives from the departments handling street maintenance, engineering, planning, budget, and water. Their assignment was to assess the then-current condition of the city streets, review the latest street maintenance technology, evaluate sources of funding, and draw up an action plan.

The condition of a road depends on many factors including the strength of the pavement and underlying soils, drainage, traffic loading, weather, and the maintenance of utilities buried underneath the streets. There are sophisticated ways to evaluate each of those factors. Also, these factors may vary over time. But the sum of it all is the condition of the street today.

City employees did a visual inspection from the vehicle (called a “windshield survey”) of all city streets. Using a standard inspection form, notes were taken on each segment of each street to record street roughness, cracking, potholes, repair patches, utility cuts, utility castings, curb conditions, etc. Also, the streets were classified as to usage: arterial, collector, local, and alleys. All of these factors were evaluated, giving due consideration to community priorities, in order to establish priorities for maintenance and repair operations.

The review of street maintenance technology revealed that deterioration is gradual for the first 80% of a street’s useful life, but once surface cracks open up to admit water, the rate of deterioration increases dramatically. That is because if water penetrates the surface faster than the underlying foundation of crushed rock can drain the water away, the excess water is absorbed by the supporting soils and the soils are weakened thereby. Then heavy traffic loads cause more cracks to open up, hastening the ultimate failure of the pavement. The conclusion of the task force was that it costs less to maintain streets in good condition than to neglect them until they fall into poor condition. For instance, a two inch overlay of asphalt applied before failure saves the expense of a five inch overlay or complete reconstruction after failure. (Studies have documented the extra cost of vehicle maintenance caused by bumpy road with potholes, but that factor was not evaluated by the task force.)

The task force evaluated various street maintenance procedures and incorporated the following operations in its final recommendations:

Routine Maintenance

City crews need to do crack sealing and pothole patching on a routine basis. This is particularly challenging in the Northeast, where winter freeze-thaw cycles hasten the formation of potholes, and city crews are used in the winter for ice and snow control operations. Crews need to be trained on the proper method for preparing potholes to be patched. Modern equipment needs to be provided so that hot patch material can be made from street millings (see below), unloaded from a heated compartment in the truck directly into the pothole, and properly compacted.

Chip Seal

Chip sealing consists of spraying the street surface with a hot asphalt emulsion and applying a thin layer of stone chips. The chips are rolled into the hot asphalt. Traffic can resume shortly thereafter, but at a reduced speed. The streets must be swept several times during the following week or two to pick up loose chips. The procedure was not popular with residents because of the reduced speed required in order to avoid kicking up chips and scratching the car's paint. And it is only suitable for local streets and alleys. But the program was forced by economic reality. Within the available funding, the local streets could be chip sealed every five to six years, thereby controlling excessive pavement cracking.

The city had previously used hot asphalt overlays on local streets. Continuing that practice within available funding would have resulted in maintenance cycles of over sixty years, well beyond the time of complete failure for most streets. A distinct advantage of chip sealing is that it raises the street surface only about $\frac{1}{4}$ " , the size of the stone chips. It is important to maintain the height of the street curbs. Curbs keep vehicles off of the sidewalks and landscaped areas, and provide drainage ways for rain water to the storm water inlets. Much to its regret, Rochester has buried many curbs on local streets with layers of hot asphalt, resulting in muddy grass areas, particularly at street corners.

Street Rehabilitation

Street rehabilitation consists of applying and rolling in a layer of hot asphaltic material (black top) two inches or more in thickness. It is usually preceded by a street milling operation. Heavy equipment grinds down the road surface to remove the top layer of material. The milling is done to "true and level" the road surface and to provide the desired height of curb reveal after the overlay has been applied. The milled material can be processed and be recycled as part of the mix for pothole patching or hot overlays. Where the road base is not in good condition, a nonwoven engineering fabric may be put down before the overlay to provide reinforcement, or street reconstruction may be indicated. Street rehabilitation may be applied to arterial and collector streets, and to some local streets that are in bad condition.

Street Reconstruction

The reconstruction of a street involves the complete removal of the road material, including the underlying layers of rock, down to the original soils. Abandoned trolley tracks may need to be removed. Curbs and sidewalks may be replaced depending on

their condition. Then the road is replaced using up-to-date design standards. Street reconstruction is very expensive. Sometimes a street rehabilitation project will include the reconstruction of some segments that are in bad shape. A significant factor in both Street Rehabilitation and Street Reconstruction projects is the requirement that any utility castings in the street must be adjusted by the utility to the grade of the improved street surface prior to placing the wearing course of pavement.

Street Cuts

The task force found that street openings made by utilities significantly affected the condition of the roadways. Often the opening was not backfilled and patched properly. No matter how well the job is done, cracks will open up between the patch material and the original material. These cracks will require periodic sealing for years to come, until one of the maintenance procedures described above is done.

The task force saw the need for better inspections and more effective enforcement of street-cut regulations. After reviewing the issue with local utilities and contractors, the city engineer recommended changes to the city code which were accepted and implemented. Every applicant for a street cut must provide a letter of credit which guarantees workmanship for two years. Inadequate repairs are fixed by the city and charged against the letter of credit. This procedure is much more efficient than trying to get each utility to maintain their own patches at the same time that city crews were repairing pot holes on the same street.

Also, the city engineer routinely informs the utilities of future capital improvement programs. Utilities are required to perform any needed maintenance on their below-street facilities AND to upgrade these to include growth for the expected life of the capital improvement. An additional maintenance fee is imposed on any street-cut permit applicant for requested cuts in streets that have been improved within the past four to six years.

Water and Sewer Leaks

Leaks in water and sewer pipes buried under or near the roadway can result in the erosion of the supporting soils. Such erosion may be quickly revealed by sink holes forming in flexible asphalt pavements. Under rigid concrete pavements, large segments of the pavement may collapse at once at considerable risk to motorists.

There are several ways to detect leaks in water mains, including sophisticated hydraulic surveys. But a leak of water from a pressurized pipe usually makes a noise that is transmitted along the length of the pipe for a distance. One simple method is to use a listening device called an aqua phone. It looks like an old-fashioned telephone receiver with a spike on its end, and it acts like a doctor's stethoscope. Hold the spike on a fire hydrant, water valve, or water meter, and you will probably hear the noise of any leak in the vicinity. Water meter readers are instructed to sound each meter each time they make their quarterly read. Other equipment can be used to locate more closely the location of any leaks detected with an aqua phone.

It was found that water service lines are a frequent offender. City code was revised so that anyone requesting a demolition permit is required to remove the service line to that property from the water main. City water also has an annual program for cleaning and lining, or replacing, old pipes that have an excessive leak history, are partly clogged, or are too small to meet today's water demands.

Like the city water system, the sewer system is very old. It includes stone box culverts as well as newer pipe materials. Rochester's sewer system is maintained by a county agency. They maintain an annual program for cleaning sewer lines and inspecting them with television equipment dragged from manhole to manhole. Follow-up repairs are done as appropriate.

Conclusion

The condition of city streets is one of the first thing observed by a visitor or potential business entrepreneur entering the city. The condition reflects on the effectiveness of the city administration and the well being of its residents. It affects the cost of vehicle maintenance to both residents and businesses.

There are many factors that contribute to a good street maintenance program: a survey of street conditions; the application of priorities that reflect engineering realities and community concerns; an efficient and well-equipped street maintenance crew; adequate street-cut permit requirements; and adequate annual funding. The program is not glamorous. It will not yield immediate and highly visible results. But a properly engineered program will yield gratifying results in the long term. And a program that is well-defined and readily explained will treat all neighborhoods fairly and help fend off unreasonable requests made to elected representatives and city officials.

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