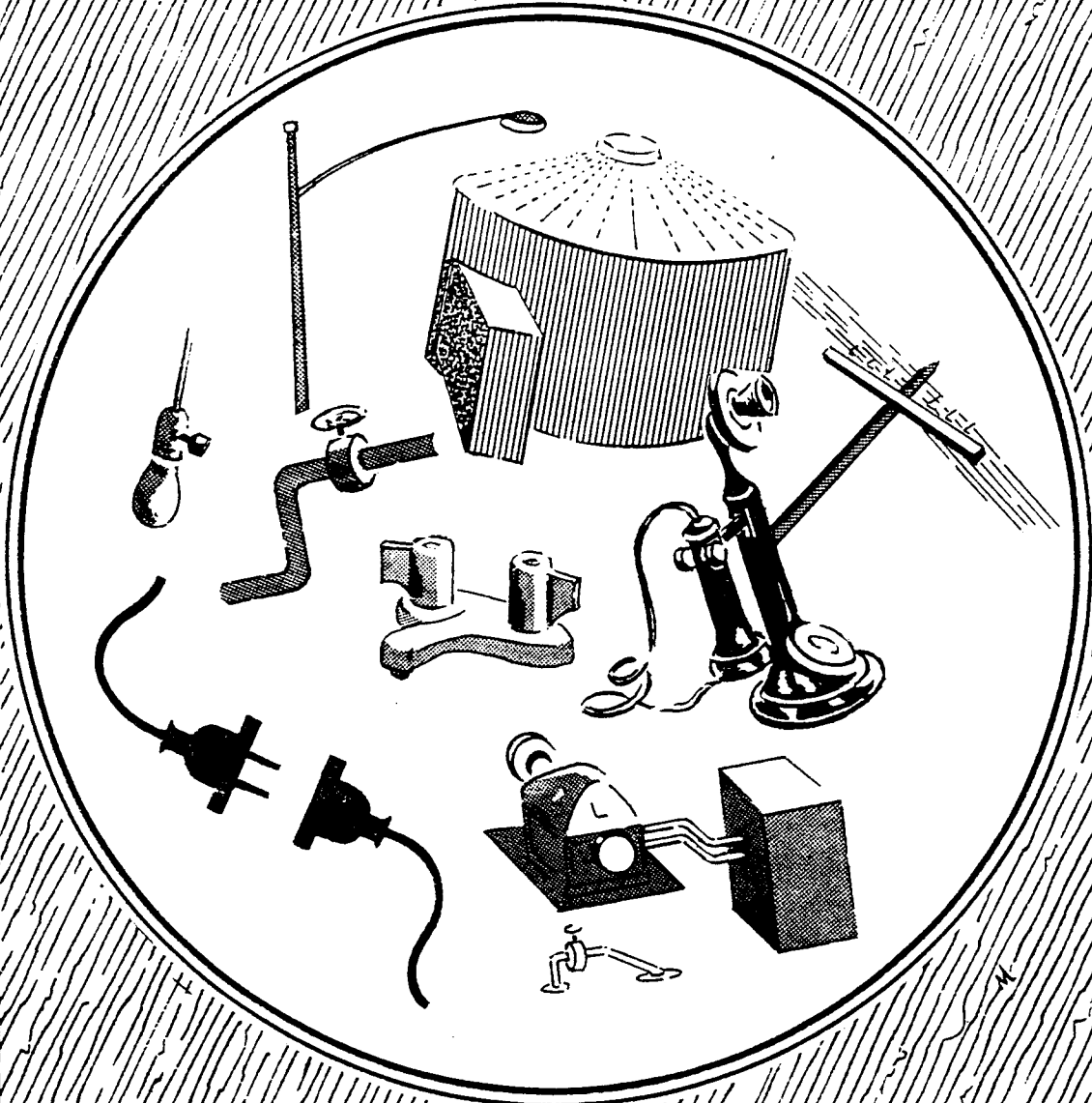
A POLICY ON THE ACCOMMODATIONS OF UTILITIES ON HIGHWAY RIGHTS-OF-WAY



Prepared by the

CONNECTICUT DEPARTMENT OF TRANSPORTATION

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BUREAU OF HIGHWAYS

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POLICY ON THE ACCOMMODATION

OF

UTILITIES ON HIGHWAY RIGHTS-OF-WAY

INTRODUCTION

The State Department of Transportation, Bureau of Highways, has the responsibility to maintain the rights-of-way of highways under its jurisdiction as necessary to preserve the integrity, operation safety and function of the highway facility. Since the manner in which utilities cross or otherwise occupy highway rights-of-way can materially affect the appearance, safe operation and maintenance of the highway, it is necessary that such use and occupancy be authorized, and reasonably regulated. The State Department of Transportation has various degrees of authority to regulate the use of utilities on highway, generally though its authority to designate and to control the use made of rights-of-way acquired for public highway purposes.

(a) Regulation by Public Utilities Control Authority

1. Section 16-18 (1958, 1966) - Powers concerning poles and wires.

2. Section 16-48 - Electricity and gas; transmission between this State and other states.

3. Section 16-243 - Jurisdiction of commission over electricity transmission lines.

(b) Regulation by State Commissioner of Transportation

1. Section 16-229 (1958, 1966) - Excavation in highway Permit required.

2. Section 13a-247 (1969) - Excavations and Obstructions. Permit required.

3. Section 13a-126 (1969) - Removal or relocation of public service service facilities for highway construction.

4. Section 13a-126a (1969) - Regulation of public service facility installations along state highway right-of-way for aesthetic purposes.

5. Section 13-126b (1969) - Agreements with public service facility operators for revision of plans of proposed installation.

6. Sections 13a-98c, 13a-98d, 13a-98f - Concerning extensions of of Federal-aid Primary and Secondary Systems in Urban areas.

Utilities also have various degrees of authority to install their lines and facilities on the rights-of-way of public roads and streets. Like highway agencies, their authoritites depend upon State law and regulations and also depend upon franchises, local laws, and ordinances which differ in the several political subdivisions within a State.

1 Section 16-288 (1958, 1966) Telegraph and telephone lines
2 Section 16-232 - Rights of companies organized under general law

3. Section 16-233 - Telegraph and telephone poles for municipal purposes.

It is the intent of this policy to establish and administer reasonable guides for uniform utility accommodations on all state highways.

Application

These guidelines apply to all public and private utilities, including electric power, telephone, telegraph, community television antenna, water, gas oil, petroleum products, steam, chemicals sewage, drainage, irrigation and similar lines, that are to be located, adjusted, or relocated within the rights-of-way of state highways. Such utilities may involve underground, surface, or overhead facilities, either singularly or in combination.

Scope

These guidelines are provided for use in regulating the location, design, and methods of installing, adjusting, accommodating, and maintaining utilities on highway rights-of-way. They do not alter current regulations or authority for installing utilities nor for determining financial responsibility for replacing or adjusting utilities. They are limited to matters which are the responsibility of highway authorities for preserving the integrity of the highway and its safe operation.

They apply, not only to state highways, but also to approved extensions of the federal-aid primary or secondary systems in urban areas, where improvments are made by the State under the traffic operations improvement programs (TOPICS). Such highways customarily remain under the jurisdication of the municipality.

Where laws or orders of public authority, industry or governmental codes prescribe a higher degree of protection than provided by these guidelines, then the higher degree of protection should prevail.

These guides supplement, but do not alter the provisions of the AASHO "A Policy on the Accommodation of Utilities on the National System of Interstate and Defense Highways" and "A Policy on the Accommodation of Utilities on Freeway Rights-of-Way," and the current "Permit Procedures Manuel."

DEFINITION OF TERMS

The following definitions used in this guide are suggested. Most of them have been selected from the AASHO Highway Definitions and the Report of the ASCE Committee on Pipeline Crossings of Highways, Geometric Highway Design Standards, and the Connecticut General Statutes.

Arterial Highway - A general term denoting a highway primarily for through traffic, usually on a continuous route.

Average Daily Traffic (ADT) - The annual average 24-hour volume, being the total yearly volume in both directions of travel divided by 365 days.

Backfill - Replacement of suitable material around and over a pipe or other buried object.

Bedding - Organization of suitable material to support a pipe.

Bury - Depth of top of pipe below grade of roadway or ditch.

Cap - Rigid structural element surmounting a pipe.

Carrier - Pipe directly enclosing a transmitted fluid (Liquid or gas).

Casing - a larger pipe enclosing a carrier.

Clear Roadside Policy - The policy employed by a highway authority to increase safety, improve traffic operations and enhance the appearance of highways by designing, constructing, and maintaining highway roadsides as wide, flat and rounded as practical and as free as practical from physical obstructions above the ground, such as trees, drainage structures, massive sign supports, utility poles, and other ground - mounted obstructions.

Coating - Material applied to or wrapped around a pipe.

Conventional highway - An arterial highway without access control.

Conduit or Duct - An enclosed tubular runway for protecting wires or cables.

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 as defined under "Limited Access Highway."

Full Control of Access - means that the authority to control access is exercised to give preference to through traffic by providing interchange connections with selected public roads only and by prohibiting crossings at grade or direct private driveway connections.

Partial Control of Access - means that the authority to control access is exercised to give preference to through traffic to a degree that, in addition to interchange connections with selected public roads, there may be some intersections at grade.

Cradle - Rigid structural element below and supporting a pipe.

Direct Burial - A technique for the installation of a utility facility, underground by plowing or other method - without use of any conduit.

Drain - Appurtenance to discharge liquid contaminants from casings.

Encasement - Structural element surrounding a pipe.

Encroachment - Unauthorized use of highway right-of-way or easements as for signs, fences, buildings, utilities, etc.

Expressway - a highway with full control of access designed to high standards for the safety and ease of operation of high speed, high volume traffic with opposing directions of travel separated by a median and no intersections at grade; a limited access highway.

Flexible Pipe - A plastic, fiberglass, or metallic pipe having large ratio of diameter to wall thickness, which can be deformed without undue stress, and which requires side support from the trench backfill to limit the diametric deflection.

Freeway - Any highway designed to separate through, high-speed, non-commercial motor vehicle traffic from all other types of traffic by the use of independent traffic lanes. Connection between local traffic and through traffic lanes shall be provided at intervals in the discretion of the Commissioner. (Sec. 13a-26).

Frontage Road - A road generally paralleling a controlled access highway designed to furnish access to property which would otherwise be isolated as a result of the controlled access feature, or to preserve local road circulation.

Gallery - An underpass for two or more pipelines.

Grounded - Connected to earth or to some extended conducting body which serves instead of the earth whether the connection is intentional or accidental.

Grout - A cement mortar or a slurry of fine sand or clay, as conditions govern.

Highway, Street or Road - A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Jacket - Encasement by concrete poured around a pipe.

Limited Access Highway - Synonymous with "Controlled Access Highway" - a highway which the Commissioner, with the advice and consent of the Governor and the Attorney General, may so lay out and construct as to allow access thereto only at highway intersections or at designated points, when in their opinion such limitations of access would be in the interest of public convenience, safety, and necessity. (Sec. 13b-27, 1969)

Manhole - An opening in an underground system which workmen or others may enter for the purpose of making installations, inspections, repairs, connection and tests.

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

Normal - Crossing at a right angle.

Oblique - Crossing at an acute angle.

Overfill - Backfill above a pipe.

Parkway - Specifically defined by Connecticut Statute, Title 13a, Part III - Any highway receiving special treatment in landscaping and marginal planting, especially designed for, and devoted exclusively to, the use and accommodation of noncommercial motor vehicle traffic and to which access may be allowed only at highway intersections designated by the Commissioner and designed by him so as to eliminate cross traffic of vehicles (Sec. 13a-26).

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

Pipe - A tubular product made as a production item for sale as such. Cylinders formed from plate in the course of the fabrication of auxiliary equipment are not pipe as defined here.

Pressure - Relative internal pressure in psig (pounds per square inch guage).

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

Rigid Pipe - A welded or bolted metallic pipe or reinforced, prestressed, or pretensioned concrete pressure pipe designed for diametric deflection of less than 1.0%.

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 movement. A divided highway has two or more roadways.

Scenic overlook - A roadside area provided for motorists to stop their vehicles beyond the shoulder, primarily for viewing the scenery in safety.

Semi-rigid Pipe - A large diameter concrete or metallic pipe designed to tolerate diametric deflection up to 3.0%.

Shoulder - The portion of the roadway continuous with the traveled way for accommodation of stopped vehicles, for emergency use, and for later support of base and surface courses.

Sidefill - Backfill alongside a pipe.

Slab, floating - Slab between but not contacting pipe or pavement.

Sleeve - Short casing thru pier or abutment of highway structure; casing.

Traveled way - The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Trenches - Installed in a narrow open excavation.

Untrenched - Installed without breaking ground or pavement surface, such as by jacking or boring.

Use and Occupancy Agreement - The document by which the highway authority regulates and/or gives approval of the use and occupancy of highway rights-of-way by utility facilities or private lines.

Vent - Appurtenance to discharge gaseous contaminants from casings.

Walled - Partially encased by concrete poured alongside the pipe.

GENERAL CONSIDERATIONS

The following general considerations are suggested for the location and design of all utility installations within the highway rights-of-way.

Location

1. Utility lines shall be located to minimize need for later adjustment to accommodate future highway improvements and to permit servicing such lines with minimum interference to highway traffic.

2. Longitudinal installations shall be located on uniform alignment as near as practicable to the right-of-way line so as to provide a safe environment for traffic operation and preserve space for future highway improvements or other utility installations.

3. To the extent feasible and practicable, utility line crossings of the highway shall cross on a line generally normal to the highway alignment.

4. The horizontal and vertical location of utility lines within the highway right-of-way limits shall conform with the clear roadside policies applicable for the system, type of highway, and specific conditions for the particular highway section involved. The location of above ground utility facilities shall be consistent with the clearances applicable to all roadside obstacles for the type of highway involved.

5. In all cases full consideration shall be given to sound engineering principles and overall economic factors, necessary to preserve and protect the integrity and visual quality of the highway, its maintenance efficiency, and the safety of highway traffic.

Design

1. The utility will be responsible for the design of the utility facility to be installed within the highway rights-of-way or attached to a highway structure. The highway authority is responsible for review and approval of the utility's proposal with respect to the location of the utility facilities to be installed and the manner of attachment. This includes the measures to be taken to preserve the safe and free flow of traffic, structural integrity of the roadway or highway structure, ease of highway maintenance, appearance of the highway, and the integrity of the utility facility.

2. Utility installations on, over, or under the rights-of-way of State highways and utility attachments to highway structures shall, as a minimum, meet the State Public Utilities Control Authority Docket requirements and the following requirements:

   (a) Electric power and communication facilities shall conform with the current applicable National Electrical Safety Code and with the current Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines, issued by the National Bureau of Standards, U. S. Department of Commerce.

   (b) Water lines shall conform with the current American Water Works Association Standards and Specifications.

   (c) Pressure pipelines shall conform with the currently applicable sections of the ANSI Standard Code for Pressure Piping of the American Standards Institute and applicable industry codes, covering Power Piping, Petroleum Refinery Piping, Liquid Petroleum Piping Systems, and Gas Transmission and Distribution Piping Systems.

   (d) Natural and other gas pipelines shall conform to the regulations of the Federal Register, Volume 35, Number 161, dated August 19, 1970, pertaining to minimum safety standards, issued by the United States Department of Transportation, and to the requirements of the Natural Gas Pipeline Safety Act of 1968

   (e) Other recommendations or specifications, which should be considered for pipelines are given in the Specifications for conveying Flammable and Non-Flammable Substances, 1966, by the American Railway Engineering Association, and in the current issue of the Recommended Practice for Liquid Petroleum Pipelines Crossing Railroads and Highways, issued by the American Petroleum Institute.

3. Ground-mounted utility facilities shall be of a design compatible with the scenic quality of the specific highway section being traversed. See text under Scenic Enhancement.

4. All utility installations on, over, or under high rights-of-way and attachments to highway structures shall be of durable materials, designed for long service life expectancy, and relatively free from routine servicing and maintenance.

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

PIPELINES

Location and Alinement

The following controls govern the location and alinement of pipeline installations:

1. For all crossings, the angle of crossing should be based on economic considerations of practical alternates, but shall be located as near normal to the highway alinement as practical.

2. Conditions which are generally unsuitable or undesireable for pipeline crossing should be avoided whenever possible. These include locations such as in deep cuts, near footings or bridges and retaining walls, across intersections at grade or ramp terminals, at cross drains where flow or water or stream bed may be obstructed, and in wet or rocky terrain where it will be difficult to attain minimum required bury.

3. On logitudinal installations, utility locations parallel to the pavement at or adjacent to the right-of-way line are preferable so as to minimize interference with existing or future highway drainage, the structural integrity of the traveled way, shoulders, and embankment, and the safe operation of the highway. Whenever possible, such installations shall be located as far off the paved roadway or curb line as practicable. However, in some instances, when approved by the State, the installation may be made in the paved area on non-limited access highways, but not in the gutter or that part of the shoulder normally reserved for drainage.

4. Vertical and horizontal clearance between a pipeline and a structure or other highway or utility facilities should be sufficient to permit maintenance of the pipeline and the other facilities, with desired minimum of 12 inches.

5. The proposed locations of all pipelines shall be reviewed by the State's highway engineer to ensure that the proposed utility installation will not interfere with existing or planned highway facilities or with highway maintenance and operation processes, and must be approved before installation.

Bury

The critical controls for bury on a pipeline crossing are the low points in the highway cross-section, usually the bottoms of the longitudinal ditches. In establishing the depth of bury below an unpaved ditch, consideration shall be given to potential increases in ditch

depth resulting from scour, ditch maintenance operations, or the need to increase the capacity of the ditch. Such crossings shall also be made in such way as to avoid conflict with existing or proposed drainage structures and with existing utility facilities. On longitudinal installations the critical controls for bury are the depths of lateral drainage facilities, landscaping, buried utility lines, bridge structures, and likely highway maintenance operations.

Suggested controls for the bury of pipelines follow:

1. The depth of bury of pipelines shall be determined or approved on an individual basis by the State on the basis of engineering and safety factors for the area, the product carried, and maximum working or test pressures for the pipelines. A minimum clearance of 18" under pavement subgrade is the usual requirement.

2. Use shall be made of the safety standards and specifications for gas pipelines which have been adopted by the State Public Utilities Control Authority, and also any standards and specifications that may be established pursuant to the Natural Gas Pipeline Safety Act of 1968.

3. Specifications in appropriate codes shall be followed for depth of bury except where additional depth is needed due to highway or utility requirements.

4. Where less than minimum recommended bury is made necessary because of other utilities, water table, ordinances, or similar reasons, the pipe should be rerouted or else protected with a casing or concrete slab not in contact with the pipeline, or use should be made of other suitable measures acceptable to the highway authority.

5. Cover for pipelines carrying transmittants, which are flammable, corrosive, expansive, energized, or unstable, particularly if carried at high pressure or potential, must not be reduced below acceptable safety limits.

6. Any pipeline or undergound communication or electric facility to be installed in the paved area or abutting roadside area, which may be used for future highway widening, shall have a minimum clearance of 36" from top of structure to the grade of the existing pavement grade, as may be specified by the highway authority.

7 When an underground facility is to be installed in rock area, such facility shall not be placed directly on the rock, but shall have a minimum cushion of 6" of sand or other satisfactory material, with 12" of cushion preferred, if possible.

Encasement and Allied Mechanical Protection

In order to protect the structural integrity of the roadway and the safety of the traffic, encasement of pipelines or other kind of mechanical protection may be required at highway crossings. Final determination of such need will be made by the highway authority, at the time of review of submission of utility plans.

The methods available to provide such protection include, but are not limited to, tunnels and galleries, casing pipe, grouting by mortar filling bore-hole annulus, cradling, capping, walling, boxing or jacketing, the provision of thickened wall carrier pipe, joints of mechanical or welded leak-proof type of construction, coating and wrapping, cathodic protection, and electrical bonding.

Of these methods, only the casing and tunnel or gallery provide complete independence of the carrier from the surrounding earth. Grouting restores the continuity and integrity of the earth supporting the pavement. Cradling enhances the supporting capacity of rigid pipes. Walling does the same for semi-rigid and flexible pipes. Capping strengthens both rigid and flexible pipes and protects them from highway operations penetrating the overfill. When applied to weak or brittle pipes, boxing or jacketing provides protection from earth loads, leakage, corrosion, or abrasion. On uncased carrier pipes thickened wall sections and leak-proof type joints enhance the potential for a trouble free installation of long service life expectancy. Coating or wrapping prevents contact with corrosive water, soil, or vapor.

Encasement

The following controls are suggested for providing encasement of pipeline crossings of the highway:

1. Casings will be considered for the following conditions:

    a. As an expediency in the insertion, removal, replacement, or maintenance of carrier pipe crossings of freeways, expressways, and other controlled access highways and at other locations where it is necessary in order to avoid open trenched construction.

b. As protection for carrier pipe from external loads or shock, either during or after construction of the highway.

c. As a means of conveying leaking fluids or gases away from the area directly beneath the travelled way to a point of venting at or near the right-of-way line or to a point of drainage in the highway ditch or a natural drainage way.

2. In general, all pressurized pipelines less than 30" in diameter, crossing major highways, both limited access and non-limited access, shall be installed in a sleeve or casing. This casing may be of steel or reimforced concrete, or other suitable material, at least equivalent in strength to that of highway drainage facilities, and capable of withstanding both internal and external pressure.

   Pipelines, 30" and over in diameter, crossing major highways, may be uncased, provided they are of extra strength and long life expectancy and have leak proof type joint construction. Pipes of this size can be inspected, repaired, and maintained from the inside.

   The requirement for casing on secondary highway crossings is discretionary, subject to determination by the highway authority, and subject to Federal Safety Standards. If the utility contends that a casing is not necessary, the burden of proof lies on it.

3. In general, casings will be required for (a) pressurized carrier pipes crossing under major highways, and (b) carriers of transmittants which are flammable, corrosive, expansive, energized, or unstable, particularly if carried at high pressure of potential, which cross under any road.

All high pressure gas transmission lines crossing any state highway shall be encased in accordance with the requirements of the State Public Utilities Control Authority and Federal Safety Standards.

4. Jacked or bored installations of coated carrier pipes should be encased, unless assurance can be provided against damage to the protective coating.

5. Consideration shall be given to encasement or other suitable protection for any pipeline (a) with less than minimum bury, (b) near footings of bridges or other highway structures or across unstable or subsiding ground, or (c) near other locations where there may be hazard.

6. Rigid encasement or suitable bridging shall be used where support of pavement would be impaired by depression of flexible carrier pipe, as may be determined by the highway authority.

7. Where pipelines are encased, the casings shall extend beyond the slope lines or ditch lines. Where appropriate, the encasement should extend to the non-access lines on limited access highways, to the outside of frontage roads, or to an indicated line that allows for future widening of the highway if it is not practical to extend the casing at the time of highway widening.

8. Casing pipe should be sealed at the ends with a flexible material to prevent flowing water and debris from entering the annular space between the casing and the carrier. The installations should include necessary appurtenances, such as vents and markers, placed at the highway right of way line.

9. A carrier pipe installed within a casing or sleeve shall have sand bedding or other acceptable means of support.

Allied Mechanical Protection

For some conditions, pipeline crossings of the highway may be installed without encasement. Normally, such installations are limited to open trenched construction. The following controls are suggested for providing allied mechanical protection to uncased pipeline crossings of the highway:

1. On uncased construction, the carrier pipe shall conform to the material and design requirements of utility industry and governmental codes and specifications. In addition, the carrier pipe shall be designed to support the load of the highway plus superimposed loads thereon when the pipe is operated under all ranges of pressure from maximum internal to zero pressure. Such installations should employ a higher factor of safety in the design, construction, and testing than would normally be required for cased construction.

2. Suitable bridging, concrete slabs, or other appropriate measures shall be used to protect existing uncased pipelines which by reason of shallow bury or location make them vulnerable to damage from highway construction or maintenance operations. Such existing lines may remain in place without further protective measures if they are of adequate depth and do not conflict with the highway construction or maintenance operations, provided both highway and utility officials are satisfied that the lines are, and will remain, structurally sound and operationally safe.

3. Uncased crossings of welded steel pipelines carrying transmittants which are flammable, corrosive, expansive, energized, or unstable, particulary 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 design, construction, and testing of the uncased carrier pipe, including such features as thicker wall pipe, radiograph testing of welds, hydrostatic testing, coating and wrapping, and cathodic protection.

Appurtenances

Vents, drains, markers, manholes, and shut-offs are appurtenances to pipeline installations. Suggested controls for such appurtenances follows:

1. Vents are appurteancces by which fluids between carrier and casings may be inspected, sampled, exhausted, or evacuated. These fluids may be leakage from the carrier within or the soil without, or atmospheric vapor and condensate, or decomposition products of pipes and coatings. Light gases are exhausted through risers or standpipes projecting above the ground surface. Vents should be located at the high end of short casings and generally at both ends of casings longer than 150 feet. Vent standpipes shall be located and constructed so as not to interfere with maintenance of the highway nor to be concealed by vegetation; preferably they should be located at the right-of-way line.

2. Drains or pressure relief pipes are appurtenances by which liquids or heavy gases may be evacuated or exhausted. They should be provided for casings, tunnels, or galleries and enclosing carriers of liquid, liquefied gas, or heavy gas. Drains may outfall into roadside ditches or natural water courses at locations approved by the highway agency. Such outfall shall not be used as a wasteway for purging the carrier unless specifically authorized. Discharge of liquids or gases shall be in conformance with Connecticut General Statutes, regulations, local codes, and Federal Safety Standards.

3. Markers: The utility should place readily identifiable and suitable markers at the right-of-way line where it is crossed by pipelines carrying transmittants which are flammable, corrosive, expansive, energized, or unstable, particularly if carried at high pressure or potential, except where a vent will serve as a marker. Markers are also desirable for other pipelines. When Markers are placed within 30' of the travelway of a highway, they shall be so located as not to interfere with highway roadside maintenance or with the normal use of the area, and shall give upon impact by a motor vehicle.

4. Manholes should not be located in the pavement or shoulders of major highways, including urban highways, if possible. Exception may be made on streets at those locations where manholes are essential parts of existing lines that are permitted to remain in place under existing and proposed roadways. Manholes may be retained or installed on low traffic roadways, within municipalities. Effort shall be made to minimize such installations and to avoid their location at street intersections, insofar as practicable, and shall never be installed at the intersection with an expressway ramp. Manholes shall be designed and located in such a manner that will cause the least interference to other utilities and future highway expansion.

5. Shut-off Valves should be installed in lines at or near ends of structures and near unusual hazards, unless hazardous segments can be isolated by other sectionalizing devices with a reasonable distance.

Restriction Against Varied Use

Subject to safety regulations adopted by the State and by the Federal Government, the following precautionary measures should be followed for pipeline installations:

1. Pipeline installation permits should specify the class of transmittant, the maximum working, test, or design pressures, and the design standards for the carrier.

2 When it is anticipated that there will be a change in the class transmittant or an increase in the maximum design pressure specified in the permit, the utility shall give advance notice to the highway agency, and shall obtain approval for such changes from the State Public Utilities Control Authority. Evidence of such approval should be given to the highway agency. The notice should specify the applicable codes to be used.

Installation

Installation or replacement of pipelines along or crossing existing highways shall be controlled by the requirements outlined in the current Standard Specifications for Roads, Bridges and Incidental Construction and "Permit Procedures Manual", and shall be subject to any further requirements that may be specified in the permit issued for said work.

Trenched Construction and Backfill

In general, trench and backfill construction shall be such as to provide: (a) restoration of the structural integrity of the entrenched roadbed; (b) security of the pipe against deformation likely to cause leakage and subsequent damage to roadbed; (c) assurance against the trench becoming a drainage channel under the roadway; and (d) assurance against blocking any highway drainage.

Untrenched Construction

Pipelines may be installed under a highway without disturbing the surface by (a) driving or jacking; (b) coring; and (c) boring.

Untrenched construction will be required for all pipeline crossing of completed controll access and other major highways. On controlled access highways, as a minimim, the untrenched construction shall extend under and across the entire roadway prism to a point 30' outside the edge of shoulder. On other major highways, the untrenched construction shall extend under and across the surfaced area of the highway to a point at least 15' beyond edges of shoulder.

If a pipe is to be installed across a highway by the boring method, the oversize of the boring excavation shall be restricted, and the void outside the carrier backfilled with grout, if so directed by the highway authority Grout backfill should be considered for pipes more than 12 inches in diameter and for overbreaks, unused holes, or abandoned pipes

As an exception, open cuts may, in certain cases, be permitted in urban areas or in other conventional highways, provided proper de tours or off-peak working hours can be established to provide for maintenance and safety of traffic

Utility Tunnels and Bridges

A utility tunnel or a bridge may occasionally, under extraordinary circumstances, be provided for a pipeline crossing a freeway at a strategic location. Where it can be foreseen that several utility crossing will be needed, the cost of the tunnel (either a large casing or a box culvert) or of the bridge may be less than that for the alternate of several untrenched or separately encased pipelines. Where these conditions exist, the highway authority shall take steps as necessary to insure that adequate study is made by the utilities to anticipate their needs for future crossings and to converge their facilities to a joint use single crossing.

Adjustment

When an existing pipeline is in the path of proposed state highway construction, it shall be relocated or adjusted to approved new location, or it shall be protected in its present location in such a manner as to preclude damage to it by construction operations or equipment. Protection may be given by encasing the pipe or by providing a protective cap or slab over it.

UTILITIES INSTALLATIONS ON OR ADJACENT TO HIGHWAY BRIDGE STRUCTURES

Utility facilities may be attached to highway structures where found to be in the public interest, taking into consideration the preservation of the highway and structure, and its safe operation, maintenance, and appearance.

The following policy shall apply to utility relocations on state highway projects, where adjustments are required due to highway or bridge construction. Exceptions to this policy may be made, at the discretion of the highway authority, when new utility installations are made on completed project:

1. a. Permanent underground installations, which are to be carried on and parallel to the longitudinal axis of the structure, shall be placed out of sight, between the fascia beams and above the bottom flanges, on the underside of structure.

In those instances where the proposed type of superstructure is not adaptable to carrying utilities in an out-of-sight location on the underside of the structure, an early determination must be made as to whether or not utilities are to be accommodated. If the utilities are to be accommodated, the type of superstructure must be selected accordingly.

In those instances where the existing type of structure is not adaptable to carrying utilities in an out-of-sign location on the structure, the proposed utility installation shall be the subject of an individual study as to disposition.

Underground facilities shall not be suspended or attached to the outside face of the superstructure, unless otherwise approved by the Department of Transportation.

Where aesthetics are a prime consideration, the facility shall be placed underground to the extent necessary to preserve the aesthetics of the structure and the surrounding area.

b. Aerial facilities (telephone, telegraph, electrical, etc.) located along a highway which passes over a structure shall, where economically feasible, be made an underground installation shall extend a minimum distance beyond the ends of the structure on each side as shall be necessary to retain the aesthetics of the structure.

Aerial facilities may be carried aerially across the structure where unnecessary expense would be incurred by going underground and the length of bridge will permit spanning the entire structure. Support poles shall not be placed on a bridge structure. The determination to carry the utilities aerially or underground shall be the subject of an individual study at an early stage of design and shall include factors such as economy, aesthetics, safety and maintenance of the characteristics of the local environment.

c. Aerial facilities (telephone, telegraph, electrical, etc.) located along a highway which passes under a structure shall in no instance be permitted to pass over the structure but may be attached to the underside of the structure. An underground installation will be permitted only if economically feasible, and an above ground installation would create an unsafe condition or be aesthetically unacceptable.

The underground portion of the installation shall extend a distance beyond the faces of the structure on each side as shall be necessary to retain the aesthetics of the structure In those cases involving interchanges, the underground portion shall extend beyond the non-access lines, if feasible

Solutions to special or unusual conditions shall be determined at a field review with the Department of Transportation and Utility Company representatives The field review team shall include the Designing Engineer and the Utilities Engineer. In the event that a mutually agreeable solution cannot be reached, the matter shall be forwarded through channels to the Transportation Chief Engineer for a ruling

2. Temporary installations of a proven emergency nature may be placed on the sidewalk of a structure, but such an installation must be either removed or replaced by a permanent out-of-sight installation within one year of the date of the temporary installation. Where sidewalks are not available, special consideration and study shall be required to insure a safe and acceptable placement of the temporary installation.

   Upon completion of the temporary installation, immediate steps shall be initiated to insure that such temporary installation is removed or replaced by a permanent installation, as the case may be, within the time limit indicated above and in a manner acceptable to the Department

3. If poles for highway lighting are needed with the non-access lines in proximity to the structure, the location and type of poles shall be as approved by the Department of Transportation

4. Long distance high voltage transmission facilities shall be the subject of special study and individual decision as to disposition. Where aesthetics are a consideration, the placing of the facility underground shall be an alternate proposal, with the final determination being weighted in consideration of both the economics and aesthetics of the location in question. If required, the alternate proposals shall be referred to the Transportation Chief Engineer for final determination.

   The requirements of approval for a casing for a pipeline attachment on a bridge structure shall be subject to the discretion of the highway authority.

   The general controls for providing encasement, allied mechanical protection, and shut-off valves to pipeline crossings of highways and for restriction against varied use should be followed for pipeline attachements to bridge structures.

Where a pipeline attachment to a bridge is cased, the casing should be effectively opened or vented at each end to prevent possible buildup of pressure and to detect leakage of gases or fluids.

Where a casing is not provided for a pipeline attachment to a bridge, additional protective measures should be taken. Such measures should employ a higher factor of safety in the design, construction, and testing of the pipeline than would normally be required for cased construction. Cast iron and asbestos-cement pipes are not considered as being satisfactory on bridge structures or other critical areas. Ductile iron, steel, and prestressed concrete are considered as being satisfactory. Other types, if proposed, shall be subject to review and approval of the State.

Communication and electric power line attachments should be suitably insulated, grounded, and preferably carried in protective conduit or pipe from the point of exit from the ground to re-entry. Preferably the cable should be carried to a manhole located beyond the backwall of the structure. Carrier pipe and casing pipe should be suitably insulated from electric power line attachments. Asbestos cement or electric power lines in exposed areas and imbedded in concrete pavement or sidewalk respectively.

In all cases, an opening with suitable sleeves should be provided through the abutment walls for the utility, with the excess opening filled with grout or other satisfactory material.

UNDERGROUND UTILITIES ADJACENT TO STRUCTURES

When underground utilities (existing or proposed) are located in the vicinity of structures, a review shall be made of the utility installation relative to the substructure design to determine if protection of the substructure is necessary. Possible factors to be considered are: The type, size and location of the utility, the pressure head, the erosiveness of the soil, the material composition of the utility, and the foundation of the structure.

The effects of initial installation and future maintenance of the utility upon the structure shall also be investigated.

If it is determined that protection is necessary, the following are variations that the designer should consider. However, this does not preclude other possibilities which the Designer or the Utility Engineer may have to offer.

1. Relocation of utility.

2. Relocation of substructure unit

3. Protection of the substructure unit with sheeting.

4. Sheeting the utility tranch. If sheeting is required, the depth of installation will be dependent on soil conditions. Such sheeting should be cut off about 2' below finished ground or road surface grade level.

5. Placement of the utility in structurally adequate encasement, sleeves, or deflectors.

6. Place substructure on piles.

7. Require material composition of utility to be ductile iron, prestressed concrete, or steel. (Desirable in all cases).

8. Use of shut off valves on both sides of the bridge. (Desirable in all cases).

OVERHEAD POWER AND COMMUNICATIONS LINES

General

The type of construction, vertical clearance above pavement and location of poles, guys, and related ground-mounted utility appurtenances along the roadside are factors of major importance to preserve a safe traffic environment, the appearances of the highway, and the efficiency and economy of highway maintenance. To preserve these, it is important to keep a clear roadside area, as free as practical from obstacles above the ground, such as poles, guys, and related facilities. Such facilities should be placed as far as practical from the traveled way and beyond the clear roadside area. The nature and extent of roadside development and the ruggedness of the terrain being traversed are controlling factors for locating poles, guys, and related facilities close to the right-of-way line.

Vertical Clearance

The minimum vertical clearing for overhead power and communication lines above the highway and the lateral and vertical clearance from bridges shall conform with the National Electrical Safety Code and with Public Utilities Control Authority regulations. Greater Clearances should be used where directed by the highway authority.

Type of Construction

In order to eliminate or reduce hazards to vehicles traveling along state highways, the following policy applies to the relocation of utility facilities within state highway construction or reconstruction projects, and to the construction or reconstruction of utility facilities within existing State highay rights-of-way. If the characteristics of the utility facilities change in their reconstruction, this policy will apply.

A - LIMITED ACCESS HIGHWAYS

The location of public service facilities shall conform to the regulations of the American Association of State Highway Officials, (AASHO) "Policy On The Accommodation of Utilities on Freeway Rights-of-Way, "adopted February 15, 1969. Although longitudinal installations of utility lines are, in general, not allowed within the right of way of limited access highways, the AASHO policy provides that a utility may be permitted along a freeeway on new location under certain stated conditions.

This revised policy provides a practical method for applying both the AASHO policy and joint development and multiple use concepts to freeways and utilities. Trunkline and transmission type utility facilities may be accommodated, provided such use does not adversely affect the design, construction, integrity, and operational characteristics of the freeway. Approval may be given for such facilities within a utility strip on and along the outer border of a limited access highway when the following conditions have been satisfied:

(1) A utility strip will be established by an inward relocation of the access control line to the extent necessary to permit installation of the utility facility outside the access control limits.

(2) The utility strip may be established only where the freeway right-of-way is of ample width to accommodate utility facilities without adverse affect on the design, construction, integrity, and operational characteristics of the freeway, only where such rights-of-way will not be needed for the foreseeable expansion of the freeway, and only where there can be satisfactory provision for any needed highway and/or utility maintenance within the utility strip.

(3) Normally, a utility strip is not to be established at locations where it is feasible to accommodate utilities on frontage roads or adjacent public roads or streets, or elsewhere.

(4) The state shall retain ownership of the freeway right-of-way so utilized, including control and regulation of the use and occupancy of the rights-of-way by utilities.

(5) Existing fences shall be retained and, except along sections of freeways having frontage roads, planned fences should normally be located at the freeway non-access line.

(6) In each case, it shall be established by the utility that the installation on the freeway rights-of-way is the most feasible and prudent location available from the standpoint of the highway users and utility consumers, and shall be concurred with by the State.

(7) (a) Overhead utility lines crossing a freeway at points removed from grade separation structures, or those crossing near a grade separation, but not within the normal right-of-way of a crossroad or street, in general, shall have the supporting structures located outside the control of access lines or, in cases warranting exception, shall be adjusted so that the supporting structure are located outside the outer edges of the through traffic side slopes. In any case, supporting poles are to be located at least 30 feet beyond the edge of shoulder, either right or left of the through-traffic roadways as planned for later widening, if any. However, supporting poles shall not be placed in medians 80 feet or less in width. Where right-of-way lines and control of access lines are not one and the same, as where frontage roads are provided, supporting poles may be located where such spanning of the roadways is not feasible, consideration may be given to conversion to underground facilities to cross the freeway.

At interchange areas, in general, supports for overhead utilities will be permitted only where all of the following conditions are met: (1) the above indicated clearance is provided with respect to the freeway through-traffic lanes, (2) there is a lateral clearance of at least 20 feet from the nearest edge of ramp shoulder, (3) essential sight distance is not impaired, and (4) the conditions of access for servicing and facilities have been satisfied.

(b) Utilities crossing underground below the freeway shall be of durable materials and so installed as to virtually preclude any necessity for disturbing the roadways to perform maintenance or expansion operations. The design and types of materials shall conform with established, accepted, and applicable government codes and specifications.

Manholes and other points of access to underground utilities may be permitted within the right-of-way of a freeway only when they are located beyond the shoulders of the through-traffic roadways or ramps as planned for any later widening, and normally where they can be serviced or maintained without access from the through-traffic roadways or ramps.

(c) Where utility supports, manholes, or other appurtenances are located in medians or interchange areas, access to them from through-traffic roadways or ramps may be permitted subject to the utility owner's "Agreement For The Maintenance of Public Utility Facilities Crossing Or Located Within The Right Of Way Of Limited Access Highways Within The State Of Connecticut."

(8) Aerial installations are preferably to be self-supporting single pole construction, with vertical configuration of conductors, and will be allowed for joint use by more than one utility. Multiple pole construction will not be ruled out, if found to be necessary. The type of structure, to be used should be designed with consideration of environmental values relating to aesthetics and multiple land use.

(9) Service connections from the trunkline or transmission type facilities to utility consumers will not be permitted from the utility strip.

(10) The facilities installed within a utility strip shall be of durable materials designed for long service life expectancy and relatively free from servicing and maintenance.

B - OTHER HIGHWAYS

Except as provided hereinafter, along rural highways all poles, guys, and other ground-mounted utility appurtenances should be located at or as near as practical to the right-of-way line. There is to be no single minimum dimension for the width of a clear roadside area, but, where there is sufficient space, 30 feet offset from the edge of pavement should be the minimum.

Except as provided hereinafter, along urban highways, if practical and feasible, all ground-mounted utility appurtenances should be placed as close to the right-of-way line as possible. Otherwise, these facilities should be located at least 8 feet beyond the edge of shoulder or 12 feet beyond the edge of pavement, whichever is greater. Where sidewalks are required, or space provided for same, these facilities should be located at least 1 foot in back of the sidewalk.

Exceptions to the lateral positioning stipulated above under "B - Other Highways" may be permitted for reasons of practicability and feasibility.

C - GENERAL

In a thickly populated community, through which a classified rural highway passes, the urban highway requirements shall be used, insofar as they may be applied.

If a utility is required to provide highway lighting along a rural highway, and this cannot be provided from poles 30 feet from the traveled way, 20 foot mast arms may be used with a 22 foot offset from the pavement to the pole line. Along urban highways, lighting facilities should be placed as close to the right-of-way line as possible.

Ground-mounted utility facilities installed in back of guide railing shall have the following clearances:

2 or 3 cable with wood posts	13 feet
2 or 3 " " metal posts	13 feet
metal beam rail with weak posts	9 feet
metal beam rail with strong posts	5 feet

Guy wires to ground anchors, push braces, or stub poles shall not be placed between a pole and the traveled way where they encroach upon the clear roadside area.

New or relocated installations of underground facilities should be located outside the pavement area whenever possible or feasible. Such locations shall not, however, conflict with existing or future drainage systems, or with anticipated highway expansion or other construction.

Where irregular shaped portions of the right-of-way extend beyond the normal right-of-way limits, variances in the location from the right-of-way line will be allowed as necessary to maintain a reasonably uniform alinement for longitudinal installations.

Utility installations in the vicinity of highway bridge structures shall be governed by Administrative Memorandum No. 16 dated July 1, 1975, with subject: "Utilities Installations on Highway Bridge Structures." The requirements outlined therein may be waived, with written approval from the State, in cases involving the installation of new facilities strictly under permit.

On State highway projects where ground-mounted utility facilities are not disturbed by construction and are considered reasonbly safe, they need not be relocated.

Each case will be reviewed by the Chief-Utilities Section and a determination made, based on its own merits, as to conformity with the above policy. Any exceptions to this policy will only be granted under unusual conditions, which shall be substantiated and found justified.

SCENIC ENHANCEMENT

The type and size of utility facilities and the manner and extent to which they are permitted along or within rights-of-way can materially alter the scenic quality, appearance, and view of highway roadsides and adjacent areas. For these reasons additional controls are applicable in certain areas that have been acquired or set aside for their scenic quality. Such areas include strips, overlooks, rest areas, recreation areas, the right-of-way of highways adjacent thereto, and the rights-of-way of sections of highways which pass through public parks and historic sites.

New underground utility installations may be permitted within such lands where they do not require extensive removal or alteration of trees or other natural features visible to the highway user or do not impair the visual quality of the lands being traversed.

New aerial installations shall be avoided at such locations where there is a feasible and prudent alternative to the use of such lands by the aerial facility. Where this is not the case, they should be considered only where:

1. Other locations are unusually difficult and unreasonably costly, or are more undesirable from the standpoint of visual quality,

2. Undergrouding is not technically feasible or is unreasonably costly, and

3. The proposed installation can be made at a location and will employ suitable designs and materials which give adequate attention to the visual qualities of the area being traversed.

These controls should also be followed in the location and design of utility installations that are needed for a highway purpose, such as for continuous highway lighting, or to serve a weigh station, rest or recreational area.

UNDERGROUND ELECTRIC POWER AND COMMUNICATION LINES

There is wide variation in the techniques and practices for undergrounding electric power and communication lines due to differences in such factors as water conditions, type of subsoil, facility congestion and the like. Accepted methods for undergrounding such lines include: Trenching for conduit or duct construction or for uncased buried cable; direct burial for plowing of buried cable: and jacking or pushing of pipe as conduit, especially for crossing of existing highways.

General

1. Underground utility construction should conform to all applicable codes, standards, and specifications.

2. Conduit or duct construction within paved area or abutting roadside area, which might be affected by highway widening, shall be installed at a minimum depth of 36 inches from top of structure to grade of crown of existing pavement, or to grade at any proposed reconstruction.

3. Pedestals or other above ground utility appurtenances installed as part of buried cable plant should be located at or near the right-of-way line, well outside of the highway maintenance operating area. Buried cable shall have minimum depth of 24 inches, with 36 inches preferred.

4. All proposed locations and utility designs should be reviewed by the highway agency to ensure that the proposed construction will not cause avoidable interference with existing or planned highway facilities or with highway operation or maintenance.

5. On cased installations, particularly on crossing of the highway, and on bridge structures, consideration should be given for placing spare conduit or duct to accommodate known or planned expansion of underground lines.

6. Uncased power cable installations will not be permitted within pavement or shoulder area, or in the immediate adjacent roadside area.

7. Normally, all underground electric power and communication cables are installed within conduits. Where it is acceptable to both the utility and the highway agency, buried communication cables can be permitted in the roadside area as close to highway right-of-way line as possible, or, at the minimum, beyond the limits of anticipated pavement widening, or behind the curb line.

8. The controls previously outlined for electric power and communication line attachments to highway bridge structures should be followed.

9. The general controls previously outlined for pipelines as relate to markers, installation, trenched and untrenched construction, and adjustment should be followed, as applicable, on underground installations of electric power and communication lines.

Location and Alinement

1. On longitudinal installation, locations parallel to the pavement or adjacent to the right-of-way line are preferable so as to minimize interference with highway drainage, the structural integrity of the traveled way, shoulders and embankment, and the safe operation of the highway. As a minimum, their laterial location should be offset a suitable distance beyond the slope, ditch, or curb line, as the highway authority may stipulate. Exceptions will be made if it is in the best interest of the State and the utility to locate the facility in the pavement or sidewalk area along non-limited access highways only.

2. Crossings should be located as near normal to the highway alinement as practical.

3. Conditions which are generally unsuitable or undesirable for underground crossings should be avoided. These include locations such as in deep cuts; near footings of bridges and retaining walls; across intersections at grade or ramp terminals; at cross drains where flow of water or stream bed may be obstructed; within basis of an underpass drained by a pump; and in wet or rocky terrain where it will be difficult to attain minimum bury.

Cased and Uncased Construction

1. Underground crossings of the highway shall be installed with protective conduit or duct.

2. On such crossings, the encasement shall extend a suitable distance beyond the slope or ditch lines. On curbed sections, it shall extend outside the outer curbs. On limited access highways, the encasement shall extend to the access control lines, to the outside of frontage roads, or to an indicated line that allows for future widening of the highway. Manholes should be located outside the non-access lines of limited access highways.

3. Consideration should be given to encasement or other suitable protection for any wire or cable facilities (2) with less than minimum bury, (b) near the footings of bridges or other highway structures, or (c) near other locations where they may be a hazard.

4. Where encased bored or jacked installations are proposed by the utility, the utility shall furnish information as to the controls and construction methods to be employed, before the proposed installations are considered or approved by the highway agency. This is to insure the necessary protection of the utility facility and the integrity and operation of the highway facility.

MISCELLANEOUS

Preservation, Restoration, and Cleanup

Disturbed Areas: The area disturbed by utility installations or relocations should be kept to a minimum. Restoration methods should be in accordance with the highway agency specifications, current "Permit Procedures Manual", and/or special provisions in utility use and occupancy agreements.

Drainage: Care should be taken in utility installations to avoid disturbing existing drainage facilities. Underground utility facilities should be backfilled with pervious material and outlets provided for entrapped water. Underdrains should be provided where necessary. No jetting or puddling should be permitted under the roadway.

Spraying, Cutting, and Trimming of Trees: The utility shall be prohibited from such activities unless written permission is given by the highway agency. In general, where permission is given, only light trimming should be permitted. When the removal of a tree is permitted, the stump should either be cut to the ground or be removed and the hole properly backfilled, as determined by the highway agency. All debris, refuse and waste should be removed from the site.

Safety and Convenience

Control of Traffic: Traffic controls for utility construction and maintenance operations shall conform with the State Department of Transportation's current manual on "Traffic Control Signing Patterns to Maintenance-Construction - Permit Operations" and the current "Permit Procedures Manual." All construction and maintenance operations shall be planned with full regard to safety and to keep traffic interference to an absolute minimum. On heavily traveled highways, construction operations interfering with traffic should not be allowed during periods of peak traffic flow. Any such work shall be planned so that closure of intersecting streets, road approaches, or other access points is held to a minimum.

Servicing, Maintenance, and Repairs: All utility facilities should be kept in good state of repair both structurally and from standpoint of appearance. The utility use and occupancy agreement should identify the maintenance operations which are permitted and indicate situations where prior notification to the highway agency is required.

REFERENCES

The following references are provided for guidance:

1. National Electrical Safety Code, current issue, Bureau of Standards, U.S. Department of Commerce (For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402).

2. Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines, current issue, National Bureau of Standards, U.S. Department of Commerce (For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. D. 20402).

3. ANSI Standard Code for Pressure Piping of the American National Standards Institute, 1430 Broadway, New York, New York, 10018.

   (a) ANSI B31.1.0, (current issue), Power Piping.
   (b) ANSI B31.3, (current issue), Petroleum Refinery Piping.
   (c) ANSI B31.4, (current issue), Gas Transmission and Distribution Piping Systems.

4. (a) A.S.C.E. Committee on Pipeline Crossing, Highway Division, Guide to Good Practice for Highway-Pipeline Crossings, Volume 90, No. HWI January, 1964, Editorial and General Offices, United Engineering Center, 345 East 47th Street, New York, New York (b) A.S.C.E. Committee on Pipeline Crossings, Pipeline Division, Regulation of Pipeline Design and Construction, Volume 89, No. PL1, January, 1963.

5. AAR-Part 5, Pipelines-Specifications for Pipelines for Conveying Flammable and Non-Flammable Substances, 1966, American Railway Engineering Association, Engineering Division, 59 East Van Buren, Chicago, Ill. 60605.

6. API RP 1102, Recommended Practice for Liquid Petroleum Pipelines Crossing Railroads and Highways, current issue, American Petroleum Institute, 1271 Avenue of the Americas, New York, New York 10020.

7. A policy on the Accommodation of Utilities on Freeway Rights-of-Way, current issue, AASHO-341 National Press Building, Washington, D. C. 20004.

8. The Citizens' Advisory Committee on Recreation and Natural Beauty, 1700 Pennsylvania Avenue N W , Washington, D. C. 20006
(a) Annual Report to the President and to the President's Council on REcreation and Natural Beauty. June 1968 Report to the Citizens' Advisory Committee on Recreation and Natural Beauty by the Electric Utility Industry Task Force on Environment.

9. American Water Works Association Standards and Specifications current issue, AWWA, 2 Park Avenue, New York, New York 10016.

10. (a) State Public Utilities Control Authority requirements.
(b) State Health Department requirements.
(c) Requirements of the Natural Gas Pipeline Safety Act. of 1968.

11. Traffic Control Signing Patterns for Maintenance - Construction - permit Operations, current issue, State Department of Transportation.

12. Permit Procedures Manual, current issue, State Department of Transportation.