

# THE RESTORATION AND REPAIR OF UTILITY BOXES IN PAVEMENTS

A BEST PRACTICE BY THE NATIONAL GUIDE  
TO SUSTAINABLE  
MUNICIPAL INFRASTRUCTURE

National Guide  
to Sustainable  
Municipal  
Infrastructure



Guide national pour  
des infrastructures  
municipales  
durables

Canada

**NRC - CNRC**



*The Restoration and Repair of Utility Boxes in Pavements*

Issue No.: Issue 1.0

Publication Date: December 2002

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## FOREWORD

In spite of recent increases in public infrastructure investments, municipal infrastructure is decaying faster than it is being renewed. Factors such as low funding, population growth, tighter health and environmental requirements, poor quality control leading to inferior installation, inadequate inspection and maintenance, and lack of consistency and uniformity in design, construction and operation practices have impacted on municipal infrastructure. At the same time, an increased burden on infrastructure due to significant growth in some sectors tends to quicken the aging process while increasing the social and monetary cost of service disruptions due to maintenance, repairs or replacement.

With the intention of facing these challenges and opportunities, the Federation of Canadian Municipalities (FCM) and the National Research Council (NRC) have joined forces to deliver the *National Guide to Sustainable Municipal Infrastructure: Innovations and Best Practices*. The Guide project, funded by the Infrastructure Canada program, NRC, and through in-kind contributions from public and private municipal infrastructure stakeholders, aims to provide a decision-making and investment planning tool as well as a compendium of technical best practices. It provides a road map to the best available knowledge and solutions for addressing infrastructure issues. It is also a focal point for the Canadian network of practitioners, researchers and municipal governments focused on infrastructure operations and maintenance.

The *National Guide to Sustainable Municipal Infrastructure* offers the opportunity to consolidate the vast body of existing knowledge and shape it into best practices that can be used by decision-makers and technical personnel in the public and private sectors. It provides instruments to help municipalities identify needs, evaluate solutions, and plan long term, sustainable strategies for improved infrastructure performance at the best available cost with the least environmental impact. The five initial target areas of the Guide are: potable water systems (production and distribution), storm and wastewater systems (collection, treatment, disposal), municipal roads and sidewalks, environmental protocols and decision-making and investment planning.

Part A of the *National Guide to Sustainable Municipal Infrastructure* focuses on Decision-Making and Investment Planning issues related to municipal infrastructure and therefore is qualitatively distinct from Part B. Among the most significant of its distinctions is the group of practitioners for which it is intended. Part A, or the DMIP component of the Guide, is intended to support the practices and efforts of elected officials and senior administrative and management staff in municipalities throughout Canada.

It is expected that the Guide will expand and evolve over time. To focus on the most urgent knowledge needs of infrastructure planners and practitioners, the

committees solicited and received recommendations, comments and suggestions from various stakeholder groups, which shaped the enclosed document.

Although the best practices are adapted, wherever possible, to reflect varying municipal needs, they remain guidelines based on the collective judgements of peer experts. Discretion must be exercised in applying these guidelines to account for specific local conditions (e.g. geographic location, municipality size, climatic condition).

For additional information or to provide comments and feedback, please visit the Guide at [www.infraguide.ca](http://www.infraguide.ca) or contact the Guide team at [infraguide@nrc.ca](mailto:infraguide@nrc.ca).

## ACKNOWLEDGEMENTS

The dedication of individuals who volunteered their time and expertise in the interest of the *National Guide to Sustainable Municipal Infrastructure* is acknowledged and much appreciated.

This best practice was developed by stakeholders from Canadian municipalities and road specialists from across Canada, based on information from a scan of municipal practices and an extensive review. The following members of the National Guide's Roads Technical Committee provided guidance and direction in the development of this best practice. They were assisted by the Guide Directorate staff and Groupe Qualitas Inc. and John Emery Geotechnical Engineering Limited (JEGEL).

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In addition, the Municipal Roads and Sidewalks Technical Committee would like to thank the following individual for his participation in working groups and peer review:

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This and other best practices could not have been developed without the leadership and guidance of the Project Steering Committee and the Technical Steering Committee of *the National Guide to Sustainable Municipal Infrastructure*, whose memberships are as follows:

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## EXECUTIVE SUMMARY

This best practice forms part of the *National Guide to Sustainable Municipal Infrastructure*. The overall objective of the Guide is to assist municipalities in the management of all components of the municipal infrastructure, including transportation and water distribution systems, and all activities involved with infrastructure management, including planning, design, financing and maintenance. This document has been prepared to address the restoration and repair of utility access boxes in pavements.

The *National Guide to Sustainable Municipal Infrastructure* conducted a scan across Canada to establish the best practices for construction and restoration/repair of utility access boxes. This best practice scan established that replacement, repair and restoration of utility boxes should be considered separately from initial construction procedures of utility access boxes in roadways. **Hence, two best practices, one for new construction and one for restoration and repair, have been developed based on the results of the best practice scan.**

Utility access box construction has a profound influence on pavement performance where improper construction procedures are used. The purpose of this best practice is to provide the municipal community with the best practices and state-of-the-art technologies on the restoration and repair of utility boxes in pavements so their influence on pavement performance will be minimized. The main differences between the two best practices can be seen in the work description where the procedures for initial construction are slightly different than for a restoration/repair project in existing pavements.

The most significant initial observation resulting from the scan was that there is no single standard specification for the construction and repair of utility access boxes, and all the organizations polled had developed their procedures empirically through trial and error. It was also established that the performance of pavement near utility access boxes decreased rapidly when less emphasis was given to appropriate design or construction specifications. Consequently, this best practice focussed on providing specification guidance to the level appropriate to ensure a high level of performance for the surrounding pavement near utility access boxes.

This best practice addresses the need for standardized procedures and identifies deficiencies that can occur when poor restoration and repair practices/techniques are used. This best practice also identifies step-by-step procedures that should be implemented to minimize the impact of utility access boxes on the surrounding pavement and on long-term performance. The influence of quality assurance/control procedures on the performance of adjacent pavement is also discussed.

This best practice is considered to be applicable for all Canadian regions, noting that the resulting specifications will need to be adapted to reflect specific local climatic conditions and agency requirements. For example, the City of Vancouver does not use frost tapers because of the low freezing index in that city; conversely, the City of Québec and many municipalities in northern Ontario specify frost tapers extending to depths of about 2 m or greater.

The anticipated outcome of adoption of this best practice will be improved pavement performance near utility access boxes. However, changes in performance may not be immediately obvious and long-term evaluations will likely be necessary for the performance improvements to become fully apparent.

Several areas of additional research were identified during the course of this project:

- concerns related to the implementation of unshrinkable fill (although its use is well-established in the Greater Toronto Area, Winnipeg and Montréal, for example);
- the use and most appropriate configuration for frost tapers in relation to differential heave (under different climatic and soils conditions);
- the influence of the difference in elevation on the ride comfort index, such as the IRI, in relation to drainage requirements;
- the use of geotextile (or geosynthetic membranes or equivalent products) to mitigate frost heave;
- the use of radiator bags (under investigation by NRC) to mitigate differential and frost heave around maintenance access holes (manholes) (which can be seen at [www.nrc.ca/irc/uir/ur/manholes/index.html](http://www.nrc.ca/irc/uir/ur/manholes/index.html));
- the short- and long-term performance of the adjustable frame and cover systems to establish the performance and cost benefits in comparison with conventional systems; and
- the asphalt concrete parameters and design methods for congested areas to establish criteria and properties most appropriate for placement and use around utility access boxes.

It is recommended that this best practice be reviewed every three to five years to reflect any new research findings or technology developments. As the specific requirements for utility access boxes themselves can vary substantially based on the technical requirements of the individual utility/service provider, this best practice does not address the utility access boxes themselves. Consideration should be given to developing a separate best practice document that provides such guidance for utilities and agencies.



# 1. GENERAL

The *National Guide to Sustainable Municipal Infrastructure* conducted a scan throughout Canada to establish the best practices for construction and repair of utility access boxes. This best practice scan established that the replacement, repair and restoration of utility boxes should be considered separately from initial construction procedures. Hence, two best practices, one for construction and one for restoration and repair, have been developed based on the results of the best practice scan.

The purpose of this best practice is to provide the municipal community with the best practices and state-of-the-art technologies on the restoration and repair of utility boxes in pavement so their influence on pavement performance will be negligible. As the specific requirements for utility access boxes can vary substantially based on the technical requirements of the individual utility/service provider, this best practice does not address the utility access boxes.

This best practice addresses the need for standardized procedures and identifies deficiencies that can occur when poor construction practices/techniques are used. This best practice also identifies step-by-step construction procedures that should be implemented to minimize the impact of utility access boxes on the surrounding pavement and on its long-term performance.



## 2. RATIONALE

The most significant initial observation resulting from the scan was that there is no single standard specification for the construction of utility access boxes. All the organizations polled had developed their procedures empirically through trial and error. It was also established that the performance of pavement near utility access boxes decreased rapidly when less emphasis was given to appropriate design or construction specifications.

Consequently, this best practice focussed on providing specification guidance to the level appropriate to ensure a high level of performance for the surrounding pavement near the utility access boxes.

As demonstrated in the following section, utility access box restoration has a profound influence on pavement performance where improper construction procedures are used. The influence of quality assurance/control (QA/QC) procedures on the performance of adjacent pavement is also discussed.

### 2.1 RESTORATION/REPAIR INFLUENCES PAVEMENT PERFORMANCE

The four most frequent distresses observed in the pavements adjacent to utility access boxes established from the best practice scan are listed in Table 2–1.

Table 2–1: Frequency of Distress (restoration/repair)

Type of Distress	Photograph Number	Distress Frequency %	Most Probable Cause(s)
Old/new pavement joint degradation	1	55	Loss of soil support in influence zone of trench Deficient workmanship
Settlement	2	48	Compressible soils Deficient workmanship
Concentric cracking	3	20	Frost-susceptible soils Heavy traffic
Ravelling	4	16	Difficulty in workability of material Deficient workmanship

The following photographs show each of these distress types.

Photograph 2–1: Old/New Pavement Joint Degradation



Photograph 2–2: Slight Settlement Around Catch Basin



Photograph 2–3: Concentric Cracking



Photograph 2–4: Slight Frost Heave Problems and Some Ravelling



Data found during the review of the technical literature indicated that pavement roughness can be affected 0.55 m beyond the edge of the utility access box cut, and the pavement structural capacity can be reduced in the area extending 0.63 m on either side of the cut.

As shown in Table 2–1, a major cause of pavement distress is the lack of adequate support, due to the presence of compressible soils or frost-susceptible soils, or deficient workmanship. These major distresses have been demonstrated to have a substantial negative impact on the performance of the adjacent pavement, with up to a 50 percent loss in pavement service life reported.

## **2.2 THE BENEFITS OF QA/QC PROCEDURES**

The best practices scan also established that the performance of pavements decreases where there is reduced emphasis on quality assurance/control during utility access box restoration/repair. Recommended QA/QC procedures and guidelines have been developed for this best practice.

Respondents to the information scan indicated that city forces occasionally perform some utility access box construction/restoration projects. It was recommended that a training program for municipal staff involved in utility access box design and construction be established. This program could be based on this best practice.

## 3. WORK DESCRIPTION

### 3.1 DESIGN CONSIDERATIONS

#### 3.1.1 ELEVATION

The difference in elevation between the covers of utility access boxes and adjacent pavements should be guided principally by ride comfort/roughness considerations, except for catch basins where surface drainage must also be satisfied. Another factor influencing this parameter is the use of adjustable frames that have a tapered side frame which provides a more monolithic bond with the asphalt concrete.

The recommended elevation differences are shown in Table 3–1.

Table 3–1: Recommended Difference in Elevation Between Utility Access Boxes and Adjacent Pavement (flexible or rigid pavement)

Type of Box	Type of Frame	Difference in Elevation (Below Pavement Grade) mm	Remarks
Catch basins	Conventional	10 to 25	This difference in elevation should be implemented in a 1 m taper around the catch basin.
	Adjustable	5 to 15	This difference in elevation should be implemented in a 1 m taper around the catch basin.
Maintenance access holes (manholes) and other boxes	Conventional	0 to 15	This difference in elevation should be implemented in a 1 m taper around boxes.
	Adjustable	0	

#### 3.1.2 TYPE OF FRAME AND COVER

Conventional frames and covers usually consist of a metal frame, which rests on a concrete riser, and a cover, which is fitted to match the size of the frame.

In the last decade, new types of frames and covers have been developed and have become widely available commercially. Most adjustable frames, for instance, have two or more independent parts: a frame base that is fixed to the concrete riser and an upper section that can be adjusted to compensate for any movement of the pavement surface, resulting in less vibration and pavement deterioration. These adjustable frames are particularly useful when differential frost heave has occurred and only partial repairs are carried out.

Where the cost of a conventional frame and cover would be about \$300 per unit, the adjustable frame and cover is about \$700 (October 2002 prices).

The following figures illustrate various types of adjustable frames and cover products.



*Straight guiding frames*  
for surface inclined from 0 to 7 %

*Tapered guiding frames*  
for surface inclined from 0 to 17 %

Figure 3–1: Adjustable covers with guiding frames (tapered or straight)

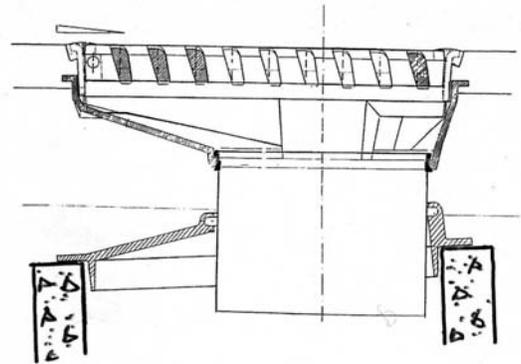


Figure 3–2: Other type of adjustable frame and cover

### 3.2 RESTORATION/REPAIR SPECIFICATIONS

All restoration/repair procedures should be completed in such a manner as to mitigate the distresses and respective causes identified in Table 2–1.

Repair/restoration must be carried out to eliminate the settlement problems caused by the loss of soil support or by the use of compressible soils, and the differential frost-heaving problems attributed to the use of frost-susceptible soils. Evidently, the joint between the old and new pavements is a priority.

Figure 3–3 describes the backfill specification requirements for proper restoration.

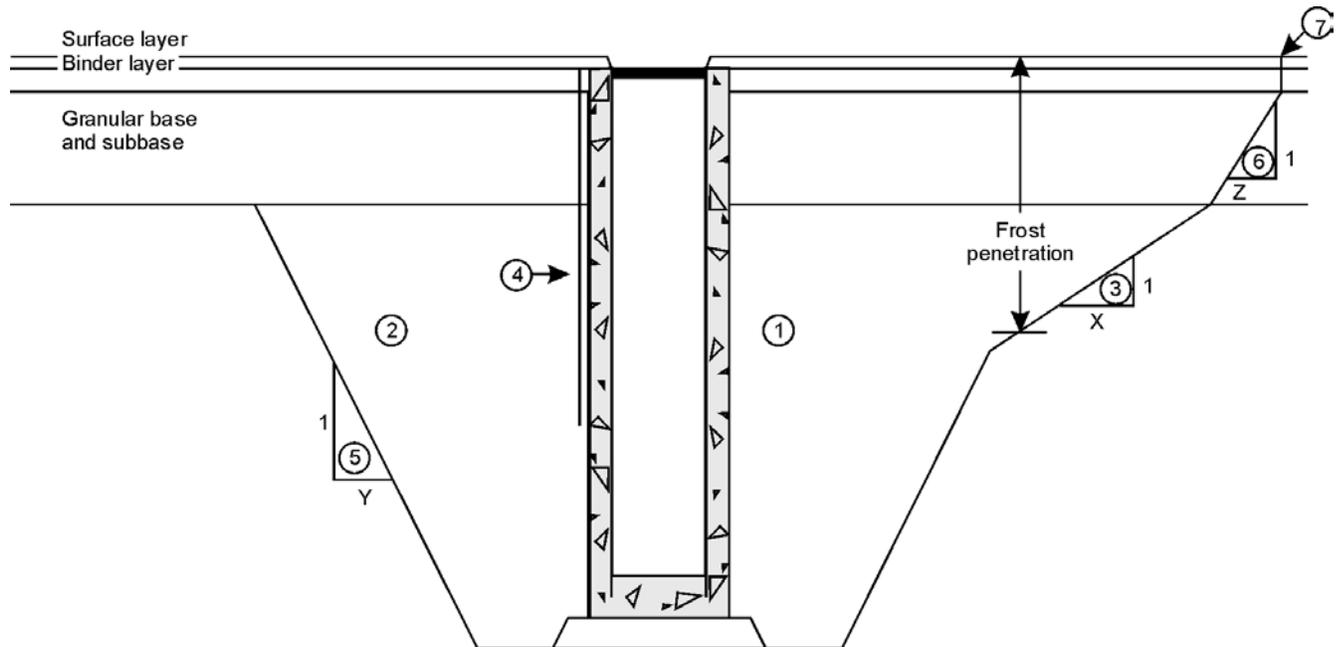


Figure 3–3: Restoration/repair specifications

- 1) Where imported backfill is to be used (different from the native/excavated soils), see section 3.2.1 for instructions for each material type.
- 2) Where backfilling is to be completed using native/excavated soils, see section 3.2.1.
- 3) Frost taper slope, see 3.2.2.
- 4) Frost heave mitigation technique, see 3.2.3.
- 5) Cut treatment, see 3.2.4.
- 6) Excavation slopes, see 3.2.5.
- 7) Slope in road foundation (base and sub-base), see 3.2.5.

### 3.2.1 BACKFILL SPECIFICATIONS

The major materials used as backfill in utility access box excavations are summarized in Table 3–2, with anecdotal comments provided on their use.

Table 3–2: Type of Material for Backfill

Type Of Backfill	Comments	Remarks								
Native/excavated material	Where suitable, reuse of the native/excavated material is usually cost effective and preferred to minimize excess material during construction. From an environmental viewpoint, reuse of the excavated material preserves and extends natural aggregate resources.									
	Some limitations on the type of native material should be established so compressible (clayey or organic) or frost-susceptible materials are not included as backfill.	Clay restriction: plasticity index <15.								
Recycled material	From an environmental viewpoint, the use of recycled materials, such as processed reclaimed asphalt pavement (RAP) or recycled concrete, are encouraged in lieu of crushed stone, sand, or sand and gravel because it preserves and extends natural aggregate resources.	Recycled material containing more than 25% of RAP should not be used in the upper layers of backfill immediately below the granular sub-base, since its California Bearing Ratio (CBR) is usually lower. Crushed concrete could potentially contain chlorides and/or sulphates that could damage/corrode concrete structures or cast iron pipes.								
Crushed stone, natural gravel, sand	Ensure reliable source/vendor for aggregate, and consider QA/QC checks to verify aggregate is not contaminated material.	A general standard for backfill could be: <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Sieve</th> <th>% pass</th> </tr> </thead> <tbody> <tr> <td>150 mm</td> <td>100</td> </tr> <tr> <td>5 mm</td> <td>30-100</td> </tr> <tr> <td>80 µm</td> <td>0-15</td> </tr> </tbody> </table>	Sieve	% pass	150 mm	100	5 mm	30-100	80 µm	0-15
Sieve	% pass									
150 mm	100									
5 mm	30-100									
80 µm	0-15									
Unshrinkable fill (UF)	<p>Very useful in restoration/repair projects; most effective in small excavations and around dense utility boxes where conventional compaction is not possible, or in situations where potential for undermining could damage the adjacent pavement.</p> <p>Specifications for UF:</p> <ul style="list-style-type: none"> <li>– Cement type (Type 10)</li> <li>– Cement content: 25 kg/m<sup>3</sup> maximum</li> <li>– Compressive strength: 0.4 MPa (28 days) maximum; 0.07 MPa at 24 hours minimum</li> <li>– Max. size aggregate: 37.5 mm</li> <li>– Slump : typically &gt; 150 mm</li> <li>– Percent of coarse aggregate &gt;50 %</li> </ul> <p>Admixture: air entraining (optional, helps fluidity/workability)</p>	<p><u>Advantages of Unshrinkable Fill vs Granular Fill:</u></p> <ul style="list-style-type: none"> <li>– Unshrinkable fill (UF) provides stable subgrade performance</li> <li>– UF provides more consistent performance</li> <li>– UF is easier to use</li> <li>– UF does not require compaction testing</li> <li>– UF requires less inspection</li> </ul> <p><u>Disadvantages of UF:</u></p> <ul style="list-style-type: none"> <li>– Higher frost penetration</li> <li>– Uneven frost heaving</li> <li>– Unstable where water infiltration in trenches is significant</li> </ul> <p>Necessity to provide 8 to 24 hours of surface protection</p>								

**Layer Thickness**

Backfilling should be carried out in uniform lifts not exceeding 300 mm of loose thickness, subject to the placement method and type of compaction equipment employed. The layer thickness should be decreased to 150 mm around obstacles, such as conduits or utilities. The thickness of the first layer of backfill material placed directly above the utility may need to be increased to prevent damage to the utility during compaction (in all cases, the utility bedding and requirements for backfilling in close proximity to the utility should be carried out in accordance with the specific requirements of the utility provider or agency).

The backfill material should be simultaneously placed in equal lifts on all sides of the utility access box.

**Degree of Compaction**

To limit settlement problems around utility access boxes, the backfill material should be compacted to at least 95 percent of its modified Proctor Maximum Dry Density. Alternatively, unshrinkable fill could be considered and does not require any compaction.

Specifying 95 percent compaction will reduce the potential for settlement of properly placed, approved backfill material. A 95 percent compaction requirement will also limit the type(s) of native materials that can be used as backfill. Note that it may be difficult to achieve this level of compaction using native/excavated materials.

**3.2.2 FROST TAPERS**

Frost tapers should be used when the type of backfill has a different frost susceptibility than the surrounding soils to avoid any differential frost heaving. The frost susceptibility of backfill or surrounding soils should be established by their “potential of segregation” as described in the research article *Frost Susceptibility Related to Soil Index Properties* (Konrad, 1999).

These frost tapers should begin at the lower limit of the sub-base to a depth equivalent to the frost depth penetration.

The frost penetration in pavements should be established with the freezing index and the formula in Chapter 20 of *Geotechnical and Geo-Environmental Engineering Handbook* (Rowe, 2001).

When frost tapers are needed, they should be used to the depth of frost penetration, and the slope should be varied (from 1H:1V to 5H:1V) depending on the type of trench (longitudinal or transversal) and the speed limit or classification of the road.

Table 3–3: Frost Tapers

Classification of Road	Longitudinal to the Direction of Traffic Slope “X”	Transversal to the Direction of Traffic Slope “X”
Residential	1H:1V	1.5H:1V
Collector	1.5H:1V	2H:1V
Arterial (<60 km/h)	3H:1V	3H:1V
High speed arterial (60 to 90 km/h)	3H:1V	5H:1V

### 3.2.3 FROST HEAVE MITIGATION TECHNIQUES

Frost heave mitigation techniques should be used, especially if the backfill is a native material that might be frost-susceptible. Frost heave mitigation techniques are shown in Figure 3–4.

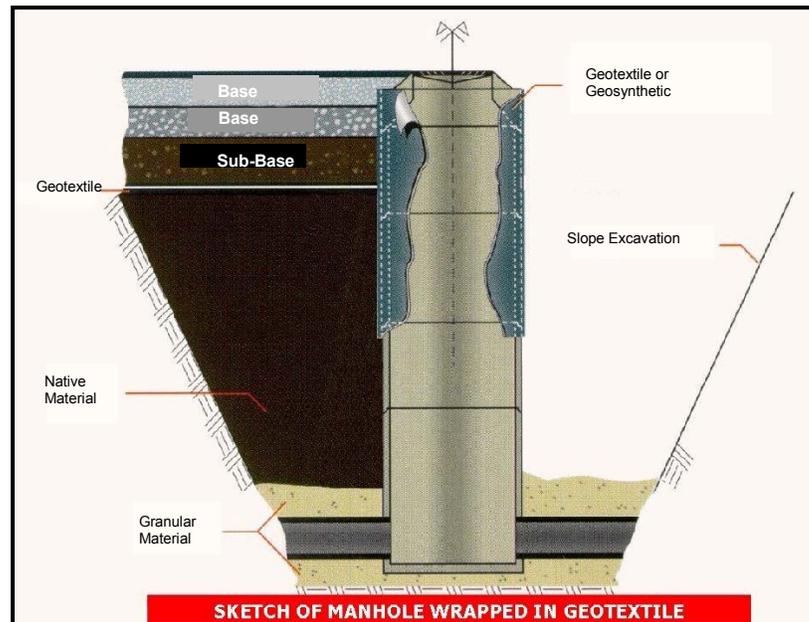


Figure 3–4: Frost Heave Mitigation

The purpose of the geotextile is to reduce the possibility of a bond developing between the utility access box and the backfill material, if frost-susceptible, on freezing, causing heaving of the riser or chimney. Provision of a geotextile at the interface will prevent the riser from heaving and also prevent infiltration of fine material between the concrete rings (which can be a problem if a frost heave mitigation technique is not used).

Wrapping the utility access box with a geotextile is not costly (typically about \$150/box), and this technique should be considered for all utility access boxes installed where frost heave problems and fines infiltration into joints can occur.

This technique should be considered particularly for projects in areas where the freezing index is between 900 and 1 000 °C.-d or greater.

The geotextile should be attached in accordance with the manufacturer's recommendations. Typically, the geotextile is attached using 100 mm nails in a vertical joint in a stitching pattern. Horizontally, it is held in place until the backfill is placed, by lapping the geotextile over the top of the chimney and then placing the frame on top of it.

Geosynthetic membranes consisting of a geotextile covered by a PVC membrane have been used successfully in arch frost heave conditions. In this case, the PVC layer should be installed on the outside, in accordance with the manufacturer's recommendations.

Another method to mitigate frost heaving is to use a cone-shaped top section on circular pre-cast maintenance access holes (manholes) and catch basins. The cone-shaped section should extend to below the frost penetration depth.

### **3.2.4 UTILITY BOX CONNECTION**

Pre-cast concrete sections are assembled together with or without waterproofing butyl joints depending on utility/agency requirements. In some cases, the interior and exterior of the joint are mortared to improve waterproofing and to avoid infiltration of fine particles. Rubber sleeves are also available that can be installed on either the interior or exterior of the utility access box to stop water and soil infiltration.

For final unit levelling and frame installation, the use of concrete brick and mortar is not recommended, and the use of concrete or rubber rings should be adopted as the industry standard method. This conclusion was developed based on the consensus of comments from the scan indicating that the poor quality of the mortar (to resist freeze-thaw cycles) and poor workmanship has generally resulted in poor performance.

#### **Flexible Pavement**

Particular attention should be given to the proper reinstatement of the cut pavement. The geometry of the cut should be rectangular. The cut should be neatly cut with a saw through its full depth. If any undermining of the pavement has occurred during the utility cut restoration work, the pavement should be further cut back and removed to the undisturbed base/sub-base. Before patching with asphalt concrete, a tack coat should be applied to all vertical surfaces (including the pavement cut) to promote a bond between the original pavement and the patched area, minimize water infiltration, and better connect the frame and the pavement. On high traffic volume roadways where traffic disruptions/delays cannot be tolerated, an asphaltic membrane could be installed on the vertical surface of the old pavement before paving. This membrane will

melt with the new asphalt concrete and assure a 100 percent bond with the old pavement.

The joint between the new asphalt patch and the existing pavement should be sealed (overbanded) at the time of construction. Crack sealing should also be carried out one to three years following construction to prevent water infiltration of the road bed.

If adjustable frames are used, they may require thicker asphalt pavement near the box to permit the adjustment and reduce potential fines infiltration. Some adjustable frames consist of two cylinders of different diameters, which slide into one another. The gap between the two components could permit fines to infiltrate and cause the units to seize. This can be mitigated by increasing the thickness of the asphalt concrete to 200 mm. Regardless, utility access box systems, including adjustable frames, should *always* be installed in accordance with the manufacturer's recommendations.

### **Rigid Pavement**

When utility access boxes are installed in rigid (concrete or composite) pavements, proper isolation joints are necessary where the concrete pavement abuts maintenance access holes (manholes), drainage fixtures or other utility access boxes. The isolation joints permit independent movement of the pavement and the utility access box structure, reducing the potential for damage to the rigid pavement. Details are presented in *Concrete Intersection, - A Guide for Design and Construction* prepared by the American Concrete Pavement Association, 1997. This reference also presents recommendations and standards for pre-formed compressive seals to be installed in the isolation joints.

### **3.2.5 EXCAVATION SIDE SLOPES**

Excavation side slopes and construction methods must, at all times, be completed in conformance with provincial health and safety regulations and requirements, and other agency requirements as applicable, to ensure worker safety during utility installation. These regulations typically require that excavation side slopes be maintained for relatively short construction periods at an angle not exceeding 1H:1V. Additionally, excavations should at all times be properly sloped, or provided with appropriate continuous temporary support as needed to avoid any loss of support/undermining of the adjacent pavement.

The slope in the road foundation (granular base and sub-base) should also be maintained at 1H:1V to avoid any loss of soil/sloughing that may undermine the adjacent pavement.

The thickness of the pavement base and sub-base layers in the repair area should at least match the existing pavement structure. If there has been any loss of material or support, the existing pavement should be cut back to undisturbed material and reinstated.

### 3.3 GUIDELINES FOR QUALITY ASSURANCE AND CONTROL

The best practice scan revealed that the pavement's performance near boxes decreases as the effort of QA/QC procedures decreases. Hence, greater emphasis on QA/QC is needed to ensure that utility access box restoration/repair work is properly carried out in accordance with the project specifications. The following guidelines have been established.

#### 3.3.1 BUDGETARY CONSIDERATIONS

Table 3–4 presents the typical fees (at the date of publication, including expenses) for QA/QC that should be anticipated for utility access box construction in the municipal context, and are based on the use of conventional granular backfill materials and placement/compaction in accordance with the previous recommendations.

Table 3–4 : QA/QC Cost vs Construction Cost

Construction Cost \$	Fees as a Percentage of Project Cost %
< 50 000	4 (min. \$1 000)
50 000 to 99 999	2.75 to 4
100 000 to 199 999	2.5 to 3.5
200 000 to 499 999	2.25 to 3.0
500 000 to 999 999	2.0 to 3.0
≥ 1 000 000	1.75 to 2.75

One main advantage of unshrinkable fill is the reduced cost of placement and associated QA/QC testing, particularly when suppliers of unshrinkable fill are pre-approved (City of Toronto, for instance). Unshrinkable fill is manufactured at a ready-mix concrete plant, or site produced (pick-a-mix systems), then placed without the need for compaction (or compaction testing). When pre-approved suppliers are used, QA compressive strength cylinders may occasionally be taken to confirm that the UF setting and strength properties meet specification requirements.

#### 3.3.2 TECHNICAL CONSIDERATIONS

The following minimum QA/QC testing requirements are recommended for relatively large utility access box installations backfilled using conventional granular materials and construction methods. For smaller installations or confined applications, the use of unshrinkable fill is recommended.

**For each type of backfill material:**

- one sieve analysis/500 t
- one Modified Proctor/each type of material or any change in sieve analysis.

**Compaction for backfill around boxes:**

- one density test (ASTM D-2922)/100 m<sup>2</sup>/layer with a minimum of two density tests/layer.

Wherever practical, full-time inspection of projects should be encouraged to ensure the utility access box restoration work is carried out in accordance with the specifications, and the adjacent soils are not undermined during the operation. A training program is also recommended for inspectors to enhance their awareness of the consequences of poor workmanship and quality, and identify key areas of concern and their mitigation.

**3.4 MONITORING**

The monitoring of pavement near utility boxes should also be enhanced, perhaps in conjunction with crack-sealing operations recommended within one to three years of construction. The specifications for crack sealing and filling in asphalt pavements are being developed by the National Guide as this document is being published. Please refer to the Guide website at [www.infraguide.ca](http://www.infraguide.ca) or to the Urban Infrastructure Rehabilitation program of the Institute for Research in Construction at [www.nrc.ca/irc/uir/](http://www.nrc.ca/irc/uir/).

Trigger values that will bring action to repair or replace should be established (see Table 3–5).

Table 3–5: Trigger Values in Terms of Difference in Elevation Between Boxes and Adjacent Pavement

Speed Limit km/h	Boxes Higher Than Pavement	Boxes Lower Than Pavement	
	Manholes, Catch Basins or Other mm	Manholes or Other mm	Catch Basin mm
<60	+25	- 30	- 60
>60	+10	-15	-40

## 4. APPLICATIONS AND LIMITATIONS

This best practice is applicable in all Canadian regions, noting that the resulting specifications will need to be adapted to reflect specific local climatic conditions and agency requirements. For example, the City of Vancouver does not use frost tapers because of the low freezing index in that city; conversely, the City of Québec and many municipalities in northern Ontario specify frost tapers extending to depths of about 2 m or greater.

It is recommended that this best practice be reviewed every three to five years to reflect any new research findings or technology developments.

The anticipated outcome of adoption of this best practice will be improved pavement performance near utility access boxes. Changes in performance may not be immediately obvious and long-term evaluation will likely be necessary before performance improvements become fully apparent.



## 5. OTHER CONSIDERATIONS

Certain areas have been identified for further research:

- concerns related to the implementation of unshrinkable fill (although its use is well-established in the Greater Toronto Area, Winnipeg and Montréal, for example);
- the use and most appropriate configuration for frost tapers in relation to differential heave (under different climatic and soils conditions) to determine more fully the parameters that should be used;
- the influence of the difference in elevation on the ride comfort index, such as the IRI, in relation to drainage requirements;
- the use of geotextile (or geosynthetic membrane or equivalent products) to mitigate frost heave;
- the use of radiator bags (under investigation by NRC) to mitigate differential and frost heave around maintenance access holes (manholes) (which can be found at [www.nrc.ca/irc/uir/ur/manholes/index.html](http://www.nrc.ca/irc/uir/ur/manholes/index.html));
- the short- and long-term performance of adjustable frame and cover systems to establish the performance and cost benefits in comparison with conventional systems; and
- the asphalt concrete parameters and design methods for patching mixes to establish criteria and properties most appropriate for placement and use around utility access boxes.



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