

Primer

Best Practices for Pothole Repairs in Canada

Introduction

Every year, through the winter and spring seasons, potholes appear with detrimental effects to roadway structure, vehicles and driver comfort. Potholes are the result of small area defects or deterioration in the pavement that may require reactive emergency repair, followed by more substantial semi-permanent repairs when weather conditions improve. A typical pothole is shown in Figure 1.



Figure 1. Typical Pothole

This publication was developed to identify current Canadian agency practices with respect to pothole repair and outline best practices from both Canadian and international agencies. Recommendations are provided for appropriate temporary and long-term patching strategies for spring, summer and winter, and for evaluating and selecting appropriate patching products that will lead to the improved performance of asphalt and chip seal roadways for Canadian climate conditions. The publication also provides recommended guidelines for the evaluation of new patching products, including laboratory and field testing.



How Potholes Are Formed

Potholes are a function of a number of causes including:

- Age and condition of the pavement
- Environmental conditions
- Traffic type and frequency
- Moisture sensitivity
- Construction defects

Potholes can occur in all types of pavement sections, including flexible (traditionally asphalt concrete surface), rigid (portland cement concrete surface), thin surfaced (surface treated) or untreated (gravel) pavements. Reactive “emergency” repairs are typically completed to improve ride quality and prevent loss of control or damage to vehicles. The formation of a pothole is described in Figure 2, courtesy of the City of Ottawa.

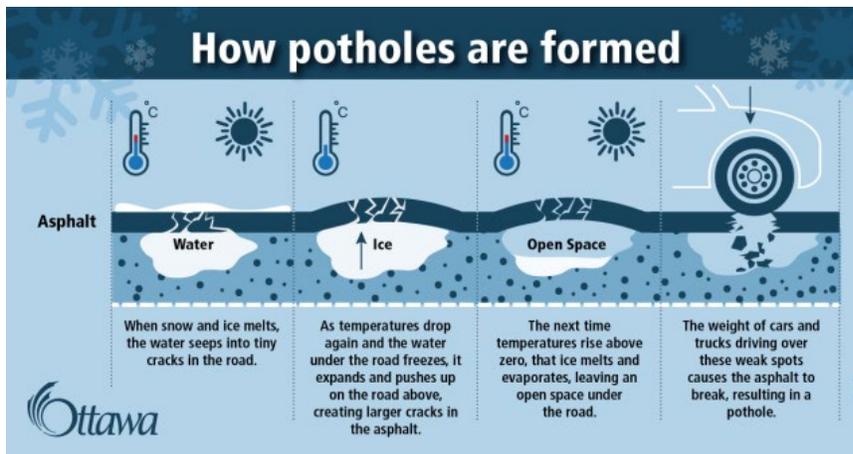
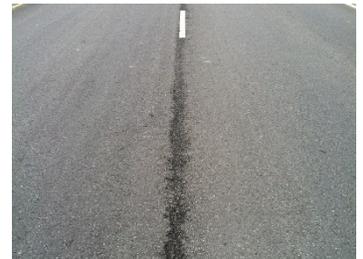


Figure 2. How Potholes Are Formed

The repair of potholes is typically considered to be corrective or emergency maintenance to address potentially hazardous impacting the safety of the travelling public. These types of pothole repairs are referred to as temporary repairs. Throw-and-go or throw-and-roll techniques are used in conjunction with cold mix asphalt. Unfortunately, in some cases, budget restrictions are such that temporary repairs have to be repeated many times before the agency is able to allocate resources for the longer-term rehabilitation of the pavement.

Patching Materials

As reported in the agency survey, the most popular pothole patching material used in Canada is cold-applied emulsion-based products, followed by hot mix asphalt. Only three agencies reported using recycled asphalt pavement reheated with specialty equipment to fill potholes; two of these three rated its performance as good, and one rated it poor. Only two agencies reported the use of cement-based products for pothole repairs, with both rating its performance as good to very good.



Laboratory Testing of Patching Materials

Very few of the agencies surveyed conduct any laboratory testing of pothole repair products. Most use ad hoc monitoring of the field performance and feedback from the maintenance crews to assess the suitability of pothole repair materials. The work completed for the U.S. Strategic Highway Research Program (SHRP) program found no correlation between field performance and laboratory-measured parameters such as resilient modulus, Marshall stability and flow, binder content, viscosity, ductility or softening point.

A recent large study on potholes completed in Europe established the following parameters that should be assessed to ensure the durability of pothole repair materials:

1. Standard properties of materials:
 - a. Deformation resistance (wheel tracking or cyclic compression)
 - b. Texture depth
 - c. Air voids content
 - d. Water sensitivity
 - e. Binder affinity
2. Compatibility in adverse conditions
3. Setting/curing time prior to traffic
4. Sensitivity to environmental conditions
5. Adhesion (including the use of tack/bond coat)

Pothole Repair Operations

Pothole repair operations are normally moving operations completed in live traffic conditions that expose workers to potentially hazardous conditions. Depending on speed and other factors, additional traffic protection vehicles including impact attenuator may be required, and should be taken into consideration in the overall cost of pothole and patch repair operations. A typical pothole and patch repair crew may consist of two to five persons depending on location, scope of work and any need for additional safety equipment. Where minimal traffic protection is required, all-in-one truck mounted systems may reduce support vehicle requirements and crew size while providing the flexibility for the crew to complete emergency/urgent/volume repairs or semi-permanent pothole and patch repairs.

Typical equipment includes a vehicle to carry the repair crew and materials to the worksite along with hand tools, compaction equipment (truck tires, plate or jumping jack type compactor) and safety appurtenances. If hot mix asphalt is being used as the repair material, it may be carried in a hot box that maintains the temperature of the asphalt so that it can be properly placed and compacted.

Automated or semi-automated pothole repair units are also available. These may be trailer- or vehicle-mounted or self-propelled, may use cold mix, hot mix or sprayed aggregate/emulsion, or have the ability to use infrared heaters to heat the pavement in the repair area so that it can be raked to grade and compacted, resulting in a sealed smooth pavement surface.



Pothole Repair Techniques

Whether a temporary or semi-permanent repair is required will likely depend upon weather conditions, and be influenced by public complaint or service level requirements. Temporary repairs are usually undertaken during poor weather conditions where a more permanent repair cannot be completed. Depending upon availability, hot mix or cold mix asphalt is used to fill the pothole or patch to temporarily restore the pavement. Semi-permanent repair is normally done during favourable weather conditions and may require removal of deteriorated pavement and loose material around the repair area. Cold mix is generally used for temporary repairs, with hot mix used to complete the repair.

Temporary Repair

During unfavourable weather conditions throw-and-go and throw-and-roll are the most likely repair methods to be used. In addition, throw-and-go is the most commonly used method during pothole repair campaigns or where high production is required to mitigate a high volume of potholes. The repair material typically consists of conventional or premium cold mix asphalt, or water setting cold mix asphalt. The repair process involves:

- Identification of the pothole area to be repaired
- Debris, water and ice are generally not cleared from the pothole
- Shoveling cold mix asphalt into the pothole
- Hand tamping with a shovel
- Moving on to the next pothole while letting traffic compact the pothole repair area

These repairs normally have a relatively short life, but they effectively address immediate safety concerns and restore pavement smoothness.

Semi-Permanent Repair

Semi-permanent repair is a more costly method, as it takes more time and effort to complete a pothole or patch repair. Semi-permanent repairs are usually completed during good weather conditions. Ideally, the material used for the repair should match the surrounding pavement as close as possible. The benefit is that semi-permanent repairs yield better overall results, as they mitigate some the fundamental underlying and adjacent pavement distresses. Semi-permanent repairs typically use hot mix asphalt, resin based, concrete and hydraulically bound materials and/thermal or spray patching techniques. The semi-permanent method normally consists of the following steps:

- Clear the pothole area of debris and water
- Square the patch by making a sawcut in sound pavement adjacent to the repair area
- Sweep and remove loose material to sound depth
- Apply tack coat bonding material
- Place hot mix asphalt
- Compact with a plate tamper or roller

Although the method takes more resources and time to complete, it is generally a longer lasting repair and is therefore more cost-effective.



New Methods and Techniques

Most of the focus on pothole repairs has been on the materials used to fill the potholes. There are hundreds of products on the market, with each generally claiming to be the best. According to the literature review and survey, the best performing pothole repair material is dense graded hot mix asphalt placed during warm and dry conditions. The publication provides benefit/cost analysis worksheets to assess cost-effectiveness of new pothole repair products, equipment and techniques.

Summary

Potholes generally trigger a very personal response from road user, as they represent a driver safety issue and cause vehicle damage. The process of repairing potholes may also be a safety hazard for repair crews, as well as vehicle congestion/flow issues during the repair. Having specific pothole repair guidelines that include the definition of a pothole, seasonality effects, and timing required to address the deficiency is useful to help staff and contractors understand expected outcomes. In addition, public education on repair strategies and weather limitations can assist in managing public expectations and transparency for temporary and permanent repairs.

The best way to treat a pothole is to make sure it does not happen in the first place. Timely preventive maintenance and adequate funding to address minor pavement deficiencies as they occur can reduce the quantity and severity of potholes, and the funding needed for pothole repairs.

More Information

This primer is based on the Transportation Association of Canada publication *Best Practices for Pothole Repairs in Canada*, which readers can purchase from TAC's online bookstore at www.tac-atc.ca. The publication can be used to help agencies to develop a best practices approach to dealing with potholes for roadway infrastructure.

Disclaimer

Every effort has been made to ensure that this primer is accurate and up-to-date. The Transportation Association of Canada assumes no responsibility for errors or omissions. The primer does not reflect a technical or policy position of TAC.

Transportation Association of Canada
401-1111 Prince of Wales Drive, K2C 3T2
Tel. (613) 736-1350 ~ Fax (613) 736-1395
www.tac-atc.ca

