

Guidelines for Underground Utility Installations Crossing Highway Rights-of-Way



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Utility Installations Crossing
Highway Rights-of-Way***

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Note

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| Abstract | | Keywords |
| <p>Utility companies provide essential services to the public. They often install their facilities within the rights-of-way of public roads. If the utilities were not allowed to use the rights-of-way, they could be required to purchase their own land, which would drive up the overall cost to the utility company. This could significantly increase the cost to the public.</p> <p>However, the responsibility of road authorities includes operating the highway rights-of-way in a manner that ensures the safety, traffic-carrying ability and physical integrity of their installations. The presence of a utility within the right-of-way can affect these characteristics, so it is necessary for road authorities to reasonably regulate the presence of utilities.</p> <p>The purpose of this general guideline is to assist the various road authorities in establishing and administering reasonably uniform criteria for the accommodation of utilities crossing highway (and freeway) rights-of-way. Ideally, existing utility accommodation guidelines should be updated in light of these guidelines, as appropriate.</p> <p>These guidelines have been written for both the road industry and the utility industry. Although they can be used by anyone in order to obtain an overview of the complex series of highway/utility interactions, it is specifically aimed at the following types of audiences:</p> <ul style="list-style-type: none"> ➤ Managers in both the public and private sectors; ➤ Consulting engineers practicing in the highway/utility field; and ➤ Individuals just entering the highway/utility field. | | <p>Planning of Transport Infrastructure</p> <ul style="list-style-type: none"> • Administration • Cable • Carriageway • Corridor (Transp) • Crossing the Road • Electricity • Fuel • Maintenance • Pipe • Risk Assessment • Safety • Subterranean |
| Supplementary Information | | |

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Foreword

Utility companies provide essential services to the public. They often install their facilities within the rights-of-way of public roads. If the utilities were not allowed to use the rights-of-way, they could be required to purchase their own land, which would drive up the overall cost to the utility company. This could significantly increase the cost to the public.

However, the responsibility of road authorities includes operating the highway rights-of-way in a manner that ensures the safety, traffic-carrying ability and physical integrity of their installations. The presence of a utility within the right-of-way can affect these characteristics, so it is necessary for road authorities to reasonably regulate the presence of utilities.

OBJECTIVE OF THE GUIDELINES

The purpose of these general guidelines is to assist the various road authorities in establishing and administering reasonably uniform criteria for the accommodation of utilities crossing highway (and freeway) rights-of-way. Ideally, existing utility accommodation guidelines should be updated in light of these guidelines, as appropriate.

These guidelines do not constitute a policy, a standard, a specification or a regulation. It simply proposes criteria, and road authorities have the option of applying other criteria.

INTENDED AUDIENCE

These guidelines have been written for both the road industry and the utility industry. Although they can be used by anyone in order to obtain an overview of the complex series of highway/utility interactions, it is specifically aimed at the following types of audiences:

- Managers in both the public and private sectors;
- Consulting engineers practicing in the highway/utility field; and
- Individuals just entering the highway/utility field.

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1. INTRODUCTION

Transportation, communications and energy networks are growing in complexity. Such networks include highways, railways and waterways at the surface; subways, pipelines and cables below the surface; communication lines and electrical lines above the surface; and wireless communications systems. The possibility of two or more networks occupying a common right-of-way or intersecting increases as the networks grow. As a result, problems arise due to the construction, maintenance and operations of one network affecting the others.

Each road authority has the responsibility to maintain highway rights-of-way under its jurisdiction and to preserve the operational safety, integrity and function of road infrastructure. Since the manner in which utilities cross or otherwise occupy highway right-of-way can materially affect the safe operation, maintenance and appearance of the highway, it is necessary that such use and occupancy be authorized and reasonably regulated. Road authorities have various degrees of power to regulate the use of utilities within highway rights-of-way generally through their statute to designate and to control the use made of right-of-way acquired for public road purposes. Their authority depends upon federal laws and regulations; and provincial laws and regulations that differ between provinces. Also, a province may have local laws and regulations differing from those applicable throughout the province. Aside from the necessary differences imposed by provincial and local laws, regulations, industry codes, climate and geography, consistency in the engineering requirements should be employed by road authorities to regulate the use of highway rights-of-way by utilities.

Utilities have various degrees of authority to install their lines and facilities on the right-of-way of public roads. Like road authorities, their rights depend upon federal or provincial laws and regulations, which differ between provinces. Utilities also depend upon local laws and ordinances.

It can be in the public interest for utilities to be accommodated on highway rights-of-way when such use and occupancy do not adversely affect highway safety, construction, maintenance or operations. In this respect, guidelines outlining safe and rational practices for accommodating utilities within highway rights-of-way are of valuable assistance to the road authorities. The guidelines herein are provided in the interest of developing and preserving safe highway operations and roadsides.

These guidelines make no reference to the legal right of utilities to use or occupy highway rights-of-way or to the financial responsibility involved in the adjustment or relocation of utilities on such rights-of-way.

It is the intent of these general guidelines to assist the various road authorities in establishing and administering reasonably uniform utility accommodation guidelines and standards. However, even if policies, guidelines, standards, specifications and regulations may vary from one province to another, utilities should be installed in accordance with each road authority's accommodation guidelines. Minimizing possible interference and impairment to the highway and its structures, minimizing adverse visual impacts and minimizing maintenance are covered in these guidelines. Wherever appropriate, existing utility accommodation guidelines and standards should be updated in light of these guidelines.

2. *APPLICABILITY*

These guidelines apply to all public and private underground utilities, including, but not limited to, electric power, communications (e.g. cable television), water, gas, petroleum products, sewer and similar facilities that are to be located, adjusted or relocated within the rights-of-way under the jurisdiction of road authorities.

These general guidelines are provided for consideration and use by road authorities in regulating the use and occupancy of highway (and freeway) rights-of-way by utilities. They are limited to matters, which are the responsibility of road authorities for preserving the safe operation, maintenance, construction and integrity of the highway.

Individual road authorities may choose to apply different rules to utilities for servicing installations that are required for operating the highway.



3. UTILITIES WITHIN HIGHWAY RIGHTS-OF-WAY

3.1 SAFETY

3.1.1 Highway Operations

Highway safety is important when accommodating utilities within highway rights-of-way. Utility accommodation should not adversely affect highway constructability, operations and maintenance.

3.1.2 Clear Zone

The design, location and manner in which utilities use and occupy highway rights-of-way should conform to the guidelines or standards of the road authority to provide and maintain a clear zone.

3.1.3 Road Users and Utility Workers

All permits for utility work should include provisions for the safety and protection of the road users, as well as provide a safe workspace for the utility workers.

3.1.4 Emergency

The road authority and the utility should provide procedures for emergency maintenance operations within highway rights-of-way.

3.2 DESIGN

3.2.1 Joint Highway and Utility Planning

Highway and utility installations, by tradition, practice and, in some instances, laws, frequently co-exist within the same corridors. Therefore, it is essential that these public service installations be compatibly designed and operated. Joint highway and utility planning and development efforts are encouraged.

3.2.2 Present and Future Impacts Consideration

The potential impact on the highway and its use should be considered in the design and location of utility installations within the highway rights-of-way. Likewise, the impact of a new or reconstructed highway on existing utility installations should be considered in an attempt to avoid utility relocations.

On new installations or adjustments of existing utility facilities, provisions should be made for known or planned expansion of the utilities. They should be planned so as to minimize hazards and interference with highway traffic when additional overhead or underground facilities are installed at some future date.

3.2.3 Highway and Utility Responsibilities

The utility should be responsible to ensure that their installations are properly designed, installed, operated and maintained including depth, clearances and separation between facilities, and the work is in accordance with the road authority's utility accommodation guidelines and standards.

The road authority should be responsible for review and approval of the utility's proposed installation in accordance with the road authority's utility accommodation guidelines and standards.

3.2.4 Survey Information

Underground utilities should be accurately located where the exact location of underground utility installation is required. The survey information should be developed early in the design process so that the designer can show on the plans the accurate location of underground utilities that could cause injuries and property damage. Mapping requirements for the recording and depiction of exposed underground utility installations and related accessories should conform to CAN/CSA-S250 "Mapping of underground utility infrastructure".

3.2.5 Highway Integrity

Utilities should be designed to preserve and protect the structural integrity, aesthetic quality, safety, maintenance and operation of the highway during construction and operation of the utility.

3.3 LOCATION

3.3.1 Later Adjustment and Interference

New utility installations should be located to minimize the need for later adjustment to accommodate future highway improvements and to permit servicing such installations with minimum interference to highway traffic.

3.3.2 Highway Crossings Alignment

Utility crossings of the highway should be as near perpendicular to the highway alignment as practical, but no less than seventy (70) degrees, except in special circumstances.

3.4 PRESERVATION AND RESTORATION

3.4.1 Erosion and Sediment Control

Appropriate erosion and sediment control devices should be placed before work starts. The surface area disturbed by utility installations or relocations should be kept to a minimum.

3.4.2 Restoration

Restoration methods should be in accordance with the road authority's specifications and special provisions in utility use and occupancy permits.

3.4.3 Drainage

Care should be taken in utility installations to avoid disturbing existing highway or private drainage facilities.

3.4.4 Trees

The road authority's utility accommodation guidelines and standards, and permission to spray, cut, trim or remove trees, should be incorporated into the use and occupancy permit. When the removal of a tree is authorized, the stump should either be cut to the ground or be removed, and the hole properly backfilled once the tree has been removed. All debris, refuse and waste should be removed from the site. With the road authority's approval, removed trees may be chipped and/or shredded and used as mulch for site restoration.

3.4.5 Traffic Control

Traffic controls for utility construction and maintenance operations should conform to the road authority's requirements. Any utility construction or maintenance operation should be planned with full regard to safety, and interference with highway traffic should be kept to an absolute minimum. On heavily traveled highways, utility construction or maintenance operations interfering with traffic should not be allowed during periods of peak traffic flow.

3.4.6 Utility Maintenance

Maintenance activities within the right-of-way should be considered when installing utility facilities and appropriate markers or other warning devices. The use and occupancy permit, or where applicable the road authority's utility accommodation agreements, guidelines and standards, should identify the maintenance operations that will be permitted and indicate situations where prior notification to the road authority is required.

3.4.7 Records

Records should be maintained by the utility that describe the facility, usage, size, configuration, material, location and vertical clearance (or depth of cover) at time of installation and any special features such as encasement. Upon completion of construction, the utility should provide accurate as-built plans to the road authority, as requested. This information should be in a reproducible form available to other utilities and road authorities. As-built records should conform to CAN/CSA-S250 “Mapping of underground utility infrastructure”. Mapping records should be measured and levels of accuracy should be specified by the road authority.

3.4.8 Existing Utilities

Where highway construction or alterations are considered, utilities should be involved early in the design process. This will permit joint and parallel activities to be coordinated throughout the life of the highway project. Early involvement may facilitate completion of utility relocations prior to the start of project construction. Where utilities exist within the right-of-way of a highway to be widened or improved and a utility relocation is likely, consideration should be given to again accommodate those existing utilities within the highway right-of-way.

3.4.9 Abandoned Utility Facilities

The utility should notify the road authority in writing of the intention to abandon its facilities in place. Such abandoned facilities within the right-of-way should remain the responsibility of the utility. The road authority may give reasonable notice to require the removal of abandoned utility facilities and restoration of the right-of-way, or the filling of any such facilities by an approved method, when necessary to avoid interference with the operation, maintenance or reconstruction of the highway. Any facilities that the utility requests to abandon that contain hazardous materials should not be permitted to remain in the right-of-way and should be removed at the utility’s expense. Any utility facilities that are proposed to be abandoned and removed by the utility should be disposed of consistent with industry standards and provincial and local laws.

4. UNDERGROUND UTILITY INSTALLATIONS CROSSING HIGHWAY RIGHTS-OF-WAY

4.1 GENERAL

All gas and liquid pipelines, water and sewer pipes and underground electric power distribution and communication lines crossing highway rights-of-way should be installed alone, in joint use or in proximity to each other or other facilities according to the higher requirements for the design, construction, operation and maintenance stipulated in the present general guidelines, in CAN/CSA-C22.3 No 7 "Underground Systems" and CAN/CSA-Z662 "Oil and Gas Pipeline Systems" Standards, and in *National Energy Board Act and Regulations*.

4.1.1 Materials

All underground utility installations should be of durable materials, designed for long service life expectancy and be relatively free from routine servicing and maintenance.

4.1.2 Highway Crossings Location

Underground utility crossings should be avoided in deep cuts, near footings of bridges and retaining walls, at highway cross drains where flow of water, drift, or streambed load may be obstructed, in wet or rocky terrain where it is difficult to attain minimum cover and through paved or unpaved slopes under structures.

4.1.3 Separation from Highway Facilities

Underground utility installations should be separated from highway facilities to avoid damage during construction and to provide for reasonable success in locating utilities with electronic devices. Separation of the utilities from highway facilities or other utility facilities may require the acquisition of additional property by the utility.

4.1.4 Utility Markers

All non-metallic underground installations should be accompanied by a trace wire, metallic tape or other method to effectively locate and mark the underground installations. Whenever feasible, such methods should include devices incorporated into the facility. The method used to locate the exact location of the non-exposed underground utility should be in accordance with the road authority's utility accommodation guidelines and standards.

All new underground installations and replacements of existing installations, where practicable, should be installed with a warning tape located above the installation. The minimum separation between the facility and the warning tape should be 300 mm. The warning tape should be durable, designed to withstand extended underground exposure and be imprinted with an appropriate warning or message. The colour of the warning tape should be in accordance with the uniform colour

code proposed by the *Canadian Common Ground Alliance (CCGA)* for the colour assigned to utility surface markings.

The utility should place, as appropriate, permanent markers identifying the location of underground utility crossings. Markers should be installed in such a manner as to not interfere with highway safety and maintenance operations. Preferably, the markers should be located at the right-of-way line if that location will provide adequate warning. The telephone numbers to request marking the utility location prior to excavation and for emergency response should appear on the permanent marker.

When it is likely that highway construction or maintenance activities could involve existing underground utilities, it is desirable to locate and identify these utility installations well in advance of the commencement of the work as an aid to work crews. The location of each underground utility installation should be identified by the utility with stakes, paint or other temporary on-the-surface markings coded with an identifying colour consistent with the uniform colour code proposed by the *Canadian Common Ground Alliance (CCGA)*.

CCGA UNIFORM COLOUR CODE

| | |
|--------|--|
| White |Proposed Excavation |
| Pink |Temporary Survey Markings |
| Red |Electric Power Lines, Cables, Conduit and Lighting Cables |
| Yellow |Gas, Oil, Steam, Petroleum or Gaseous Materials |
| Orange |Communication, Alarm or Signal Lines, Cables or Conduit |
| Blue |Potable Water |
| Purple |Reclaimed Water, Irrigation and Slurry Lines |
| Green |Sewers and Drain Lines |

4.1.5 Call-Before-You-Dig System

No underground utility installation should be permitted within the highway rights-of-way unless the utility subscribes to the services of a call-before-you-dig system serving two or more utilities in the area. Where such service is not available or not required by the road authority, the utility should be required to: (a) provide copies of as-built records including horizontal and vertical controls to the road authority; (b) update these records annually or whenever a change occurs; (c) provide a single, reliable, 24-hour telephone number to be used for locating and temporarily marking requests for emergency and routine activities by the road authority or by any entity planning to work within the highway rights-of-way.

4.1.6 Accessories Location

Cabinets, pedestals, vents and other above ground utility accessories installed as part of the underground utility installations should be located at or near the right-of-way line.

Manholes and other points of access to underground utility installations should be located outside the highway right-of-way, or at an absolute minimum, outside the clear zone from the edges of traveled ways. Manholes and other points of access should not be located within the highway median.

Vents, drains, markers, manholes, shafts, shut-offs, cross-connect boxes, pedestals, pad-mounted devices and similar accessories should not be located where they would interfere with the accessible facilities for the disabled.

Accessories protruding more than 100 mm above the ground line should be located outside the clear zone from the edges of traveled ways and as close to the right-of-way line as practical. If no feasible alternative exists, accessories within the clear zone should meet breakaway criteria or be shielded by a traffic barrier.

Utility accesses and valve covers should not be located in the roadway of rural highways. In urban and suburban areas there may be no feasible alternative to locating utility accesses and valve covers in the roadway, in which case they should not be located in a wheel path, if possible. Coordination among utilities is essential where utility accesses and valve covers are to occupy highway rights-of-way.

4.1.7 Uncased Pipeline Protection

For some conditions, pipelines crossing highway rights-of-way may be installed without encasement. The following controls are suggested for providing protection to these uncased pipelines (see Figure 1).

- Uncased pipelines should conform to the material and design requirements of utility industry and governmental standards. In addition, the pipelines should be designed to support the load of the highway plus superimposed loads thereon when the pipeline is operated under all ranges of pressure from maximum internal to zero pressure. Such pipelines should employ a higher factor of safety in the design, construction and testing than would normally be required for cased pipelines.
- Suitable bridging, concrete slabs or other appropriate measures should be used to protect existing uncased pipelines which by reason of shallow cover or location make them vulnerable to damage from highway construction or maintenance operations (see Figure 2). Such existing uncased pipelines may remain in place without further protection measures if they are of adequate depth and do not conflict with the highway construction or maintenance operations, provided both road authority and utility are satisfied that the pipelines are, and will remain, structurally sound and operationally safe.
- Uncased welded steel pipelines which carry flammable, corrosive, expansive, energized or unstable materials, particularly if carried at high pressure or potential, may be permitted, provided additional protective measures are taken in lieu of encasement. Such measures would employ a higher factor of safety in the location, design, construction and testing of the uncased-carrier pipe, including such features as increased depth of cover, thicker wall pipe, radiograph testing of welds, hydrostatic testing, coating and wrapping, and cathodic protection.

4.1.8 Underground Utility Cover

The minimum utility cover depths should be as specified hereafter (see Table 1 and Figure 4) for each utility installation type. The provisions should apply for new utility installations, additions to or alterations of existing installations, adjustments or relocations of utilities incidental to highway construction and to existing utility installations within highway (and freeway) rights-of-way. Utility installations should conform to all conditions described in columns A, B, C and D of Table 1. The minimum utility cover depths specified by a road authority may be greater when installed within freeway rights-of-way. The road authority may approve other protection designed by the utility in lieu of the minimum cover depth specified.

4.2 UNDERGROUND UTILITY CROSSINGS CONSTRUCTION

Generally, open trenching across paved surfaces is not permitted in areas where the highway section involved has a pavement structure that was constructed or reconstructed within a period of time determined by the road authority or when the road authority determines that traffic and safety considerations take precedence. Jacking and/or boring may be required in these areas unless solid ledge or boulders are known to exist.

Generally, no open excavation is permitted within freeway rights-of-way unless specifically authorized by the road authority.

When the trench method is employed to install a utility crossing highway right-of-way, pavement restoration can be complicated by the details involved with the restoration and need for a detailed Traffic Control Plan. If open trenching is permitted by the road authority, the utility should provide a quality of works guarantee covering a period of time determined by the road authority.

4.2.1 Trenchless Technology Construction and Controls

a) Construction

In general, underground utility facilities crossing highway rights-of-way should be installed by jacking or boring (wet boring should not be allowed) or by other trenchless technology methods as approved by the road authority. Minimum cover of jacking and boring installations should be 3 m under highways (and freeways) unless approved by the road authority.

When installed by jacking or boring, encasement of the pipeline may be required. All jacking or boring pits (temporary access points) should be located outside the freeway rights-of-way, and outside highway roadways, as far from the edge of the traveled ways as possible and outside the clear zone, unless approved by the road authority. All pits should be located and constructed so as not to compromise the integrity of highway structure footings or traffic operations. The road authority may require the use of support structures to achieve the proper degree of protection.

Backfilling of boring pits should be compacted as specified by the road authority.

Other trenchless technologies which may be utilized for installing utility facilities under a highway without disturbing the surface include: driving, piercing, dry boring, horizontal directional drilling, auger and slurry boring, pipe jacking and tunneling, impact moling and ramming and pipe bursting. These techniques should follow the manufacturer's requirements and specifications. The road authority may require additional special guarantees or specifications for utility installations utilizing these trenchless methods.

b) Controls

Where unstable soil conditions exist, boring or tunneling operations should be conducted in such a manner as not to be detrimental to the roadside being crossed. Soil coring indicating the type of subsurface material and verifying the absence of rock may be required by the road authority.

If an obstruction (such as rock) is hit during construction and the bore is to be abandoned, the void should be grout filled immediately. Abandoned casings should also be backfilled with grout as well.

The use of water under pressure (jetting) or puddling should not be permitted to facilitate boring, pushing or jacking operations. Horizontal directional drilling using approved drilling fluids, such as bentonite, may be used in accordance with *Horizontal Directional Drilling Good Practices Guidelines* released by North American Society for Trenchless Technology. No directional boring work should be allowed until approved by the road authority.

All directional drilling methods utilized should include a locatable conduit system, with identification markers on each side of the highway right-of-way.

4.2.2 Open Trench Construction

Open trench construction within pavement structure limits should only be allowed when approved by the road authority and in no case should be permitted on freeways. Approvals for open trenching not performed in conjunction with highway improvement projects should normally be limited to low volume highways, urbanized non-freeway highways or where soil or right-of-way conditions justify such an installation as determined by the road authority. In conjunction with construction or reconstruction projects, the road authority may allow open trench construction as coordinated with progress schedules of referenced projects.

Where trenching within the right-of-way is permitted, proper backfill compaction and materials should be required. Compaction should equal that of the surrounding soil and restoration of the area's vegetation should be required. Erosion control measures as determined by the road authority should be required.

Where open trenching across an existing highway is permitted, backfill and compaction requirements should be specified by the road authority. All pavement trenching edges should be saw cuts. Pavement restoration should be designed to prevent both front wheels of vehicles from impacting the patch at the same time and pavement restoration edges should be at an angle different than the normal snowplow angle to avoid plow conflict.

4.3 PIPELINE CROSSINGS – SPECIFIC CONSIDERATIONS

4.3.1 General

a) Encasement

In general, underground pipelines crossing highway rights-of-way warrant encasement to:

- facilitate the carrier pipe removal and/or replacement;
- prevent a spill or mitigate its effects on the highway;
- protect the pipeline from external loads and/or accidental dig-ups, access the utility; or
- prevent corrosion.

Encasement should be as specified for each type of pipeline discussed herein. Pipeline encasement should be mandatory for bridge approaches, freeways and interchange ramps crossings.

Casings should consist of a pipe or other separate structure around and outside the carrier pipe and should be designed to support the dead loads of the highway and superimposed loads thereon, including that of construction machinery. The strength of the casing should, as a minimum, equal the structural capacity of drainage culverts in the area and should be composed of durable materials designed to meet the conditions to which it may be subjected.

Casing should be sealed at the ends to prevent debris and moisture from entering the annular space between the casing and carrier pipe (see Figure 3).

Optional for Gas or Liquid Petroleum Pipelines

It is difficult to provide required cathodic protection for gas or liquid petroleum pipelines inside a casing. Pipeline protective coatings are frequently damaged during the insertion of the carrier pipe into casing pipes. Because of this, utilization of a sleeve should be applied judiciously by the utility and the road authority on an individual basis.

These pipelines may be installed without encasement under non-freeway highways if the design of the pipeline provides:

- increased wall thickness and/or higher strength pipe materials and/or greater cover; and
- adequate coating and wrapping and cathodic protection.

b) Crossings Location

Vertical and horizontal clearances between a pipeline and a structure, highway or other utility installation should be sufficient to permit maintenance of both the pipeline and the other facility without interference.

The locations of all pipelines should be reviewed by the road authority to ensure that the proposed utility installation will not interfere with existing or currently planned highway facilities or with highway maintenance and operation processes.

Highway drainage pipes and structures should be protected during pipeline installation and maintenance. Utilization of existing drainage pipes as sleeves for pipelines should not be permitted.

c) Product Transmission

All applications for pipeline installation permits should specify which products are transported and the maximum working, test and design pressures of the carrier and casing (if a casing is required).

Prior to any change to the transported products or increase in the working pressure from that specified in the original permit, the utility should notify the road authority and obtain approval. The applicable codes and standards should be specified in the request.

d) Highway Drainage Protection

Where it is necessary for pipelines to cross existing easement drainage flows outside of the right-of-way, the same minimum cover should be maintained as when crossing drainage ditches within the highway right-of-way. Existing surface and subsurface drainage flows should not be obstructed or altered. In cases where soil conditions are such that erosion might occur or where it is not feasible to obtain specified depths, it should be the responsibility of the utility to take such other measures as needed for safety and to protect the highway and the pipeline. Where grades on the pipelines must be maintained, such as gravity flow sewer pipes, each case should be resolved on an individual basis and is subject to the road authority's approval.

4.3.2 High Pressure Gas or Liquid Petroleum Pipelines (Over 680 kPa)

a) Encasement

Where encasement is to be employed such encasement should be provided under center medians and within the limits of pavement structure to a point beyond the ditch line for cut sections, 1.5 m beyond the toe of slope for fill sections or 1.5 m beyond the face of curb of all urban section roadways including roadsides and 8 m beyond any overpass or other structure where the line passes under it. Exceptions for encasement within a portion of the median may be approved when excessive median width or significant changes in the roadway cross-section make a continuous installation

impractical (see Figure 3). All pipelines should be encased under a bridge approach slab or if they pass closer than 8 m from a structure footing.

Existing pipelines under rural highways within construction projects may be permitted to remain in place without encasement or extension of encasement if they are protected by a reinforced concrete slab or equivalent protection, or if they are located not less than minimum cover depths specified for existing pipelines (see Table 1). The concrete slab should be designed by a Professional Engineer.

b) Vents

One or more vents should be provided for each casing or series of casings. For casings longer than 45 m, vents should be provided at both ends. On shorter casings a vent should be located at the high end with a marker placed at the low end. Vents should be placed at the right-of-way line immediately above the pipeline, situated so as not to interfere with highway maintenance or be concealed by vegetation. Ownership of the pipelines should be shown on the vents.

c) Drains

Drains for liquid petroleum pipelines should not be permitted to outfall into roadway drainage ditches, natural watercourses or highway rights-of-way.

d) Plastic Pipes

Plastic pipes should not be allowed for High Pressure Pipelines.

4.3.3 Medium and Low Pressure Gas Pipelines (Under 680 kPa)

a) Encasement

Encasement of low and medium pressure gas pipelines should comply with the requirements for *High Pressure Gas and Liquid Petroleum Pipelines*. Pipelines placed without encasement should be plastic or welded steel construction protected by approved coatings or cathodic protective measures.

b) Vents, Drains

Vents and drains should comply with the requirements for *High Pressure Gas and Liquid Petroleum Pipelines*.

c) Plastic Pipes

Plastic pipes may be used provided the internal pressure will not exceed road authority's standards, or the manufactures recommendations. The maximum size of plastic pipes should not exceed 300 mm. Where a plastic pipe is installed, a durable metal wire or magnetic tape should be concurrently installed just above the pipe, or other means should be provided for detection.

4.3.4 Water Pipes

a) Encasement

All water pipes under bridge approach slabs, under or within 8 m of the footing of any structure should be encased. Any freeway crossing should be encased within and beyond the right-of-way, or at a minimum 1.5 m beyond slope intercept of the original ground in fill sections or the slope ditch intercept in a cut section.

Continuous welded ductile iron water pipes of 300 mm diameter or less need not be encased under other existing non-freeway highways, provided the pipe is jacked or bored. For water pipes installed by open cut, or installed concurrently with a highway improvement project, encasement should not be required if suitable extra heavy pipe is used.

b) Shutoff Valves

Shutoff valves should be located beyond the limits of a structure, where a water pipe is accommodated and on both sides of a structure footing.

c) Drains

Water pipe encasement or drains may be permitted to outfall into roadside ditches at locations approved by the road authority.

d) Plastic Pipes

Plastic pipes may be used. Crossings should be encased. Where plastic pipe is installed a durable metal wire should be concurrently installed or other means should be provided for detection.

4.3.5 Sanitary Sewer Pipes

a) Encasement

Encasement requirements as stipulated for *Water Pipes* should apply for all pressurized sewer pipes and any existing gravity pipe which does not comply with material or cover requirements.

b) Manholes

Manholes serving sewer pipes up to 600 mm in diameter should have a minimum inside diameter of 1.2 m. For any increase in line size or number of pipes, the inside diameter of the manhole may be required to be increased a like amount. Manholes for large interceptor sewers should be specially designed, keeping the overall dimensions to a minimum. The outside diameter of the manhole chimney at the ground level should not exceed 900 mm. Any manholes allowed within the pavement should be set flush with the pavement and should not be in the vehicular wheel path.

c) Drains

Sanitary sewer pipe encasement drains should not outfall into highway drainage ditches, natural watercourses or the right-of-way.

d) Plastic Pipes

Where non metallic pipe is installed, a durable metal wire should be installed concurrently or other means should be provided for detection purposes.

**4.4 UNDERGROUND ELECTRIC POWER DISTRIBUTION LINE (< 69 kV)
CROSSINGS – SPECIFIC CONSIDERATIONS**

a) Encasement

All underground electric power distribution lines within the highway right-of-way should be in conduit.

b) Location of Highway Crossings

Underground electric power distribution lines should be located at approximate right angles to the highway to the extent feasible and practical. Reasonable latitude may be exercised regarding the crossing angle of existing lines that are otherwise qualified to remain in place.

c) Accessories

Underground electric power distribution lines that include above ground transformers or other utility accessories should be located at or near the right-of-way line, outside the clear zone and maintenance operation area. For those proposed installations that can not comply with the above requirements the road authority may, on a case-by-case basis, approve the installation. The utility should document that the installation does not present a safety hazard to vehicular travel and that normal highway maintenance operations are not impeded.

d) Manholes

Manholes should be limited to those necessary for installation and maintenance of underground lines. On non-freeway highways existing manholes may be permitted to remain in place to service existing lines. The elevation of manhole rims and covers should be set at finished grade. Except within urban type areas, new manholes should not be permitted within the traveled way or shoulder of a highway.

To conserve space within the right-of-way for highway and other utility facilities, manhole vault dimensions should be no larger than is necessary to hold the equipment involved and for safety standards to be assured for maintenance personnel. The outside width should not exceed 2.1 m, with

the length held to a reasonable minimum. The outside dimensions of a manhole chimney should not exceed the minimum required to support the manhole frame and cover. Manhole covers (for personnel access) should be installed flush with finished grade and should not be in the vehicular wheel path. The top of the roof of the manhole vault should be set to meet the minimum cover specified.

Exceptions may be authorized provided that justification is supplied to the road authority and it is found acceptable.

4.5 UNDERGROUND COMMUNICATION LINE CROSSINGS - SPECIFIC CONSIDERATIONS

a) Encasement

Underground communication lines and cable television lines crossing highways should not require conduit except where, in the judgment of the road authority, such conduit is necessary for the protection of the highway facility. Conduit or other suitable protection should be required for any communication installations (a) with less than minimum cover, (b) within 8 m of the footings of bridges or other highway structures or (c) under the approach slabs of structures.

Conduit should be designed to support the load of the highway and superimposed loads thereon, including that of construction machinery.

b) Location of Highway Crossings

Underground communication lines and cable television lines should be located at approximate right angles to the highway to the extent feasible and practicable. Reasonable latitude may be exercised regarding the crossing angle of existing lines that are otherwise qualified to remain in place.

c) Accessories

Above ground pedestals, buildings or other utility accessories installed as a part of an underground communication line should be located at or near the right-of-way line, outside the clear zone and maintenance operation area. The road authority should approve the site.

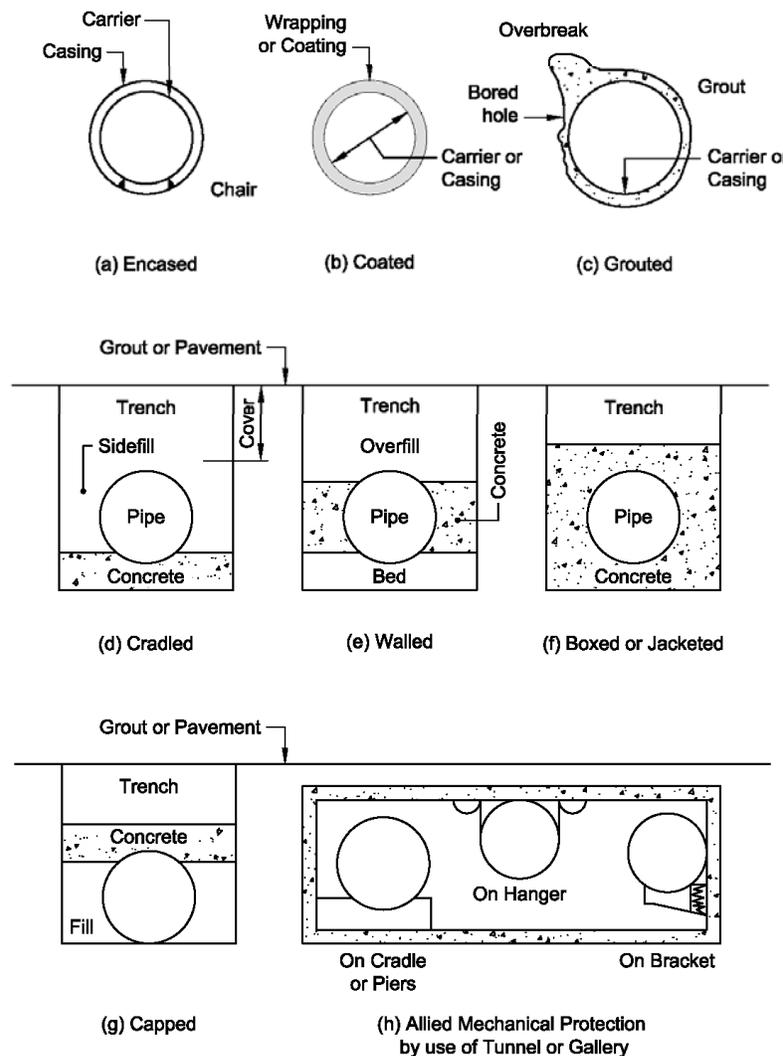
d) Manholes

Manholes should be limited to those necessary for installation and maintenance of underground lines. On non-freeway highways, existing manholes may be permitted to remain in place to service existing lines. The elevation of manhole rims and covers should be set at finished grade. Except within urban type areas, new manholes may not be permitted within the traveled way or shoulder of a highway.

To conserve space within the right-of-way for highway and other utility facilities, manhole dimensions should be no larger than is necessary to hold the equipment involved and for safety standards to be assured for maintenance personnel. The outside width should not exceed 2.1 m, with the length to be held to a reasonable minimum. The outside dimensions of the manhole chimney should not exceed the minimum required to support the manhole frame and cover. Manhole covers (for personnel access) should be installed flush with finished grade. The top of the roof of the manhole vault should be set to meet the minimum cover specified.

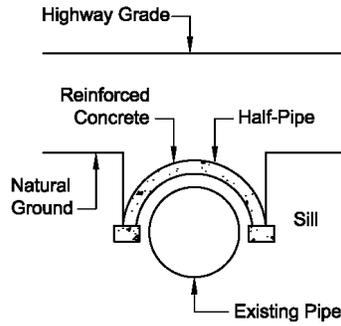
Exceptions may be authorized provided that justification is supplied to the road authority and is found acceptable.

FIGURE 1 – Pipelines Protection

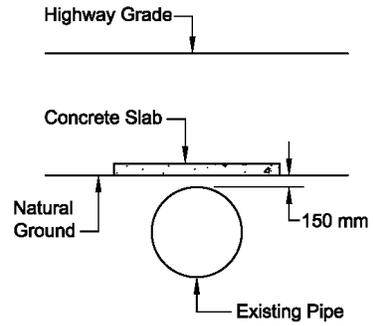


Note: Transitioning of trench shoulders required in frost susceptible soil.

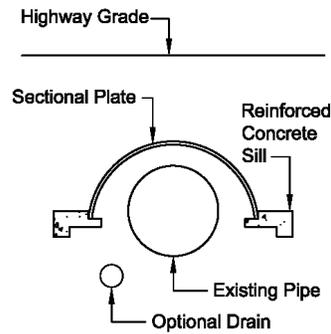
FIGURE 2 – Existing Pipelines Protection



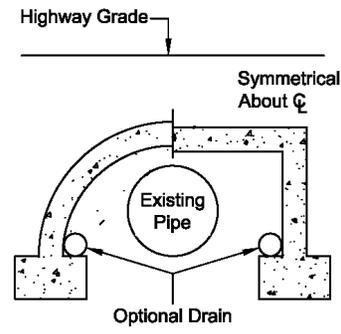
(a) Half-Pipe Protection



(b) Floating Slab Protection

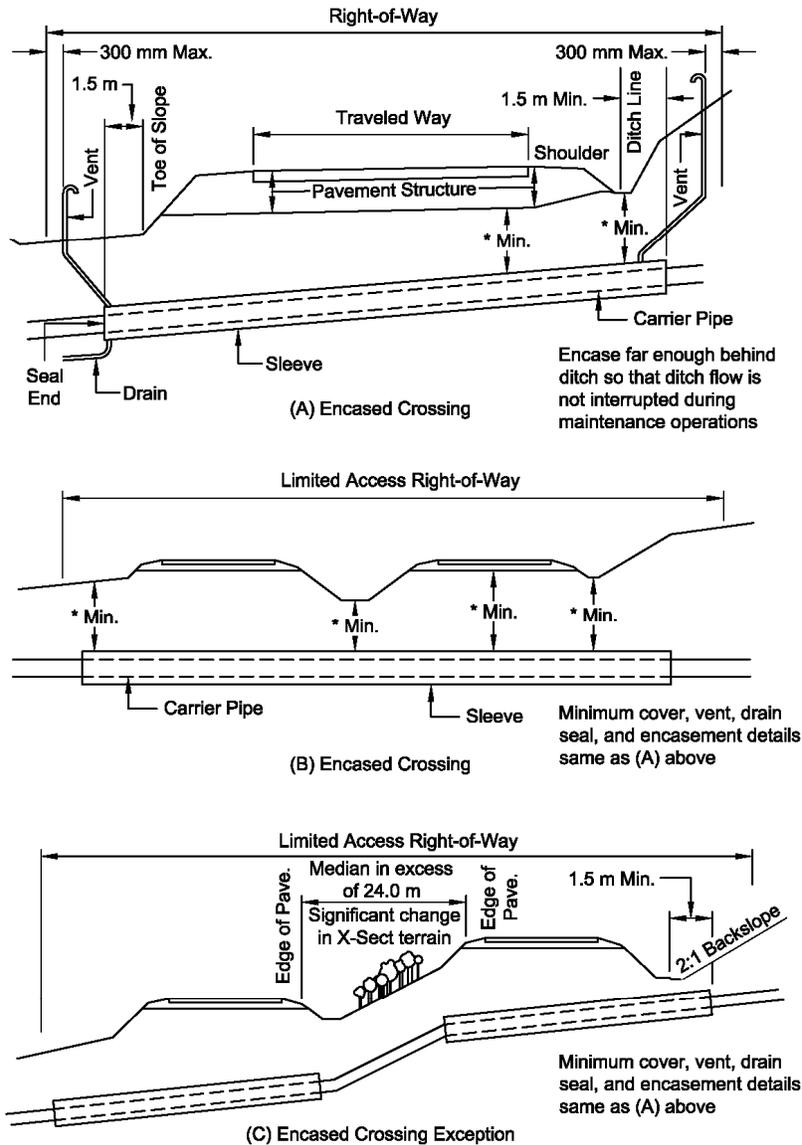


(c) Plate Arch Protection



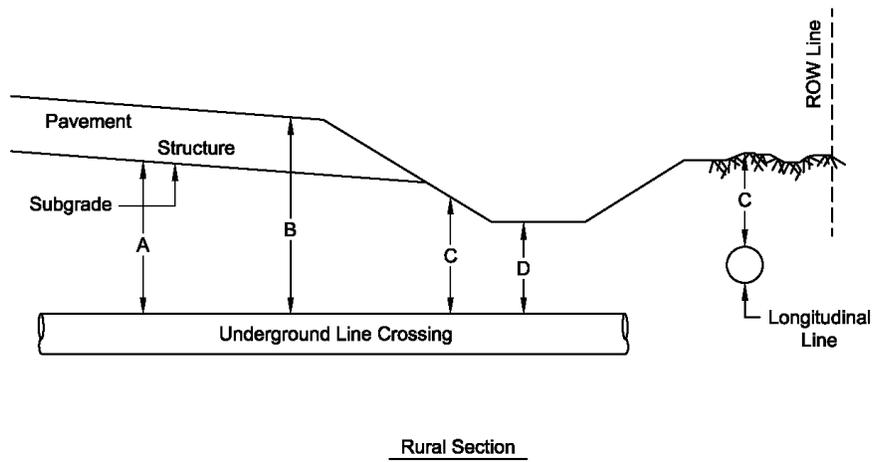
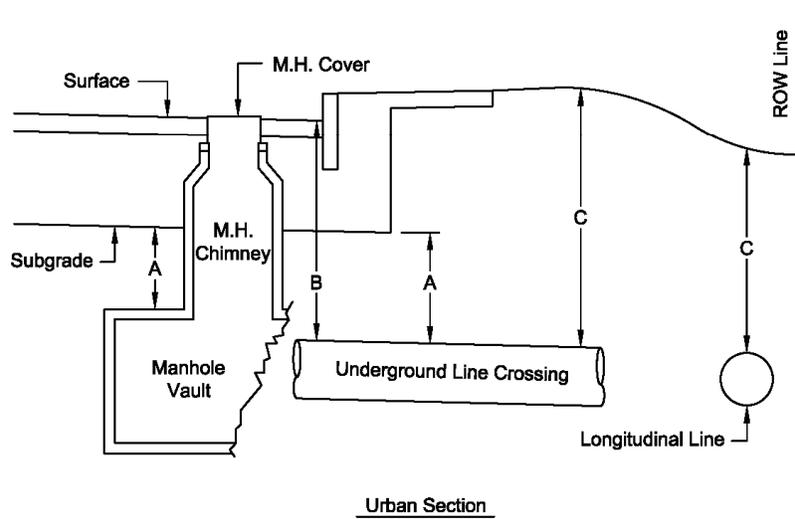
(d) Monolithic Arch or Box

FIGURE 3 – Encased Pipeline Crossings



For the bifurcated roadway above, encasement is not required across the natural terrain. However, encasement is continuous across a typical divided roadway. (see (B) above)

FIGURE 4 – Minimum Cover DEPTH for Underground Installations



**TABLE 1 -- Minimum Cover DEPTH FOR Underground Installations
 Crossing Highways (and Freeways)**

| Utility Facility Type | | A | B | C | D |
|---|----------------------|--|---------------------------|---------------------------|-------------------------------|
| | | Below pavement structure (subgrade) mm | Below pavement surface mm | Below ground elevation mm | Below ditch line elevation mm |
| High Pressure Gas or Liquid Petroleum Pipelines (> 680 kPa) | unencased existant | 450 | 1 200 | 900 | 900 |
| | unencased new | 450 or ½∅ | 1 500 | 1 000 | 1 200 |
| | encased existant | 300 | 1 000 | 750 | 750 |
| | encased new | 450 or ½∅ | 1 200 | 900 | 1 200 |
| Medium and Low Pressure Gas or Liquid Petroleum Pipelines (< 680 kPa) | unencased existant | 450 | 1 000 | 600 | 750 |
| | unencased new | 450 or ½∅ | 1 200 | 600 <i>750 plastic</i> | 900 |
| | encased existant | 300 | 1 000 | 600 | 750 |
| | encased new | 450 or ½∅ | 1 200 | 600 | 900 |
| Water and Sewer Pipes | existant | 450 | 1 200 | 1 000 | 1 000 |
| | new | 450 or ½∅ | 1 800 | 1 500 | 1 200 |
| Electric Power | existant | 300 | 1 000 | 750 | 750 |

| | | | | | |
|--|----------|-----|-------|-----|-------|
| Distribution Lines (all in conduit) | new | 450 | 1 500 | 900 | 1 200 |
| | existant | 300 | 1 000 | 750 | 750 |
| Communication Lines | new | 450 | 1 200 | 750 | 900 |

(∅ : pipe diameter)

GLOSSARY

Backfill - Material used to replace or the act of replacing material removed during construction; also may denote material placed or the act of placing material adjacent to structures.

Boring - The operation by which large carriers or casings are jacked through oversize bores. The bores are carved progressively ahead of the leading edge of the advancing pipe as soil is mucked back through the pipe.

Carrier - A pipe directly enclosing a transmitted fluid (liquid, gas or slurry). Also an electric or communication cable, wire or line.

Casing - A larger pipe, conduit or duct enclosing a carrier.

Clear Zone - The total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope and/or a clear run-out area. The desired width is dependent upon the traffic volumes and speeds, and on the roadside geometry.

Coating - Material applied to or wrapped around a pipe.

Conduit - An enclosed tubular casing, singularly or multiple, for the protection of wires, cables or lines, usually jacketed and often extended from utility access hole to utility access hole.

Control of Access - The condition where the right of owners or occupants of abutting land or other persons to access, light, air or view in connection with a highway is fully or partially controlled by road authority.

Coring - The operation by which a small casing is drilled into firm soil. As the pipe advances, the core material is removed by sluicing during or after the drilling.

Cover - Depth to top of pipe, conduit, casing, cable or similar line or utility tunnel below the earth or roadway surface.

Drain - An accessory to discharge liquid contaminants from casings.

Driving - The operation by which a small pipe is driven through compressible soils by a steady thrust, hammering or vibrating. A casing or corrosion-resistant covering should be used.

Duct - An enclosed tubular casing for protecting wires, lines or cables, often flexible or semi-rigid.

Encasement - Structural element surrounding a carrier or casing.

Freeway - A controlled-access, divided highway with grade separations at intersections.

Grout - A fluid mixture of cement and water or of cement, sand and water used to fill joints and voids. Also called slurry.

Highway - A major public road, especially one connecting municipalities and cities, for the transportation of people, materials, goods and services, but primarily for high speed vehicular travel, including the entire area within the right-of-way. For the understanding of the present guidelines, highways include freeways.

Jacket - A concrete encasement placed around a carrier or casing.

Manhole (Utility Access Hole) - An opening in an underground system which workers may enter for the purpose of making installations, removals, inspections, repairs, connections and tests.

Median - The portion of a divided highway separating the traveled ways for traffic in opposite directions.

Pavement Structure - The combination of subbase, base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Permit - The written agreement by which a road authority approves the use and occupancy of highway rights-of-way by utility facilities or private lines. Also called Occupancy Agreement and/or Encroachment.

Pipe - A formed hollow cylinder for the conveyance of liquids or gases. Cylinders formed from plate material in the course of the fabrication of auxiliary equipment are not pipe as defined here.

Pressure - The relative internal pressure in a pipe.

Private Lines - Privately owned facilities, which convey or transmit the commodities outlined in the definition of utility facilities, but are devoted exclusively for private use.

Right-of-Way - A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes.

Road authority - The ministry, agency, commission, board or official of any provincial or political subdivision thereof charged by its law with the responsibility for highway administration.

Roadside - A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

Roadway - The portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways.

Slab - A slab between a utility line and a structure or pavement, that does not contact either.

Sleeve - A short casing through pier or abutment of highway structure

Slurry - A thin mixture of liquid, especially water, and any of several finely divided substances, such as cement or clay particles. Also called grout.

Traffic Barrier - A device used to prevent a vehicle from striking a more severe obstacle or feature located on the roadside or in the median, or to prevent crossover median accidents

Traffic Control Plan - A plan for handling traffic through a specific highway or road work zone or project.

Traveled Way - The portion of the roadway for the movement of through traffic.

Trench - Narrow open excavation.

Trenchless - Installed without breaking the ground or pavement surface for such operations as jacking, tunneling or boring.

Utility Access Hole (Manhole) - An opening in an underground system which workers may enter for the purpose of making installations, removals, inspections, repairs, connections and tests.

Utility Facility - A privately, publicly or cooperatively owned line, pipe or system for producing, transmitting or distributing communications, cable, heat, gas, oil, crude products, water, steam, waste, storm water not connected with highway drainage or any other similar commodity, including any fire or police signal system or street lighting system, which directly or indirectly serves the public.

Vent - An accessory to discharge lighter than air contaminants from a casing.

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