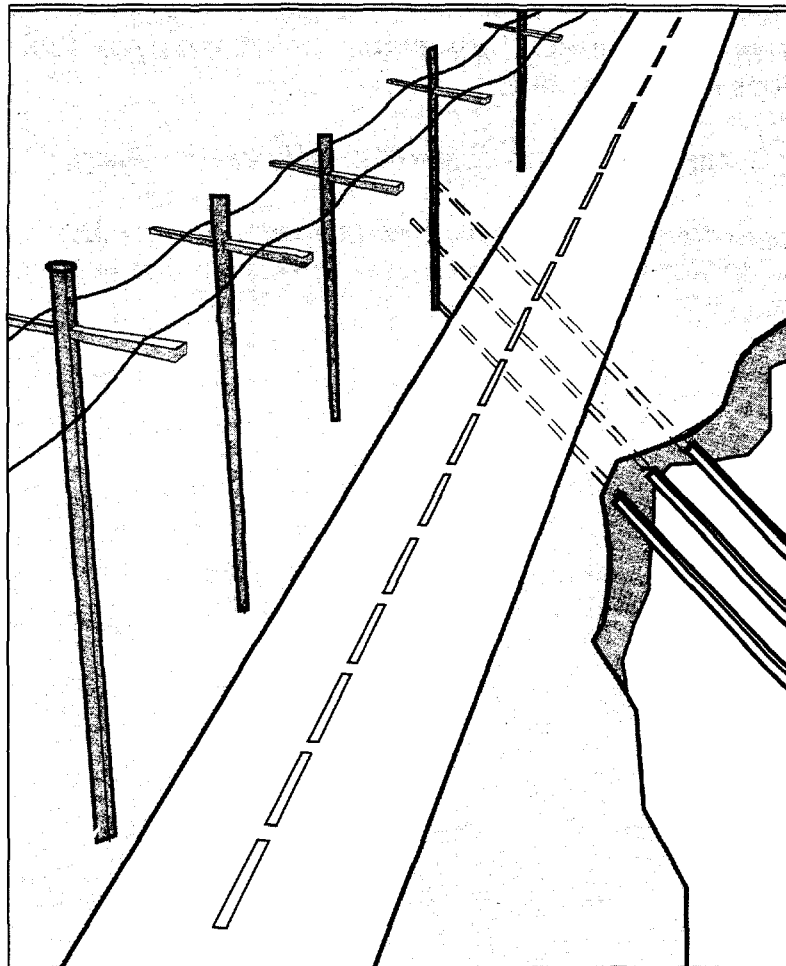




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HIGHWAY/UTILITY GUIDE



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HIGHWAY/UTILITY GUIDE

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FOREWORD

For many years there has been a need to assemble, under one cover, state-of-the-knowledge guidance on the better practices being employed to address the full array of issues that can arise from highway and utility facilities sharing common right-of-way. The Highway/Utility Guide contains such guidance. It will be useful to utility and highway professionals, educators, and government managers.

A standard distribution of the Highway/Utility Guide was made to Federal Highway Administration headquarters, regional, division, and Federal lands offices; to State highway agencies; to technology transfer centers; and to various utility committees. A limited number of copies are available from the Federal-Aid Program Branch (HNG-12), Federal Highway Administration, 400 7th Street, S.W., Washington, DC 20590, (202) 366-0450, and the Research and Technology Reports Center, HRD-11, Federal Highway Administration, 6300 Georgetown Pike, McLean, VA 22101-2296, (703) 285-2144. Copies may be purchased in quantity from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

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CHAPTER ONE

OVERVIEW

INTRODUCTION

Utility firms provide necessary services to the public. They often install their lines and facilities on the right-of-way (ROW) of public roads and streets. If the utilities were not allowed to use the ROW, they would be required to purchase their own land, driving up the overall cost to the utility organization. This could increase the cost to the public.

There are other reasons to encourage joint ROW use. ROW's frequently offer the most practical engineering, construction, and maintenance solutions for utility service to businesses and residences. They provide strips of property for utility distribution and access to adjacent properties desiring utility services. Many times property owners would not willingly allow utility facilities to cross their land, and access to adjacent properties would be blocked.

For these reasons, it is generally considered in the best interest of the public to allow joint use of ROW's when it does not impair surface use by the public. To this end, utilities are normally given some level of ROW privilege by State law or by local government franchises or ordinances; however, the utility's authority to use the ROW is subject to the approval and overall control of a public agency.

The responsibility of public agencies generally includes operating the ROW of roads and streets in a way that ensures the safety, traffic-carrying ability, and physical integrity of their facilities. A utility's presence within the ROW can affect these characteristics, so it is necessary that public highway agencies reasonably regulate the

utility's presence. In addition to laws, regulations, and ordinances, professional organizations and their publications influence utilities' rights and roles within the ROW. For example, the American Association of State Highway and Transportation Officials (AASHTO) has prepared policies and guides to distinguish good highway/utilities practices. Consequently, utilities find themselves governed by multiple agencies, many rules and laws, and various publications.

NEED FOR THIS DOCUMENT

More than 90 percent of the highways currently in use in the United States were built prior to 1950. Many of these roads have narrow ROW's, or lie in older, crowded urban areas. Since 1950 there has been tremendous growth in traffic. At the same time, the American public has created a demand for increased access to various utilities. It has become difficult to upgrade these older roadways to provide the desired capacity and safety for motorists, while trying to place more and more utility facilities on the same crowded ROW's.

The demand for good street and highway systems and for increasingly sophisticated utility service will continue to grow in America. Many more occasions will arise when a highway and a utility facility, or two utility facilities, desire to occupy a common space within the ROW. The construction of new facilities, the accommodation

of physical plant, and the maintenance of existing facilities will continue to cause conflicts that must be addressed.

This *Highway/Utility Guide* (hereafter called *Guide*) has been prepared to help public agencies and utilities use crowded highway ROW's efficiently. The *Guide* provides examples of good practices, especially of cooperative efforts between highway and utility organizations. It is hoped that this document will help maximize cooperation between highway and utility agencies, and thereby help minimize existing and future problems.

OBJECTIVE OF THE GUIDE

The *Guide* is intended to provide comprehensive, state-of-the-knowledge guidance on highway/utility issues. It is a collection of good practices, expected to provide the following:

- (1) A comprehensive source of useful information for State highway agencies (SHA's) to consult while revising their own utility manuals;
- (2) A guide for cities, counties, and small utilities that do not have their own utilities manuals or in-house expertise;
- (3) Insight into current utility practices for highway agencies and their employees;
- (4) Insight into current street and highway practices for utility firms and their employees; and
- (5) Educational materials for highway agencies and utility companies for use in training their employees.

The goal is to provide a document for practicing highway and utility engineers that addresses both sides of a variety of issues in the complex highway/utility field. This includes in-

formation on the latest technologies, procedures, and practices for efficient and safe utility use within the public ROW. It provides a simple perspective on such topics as advanced planning and coordination, design, construction, maintenance, permitting, legal issues, and reimbursement.

INTENDED AUDIENCE

This *Guide* has been written for both the highway and the utility industries. Although it can be used by anyone to obtain an overview of the complex series of highway/utility interactions, it is specifically aimed at the following types of audiences:

- (1) managers in both the public and private sectors;
- (2) individuals just entering the highway/utility field; and
- (3) consulting engineers practicing in the highway/utility field.

DEFINITION OF UTILITY

In this *Guide*, utility holds the same definition as that given by Title 23, Code of Federal Regulations, Part 645, Subpart A (23 CFR 645A):

A utility is a privately, publicly, or cooperatively owned line, facility, or system for producing, transmitting, or distributing communications, cable television, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, stormwater 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.

Such utilities may involve underground, surface, or overhead facilities, individually or in combination.

RELOCATION AND ACCOMMODATION OF UTILITIES

The terms relocation and accommodation are so basic to the understanding of the highway/utility issues that they have been placed in the introduction of this document for emphasis. An understanding of these terms is necessary before proceeding further in this manual.

Under the practice of jointly using a common ROW, there are two broad areas of concern to highway and utility officials. The first of these is the relocation, replacement, or adjustment of utility facilities that fall into the path of a proposed highway improvement project. This is commonly referred to as a utility *relocation*. The second major area of concern is the installation of utility facilities along or across a highway ROW with the intent of occupying and jointly using this ROW. This is commonly referred to as utility *accommodation*.

CONTENT OF THE GUIDE

The interface between highway agencies and the utility industry is broad and complex. It is not possible to cover all details in a single document. This manual is intended to illustrate the normal sequence of events and practices that occur frequently in this field. This document does not provide detailed information, nor is it intended to be adopted as a regulation or rule. It is intended to guide the user to a better understanding of the overall process so that individuals, agencies, and companies might establish or upgrade their own utilities practices.

There are too many details to cover all aspects of the highway/utility picture, even in an overview mode. Utility situations are different for Interstate highways than for city streets. Rural State highways are different from county roads. Differences also exist in the types of government agencies that control ROW's. It should be understood that when a topic like permits issued by SHA's is discussed, the information usually applies to all types of roads and public agencies, even though there may be differences in the application of the topic.

On the highway side of the interface, this document describes practices of organizations ranging from large SHA's to small city public works departments. On the utilities side of the interface, interstate pipeline and telephone companies cover broad expanses of the nation, while local rural water boards may have only a handful of customers. The same concepts apply to utility and highway agencies of many sizes and degrees of complexity, but different rules and procedures may be necessary to fit the various types and sizes of organizations.

CHAPTER TOPICS

The material in this document has been organized by subject, with each chapter covering a separate issue. The following topics are covered:

- Chapter 1. Overview
- Chapter 2. Historical Perspective
- Chapter 3. Planning and Coordination

Chapter 4. Design
Chapter 5. Permits
Chapter 6. Information Management and Mapping
Chapter 7. Notification
Chapter 8. Legal Issues
Chapter 9. Safety
Chapter 10. Construction
Chapter 11. Maintenance
Chapter 12. Relocation Reimbursement
Appendixes
Index

A general listing of the topics in each chapter may be found in the table of contents. A key word index is available in the appendix to provide additional information about the contents of the *Guide*.

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CHAPTER TWO

HISTORICAL PERSPECTIVE

INTRODUCTION

This chapter briefly reviews the development of prominent utility policies. The Federal government's role is emphasized because it has been paramount in establishing policies and funding to guide State highway development. The important Federal contribution to the highway/utility process was thoroughly documented in a 1980 report by James Kirk, whose work serves as the basis for most of this chapter.

FEDERAL LAWS, REGULATIONS, AND DIRECTIVES

Since the Federal role has been so important in shaping utility policies, a brief explanation of regulatory documents is offered to explain the relationship between Federal laws, regulations, and directives. A more complete discussion of this topic may be found in chapter 8, which covers legal issues.

Federal *laws* are adopted by Congress and are contained in the U.S. Code. A typical citation is "23 U.S.C. 123," to indicate Section 123 of Title 23 of the U.S. Code.

Federal *regulations* are promulgated by Federal agencies, usually to carry out the intent of Congress as expressed in the U.S. Code. The regulations are contained in the Code of Federal Regulations. A typical citation is "23 CFR 645A," to indicate Title 23, Part 645, Subpart A of the Code of Federal Regulations.

Federal *directives* are usually provided to clarify or implement the laws and regulations.

They generally contain regulatory and nonregulatory material. The primary highway/utility directives were contained in the *Federal-Aid Highway Program Manual* before 1992. A typical citation was "FHPM 6-6-3-1," to indicate volume 6, chapter 6, section 3, subsection 1 of the *Federal-Aid Highway Program Manual*. In late 1991 the manual was replaced by the *Federal-Aid Policy Guide*. FAPG 645 is a typical citation.

In effect, the regulatory documents are layered. Laws take precedence over regulations, which take precedence over directives.

EARLY ROAD-BUILDING EFFORTS

The first Federal involvement in highway construction was in 1806 when the National Pike, or Cumberland Road, was authorized. As early as 1893, direct Federal involvement in roadway design began when the Office of Road Inquiry of the U. S. Department of Agriculture was created to inventory State road design practices. Of course, roads were being designed for horses and buggies at that time. They were usually 4 to 5 m (12 to 15 ft) wide with severe crowns to encourage good drainage.

In the early 1900's, the automobile was introduced and existing roadways were no longer adequate. Roads then needed to be wider, flatter, and paved. In 1912, the Post Office Appropriations Act provided \$500,000 for postal road improvements. This was a large sum in its

day. The funds were administered by the Office of Road Inquiry.

The landmark Federal-Aid Highway Act of 1916 provided substantial road funding to all States with highway departments. States without highway departments quickly formed them. In 1918 the Office of Road Inquiry became the Bureau of Public Roads (BPR) of the Department of Agriculture. The 1921 Federal-Aid Highway Act was a huge step forward. It created the primary road system, consisting of 7 percent of the rural highways in each State.

Traffic volumes, vehicle speeds, and vehicle weights grew rapidly in the 1930's and 1940's. Efforts were made to standardize road design criteria like widths, rates of curvature, and grades. The American Association of State Highway Officials (AASHO, later to become AASHTO) was a leader in establishing roadway criteria and in improving highways.

In 1939, the BPR was transferred to the Federal Works Agency and was renamed the Public Roads Administration. A decade later, in 1949, the name was changed back to the Bureau of Public Roads when the organization was moved to the Department of Commerce.

The 1966 Department of Transportation Act brought many transportation-related agencies together under a cabinet-level manager, the Secretary of Transportation. The BPR joined them and became the Federal Highway Administration (FHWA).

Between 1916 and 1944, Federal-aid highway funds were dedicated primarily to building roads in rural areas. Funds could not be spent inside

cities of 2,500 population or more. Federal-aid funds were limited to actual construction of highways and could not be spent on activities like surveys, highway location studies, or ROW purchase. Almost no Federal funding was spent on utility relocations prior to 1944 because (1) Federal aid was confined to rural areas where there were fewer utility facilities and less-crowded ROW's, and (2) States generally had no responsibility to reimburse utilities for relocating their facilities from highway ROW's to make room for highway construction projects.

1944 FEDERAL-AID HIGHWAY ACT

Major changes occurred with the 1944 Federal-Aid Highway Act. First, it substantially increased the funding apportioned to the States. The Act also modified the definition of highway construction to include preliminary engineering, surveys, mapping, ROW, railway grade crossings, and similar activities. The third major change contained in the Act was the establishment of the secondary and Interstate highway systems. The fourth change allowed primary, secondary, and Interstate projects to extend into urban areas.

In this single act, much more money became available for more types of road building activities and roadway systems in both urban and rural areas. Payment for utility relocation became an issue, and a need arose for a Federal policy covering utility adjustments.

UTILITY RELOCATION POLICY DEVELOPMENT

As a result of the substantial changes in the 1944 Federal-Aid Highway Act, the Public Roads Administration of the Federal Works Agency

prepared a single document to cover the Federal role in utility activities.

GENERAL ADMINISTRATIVE MEMORANDUM NUMBER 300 (GAM-300)

GAM-300 was issued in May 1946. This was a remarkable document. Many of its basic provisions still serve as the basis for the current Federal utility relocation policy. For example, the GAM specified written agreements between a State and a utility company, required a detailed cost estimate and plans for the proposed relocation, and limited reimbursement to the actual cost of highway construction as verified by an audit.

Even with the GAM in place, many unanswered questions remained. The 1954 Federal-Aid Highway Act required a study of problems associated with utility relocation on highway projects. The study noted that all States had established legal authority to permit utilities to occupy State ROW's, and about half of the States had authority to require utilities to move at their own expense to make way for highway projects. More and more utility facilities were being relocated and utility firms were mounting increased pressure for reimbursement.

1956 FEDERAL-AID HIGHWAY ACT

The next major occurrence was the passage of the 1956 Act, the importance of which cannot be overemphasized. First, the act created a statutory basis for Federal reimbursement. Second, eligibility was changed to require a finding that the relocation was made necessary by highway improvement and the State had actually paid such costs. Reimbursement of utility relocation costs could be made in the same proportion that Federal funds were spent on a project. The act removed a previous limit on utility expenses of 2 percent of total construction.

Because of these changes, the States scrambled to establish enabling legislation. Bills were introduced in 42 State legislatures between 1956 and 1959 to make payment of relocation costs valid. Although less than half of these bills were adopted, the pattern had been set. Currently, the vast majority of the States have statutory authority to pay for utility relocations as part of the cost of some types of highway construction projects.

Another aspect of the 1956 Act had a pronounced impact on highway utilities. The act included about \$25 billion to be spent over three years to expedite construction of the Interstate system. The States rushed ahead with the preliminary Interstate work, including utility adjustments and relocation. At this point, the BPR saw a need to develop a new policy for utilities.

In 1955, Policy and Procedure Memorandum (PPM) 21-6.2 indicated that it was in the public interest to perform installation or adjustment of utilities by the force account method. In 1958, PPM 20-11.1 established measures of preparatory work to be done in advance of highway construction to avoid unnecessary delays and additional costs. Both of these became important lasting principles in Federal relocation policy.

POLICY AND PROCEDURE MEMORANDUM 30-4 (PPM 30-4)

In December 1957, BPR issued PPM 30-4, "Payment Procedures for Reimbursement of Utility Work," which superseded GAM-300. Important legal principles were included in the PPM. First, just compensation was to be paid where property was taken. Second, Federal funds could be used to help the State pay for utility relocations. Third, the State had the authority and the duty to carry out its statutory

responsibilities. While these three simple concepts were adopted to clarify the reimbursement process, their application became very complex.

As an example, one portion of PPM 30-4 indicated that if State law varied from the PPM, the more restrictive of the standards was to govern. If a State's policy for payment of relocation costs was more liberal than the PPM, the State might not receive Federal reimbursement for all its expenses in relocating the utility. This provision often required audits to determine how much of the amount paid by the utility could be properly attributed to the relocation.

The most complex and controversial provision of the PPM involved enhancement of utility plants during relocation. PPM 30-4 allowed reimbursement for removal and relocation of the existing utility facility. The concept required that the utility be paid for the cost of relocation, less any increase in the value of the new facility and any salvage value derived from the old facility. Measuring "increase in value," where the increase was an extended service life for the utility's plant, became a problem. If the replacement was a major and independent segment of the utility's system, then the credit for the extended service life had to be used. This complex and controversial provision was resisted by the utility industry. These concepts remain in effect today with some modification.

Between 1958 and 1966, six formal amendments were added to PPM 30-4, designated as PPM 30-4 (1) through (6), to address various operating problems. Seven Instructional Memoranda (IM's) were also issued during the same period.

In addition to the six amendments to the PPM and the seven IM's, the FHWA also issued Circular Memoranda (CM) during the period 1958 to 1966. These provided instructions or clarified questions on topics like audits and accounts, civil rights and labor compliance,

reviewing utility agreements, and distribution of Federal directives. Interestingly, the distribution procedure was established because many utility firms had not read, or even heard of, PPM 30-4. State highway agencies were charged with distributing Federal directives like the PPM to the utilities.

SECOND EDITION OF PPM 30-4

In October 1966, the second edition of PPM 30-4 was issued under a new name, "Utility Relocations and Adjustments." Its scope was much broader than the original PPM. As with the original edition, its most controversial provision was a requirement for the utility to issue a credit for any increase in value for an extension of service life. Although the credit mechanism was not precisely defined, the new PPM listed three examples in which a credit would be required. These were

- (1) a replacement-in-kind of a utility segment 1.6 km (1 mile) or more in length;
- (2) a replacement involving a building, a pumping station, filtration plant or other facility; and
- (3) a replacement with greater functional capacity than the facility it replaced, excluding utility lines crossing the highway.

Two examples were given in which credit would not be required:

- (1) utility lines crossing the highway; and
- (2) longitudinal segments of utility lines involving replacement-in-kind of segments less than 1 mile in length.

One very interesting aspect of the second edition of the PPM was a provision for extensive liaison

between the utility and highway industries. AASHO and the American Right of Way Association arranged a comprehensive review by States and utility firms of the proposed policy prior to its adoption. This review worked extremely well.

THIRD EDITION OF PPM 30-4

In February 1969, the third edition of PPM 30-4 was issued. For the first time, a section covered the accommodation of utilities. Provisions were adopted for an "alternative procedure" to process utility relocation agreements if the cost was \$25,000 or less. Approval was by correspondence between the State and BPR without plans and estimates. This eliminated administrative steps and simplified the process.

FOURTH EDITION OF PPM 30-4

The fourth edition of PPM 30-4 was issued in June 1973, incorporating previous CM's and IM's while simplifying and clarifying several provisions. The \$25,000 ceiling was removed to encourage use of the alternative procedure and to shift the responsibility for day-to-day oversight of utility relocations to the States.

FEDERAL-AID HIGHWAY PROGRAM MANUAL (FHPM)

In October 1973, PPM 30-4 was incorporated into the new *Federal-Aid Highway Program Manual* (FHPM). PPM 30-4 became Volume 1, Chapter 4, Section 4 (FHPM 1-4-4).

COST-EFFECTIVENESS FINDING

The 1982 Surface Transportation Assistance Act required that each utility construction project be competitively bid unless some other method was shown to be more cost-effective. In May 1983, FHWA issued a cost-effectiveness finding that qualified utilities could use their own forces to adjust their own facilities for "minor" utility relocation projects on existing ROW. The companies' own forces could also perform minor installation of new facilities. This finding did not mean that major utility adjustments had to be accomplished by competitive bid. They could still be accomplished by the utility, if an individual cost-effectiveness finding had been made by FHWA. FHWA did not establish specific criteria to distinguish what constituted a minor or a major utility adjustment. Most of the utility relocation activities since 1983 have qualified as minor adjustments.

FHPM 6-6-3-1

The last major change in FHWA's utility relocation regulations took place in May 1985. As a result, in September 1985, FHPM 1-4-4 (PPM 30-4) was replaced by FHPM 6-6-3-1 entitled "Utility Relocations, Adjustments and Reimbursements." FHPM 6-6-3-1 was essentially the same as 23 CFR 645A. FHWA also adopted a rule allowing reimbursement to local governments for utility relocations and adjustments for which the State did not participate in reimbursement. The project had to be purely local in nature and the local government had to have the authority and legal basis to pay for utility relocation.

FHPM 6-6-3-1 also revised the expired service life credit provisions. Credit was no longer required for replacement of segments of the utility's service, distribution, or transmission lines regardless of line length. This repealed the 1.6 km (1 mile) rule that had been controversial for the utility industry for many years.

The only significant change that has occurred since the 1985 revision was in July 1988, when an amendment was adopted to make the costs of highway safety projects to correct hazardous highway utility problems eligible for reimbursement.

PROGRAM GUIDE

The first edition of the FHWA *Program Guide, Utility Adjustments and Accommodation on*

Federal-Aid Highway Projects was published in June 1986. The second edition was published in October 1990. That document reviews and comments on Federal-aid regulations for utility relocations and accommodations. It reviews code and regulations by topic, and explains the rationale for certain FHWA policies.

FEDERAL-AID POLICY GUIDE

On December 9, 1991, the *Federal-Aid Policy Guide* (FAPG) was published and the FHPM was canceled. The portions of the FAPG and the CFR relating to highway utilities reimbursement are essentially the same.

UTILITY ACCOMMODATION POLICY DEVELOPMENT

Until 1954, there was almost no Federal concern for utility accommodation policies. The emphasis was on building highways and creating national highway systems, mostly in rural areas. The modest attention given utilities dealt with relocating, replacing, or adjusting facilities that fell in the path of highway construction projects.

1954 AND 1955 STUDIES

As a result of the 1954 Federal-Aid Highway Act, a study was conducted on the problems associated with utility relocation, replacement, and adjustment. This study included an analysis of legal issues, several of which would later become important in utility accommodation policies. The study found that State legislatures often delegated control of ROW to State highway departments. A utility obtained consent to

locate its facilities in the ROW, as a privilege granted by the highway department.

The study found that all States had laws allowing public utilities to use public highway and street ROW, subject to various restrictions. These restrictions generally involved a franchise, permit, or other permission for some or all utilities to use some or all highway ROW's.

IMPACT OF THE INTERSTATE HIGHWAY PROGRAM

The 1956 Federal-Aid Highway Act provided funding to accelerate the beginning of the Interstate highway system. During the adoption of geometric design standards for this new highway system, it became apparent that control of access was essential to maximize safety and to preserve the traffic-carrying capacity of the system. This control would have a substantial

impact on utilities. At that time, State laws and regulations differed substantially and a uniform national policy was needed to establish conditions under which utilities could be accommodated on Interstate highway ROW's.

AASHO was asked to create a policy for:

- (1) developing and maintaining access control;
- (2) maximizing highway safety and function; and
- (3) ensuring uniformity of utility treatment among the States.

The AASHO committee prepared a draft policy and extensively coordinated the draft among the States and national utility associations and groups. In 1959, the "Policy on the Accommodation of Utilities on the National System of Interstate and Defense Highways" was adopted. The BPR accepted the AASHO policy as a design standard for Interstate projects. In October 1966, the BPR extended the application of the AASHO policy from Interstate highways to all Federal-aid freeways in its second edition of PPM 30-4.

OTHER FREEWAY GUIDANCE

In 1960, the BPR issued CM's to provide guidance on several topics, including (1) utility service lines crossing Interstate highways; (2) encasement of pipeline crossings; (3) conversion of overhead lines to underground crossings; and (4) pipeline crossings on grade separations.

EARLY ACCOMMODATION CONSIDERATIONS

In 1966, the first statement on accommodations was included in the second edition of PPM 30-4

the utility reimbursement regulation. More than 90 percent of America's present roads had already been built and billions of dollars of utility facilities were already in place. In 1967, guidelines were issued clarifying the PPM provisions for projects within the boundaries of cities, towns and other political subdivisions. The difficulty of locating existing utilities and including such data on construction plans was of particular concern.

In 1967, guidance was issued on utilities and scenic enhancement to guard against utility construction that might detract from the appearance of scenic strips, overlooks, rest areas, landscaped areas, other areas of roadside development, or particular scenic enhancements.

In 1967, AASHO issued its report *Design and Operational Practices Related to Highway Safety* (the Yellow Book). This document drew attention to the large percentage of serious off-roadway crashes with guardrails, sign posts, bridge structures, trees, and utility poles. This was the forerunner of the roadside clear zone, now a very important consideration for utilities.

In 1968, Vice President Hubert Humphrey established a Federal committee to define actions to assure that utility transmission and distribution lines and utility plant sites were compatible with environmental values. Safety and environmental issues had become a strong concern. Consequently, BPR decided to develop a policy and procedure memorandum dedicated to accommodation of utilities on all types of highways. At the same time, AASHO decided to develop a companion guide booklet for utilities on all types of highways.

PPM 30-4.1

This November 1968 PPM addressed the accommodation of utilities. It was under development for more than a year and had been

extensively reviewed by the States, AASHO, and other organizations and utility companies.

The PPM made each State highway department responsible for maintaining the ROW of Federal-aid projects to preserve the integrity, operational safety, and function of the highway facility. The new PPM asked the States to strengthen or develop their utility accommodation policies, particularly to provide safe roadsides. The PPM was intended to apply principally to new utilities installed after its effective date, but also included existing utility lines on highway construction projects.

One special provision of the PPM was noteworthy. The provision applied to cases in which the State did not have legal authority to regulate utilities in the ROW of a Federal-aid project because the ROW was regulated by another governmental unit. The PPM required that the State obtain a formal written agreement with the appropriate officials controlling the ROW, such as a county or municipal government. The written agreement would require regulation of utilities within the ROW in a manner at least equivalent to the State's utility accommodation policies.

Two provisions of this PPM may have received more comments than any others. This PPM encouraged utilities and highways to avoid scenic areas and greatly reduced the Federal role in approving utility installation.

JOINT DEVELOPMENT AND MULTIPLE-USE CONCEPTS FOR FREEWAYS AND UTILITIES

Utility firms expressed strong concerns about the differences among States in applying the AASHO policy for accommodating utilities on interstate freeways. As a result, a 1969 guidance was issued indicating that Federal approval could be given for installing trunk line or transmission-type utility facilities within a

utility strip along the outer border of an existing freeway ROW under certain strict conditions. State highway agencies (SHA's) were encouraged to endorse and adopt the guidance in their utility accommodation policies. Not all States accepted and implemented this policy.

SECOND EDITION OF PPM 30-4.1

In 1969, less than a year after the first edition, the second edition of the PPM was issued with minor editorial changes.

AASHO POLICY ON ACCOMMODATING FREEWAY UTILITIES

In February 1969, AASHO adopted *A Policy on the Accommodation of Utilities on Freeway Rights-of-Way*. This document repeated the provisions of the 1959 policy, except that it was broadened to cover all freeways as well as Interstate highways.

AASHO GUIDE FOR ACCOMMODATING UTILITIES

In October 1969, AASHO issued its *Guide for Accommodating Utilities on Highway Rights-of-Way*. In December of that year, BPR issued guidance accepting this AASHO guide for use by its divisions and regions. This document provided a uniform basis and offered a sound approach for State highway agencies to develop or revise their utility accommodation policies.

The AASHO *Guide* offered safe, rational practices to accommodate all types of utility facilities. For example, it recommended limiting longitudinal installations of overhead lines along roadsides to single-pole construction. Joint use of a single pole was also encouraged. It included recommendations for poles, guys, and other

facilities to be placed beyond clear roadside areas (clear zones) or as far as practical behind curbs, and where feasible behind sidewalks. It also recommended minimum bury for underground lines, placement of spare ducts for later expansion, attachments to bridges, and controls for markers on underground crossings.

THIRD EDITION OF PPM 30-4.1

In November 1972, the third edition of PPM 30-4.1 was published. This PPM included no significant changes. However, there were two problems with the implementation of this document. First, there was no suspense date for approving the States' accommodation policies. Second, some States were reluctant to follow the AASHTO *Guide* and prescribed format when developing their plans.

STATE-OF-THE-ART REPORT AND MANUAL OF IMPROVED PRACTICE

The American Public Works Association (APWA) studied the accommodation of utility facilities within urban ROW's to provide guidance and assistance to public officials. The resulting 1975 manual and report set out certain principles and practices under which utility facilities could be successfully accommodated within urban ROW's. These were divided into five steps:

- (1) enabling legislation to establish rights of local agencies to control the use of their ROW's;
- (2) provision of adequate staff and budget to protect the public's investment in its streets and highways;
- (3) establishment and implementation of adequate permit, inspection, and

pavement restoration controls;

- (4) implementation of coordination and cooperation mechanisms and record systems; and
- (5) provision of accurate information to field forces who excavate in the ROW to allow them to work safely and to protect the existing utility plant.

NCHRP SYNTHESIS REPORT NUMBER 34

In 1976, the National Cooperative Highway Research Program (NCHRP) issued a report entitled "Policies for Accommodation of Utilities on Highway Rights-of-Way." This was a very thorough examination of State and local government utility policies and practices. The report made several recommendations, including the following:

- (1) encouragement of dual and multiple use of utility facilities;
- (2) revision of the AASHTO *Guide* to cover guidance for accommodating utilities in urban areas or on roads with narrow ROW's;
- (3) agency provisions for permits, inspections, fees, and bonding requirements;
- (4) foundation of local and regional coordination committees between highway agencies and utilities; and
- (5) adoption of standard color codes for stakes marking underground facilities.

Several other recommendations were made, and research topics were identified to provide data for formulation of more thorough policies.

CLEAR ZONE

In 1977, AASHTO published a booklet entitled *Guide for Selecting, Locating, and Designing Traffic Barriers* (AASHTO Barrier Guide). This booklet was a major step forward in supplying quantitative criteria to identify appropriate lateral clearances for objects in the clear zone. In 1989, AASHTO published the *Roadside Design Guide*, a very comprehensive document to be used in determining appropriate clear recovery areas. FHWA determined that it was also suitable for evaluating State policies for accommodation of utilities in the clear zone.

In 1984, AASHTO published *A Policy on Geometric Design of Highways and Streets* (the Green Book). The second edition of the Green Book was published in 1990. It recognized the AASHTO *Roadside Design Guide* as an appropriate guide for determining rural clear zone widths and stated that the minimum distance in urban sections should be 0.5 m (1.5 ft) behind the face of a curb. FHWA considered the 0.5 m (1.5 ft) offset for curbed urban highways the absolute minimum, and emphasized that greater offsets were appropriate for utility poles. FHWA strongly encouraged the States to develop policies providing as much clear zone as reasonable and feasible, and to place utility poles as near as practical to the ROW line.

1978 SURFACE TRANSPORTATION ASSISTANCE ACT

This Act provided that utilities could not use Federal-aid system ROW if such use would "adversely affect any aspect of safety." Some of the States interpreted this requirement very strictly, which negatively affected utility accommodation.

A 1979 technical amendment clarified Congress' intent that safety should be of

paramount, but not sole, importance when considering the accommodation of utility facilities within the ROW. The Act also required that certain environmental and economic impacts of the loss of productive agricultural land be evaluated and considered before denying utilities' use of the ROW. In 1982, AASHTO revised its policy on accommodating utilities on freeways. The revision reaffirmed the basic policies of previous editions on utility use of freeway ROW and reflected environmental and economic concerns.

SECOND EDITION OF AASHTO GUIDE FOR ACCOMMODATING UTILITIES

In 1981, AASHTO issued the second edition of *A Guide for Accommodating Utilities Within Highway Rights-of-Way*. FHWA considered this a valuable guide on good practices and procedures, but did not require the States to incorporate its provisions into their utility accommodation policies.

FEDERAL-AID HIGHWAY PROGRAM MANUAL (FHPM)

In October 1973, PPM 30-4.1 was incorporated into the new Federal-Aid Highway Program Manual. PPM 30-4.1 became FHPM 6-6-3-2.

REVISED FHPM 6-6-3-2

In May 1985, FHWA rewrote FHPM 6-6-3-2 on utility accommodation. The new FHPM was called "Accommodation of Utilities." A key change was the clarification of freeway accommodation policy to permit longitudinal use only for special and unique circumstances and if denial would cause undue or exceptional hardship on utility customers or others.

The revised FHPM 6-6-3-2 also placed significant importance on keeping the established clear recovery area free of new above-ground utility facilities. That placement of new utility facilities had to be within the clear recovery area was emphasized. New above-ground utility installations could only be considered when underground installations were not technically feasible or cost-effective. It was expected that appropriate countermeasures would be used (breakaway features or similar measures) to reduce hazards created by the new facilities.

FHWA also restated its requirement that each SHA establish a program, in cooperation with the utilities, to identify and initiate corrective procedures to reduce hazards associated with utility facilities in clear recovery areas. In July 1988, FHWA issued a rule allowing the costs of highway safety projects undertaken solely to reduce the hazards of utilities to be eligible for Federal-aid funding, thus creating incentives for SHA's to implement the program.

FHPM 6-6-3-2 also incorporated the concept of considering potential utility uses in the determination of ROW needs.

1988 FHWA FREEWAY ACCOMMODATION CHANGE

In February 1988, FHWA significantly changed its regulations and no longer required States to follow the AASHTO *Policy on the Accommodation of Utilities Within Freeway Right-of-Way*. Instead, each SHA was allowed to adopt its own freeway utility accommodation plan. The States had to decide whether they

wanted utilities on their freeways, and if so, to what extent and under what conditions utilities would be allowed. FHWA retained the authority to approve each State's freeway accommodation plan. If utilities were to be allowed, FHWA required that:

- (1) careful consideration be given to measures proposed to ensure safety of the traveling public and features to protect the highway;
- (2) a utility strip be established along the outer edge(s) of the ROW;
- (3) fences be retained;
- (4) the State or political subdivision retain control of the utility strip; and
- (5) service connections not be provided to properties adjacent to the utility strip.

In turn, AASHTO revised its policy covering utilities within freeway ROW in February 1989. While generally consistent with FHWA's regulations, this AASHTO policy revision is considered to be more restrictive. As a result, FHWA has no plans to adopt the AASHTO policy as a Federal standard.

FEDERAL-AID POLICY GUIDE

On December 9, 1991, the FHWA published the *Federal-Aid Policy Guide* (FAPG) and canceled the FHPM. The provisions for accommodation of utilities are in Part 645 of the FAPG, cited FAPG 645. These provisions are essentially the same as the corresponding portions of the CFR.

SUMMARY

This chapter provided background information to help the reader understand the evolution of highway/utility policy. The prominent role of the Federal government was featured. Key docu-

ments like GAM-300, PPM 30-4, FHPM, FAPG, and the AASHTO guides have been placed into historical perspective.

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CHAPTER THREE

PLANNING AND COORDINATION

INTRODUCTION

Community planning and utility planning have traditionally been carried out by two different groups: governmental agencies and investor-owned utilities, respectively. Community plans often have been developed and modified with little regard for the effects of these decisions on utility networks. Utilities have found themselves “making do” with available and often inadequate space in street ROW. Though utility services such as electricity, telephone, gas, and other privately owned utility services are as essential to modern life as municipally provided water, sewer, signal, and transportation systems, their planning has not typically been integrated into the community planning process.

This chapter reviews the typical planning process for the construction of highways and utility facilities. It discusses important issues such as joint planning, alternatives analysis, and liberal acquisition of right-of-way; it also provides examples of methods used by governmental agencies and utilities to encourage the exchange of information and avoid undue delays and confrontations.

Many individual agencies and companies plan improvements to their facilities in isolation from others who may directly affect or be affected by these plans. In such cases, the agency may be ready to construct the project when a host of other public and private agencies arrive on the scene with issues to be addressed and impacts to

be mitigated before the project can proceed. Successful highway and utility projects require participation of everyone represented in the ROW. All parties with facilities in or abutting the public ROW should have the opportunity to examine and consider the impact of proposals affecting that ROW.

What types of projects are included in this planning and coordination effort? Planning and coordination are needed for all public roadways, whether Federal Interstate routes or local residential streets. All private and public utilities—including communication, electric power, water, gas, oil, petroleum products, steam, sewer, drainage and irrigation, and similar facilities affecting the public ROW for streets and highways—should be given similar planning attention. These utilities may involve facilities that are underground, at surface level, or overhead. Planning and coordination activities related to these facilities include placement of new facilities, extension of existing service lines, replacement/upgrading of existing facilities, maintenance, and service connections.

Joint planning involves agencies (sometimes very diverse agencies) working together, sharing information, and developing workable, comprehensive solutions for sharing the ROW. Methods for achieving joint planning will be presented in this chapter.

HIGHWAY PLANNING

Planning is part of good management. It requires anticipating and preparing for future events, while taking steps to solve existing problems and avoid creating new ones. The planning process is directed toward achieving stated goals and objectives by carefully examining a range of potential solutions. The end result of successful planning is the best allocation of resources.

The typical process for implementation of a highway or street project includes four major steps:

- (1) *comprehensive planning or systems planning*, which are ongoing processes that examine a number of proposals in limited detail;
- (2) *project programming*, which takes projects from the system plan, commits funding, and sets a schedule for implementation;
- (3) *project development*, which includes alternatives analysis, preliminary engineering, design, and ROW acquisition; and
- (4) *construction*, which includes site preparation, construction procedures, and inspection.

The first three steps will be considered in this chapter. Construction is covered in Chapter 10.

COMPREHENSIVE PLANNING

Comprehensive plans typically identify projected growth patterns, criteria for land use development, and perhaps plans for certain public and commercial facilities such as schools, libraries, governmental buildings, fire stations, police stations, transportation facilities, and

government-owned water, sewage, and drainage systems. In the United States, planning is typically carried out by local and regional government agencies through staffs of professionals or consultants working for boards and commissions. Planning for expansion of private or investor-owned utilities is often not integrated into this public planning process.

Several major steps typically included in the planning process are:

- (1) identify current conditions;
- (2) forecast trends, problems and needs;
- (3) establish goals and objectives;
- (4) develop alternative plans;
- (5) evaluate alternatives;
- (6) select recommended plan; and
- (7) implement the plan.

In some cases, comprehensive land use plans identify existing utility systems and future system expansions.

SYSTEMS PLANNING

In urban areas, long-range transportation plans are developed to identify highways and transit services to serve the communities' needs for the foreseeable future (a twenty year horizon is commonly used). This systems plan may be part of the overall plan for the community or a separate document dealing specifically with transportation needs.

Coordinating the development of utilities and roadways helps achieve community goals and development objectives. The availability of roadways, potable water, and power and sewer lines increases the potential for land use changes. These land use changes may also create a need for change in the available

infrastructure wider roads, extended utility lines, or expanded water or sewer service. The timing and sequence for providing utility services and roadways affects the development pattern of the community.

The recommendations included in these comprehensive or systems-level plans may be no more than broad lines on a map that identify corridors where additional roadway capacity is needed to serve traffic volumes projected in some future year. While these lines on a map may have no funding or commitments attached to them, they do serve to identify areas of potential change that should be considered in developing other facility plans. Systems-level planning seeks to integrate land use, transportation, and environmental planning into a process that produces the most desirable overall development plan for the community.

PROGRAMMING PROJECTS

As projects evolve, they move from the long-range or systems-level plan to the programming phase. A Capital Improvement Program (CIP) is a listing of project development and construction schedules for priority projects over the short term (four to five years). The CIP consolidates these projects into a funding plan, and matches phases of priority projects with available funds from local, State, Federal, or private sector sources. The programming documents are always being modified as projects are deleted, delayed, or accelerated.

In urbanized areas, transportation projects using Federal funds are programmed in a Transportation Improvement Program (TIP) that is maintained by the agency responsible for urban transportation planning: the Metropolitan Planning Organization (MPO). This TIP includes the capital improvement programs (at least those projects funded with Federal dollars)

of local and State highway and transit agencies for a four to five year time frame.

Metropolitan Planning Organization

Metropolitan Planning Organizations (MPO's) operate in urbanized areas of more than 50,000 population to coordinate the planning and development of transportation facilities and services. MPO's typically receive Federal funding from the FHWA and the Federal Transit Administration (FTA) to conduct system and project level planning for highways and transit. Beyond planning, MPO's also coordinate funding for transportation facilities and services. A TIP is developed in cooperation with transportation agencies to schedule the implementation of recommended improvements.

Statewide Programs

Outside of urbanized areas, the State highway agency (SHA) plans and programs projects in conjunction with local governmental agencies as required by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). A statewide highway improvement program consolidates Federal- and State-funded projects under development. Projects from urbanized areas are also incorporated into this statewide program. Individual counties may have projects included in this statewide program, or they may initiate and conduct project development activities using their own funds and capital improvement programming process.

An agency such as the SHA, county highway department, or public works department will schedule phases of the project and allocate funding for preliminary engineering, ROW acquisition, design, and construction. Through this process, the broad corridor identified in the

long-range plan will be examined in more detail to evaluate alternative methods for meeting the travel needs of the community

PROJECT DEVELOPMENT

As a project moves from the conceptual phase of the long-range plan to the problem-solving phase of project development, it may change dramatically. As detailed studies and field work are done, the choices made in the beginning may be set aside in favor of a better alternative.

Several alternative roadway alignments and configurations may be studied to determine the best project for the community. There are many considerations in such a study: construction costs; projected traffic volumes on the new roadway and existing roadways; congestion relief; accessibility; air quality effects associated with the project; noise; sensitive land uses such as historical and archaeological sites, wetlands, parks, and neighborhoods; drainage; and certainly the interaction with utilities. The findings for these project selection criteria are typically presented in public meetings to gain community involvement in the development of the transportation system.

Systems plans are thus translated from very broad statements of needs into specific proposals, eventually resulting in detailed engineering drawings and specifications. This process yields a precise location (project beginning and ending points, horizontal and vertical alignment), dimensions, slopes, construction standards, and material types and quantities.

Utilities need routes to serve new or increased areas of demand. If adequate ROW is available, highways provide such routes for new utility installations. Utilities should be included in the planning and project development process to coordinate these needs, both with the highway agency and other utilities.

Corridor Plans

As alternative highway plans are developed, ROW requirements will be defined. A plan sheet presenting the proposed alignment will display proposed ROW acquisition limits. If the highway improvement is widening an existing roadway, the existing ROW limits are usually shown along with the proposed ROW requirements. It is a good practice to provide these plan sheets to utilities that may have facilities within the ROW. These plans are important tools for communication among agencies involved in the project. With them, the utility can become part of the project development process by identifying the location of all overhead and underground facilities within the project limits, providing record drawings of all underground facilities, indicating if facilities are installed by permit or easement, and indicating if reimbursement will be sought. The utility sends the information on its facilities in the project ROW back to the highway agency for consideration.

Preliminary Construction Plans

The alternatives presented in the corridor plans will be evaluated to determine the most cost-effective and environmentally acceptable option for constructing the project. As the many alternatives are narrowed down to the preferred alternative, preliminary construction plans are developed. These plans provide greater detail on design and impacts of the preferred alternative.

Final Construction Plans

The highway agency will incorporate the comments and data gathered during the review of the preliminary construction plans and

subsequent negotiations into final plans for construction. These plans are provided to the utility which:

- (1) reviews the plans for any possible conflicts or changes;
- (2) completes the utility engineering plans;
- (3) develops a detailed relocation scheme; and
- (4) submits information on reimbursable costs.

The detailed relocation scheme indicates if the utilities will be relocated before highway construction begins, or if the utility work is to be done simultaneously with the highway project.

Time Frame for Project Development

The time frame for major capital project development activities typically ranges from 4 to 7 years, depending on the complexities of the project. Figure 3-1 outlines the steps and schedule for implementing a typical project, including the Environmental Impact Statement (EIS) described in more detail later in this chapter.

2 Years	2 Years	3 Years	
Preliminary Study & Design Concepts Draft EIS	Alternative Analysis & EIS Approval	Design ROW	Ready to Advertise

Figure 3-1. Typical Project Development Timeline

Each of the broad blocks of time identified in Figure 3-1 is actually composed of a number of activities and sometimes extensive procedures. Each highway agency may have a checklist or flowchart that depicts the major tasks in developing a project.

The Alabama Department of Highways has prepared a *Guide for Developing Construction Plans* that identifies 65 steps in the development of project plans and highlights activities that involve utilities. The steps in the process can be summarized as follows:

- Steps 1-7 Design preliminaries
- Step 8 Design initiation
- Steps 9-18 Primary design integration
- Steps 19-37 Secondary design integration
- Step 38 Plan-in-hand inspection
- Steps 39-52 Design refinement
- Step 53 Plans-Specifications-and-
Estimate Inspection (PS&E)
- Steps 54-65 Design completion

Alabama's *Guide* shows involvement of utilities at several key points in the process (steps 7, 19, 30, 37, 40, for example). The complete *Guide* is given in Table 4-1.

Central Arizona's Project Development Process

The Central Arizona Coordinating Committee (CACC) in Phoenix was formed in 1985 to address a regional need for improved coordination and communication among government agencies, utilities, and contractors involved in public improvement projects. The CACC promotes improved policies and practices for facilities located in the ROW and easements both public and private in the central Arizona area. Members of the committee represent

government agencies, utilities, and other organizations with interest in public ROW activity.

The CACC developed a public improvement project guide that describes a typical project life cycle to maximize communication and coordination among agencies involved in such projects. Figure 3-2 displays the flowchart for this coordination process. The chart denotes milestone events in which important communication and coordination should take place. The CACC's process promotes early, frequent, and active communication among participants.

Early Utility Involvement

Responses to a 1992 survey of SHA's by the International Right-of-Way Association (IRWA) indicate that most States believe they involve utilities in the early stages of developing highway construction plans. However, the States varied as to specific phases during which they involved utilities. States reported utilities were first involved in the following phases: at the project concept level, pre-environmental, preliminary line and grade inspection, preliminary design, approval of ROW plans, and at either 10, 25, 50, or 60 percent completion of design. Utah, for example, meets with utilities on major projects to develop the project concept. In Rhode Island, conceptual design plans (10 percent of design) are mailed to all utility companies potentially affected by the project.

Differences Between State and Local Highway Agencies

Highway improvement projects may be initiated and implemented by SHA's or local (municipality or county) public works or highway departments. SHA's have more specialized departments and personnel to aid in the highway project development process than local departments. SHA's regularly develop highway construction programs, plan utility coordination meetings, and phase submission of plans (for example, plans may be distributed to utilities for review when they are 30 percent complete, 60 percent complete, or 90 percent complete). SHA's also have specialized personnel such as utility engineers to deal with utility related matters.

Local agencies have smaller organizational structures, with possibly one staff person responsible for several different aspects or phases of a project. Except for urbanized areas with an established transportation planning process, local departments may not have project plans that extend beyond a couple of years. Usually the local agency does not have a utility engineer or a regular process for incorporating utilities into the project development effort. Many times, only final plans are prepared and distributed with no opportunity for utility review of preliminary design plans.

The lack of local resources to deal with utilities and ROW issues is compounded by the limited ROW typically found in urban areas. In addition, traffic congestion and intensively developed areas add constraints and urgency to any disruption of the roadway.

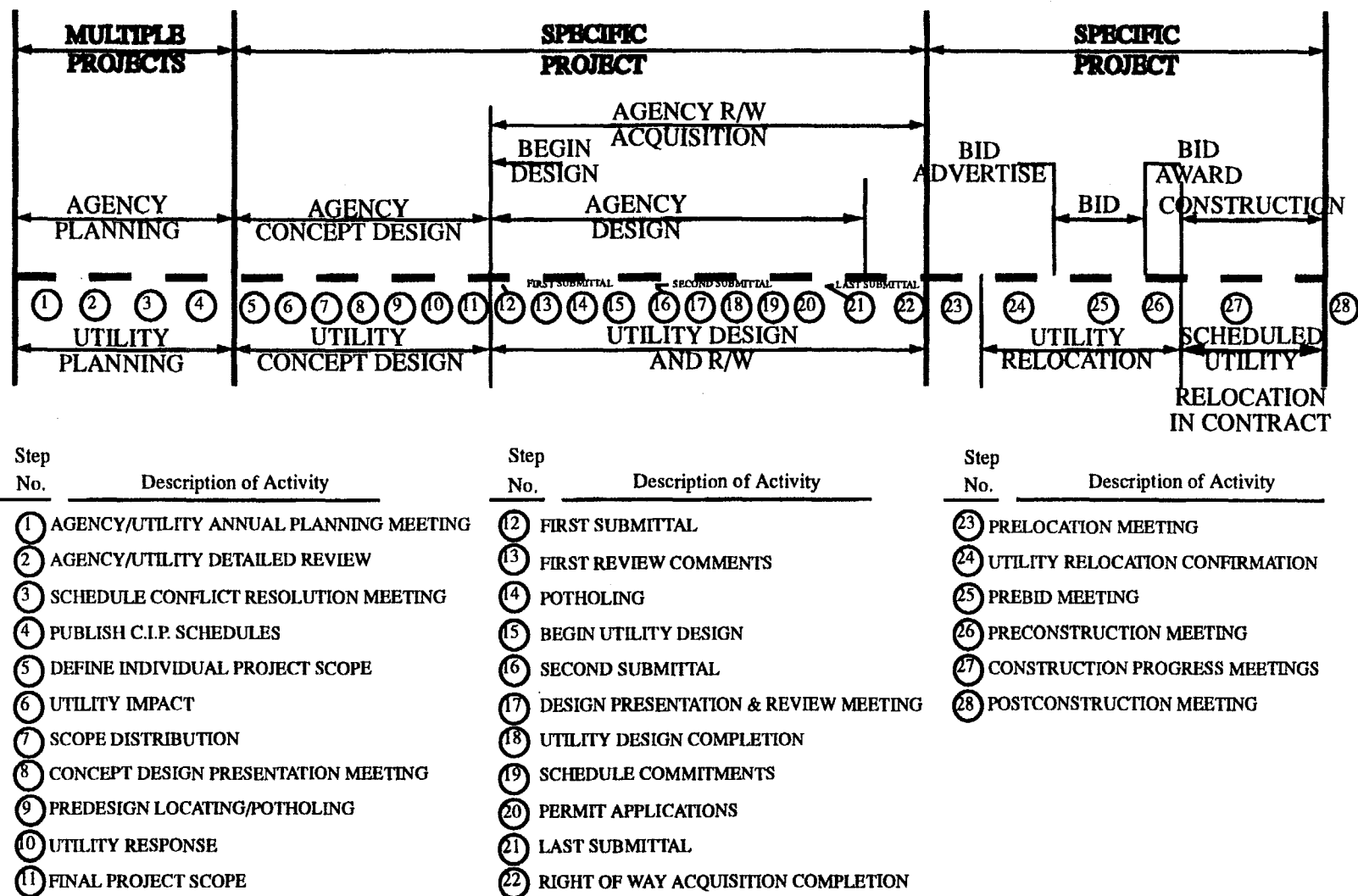


Figure 3-2. Arizona Public Improvement Project Model

Source: Central Arizona Coordinating Committee, Public Improvement Project Guide.

UTILITY CONSIDERATIONS IN HIGHWAY PLANNING

It is in the public interest for utility facilities to use the ROW of public roads and streets when such use and occupancy does not interfere with the primary purpose of the highway. Joint use of the ROW avoids the additional cost of acquiring separate ROW for the exclusive accommodation of utilities. Highway ROW, particularly local roads and streets, is thus used to provide public services to abutting residents as well as to serve conventional highway needs. Because utilities in the ROW are not owned or operated directly by state or local highway agencies, these authorities have developed policies and practices to govern when and how the public ROW is used.

FEDERAL HIGHWAY ADMINISTRATION REQUIREMENTS

The FHWA's authority for allowing utility use and occupancy of the ROW of Federal-aid and direct Federal highway projects is contained in 23 CFR 123. Under this section, the State must acquire ROW that is adequate not only for the construction of the highway facility, but also for its operation and maintenance. The ROW must be devoted exclusively to public highway purposes. However, this section of the CFR also allows certain nonhighway uses of the ROW that are found to be in the public interest, provided they do not interfere with the free and safe flow of traffic.

When a state intends to permit a utility to use and occupy public highway ROW, consideration should be given to determining the adequacy of the ROW for the project. It is common practice in urban areas to acquire a border strip behind the curbs for sidewalks and utilities. These border strips, as well as the roadside on rural sections, provide space for

necessary road construction, drainage, road maintenance activities, and clear recovery areas for vehicles that may run off the roadway.

Federal-aid funding of additional ROW for utilities is not mandated. Consideration is given to obtaining sufficient multiple purpose ROW when possible to insure that all the planned ROW uses are reasonably compatible and highway interests are adequately provided for and protected. When unique utility installations warrant additional space solely for their use, they are best handled under a joint development concept with the benefiting parties sharing costs.

Generally, utility relocation is funded either as a separate project or as an element of the ROW or construction phase of the highway improvement. Additionally, preliminary engineering work and other related preparatory work done by or under the direction of a utility may be programmed and authorized as:

- (1) an expense incidental to the cost of relocation;
- (2) as part of the preliminary engineering phase of the overall highway project; or
- (3) as a separate utility relocation project.

Replacement ROW to be acquired by or on behalf of a utility may also be programmed and authorized either as an expense incidental to the cost of relocation, as part of the ROW acquisition project as a whole, or as a separate utility relocation project.

LOCATION AND DESIGN ISSUES

The American Association of State Highway and Transportation Officials publication, *A Guide for*

Accommodating Utilities within Highway Right-of-Way includes some general considerations for the location and design of utility installations within the highway ROW, including:

- locating utility lines to minimize later adjustment;
- placing utility lines to permit servicing with minimum interference to highway traffic;
- installing longitudinal facilities on a uniform alignment close to the right-of-way line; and
- placing utility line crossings on a line generally normal to the highway alignment.

The AASHTO publication also notes that horizontal and vertical alignment of utility lines should conform with clear roadside policy, and that the location of above ground facilities should be consistent with clearances applicable to all roadside obstacles for that type of highway. Consideration should be given to measures necessary to protect and preserve the integrity, visual quality, maintenance efficiency, and safety of the highway.

UTILITY PLANNING

Utilities' planning efforts are more diverse than those of highway agencies. There are many different types of utilities private, public, and quasi-public. Some involve major facilities buried relatively deep; some are thin cables plowed into the ground; and some are placed overhead. Appropriate levels of planning vary with each of these conditions.

CURRENT AND LONG-RANGE PLANS

Utility planning generally consists of both long-range and current plans. These plans are based on present needs and projected demands to satisfy customer requirements.

Long-range plans typically specify the location and characteristics of new facilities but do not include design at the level required for construction. These plans are subject to change and cancellation as determined by changes in community development, company policies, and

demand. Long-range plans are updated annually or at more frequent intervals.

Current or short-term planning is usually at the level of detail for construction engineering of installations in the current year and the following year. These projects will be developed to a level ready for installation. The utility then commits funding and begins project scheduling for installing a facility.

Utility planning examines:

- estimates of present and future demand;
- operating characteristics of the system, such as minimum delivery pressure;
- availability of ROW;
- physical barriers such as rivers, railroads, expressways and ravines; and
- safety considerations and company design policies.

Alternative proposals may be evaluated to determine the most efficient and cost-effective method to deliver service.

Utility planning efforts may depend on the type of service and geographic area. Public water distribution and sanitary sewerage systems are typically governmental responsibilities, while natural gas, electricity, telephone and cable television (CATV) are provided by the private sector in most areas. Utilities requiring extensive capital facilities to deliver a service, such as gas or electric, invest more effort in planning the location and characteristics of the system. Utilities that are more easily placed, such as CATV and telecommunications, may not involve elaborate planning programs to locate facilities.

PLANNING OVERSIGHT

The review and approval of major utility installations is typically done through a branch of State government that regulates utility activity. State public service commissions review utility plans developed and submitted by utilities in that State and decide whether to license new facilities. State authorities, such as public service commissions, may specify planning requirements and guidelines for utility companies. For example, Wisconsin law requires that utilities make 20-year estimates of electricity demand for their service area. This law considers that it can take from 8 to 15 years to plan and build a large power plant, and from 3 to 10 years to plan and build a major expansion of a transmission line.

PLANNING PERIODS

Most community plans are prepared for planning periods ranging from 20 to 25 years. The expected life of many utility facilities is often

much longer than 20 years, and some of these may be designed for 50 years or more. As a result, utility planners and designers are concerned with growth and capacity needs substantially beyond normal planning horizons. A common approach is to plan the utility system anticipating full development of the area, if that assumption appears reasonable and consistent with the long-range community plan. For some underground facilities, it is economical to provide extra capacity to allow for future growth. If capacity can be added relatively easily, shorter utility planning periods may be appropriate and cost-effective.

LAND USE IMPACTS

The decisions of the planning commission, zoning board, building code officials, and public works officials can significantly, and often adversely, affect utility agencies. Changes in land use density can tax existing utility plant capabilities. The approval of leapfrog subdivisions not adjacent to existing utility facilities can require the extension of the utility plant and leave utility officials with the problem of estimating the ultimate extent and timing of the loading of their facilities during the development stage. Vacating street ROW's without consideration for the utilities within those ROW's may force utility companies into buying back an easement or relocating their facilities. Street ROW widths planned without regard to utility space needs may force utilities into undesirable locations.

Street realignments, widenings, and grade changes may require the relocation of existing utility facilities. Poorly coordinated street resurfacing projects can disrupt independently developed utility construction and maintenance plans or result in cutting newly surfaced streets. Granting street encroachment permits to building owners to allow them to expand basements, parking garages, vaults, stairwells,

or other building appurtenances into the subsurface space beneath sidewalks or into the roadway area can take valuable space from the utilities needing those alignments. Figure 3-3 lists a range of methods for improving the

interaction between utility and community planning. These methods may help avoid some of the difficulties that can result from lack of coordination.

- Establish liaisons among planning and zoning boards, commissions, and all publicly and privately owned utilities.
- Route requests for zoning changes, subdivision approvals, annexations, street improvements, building encroachments, etc., through utility coordinating committees (or individual utilities) for comment before governmental action.
- Develop utility plans concurrently with overall community plans.
- Incorporate utility plans into the comprehensive plan.
- Program public improvement projects (street improvements, urban renewal, municipal utility projects, etc.) cooperatively with privately owned utilities.
- Develop ROW standards with consideration of utilities.
- Investigate the applicability of common duct or tunnel systems for placing utilities.
- Develop policies on designing, staging, and financing utility facilities that consider ultimate service demand and cost-effectiveness.
- Use major reconstruction projects to improve the arrangement and accommodation of utilities in existing street ROW.

Figure 3-3. Methods to Integrate Utility and Community Planning.

ENVIRONMENTAL PROCESSES AND ISSUES

Individual projects, whether proposed by governmental agencies, private utilities, or developers, are screened to determine adverse environmental impacts. If these preliminary studies indicate that significant adverse impacts may occur, then more detailed and extensive environmental studies are done. The scope and requirements of the environmental studies depend on the nature of the project, applicable State and local laws, and Federal regulations.

A clearly defined structure has been developed in the United States to examine and consider the environmental impacts of major projects. A number of Federal laws identify what must be done to assess the environmental impacts of federally funded transportation facilities.

The FHWA has adopted an Environmental Policy Statement to ensure that measures are taken to minimize the adverse environmental

effects of transportation construction activities. Many states also have laws governing environmental quality and project evaluations.

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) requires that laws, regulations, and procedures be interpreted in a manner consistent with environmental protection objectives. The level of detail at which a project must be examined for environmental impacts depends on the scope of the project and the likelihood of significant environmental impacts. If a roadway project is federally funded and the level of impacts are unclear, an environmental assessment (EA) is prepared. The EA is a relatively concise examination of the expected impacts of the project and is used to determine whether more extensive examination is required.

If the EA shows significant environmental impact, more work is done to prepare an environmental impact statement (EIS). If the EA concludes that there are no anticipated significant impacts, then a finding of no significant impact (FONSI) is prepared. Federal guidelines for preparing an EA, EIS, and FONSI detail the issues that are to be studied. They include noise, air pollution, water pollution, solid waste pollution, effects on surrounding land use, ecological factors, resource usage, historical and cultural area effects, and economic impact. Figure 3-4 summarizes the issues to be considered in preparing an EIS.

ENVIRONMENTAL ISSUES IN THE RIGHT-OF-WAY

Environmental issues increasingly arise in highway projects. Some are obvious, such as

effects on air quality, farmlands, or wildlife habitats. Others are somewhat hidden, such as underground storage tanks or potentially hazardous materials like asbestos. Treatment of wetland areas is also an issue that is increasingly affecting the development of highway and utility systems.

Underground storage tanks have become a major concern in recent years. A highway department may acquire ROW for a road project and uncover abandoned underground storage tanks. This unexpected liability may create significant additional expenses in the project because these tanks require special treatment for proper disposal. It is often more effective for the highway department to identify and negotiate the remediation of these sites before property acquisition.

The FHWA Environmental Policy Statement calls for environmental considerations to be accorded sensitive treatment early in the project development process. Efforts to protect and enhance the environment must extend throughout all phases of project development, including location, design, construction, maintenance, and operations. It is FHWA policy to use the NEPA process as a framework for project decisionmaking, taking all relevant environmental requirements of law and policy into account in reaching conclusions that reflect the public interest.

The agency developing a highway project should provide available information regarding environmental issues or archaeological or paleontological sites within the ROW to a utility when it considers placing, relocating, or rehabilitating facilities within the ROW. This information should also be shared with utilities whenever plans are provided for a highway improvement project.

Notice of Intent	
Early Coordination	
Scoping	
Lead Agency — Field Review	
Format:	
Cover Sheet	
Summary	
Table of Contents	
Purpose and Need:	Discuss demand, safety, growth, system linkage, transportation plans.
Alternatives:	Include description of the “no build” alternative.
Affected Environment:	Existing setting, social, economic, environmentally sensitive features.
Environmental Consequences:	Visual, social, economic, relocation needs, land use, wilderness, air, noise, water, wetlands, floodplains, historic properties, Section 4(f) requirements, farmlands.
List of Preparers	
EIS Distribution	
Comments and Coordination	
Index	
Appendices	

Figure 3-4. NEPA Environmental Document Outline.

RIGHT-OF-WAY PLANNING

ROW needs must be considered in placing new facilities or expanding existing highway or utility facilities. Dealing in real estate is not an activity usually associated with highway or utility engineers, but these personnel are well positioned to determine exactly how much ROW is needed for a new facility, as well as what compromises can be made in ROW acquisition without adversely affecting the safe and efficient operations of the system after construction.

Real estate acquisition requires knowledge and skills in areas such as real estate law, title insurance, legal descriptions, appraisal, real estate closing practices, condemnation law, and Federal and State procedures relating to ROW acquisition and relocation. Personnel responsible for public works projects and placement of

facilities must have an effective program for acquiring ROW.

WHO ACQUIRES PROPERTY?

The SHA or responsible local agency typically acquires all properties and ROW needed for construction of a highway improvement and for the relocation of families, individuals, businesses, and nonprofit organizations potentially displaced by the project. If Federal funds are involved, acquisition of the needed ROW has normally begun after the design engineering work is completed and location and design approvals have been obtained from the FHWA.

Federal and State laws and regulations ensure all affected property owners receive fair

compensation for the properties needed and that all persons are treated fairly and equally. For federally funded projects, property acquisition should conform with provisions of the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, Public Laws 91-646 and 100-17, and the current Code of Federal Regulations, Titles 23 and 49.

ROW acquisition requires early knowledge of the exact route of the proposed facility. The various potential problems on the proposed route are then investigated. These problems include determination of property ownership, environmental concerns, archaeological concerns, highway permitting, river and stream crossings, and railroad crossings.

ROW acquisition consists of two phases: engineering and services. The engineering phase includes abstracting or title search, preparation of final ROW plans, preparation of individual plats for each parcel, description of each acquisition, and ROW stake-out. ROW services cover the actual acquisition of land, including appraisals, written offers, and negotiations. If Federal funds are used to acquire ROW, additional steps may be included for appraisal problem analysis.

TIME REQUIRED FOR ACQUISITION

On a large State highway project, an average of eight years is spent from the inception of the project to completion of construction. Two years may be spent in project planning, two years for preliminary engineering, two years for ROW engineering and services, and two years for construction. On local highway or bridge projects, the project schedule may be reduced depending on the amount of ROW required and availability of personnel or qualified consultants. The minimum time involved in acquisition of ROW is 6 months, as illustrated in Figure 3-5.

This minimum does not allow for relocation of any residents or condemnations that would automatically add approximately 90 days to the schedule. Federal law requires at least 90-days' written notice to vacate property.

Each agency has procedures for land acquisition, and the time required to go through the process typically depends on the scale and complexity (e.g., number of parcels, condemnation) of each project. Adequate time must be allocated in the project schedule for acquiring ROW.

Right-Of-Way Engineering	60 days
Review by State highway agency	30 days
Right-Of-Way Services	
Appraising	30 days
Review Appraising	10 days
Buying	10 days
Owners Decision Time	25 days
Review of Right-Of-Way by State	7 days
Certification of FHWA, etc.	7 days
TOTAL	179 days (six months)

Figure 3-5. Project Right-of-Way Acquisition.
Source: Indiana Department of Highways.

HOW MUCH RIGHT-OF-WAY IS NEEDED?

ROW widths used in urban areas depend on the land costs, topography, traffic (vehicle, pedestrian, and transit), street geometrics selected, and land use characteristics. In many municipalities, planning regulations and ordinances specify the desired ROW for various classes of streets. This is particularly true for new residential subdivisions. A balance must be struck between providing adequate land for all present and future uses of the ROW and taking too much land. In developed areas, the sum of individual components of the roadway (travel lanes, medians, curbs and gutters, and sidewalks) must typically fit within the available

ROW. Acquisition of additional ROW can be very expensive and time-consuming.

In less developed areas, the components of the proposed road improvement can simply be added together to identify the needed ROW that may be more readily available. Typical ranges for the amount of ROW needed for different facility types are indicated in Figure 3-6. Many areas have narrower ROW's than the ranges shown because of abutting land uses, historical development patterns, or facility design.

EARLY ACQUISITION

Early acquisition of ROW can yield many benefits for the highway agency and community. Neighborhood and social problems can be minimized when the ROW for a proposed roadway is acquired prior to construction. Having the ROW reserved helps the community implement its comprehensive plan. It also reduces the cost of implementing the road improvement if the necessary land is obtained in advance of extensive development and improvements in the area. The negative aspects of early ROW acquisition include removing land from tax rolls for a longer period of time and investing limited public monies in land acquisition for future projects.

It is desirable to determine the requirements for acquisition of ROW for utility relocation as early as possible in the planning process. Consideration should be given to the use of ROW by more than one utility in a designated area outside the planned highway corridor. Development of a separate utility corridor may sometimes be in the best interest of the highway agency and the affected utilities. ROW acquisition activities must also balance the need for acquiring property with public relations.

LIBERAL ACQUISITION

The FHWA has determined that it is in the public interest for utility facilities to jointly use the ROW of public roads and streets when such use and occupancy does not interfere with the primary purposes of the highway. Thus, if utilities are to be located in the public highway ROW, they must be provided for in a manner that ensures the safe operation of the roadway.

When a State or locality routinely dedicates or permits a portion of the road and street ROW for use by utilities pursuant to State law, ordinance, or administrative practice, the ROW may be considered eligible for Federal-aid reimbursement as an integral part of the project ROW. Federal-aid highway funds are not

Arterials	80 – 130 feet:	Minimum width provides four travel lanes and minimal border areas.
Collector	60 – 80 feet:	Maximum width provides six lanes plus median and parking. Minimum width provides two travel lanes with turn lanes at intersections and parking.
Local	50 – 70 feet:	Maximum width provides four travel lanes plus median. Minimum width provides two travel lanes, with parking and minimal border areas.
Maximum width allows possible conversion to four travel lanes.		
1 m = 3.28 feet		

Figure 3-6. Typical Right-of-Way Widths.

Source: Derived from FHWA Design of Urban Streets training material.

eligible for use in acquiring ROW solely to accommodate utility facilities in excess of that normally acquired in accordance with standard criteria and procedures. Federal funds may be used if the ROW acquired is also needed for a highway purpose such as clear zone, drainage, construction, or maintenance.

Standard cross-sections are used in many communities to define the required ROW and allocation of space. A standard cross-section can facilitate utility coordination and damage prevention. Utility companies, public works personnel, and excavators can better anticipate and plan for the location of utilities with a standard model. Of course, the cross-section is not a substitute for actual field location of

underground facilities prior to excavation, but it can eliminate a lot of uncertainty in the early planning stages of a project. The use of a standard cross-section is also beneficial for showing that arbitrary decisions are not being made to include space in the ROW just for utilities. Figure 3-7 provides an example of a standard cross-section for a local street.

While planning for ROW requirements, consideration should be given to future activities in the area. If a standard cross-section allocates space for a utility that may not be installed in the immediate future, it may be reasonable to include and plan for the placement of this utility within the ROW acquisition.

JOINT PLANNING

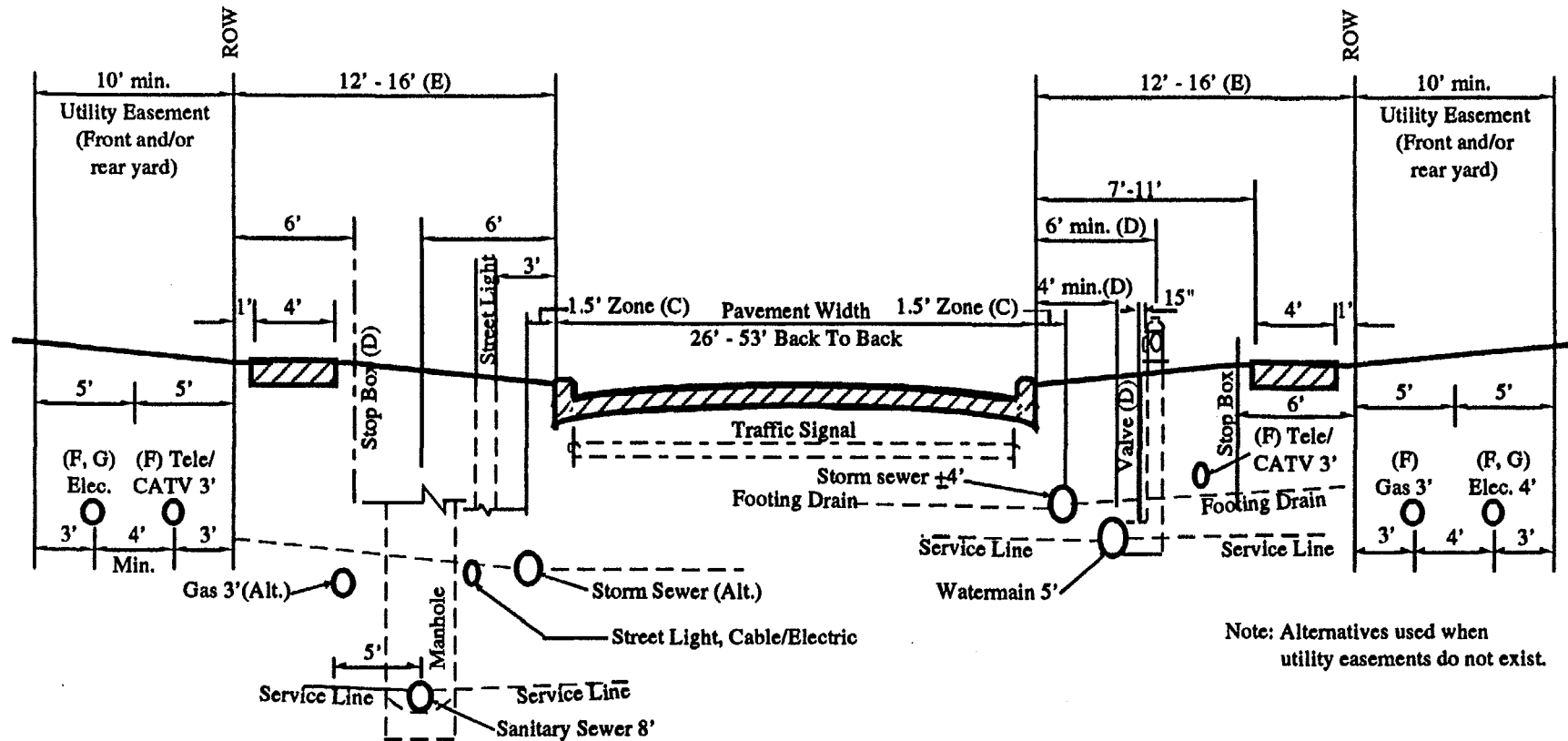
Highway agencies engaging in project development work are bound to encounter problems relocating existing utility facilities in the public ROW. Many of these problems are generated by poor communication and coordination efforts. Some of the complications that can result from lack of coordination or joint planning are:

- insufficient time for the utility to perform relocation design;
- slowness of utilities in performing their relocations;
- shifting project and utility schedules or priorities;
- project or utility plans with omissions or errors;
- late changes to plans;
- agency or utility change of policies without adequate notification; and
- lack of utility 3 to 5 year capital improvement plans.

These complications lead to substantial undesired costs, project construction delays, unsafe conditions, and difficult working relationships.

A comprehensive approach to infrastructure planning has been hindered partly by the varying institutional structures and operating policies of public and private utilities and highway agencies. With some utilities developed as a government service and others as private enterprises, different approaches have evolved for planning and operating these systems.

Public water supply and sewer and drainage systems were the first utilities to be installed in communities and became government-operated enterprises. Telephone, telegraphs, and electric supply systems followed as private or investor-owned utility services. These newer utility services were granted franchises to operate within communities and, although bound by certain restrictions, were left to plan and develop systems for providing their services as private



GENERAL NOTES:

(A) ROW width varies (see Design Standards).

(B) Unless otherwise approved, the following apply to utilities in the ROW:

1. Utilities are normally buried. When overhead utilities are allowed and cross the roadway, the minimum vertical clearance for main cable is 20 feet and service cable is 18 feet.

2. Telephone, cable TV and water are on east and south side of road

3. Gas, electric and sanitary sewer are on west and north side of road

(C) Storm Sewers: Normal clearance for intake is 1.5' from back of curb. When combination manholes and intakes are used, clearance increases to 5'.

(D) Watermains, Valves and Hydrants. Normal watermain location is 4' back of curb. For combination manholes and intakes, this distance will increase to a minimum of 6'. For local streets and minor collectors with limited ROW, use a 6" 90° anchoring elbow to

eliminate the coupling between the anchoring tee and valve. For maintenance purposes, the min. distance between centerline of valve box to face of hydrant must be 15". Stop boxes should be located 1' from ROW line in areas without sidewalks.

(E) Parking Area Widths. Varies by roadway classification (see Design Standards). Jurisdiction may require wider parking area for future widening.

(F) Utility Easements - Telephone, Fiber Optics, Cable T.V., Electric and Gas Lines:

Located in front or rear yard easements on local and minor collector routes. For major collectors and arterials, they may be placed in ROW upon approval of the Jurisdiction. Normally, telephone and cable T.V. lines are placed in rear yards; fiber optics, electrical lines and gas lines in front yards. Placement of electric lines in rear yards depends on transformer locations and requires approval of the electric company and Jurisdiction.

(G) Electric Recommended bury for electric cable is 4'. Minimum bury for electric lines is per the National Electric Safety Code.

Figure 3-7: Sample Typical Section for Local Street.
Source: Patterned after Des Moines Metropolitan Design Standards

Note: 1 m = 3.28 ft

entrepreneurial enterprises. As communities evolved, utility planners generally proceeded with minimal interaction with government planners.

WHY PLAN TOGETHER?

Joint planning among utilities, municipalities, State highway agencies, and other entities involved in the public ROW should seek to maximize the use of the ROW and eliminate unnecessary or untimely excavations of streets, roads, and highways. It's a story cited so often that it is almost a cliché, but one example of the annoying and costly results of lack of joint planning is a newly paved street that is cut open to access and repair underground utilities. Perhaps the water company needs to replace a main line or lateral connections, or the gas company is upgrading its network. Unfortunately, this worthwhile work is often not scheduled until after a street is resurfaced. Early communication between the parties in the ROW and exchange of plans and programs can prevent this costly mismatch of schedules. Everyone benefits if the utility can perform needed maintenance and capitalization of its facilities before the most visible work—repaving—is done.

JOINT USE OF RIGHT-OF-WAY

A 1989 survey by the American Public Works Association of 2,400 public works officials in the United States and Canada indicated that coordination of joint use of street ROW by utilities was one of the most widely adopted good municipal engineering practices. This practice was adopted by 78 percent of the respondents from municipalities with populations of more than 250,000 and by 52 percent of the municipalities with populations under 10,000.

The survey results indicated that coordinating the joint use of ROW by utilities had the highest degree of interest among respondents.

Joint use of aerial utility poles by two or more utility types (e.g., power, telephone, telegraph, CATV) is widely practiced to cut costs and minimize street clutter. Joint trenching is not so widespread. Only 22 percent of municipalities responding to an APWA survey reported combining two or more utilities in a common trench. The most common joint trench combination places water and sewer lines in the same trench when sanitation hazards will not result. The second most common joint trench includes primary and secondary electrical and gas lines.

Joint use of ROW by utilities minimizes the amount of land required for all utilities and leads to potential cost savings. In San Diego, California, joint trenches are used for gas lines, primary and secondary electrical lines, and occasionally other utilities such as CATV, fire and police communication cables, street lights, and other electrical lines.

Joint Trenching

Development of the joint trenching concept began in the early 1970's. Continued urbanization, residential and commercial construction, population growth, increased demands for utility services, and the advent of new utility services increased congestion of underground utility placement. Increases in accidental utility excavation, crowding of sub-surface space, haphazard location of many old utility lines, and lack of reliable underground utility information led many government agencies to develop joint trenching procedures and practices to alleviate these problems and provide for more efficient and orderly use of space. Costs of joint utility trenches can be much lower than separate trenches, particularly for previously undeveloped

sites. Fewer excavation accidents occur when utility location is clearly identified.

The Gas Research Institute (GRI) is working on a project to develop, test, and commercialize a system for common burial of multiple utility lines to reduce cost, improve facilities management, and enhance operations. A survey conducted by the GRI indicated that 75 percent of combined gas and electric utilities perform common placement of utilities, while slightly over 20 percent of gas only utilities participate in common trenching. Approximately 17 percent of new gas mains and 10 percent of new gas services were placed in common trenches. A significant portion of electric, telephone, and CATV installations are placed in common trenches. Figure 3-8 provides one example of common placement of utilities in a single trench.

The GRI study indicated that common utility placement caused no increase in the number or severity of incidents. It reduced accidental digs into buried utility facilities, although there were some safety concerns related to thermal effects and high current discharges on gas facilities. Figure 3-9 presents some of the advantages and disadvantages associated with common utility placement.

Regulations affect common placement. Federal regulations apply to natural gas installations and contain no specific provisions for common placement. Electric and communication facilities are installed in accordance with the ANSI National Electrical Safety Code. A number of States require underground residential electric and telecommunications distribution, but none require that natural gas facilities be included in the trench. Municipal regulations tend to affect locations of utility easements, breaking of pavement, and design of road crossings. Additional communication and greater utility-municipal cooperation could streamline adoption of common utility placement. Advancing common utility placement comes down to resolving basic issues such as

safety, coordination, quality of construction, economics, and competition.

ALTERNATIVES ANALYSIS

Joint planning of projects can identify better alternatives. Working together to accomplish the overall goals of a project may enable the highway agency and the utility company to derive a better solution than each would have discovered separately. For example, by comparing each other's project objectives and constraints, the design staffs may find that the use of trenchless technology to place underground utilities will work to everyone's benefit. Or they may find that the utility system will need to be expanded in a few years, and it would be cost-effective to acquire additional ROW now, rather than later.

Joint planning among utilities, municipalities, state highway departments, and any other entities involved in highway ROW should be standard operating procedure to maximize the use of ROW, eliminate unnecessary relocations and excavations, and avoid undue delays in project implementation.

NEED TO COORDINATE

Lack of coordination is a major impediment to adoption of common utility placement. Coordination requires support of company management and engineering staffs. One of the principal problems concerns timing of construction activities with common placement, that is, which utility places its facilities first, second, and so forth.

Common utility placement requires interaction among utilities in obtaining easements and installing and maintaining distribution systems. Enhanced coordination among these groups and public works departments should

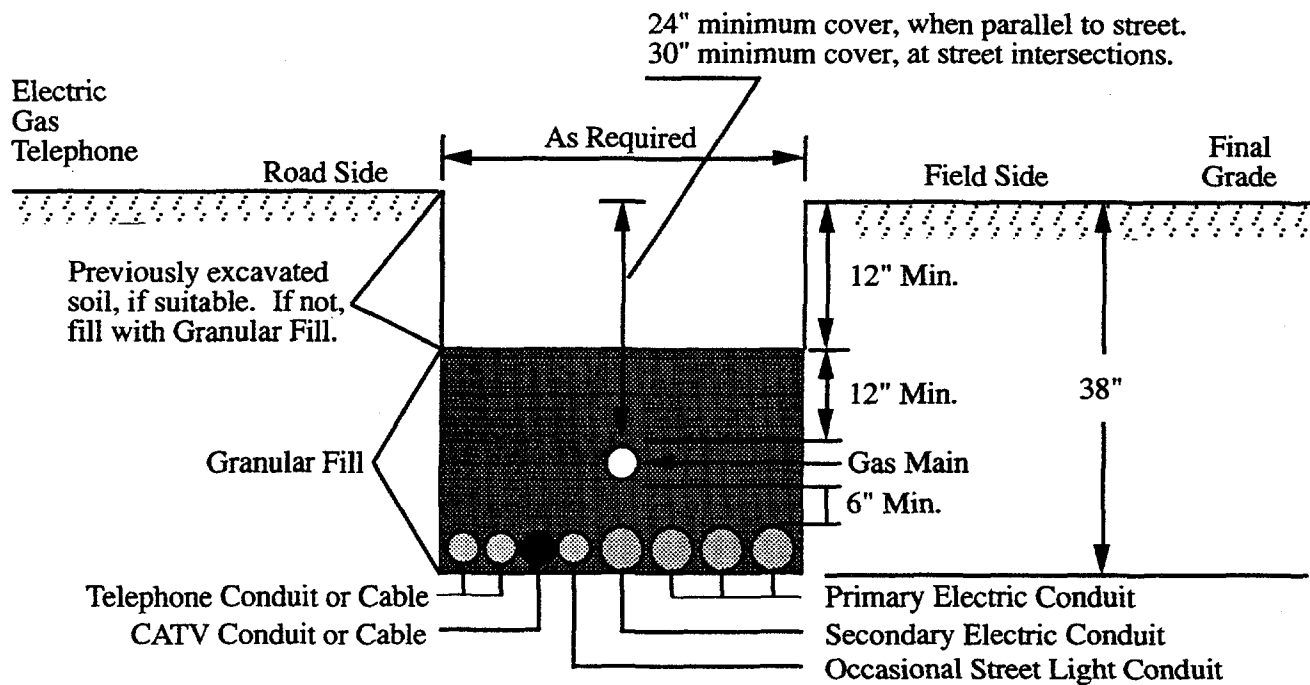


Figure 3-8. Typical Joint Electric, Gas, Telephone, and CATV Installation.

Source: Cincinnati Bell Telephone Company.

Note: 1 m = 3.28 ft.

25 mm = 1 inch

Advantages

- Reduces construction costs.
- Limits construction conflicts.
- Reduces incidents of dig-ins or hit lines.
- Improves aesthetics from integrated, standardized designs.
- Increases cooperation and awareness among utilities.
- Induces higher level of customer satisfaction.
- Enhances control of developers and site contractors.

Disadvantages

- Increases potential for electricity to act as source of ignition of gas.
- Reduces scheduling and monitoring control of construction.
- Increases perceived difficulty of repair and maintenance.
- Requires cumbersome interutility bookkeeping.

Figure 3-9. Advantages and Disadvantages of Common Utility Placement.

lead to cost savings, improved safety, and less community disruption from utility work. Improved communications is one way to establish more cooperative placement programs.

The power and telephone utilities in Cincinnati, Ohio, developed an approach to two-way joint trenching in 1988 that succeeded in overcoming most joint construction coordination problems. The utilities standardized construction operating procedures and agreed to adhere to a standard approach to trench routing based on the most critical needs of either party. To resolve problems with construction timing the two utilities agreed to rely on a single source for all construction excavation and placing activities for any given project. Thus, the joint planning and coordination problems often cited as impediments to successful joint trenching were overcome. This joint trenching agreement has provided more efficient use of the ROW and substantial cost savings. In 1992, this same basic approach was used to include gas, power, telephone, and CATV in a common trench.

COORDINATION MECHANISMS

Coordination is a term so commonly used in highway and utility projects that its meaning can become diluted or confused. Coordination or the active effort to share information and interact productively with others should occur in all phases of the development of a project. Benefits from coordination can be found during each phase (planning, design, preliminary engineering, construction, operation and maintenance). Effective coordination during construction begins with better coordination prior to construction.

KNOWING THE PLAYERS

Coordination between highway agencies and utilities (and among utilities) may begin with public relations efforts. Knowing the other people involved in utility and highway programs goes a long way toward resolving potential conflicts. Getting to know the other people who have an interest in the public ROW may be as simple as attending meetings of local contractors' associations, various professional development associations, or related groups.

Most states and many larger metropolitan areas have a number of statewide or local meetings to bring personnel together from highway agencies, contractors, and utilities. These may be State transportation conferences sponsored by the SHA; luncheon or dinner meetings of professional development organizations such as the American Public Works Association, International Right-of-Way Association, or American Society of Civil Engineers; or special events for individuals who work in public ROW. Becoming aware of the other players in the game makes it easier to share information that may lead to improved project coordination.

NOTIFICATION OF CHANGES IN PLANS

Coordination should not end when the project begins. Open and continuous exchange between the government agency staff and utility company staff throughout the project will help avoid surprises in the field and the accounting office. As field operations begin, utility and highway personnel should stay in close communication to deal with unexpected conditions and necessary field changes.

UTILITY COORDINATION FOR ALL

Utility coordination efforts, such as formation of utility location coordinating committees, are not directed only at private utilities. Public works departments, utilities operated by public agencies, private utilities, engineering firms, and basically anyone with facilities in the ROW should be part of a cooperative coordination program. Compatible and safe use of the ROW by all interested parties is the underlying concern of public officials.

Coordination committees or councils operate in a number of communities to promote project

coordination. Typical problems addressed by coordination councils include utility excavations in newly paved roads, disruption of essential utility services, injuries caused by inadvertent severing of utility facilities, location of utility poles, and environmental impacts of damaged facilities.

In the absence of formal utility coordination councils, planners from governmental agencies and utility companies should regularly meet and discuss future plans. These groups can easily arrange informal meetings without formal structures or bylaws.

The following examples should provide an idea of how successful coordination councils work.

Los Angeles Substructure Committee

In Los Angeles, California, the Substructure Committee meets monthly to review issues related to highways and utilities and to share information on specific projects. Participants include representatives from city agencies such as Contract Administration, Engineering, General Services, Street Lighting, Transportation, Water and Power; county agencies such as Public Works and Sanitation District; and utilities such as telephone, CATV, and the gas company.

The committee conducts business with agenda items including minutes of prior meetings, treasurer's report, project status reports, reports from related organizations, one-call centers, and subcommittees and new business. The monthly substructure reports distributed for these meetings list individual construction projects of each agency. Agenda topics may also cover permit requirements and procedures or new technology and methods. The Substructure Committee was formed in 1926.

Indianapolis Public Works Coordinating Council

In Indianapolis, Indiana, a Public Works Coordinating Council meets monthly. Member agencies include Indiana Contractors Incorporated, the Indiana Department of Transportation, Indianapolis Power and Light, Citizens Gas, Indiana Bell Telephone, Indianapolis Water Company, Northern Indiana Public Service Company, American CableVision, and local government departments such as Transportation, METRO (transit service), Public Works, Parks and Recreation, and the Surveyor's Office. Members of the committee report on the status of proposed projects as well as those under construction. Agenda items may also cover permit requirements and changes in agency procedures.

The Albuquerque Utility Council

In Albuquerque, New Mexico, representatives of the city and the gas, telephone, and power companies set up the Albuquerque Utility Council to enhance communication and coordination. The Utility Council convenes a biannual construction coordinating planning session in which each member (gas, telephone, power, water, sewer, storm drainage, major street construction, street maintenance, and CATV) place their projects for the next year on an overlay map. Participation by the governmental agencies in this process is mandatory for effective coordination.

The Albuquerque Utility Council has also:

- (1) started a call-before-you-dig program;
- (2) established a provision in State law requiring excavators to call for locates;
- (3) established utility street corridors;
- (4) initiated a requirement for utility review of summary plats;
- (5) initiated a requirement for locate numbers from the call-before-you-dig program prior to issuing excavation permits;
- (6) established criteria and approval for utility coordinator; and
- (7) established a requirement through franchise agreements that CATV companies become members of the utility council.

The Council has also developed a utility coordination agreement that has been adopted by the members. The agreement outlines the steps to be taken by city agencies and utility companies to coordinate programs during planning, design, and construction of infrastructure projects. In summary, the agreement provides that the city and utility companies exchange information on planned utility/infrastructure projects on a continual basis. Highway and street project design plans are sent to all utility companies for review and comment. Utility companies then comment within two weeks on the location of existing or planned utilities. For city projects with extensive utility concerns, a project coordination plan is prepared after project utility coordination meetings.

The utility coordination agreement notes that the goal of project coordination is to provide a means to properly plan, design, and construct projects by:

- avoiding utility conflicts during the design stage when possible;
- developing and evaluating innovative methods of resolving utility conflicts;
- identifying and planning the resolution of utility conflicts in advance of construction;

- determining responsibilities (including payment of costs and expenses) involved with affected participant utilities relocations;
- avoiding delays during project construction due to unresolved utility conflicts; and
- following up to ensure that all participants have performed their responsibilities.

One specific method of fostering project coordination is to require that, for projects planned for construction within the next 12 months, each party to the agreement provide others with the project name, location, synopsis of project work, schedule, and project manager's name and phone number.

Each party to the agreement develops implementation procedures to meet the objectives of the utility coordination agreement. The city's procedures outline steps to be taken during project planning, concept design, project design, and construction. Notably, these procedures require that all agencies' capital improvement project schedules be submitted quarterly and reviewed for potential schedule conflicts. Unique characteristics of projects are identified early in the concept design phase so that the project is not slowed down when the unique aspects show up later. Project layout maps are distributed to all parties to identify facilities. The utility may provide system maps instead of marking the project maps.

Field verification requirements are identified, both for horizontal and vertical location of underground facilities. For new or resurfaced roadways, all underground utility companies perform condition surveys of their facilities during early phases of design. Condition surveys include excavation and potholing at appropriate intervals. A concept design presentation meeting is held for each project involving utilities. All utilities and agencies

affected by the project participate and address potholing requirements—where, who performs, who pays—and joint use by utilities to minimize work activity on the project site.

Ft. Collins Early Planning / Coordination Process

Ft. Collins, Colorado, uses a construction location coordination sheet to exchange information about construction activity. The two-page summary is distributed to a broad cross-section of personnel from government agencies and utilities. The form contains a description of the project, approximate construction dates, and a map of the location. It also provides a space for the reviewer to make comments. The Ft. Collins Public Works Department also prepares a project directory that lists each engineering project, type of construction, project manager, and schedules for design, ROW acquisition, and construction.

San Diego Utility Agreement

Fifteen agencies and utilities in San Diego, California, have signed an agreement defining policies and procedures for working in public ROW in the City of San Diego. The *Manual of Administrative Practices for Utility Installations in the Public Rights-of-Way* was also adopted by the city council. The agreement requires that all utilities franchised by the city and operating in the public ROW maintain membership on the Utilities Coordination Committee. The committee reviews and makes recommendations on utility installations and operations within the public ROW.

Three standing subcommittees were formed to deal with specific issues. The Utility Planning Committee coordinates all street and utility construction projects; the Cathodic Protection Committee coordinates all cathodic protection

facilities and programs; and the Underground Conversion Committee develops, schedules, and coordinates all utility conversion projects. Among the matters addressed by the committees are utility locations within public ROW; preservation of ROW for future public services; coordination of project schedules; and laws, policies, and procedures to promote coordination of work in the public ROW.

The Boston Big Dig

Boston's \$5 billion Central Artery/Tunnel Project is the largest public highway improvement ever undertaken in the core of a densely populated American city. The utility relocations for this project are extensive and complex. Cooperation and communication among business leaders, government, and utility companies have been cited as the key to the success of the relocation program. The 29 miles of utility lines within the ROW lie at varying depths in a tangled maze and include wastewater pipes, storm drains, water mains, electric, gas, telephone, cable television, and steam lines. No less than 31 utility companies are affected.

Utility lines must be relocated to the sides of the alignment to construct the highway project. Dedicated utility corridors will be used for these relocations most of them outside the roadway alignment.

Experience proves that even the best plans can encounter surprises during construction. To handle the occasional but inevitable broken pipes and severed lines, the project is undertaking a risk assessment of potential utility disruptions. High-risk sectors, sites, and time periods are being identified. Preventive plans are required of each contractor during final design. Appropriate responses for large and small field situations will be developed.

A utilities maintenance plan is a tool used in the project to minimize both the disruption to

utility service and the potential for accidental service outages. The plan identifies and anticipates potential utility problems and ensures that preventive actions are implemented. The plan has three major components:

- (1) programs targeted toward prevention (measures to facilitate design and minimize service disruption of scheduled relocations and cross-overs);
- (2) incident management (quick response mechanisms and guidelines to address unanticipated and isolated disruptions); and
- (3) emergency response (procedures to effectively handle large-scale emergency situations caused by accidents or natural disasters).

Project and contractor staff run these programs with utility company participation. Training is included in all construction contracts to ensure that appropriate guidance is provided to field personnel on dealing with utilities.

Forums for Discussion

These and similar local coordination committees provide forums for discussion and resolution of issues affecting agencies working in the ROW. These issues may be general in nature, such as whether construction crews are required to have a copy of the permit on-site, or the implementation of holiday season restrictions on permits. These committees also deal with specific projects and allow the many agencies that have business in the ROW to meet and resolve potential conflicts. To facilitate the exchange of information, some communities incorporate the capital improvement programs of all agencies with infrastructure into one document or map. The advance of computerized mapping (AM/FM)

has facilitated the production of common maps showing planned projects.

Utility Coordination in Fairfax

Fairfax County, Virginia, has aggressively fostered coordination of utilities in projects for many years. The Public Works Department involves the 12 or more utilities in the county in the implementation of its Capital Improvement Program. Figure 3-10 displays a process for active participation of utilities in the development of public works projects. Obtaining advance information on underground utilities provides a more complete and workable project. It also helps avoid damage to underground utilities. It requires effort on the part of the public works department and the utilities to follow through on project reviews.

Statewide Utility Coordination in Alaska

The Alaska Utility Coordinating Council is a nonprofit organization formed to serve as a statewide organization of utilities, governmental agencies, contractors, and other interested organizations or individuals to promote coordination between utilities and government agencies, reduce damage to above-ground and substructure utility facilities, and disseminate legislative information affecting utilities. The council sponsors an annual statewide utility conference that provides a forum for discussion

and exchange of ideas and technology. The council also distributes a quarterly newsletter.

A 1992 survey of SHA's conducted by the IRWA found that 20 States regularly convene highway/utility conferences. These may be organized or hosted by the highway agency or utilities. Other mechanisms used by SHA's to foster coordination include hosting monthly or quarterly meetings of state construction personnel with utilities and contractors and distributing project development schedules to utilities.

Coordination is the Key

Utility and highway agencies can benefit from better coordination. Input from utilities early in the project development process can greatly assist agencies in scheduling design, start, and completion of ROW acquisition, as well as designation of construction bid dates. Prebid conferences involving utility input on scheduling, timing for removal of facilities, sequencing, and construction can assist the contractor and benefit the public by producing informed, realistic bids. Another benefit of regular, face-to-face meetings is a more cooperative and less adversarial relationship among users of public ROW. This can yield more workable and innovative policies and approaches for using limited space to everyone's advantage. Highway agencies win a better project with fewer delays, while utilities win fewer damaged facilities and efficient relocations.

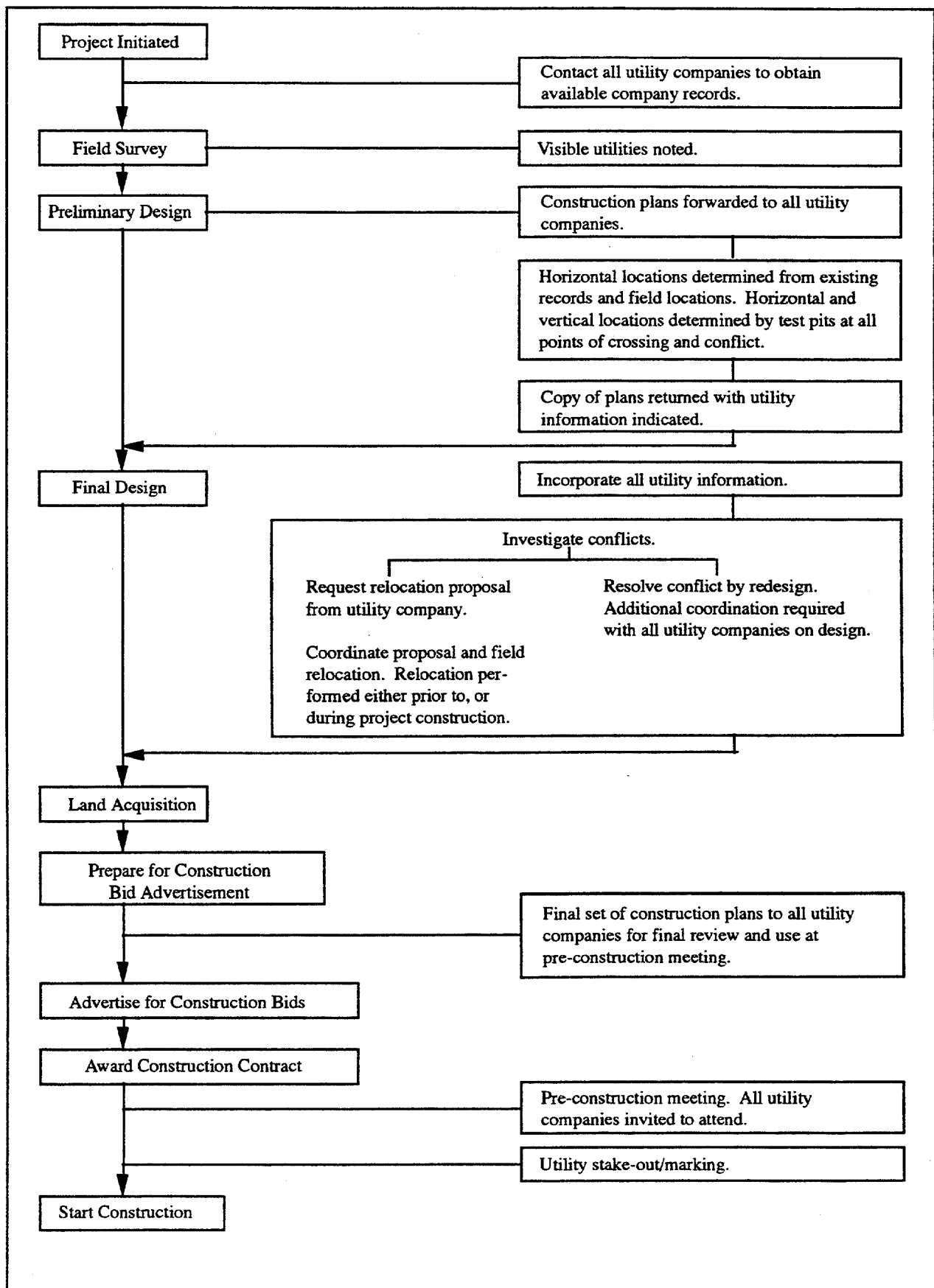


Figure 3-10. Utility Coordination on Public Works Projects.

Source: Fairfax County, Virginia.

SUMMARY

Many challenges face highway agencies as they manage public facilities. The challenges include funding of capital and maintenance programs, selecting and evaluating improvement projects, and addressing concerns of highway users, neighborhood groups, and special interest groups. Accommodating the needs of the users of highways and streets (motorists, pedestrians, bicyclists, buses, and trucks) is balanced with other community goals that involve issues as diverse as urban development patterns, utilities, wetlands, and dust control.

Utility companies also work in a complicated environment, attempting to address many of the same issues as highway agencies: system capacity, rehabilitation of facilities, planning and programming improvements, funding capital and operating expenses, and supporting community development efforts. When highway agencies and utilities find themselves sharing a valuable resource such as ROW, extra care and attention must be given to coordinating efforts so that entities complement each other rather than work against each other and the community's interest.

Successful accommodation of a utility plant within the urban ROW requires the following resources:

- (1) legislation to establish rights of local agencies to control use of the ROW;
- (2) adequate staff and budget to protect the public investment in streets and highways;
- (3) adequate permit, inspection, and pavement restoration controls;
- (4) cooperation and coordination mechanisms among all ROW users; and
- (5) accurate information for field forces who excavate in the ROW to allow them to work safely and protect the existing utility plant.

Basic efforts can have big benefits as highway agencies and utilities coordinate efforts. Many elements of successful coordination programs have been presented in this chapter.

Figure 3-11 presents some activities that support highway/utility coordination. These efforts not only affect the operations of the individual agencies involved, they enhance the quality of the community and the services provided by the community.

For Highway Agencies:

- (1) Develop and share a highway improvement program.
- (2) Include all construction and maintenance work in the highway improvement program planned for at least the next two years with longer time frames (five to six years) desirable.
- (3) Hold meetings (at least annually) between utility company personnel and highway personnel to discuss upcoming project development and construction activities.
- (4) Notify utilities of projects prior to the design phase.
- (5) Route plans of highway projects to utilities for comment during the design phase.
- (6) Determine the impact of all projects on other facilities in or adjoining the ROW.
- (7) Convene meetings of highway and utility personnel involved in project planning and development prior to each major phase of a project (planning, design, and construction).
- (8) Identify and resolve conflicts prior to any construction.
- (9) Share construction schedules with utilities.
- (10) Develop one point of contact in the highway agency to work with utilities on a project from inception to completion.
- (11) Publish maps each year showing municipality, county, SHA, and utility projects.
- (12) Publish detailed descriptions or directories of projects with project schedules, managers, and telephone numbers.

For Utilities:

- (1) Develop a utility master plan in conjunction with other public planning efforts.
- (2) Provide capital improvement programs to highway agencies.
- (3) Update utility system plans every two to five years and provide them to public works and highway agencies.
- (4) Meet with local or State agencies to discuss projects, determine impacts, and explore alternatives to avoid potential conflicts.
- (5) Develop one point of contact to work with the highway agency on resolution of potential conflicts.
- (6) Seek to minimize the impact of utilities on highways with high traffic volumes, few alternative routes, or limited right-of-way.

Figure 3-11. Coordination Activities for Highways and Utilities.

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CHAPTER FOUR

DESIGN

INTRODUCTION

Design is a natural continuation of the planning process. It is the *selection* of criteria, materials, dimensions, locations, and other information and the *application* of this information to a specific

site to produce construction plan drawings and specifications. These plans are sufficiently detailed so that a contractor can build the facility.

TYPES OF DESIGN

Design may be for highway facilities, for utility facilities, or for situations where highways and utilities interact. Design may be for new facilities, for rehabilitation or improvement of existing facilities, or for special circumstances. Several types of design will be reviewed in this chapter.

New Facilities

In one way, the design of a new highway or utility facility is the simplest and purest form of design. At the beginning, all options are available and may be considered. As the design process emerges, it is possible to choose the most efficient, most economical, and most appropriate designs to fit local circumstances. For a new design in virgin territory, the designer has few of the constraints that complicate a rehabilitation design.

This chapter surveys the design of new highway facilities to acquaint utility personnel with the considerations and steps involved in this lengthy process. The survey is simplistic because of space constraints in this manual;

however, highway design criteria and practices are well documented in text books and government publications.

An introduction is also provided to the design of new utility facilities. It would be too lengthy to describe a new design for each type of utility, but several examples are presented. The existing literature is sparse on introductory concepts for utility design. For example, it is difficult to locate a simple book or pamphlet for a highway engineer to use to learn the general steps in the design of a cross-country, high-pressure pipeline. Materials of this nature are needed and would be very useful in helping highway personnel understand the particular needs of utilities.

Rehabilitation or Improvement Design

A growing concern is the ability to upgrade existing facilities so that they can safely and efficiently meet increasing demands. For highways the demand might be the addition of an extra lane or the upgrading of an intersection with new traffic signals and separate turning lanes.

For utilities, it might involve increasing the size, voltage, or pressure of existing facilities. Often these changes can be undertaken as part of a periodic replacement and upgrading program.

Rehabilitation design is normally more difficult than new design. Existing facilities may have been built to older standards than those currently in use. For example, ROW's may be too narrow, horizontal curves may be sharper, and hills may be steeper. It is very difficult and expensive to choose appropriate design criteria for upgrading these older roads. The purchase of additional ROW to meet current criteria, to add lanes or to flatten grades, might destroy homes or businesses. Costs and social impacts are so large that they sometimes effectively prohibit implementation of current design criteria during rehabilitation of older roads. SHA's might be faced with a difficult choice of making partial improvements to several roads while leaving them at less than current design criteria, or using the same funds to completely

rehabilitate one road to modern standards. These are difficult decisions that must be based on cost-effectiveness, safety, social issues, and other considerations.

Highway/utility interaction in older ROW is more difficult than for new projects. Typically, when a highway agency recognizes that it must upgrade an older road, it is because this roadway can no longer handle the volume of cars that desire to use it. Congestion and safety considerations must be addressed through a rehabilitation project.

These same types of roads have been serving utility facilities for many years. Especially in urban areas, the ROW's may be crowded with utility facilities. Widening the roadway will mean that utilities (which were already hard-pressed for room within the ROW) may be forced into nondesirable locations, or completely off the ROW. These situations deserve careful study to determine what types of joint highway and utility rehabilitation best serve the interests of the public.

DESIGN CRITERIA

HIGHWAYS

The American Association of State Highway and Transportation Officials has developed highway criteria for designing, operating, and maintaining roads. These criteria are published in several books and pamphlets. Typically, they are adopted by the FHWA as the criteria for checking plans to ensure that the design qualifies for Federal funding. Consequently, most SHA's either adopt AASHTO criteria, or develop their own criteria parallel to those in the AASHTO publications. FHWA recognizes that circumstances differ from State to State, and an SHA may develop (and submit for approval) criteria other than those developed by AASHTO.

Local governments typically adopt AASHTO criteria, SHA criteria, criteria of some other knowledgeable agency (e.g., American Public Works Association, National Association of County Engineers, American Society of Civil Engineers), or prepare their own criteria after consideration of one or another of these documents.

For highway design, two AASHTO publications are extremely important. The first of these is *A Policy on Geometric Design of Highways and Streets*. This document is a successor to previous AASHTO geometric design documents that have been in existence since the early 1940's. It was released in 1983 and soon became known as the "Green Book." It was

upgraded when a second edition was published in 1990.

The second premier AASHTO publication is the *Roadside Design Guide*, which was released in 1989. It addresses roadside safety for objects like drainage facilities, embankments, fixed obstacles, barriers, and crash cushions.

AASHTO has also prepared two documents that directly address highway utilities. These are *A Guide for Accommodating Utilities Within Highway Right-of-Way, 1981*, and *A Policy on the Accommodation of Utilities Within Freeway Right-of-Way, 1989*. Both highway agencies and utility firms rely heavily on these documents.

UTILITIES

Utility firms typically develop their own design criteria and controls based on national standards, safety considerations, cost-effectiveness, and efficiency of operation. Examples include the following:

- Electric power and communications: National Electric Safety Code (NESC).
- Water transmission and distribution: American Water Works Association (AWWA).
- Pressure pipelines: Standard Code of Pressure Piping of the American National Standards Institute (ANSI), B31.4 and B31.8.
- Liquid petroleum pipelines: American Petroleum Institute Recommended Practice for Pipelines Crossing Railroads and Highways.
- Pipelines carrying natural gas and hazardous materials: U.S. DOT Rules and Regulations governing transportation of such materials, including CFR 49, Parts 192 and 195.
- Fiber optic facilities: American National Standard for the Physical

Location and Protection of Below-Ground Physical Plant (EIA/TIA-590); also NESC provisions for communications cable.

National criteria usually provide accepted treatments for the situations that are normally encountered. They are not all-inclusive, and they may not provide complete guidance for unexpected or unusual situations. Within the protective framework established by these national criteria, utility firms, SHA's, public works departments, county governments, cities, and others develop their own criteria, manuals, and design practices. In a typical situation, much of the information in a national document may not directly apply to the prevalent type of work done by an agency. In this case, the agency might tailor its own design policies to its needs, and simplify its criteria so that its employees may design safety and efficiency for the normal situation.

It is good practice for designers to understand the basis of the code or criteria that they are using, so that they will recognize circumstances that deserve greater than normal consideration. Designers may also recognize unique circumstances where national codes or criteria are too conservative, and special designs may be warranted for the sake of cost-effectiveness. Such special designs should be rare. The designer must have unique knowledge that a special design is more appropriate than the design outlined by the normal criteria. It is a good idea for the designer to thoroughly document such a decision.

Among SHA's, it is not unusual for a utility manual to quote AASHTO criteria or to adopt them by reference. Similar situations exist for local government design documents, and for situations where utility firms incorporate provisions of national criteria.

HIGHWAY GEOMETRIC DESIGN

Geometric design is the process of creating a highway so that the elements of alignment and cross section provide a pleasing, safe, economic, and efficient means of travel for the volumes and types of vehicles that will use it. A good geometric design provides an interesting, aesthetic roadway that blends well with its surroundings and follows the existing natural topography.

The alignment is often dictated by topography and human-made developments along the route. The object of *horizontal* alignment design is to connect the two road termini by the most direct route available while avoiding major objects and undesirable topography along the path. The object in *vertical* alignment design is to overcome differences in elevation between the two termini and along the route, while avoiding areas that are prone to floods, and while crossing other transportation routes such as railroads and rivers.

It is important to coordinate horizontal and vertical alignment during the design process. If they are not coordinated, both aesthetics and safety may suffer. For example, the highway may appear to be forced on the terrain and the design will not seem pleasing to an operator of a vehicle. This may cause an operator to lose sight of the road ahead or drastically increase driver workload as a result of alignment or visibility changes. These situations are to be avoided where practical.

ROADWAY FUNCTIONAL CLASS

Categories have been developed to describe the various functions that roadways serve. The major functional classifications include the following:

- **Freeways**—these are a special subdivision of arterial highways. Separate criteria are applied to them because of their high design speed, full control of access, and high traffic volumes. They are considered to be the highest functional classification of highway.
- **Arterials**—these routes are devoted primarily to moving large volumes of traffic over great distances. For example, these might be State routes between major urban areas. They can have full or partial control of access.
- **Collectors**—these are highways that have shorter travel distances and moderate speeds. They collect traffic and funnel it into a network of arterial highways.
- **Local roads**—these provide access to local property owners. Short travel distances are involved in connecting adjacent property to the collector or arterial highway networks.
- **Ramps and parking areas**—these are special cases with special criteria to handle traffic needs.

Each of the major functional categories of roadway has its own set of approved controlling criteria. The Green Book has separate chapters devoted to criteria for freeways, arterials, collectors, and local roads and streets.

CONTROLLING CRITERIA

The FHWA has adopted certain controlling criteria as the minimum requirements for various elements involved in geometric design.

There are 13 controlling criteria, which can be categorized into four groups consisting of speed, alignment, cross section, and structures.

Speed

The first group is speed, but there are several ways to measure it. Design speed is the primary concern for geometric design. It is the maximum safe speed that a vehicle can drive on a section of highway when all conditions are so favorable that the design of the highway governs speed. For example, the radius of the curve might be the ultimate limit to maximum speed under favorable traffic and weather conditions. Shorter radii require lower design speeds.

Design speed is not necessarily the speed at which vehicles travel. Congestion, inclement weather, (artificial) speed limits, and other factors may dictate that actual speeds fall below design speed. Operating speed is the term usually used to describe actual speed.

Alignment

The second set of controlling criteria involve alignment. These include the degree of horizontal curvature, the length of vertical curve, the maximum and minimum percent of grade, and the stopping sight distance.

Horizontal curves are designed with large enough radii so that vehicles do not slide off as a result of centrifugal force. The controlling radii are a function of the speed of the vehicle, the functional class of the highway, the pavement surface friction value, and the amount of superelevation in the roadway.

The traditional way to specify the design radius has been by the "degree of curvature." The degree of curvature is defined as the

internal angle (at the radius point) which measures a 30.5 m (100 ft) arc along the curve centerline. The larger the degree of curvature, the shorter the radius and the sharper the curve. In practice, most arterial curves are 1° or 2° curves, and rarely is a curve steeper than 5°.

During vertical alignment design, minimum profile grades are established so that rainfall will run off the highway. Maximum grades are established so that large vehicles will not be unduly slowed by steep grades. For rural arterials, AASHTO recommends the following maximum grades for level terrain:

Speed, kph (mph)	50 (30)	80 (50)	100 (60)
Maximum Grade	8%	6%	5%

Slightly higher grades are allowed for rolling and mountainous terrain, and other functional classifications have different sets of maximum grades.

Where profile grades intersect, vertical curves are employed to give smooth transitions from one grade to the next. It is important that the vertical curves be long enough so that the curves are gradual. A driver must be able to see over the top of the curve to see objects in the roadway or oncoming vehicles. The curves are designed to provide stopping sight distance (SSD), which is the distance that a design driver needs to recognize an object 150 mm (six inches) high and to apply the brakes and skid to a stop. SSD varies with design speed and pavement friction. For level, wet pavement, AASHTO recommends the following stopping sight distances:

Design Speed	Design SSD
kph (mph)	m (ft)
50 (30)	60–70 (200–200)
80 (50)	120–140 (400–475)
100 (60)	160–210 (525–650)

Cross Section

The third set of controlling criteria involves cross section elements. Lane widths, shoulder widths, cross slope, superelevation (banking of horizontal curves), and horizontal clearance to obstructions are criteria under this element. For each project, the designer uses the appropriate controlling criteria to establish each cross section parameter, and displays them on a drawing called a typical section. For large highway projects, there may be several typical sections that apply to different locations within the project. A sample typical section is shown in Figure 4-1.

As with other criteria, the design value that is used for any particular project depends on the functional classification of the roadway. The most common lane width is 3.6 m (12 ft) for arterials. Greater widths are used where significant volumes of large vehicles are experienced, especially for turning roadways and ramps. Smaller widths are used for lower functional class roadways, slower speeds, and left-turn lanes.

Cross slope is used to remove rainfall from the roadway surface. The amount of pavement cross slope is a compromise between good driving characteristics and good drainage. The most widely used value is 2 percent. For multi-lane roads, the lanes closest to the centerline use flatter cross slopes and the outer lanes use steeper slopes because they are carrying more runoff. Shoulders have greater cross slope than the roadway, typically 2 percent to 6 percent if paved, and 8 percent if turfed.

The clear roadside concept requires minimum horizontal clearances to obstructions. Clearance varies with a number of factors, as explained during the discussion of the clear roadside concept in Chapter 9 — *Safety*.

Structural

The fourth set of controlling criteria are structural elements: the dimensions of bridges and tunnels including width, structural capacity and vertical clearance. Recommended values for these characteristics are contained in AASHTO publications.

INTERSECTIONS AND INTERCHANGES

Intersections

An intersection is a location where two roadways cross at the same elevation. In addition to the normal controlling criteria, there are several other concerns. Intersection sight distance is needed so that operators of vehicles can see approaching vehicles and avoid accidents. If sufficient sight distance is not available, flow through the intersection must be controlled with signs or signals.

Capacity decreases at intersections because conflicting traffic streams must share the same pavement area. The amount of time available for traffic on one road to travel through the intersection is cut in half, because part of the time must be allocated to the other roadway. Thus, capacity of an intersection is much lower than capacity of a roadway segment without an intersection. Turning paths for vehicles using the intersection often become a problem, especially if large vehicles are involved. Special turning ramps, median storage lanes, and other treatments may be constructed to improve efficiency of operations. SHA's are currently conducting many such projects to upgrade intersections.

Intersections are normally designed to reflect the type of vehicle using them. The Green Book

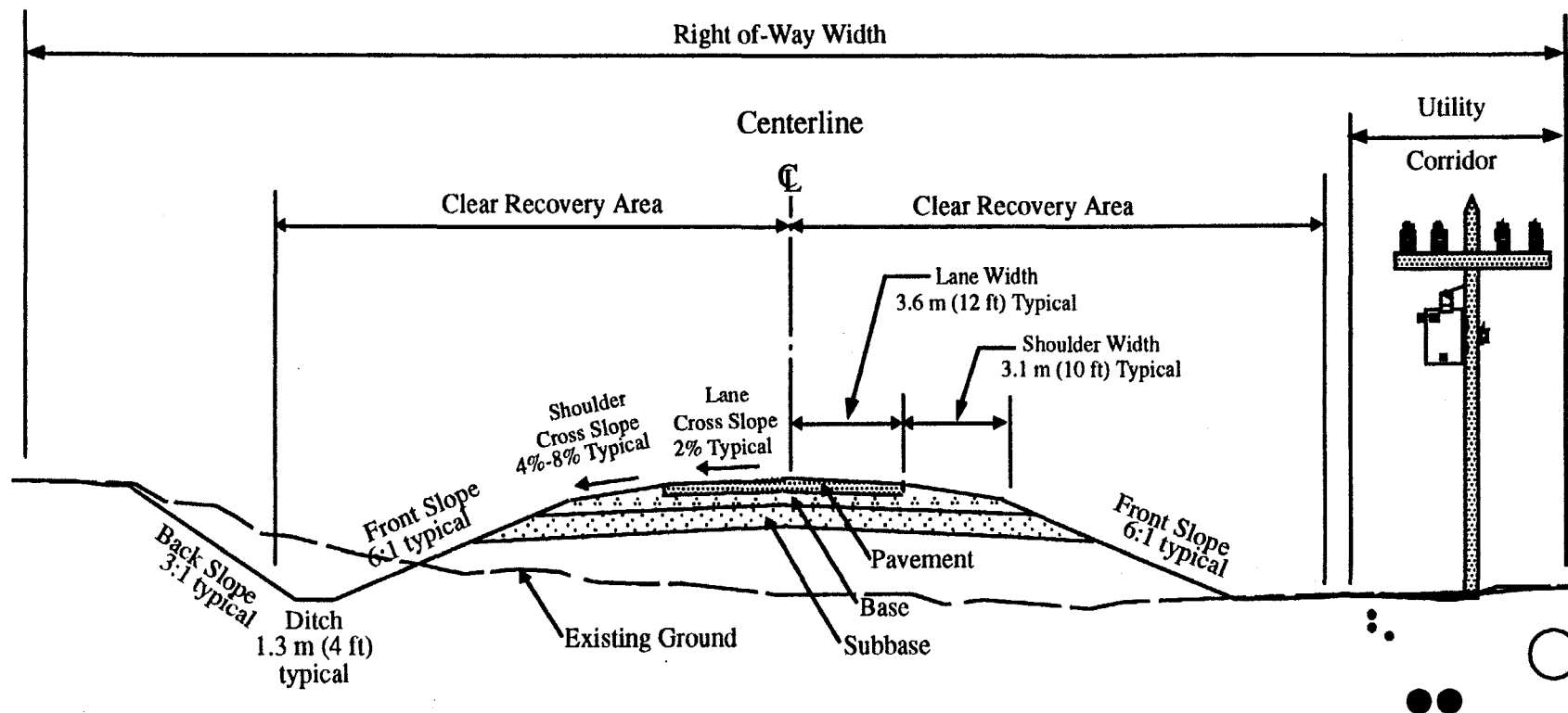


Figure 4-1. Sample Typical Section for Two-Lane Rural Highway.

contains criteria on turning radii, wheel paths, storage lengths, and other factors that influence vehicle operations, safety, and capacity.

Interchanges

Interchanges are intersections where conflicting movements have been separated with structures. Ramps provide for traffic movement from one route to the other. Capacity, safety, speed, and traffic operations are greatly improved. The number of ramps and their locations (interchange configuration) depends on the terrain and the dominant traffic movements at that location. The great expense and large land area required for interchanges usually restrict their use to high volume roadways with high turning movements.

HIGHWAY DESIGN SEQUENCE

Planning

Design is a continuation of planning. For most highway projects, it is hard to tell exactly where one stops and the other starts. The first design activities, such as general route selection, are normally handled during the planning phase. During this step, alternative routes are proposed and tested for feasibility, economics, and public acceptance. Typically, environmental considerations and ROW concerns dominate this portion of the planning process. At some point, the planning will have gone far enough that a most-desirable route will have been accepted.

Preliminary Design

In a traditional highway design, the roadway centerline for the preferred alignment is staked in the field. Survey parties establish the key

locations and lay out tangents. The tangents are connected at points of intersection. Often aerial photography is used to speed the process.

Next comes a data gathering phase. Topographic surveys, property surveys, hydrographic surveys, traffic counts, soil samples and other data gathering activities are initiated. Most SHA's now have a carefully prepared list of items they want as background material for the design process.

At the same time, designers are beginning to establish a list of functional specifications for use on the project. These include the roadway functional classification, the design speed, the current and future average daily traffic volumes, the character of the projected traffic mix, and other design specifications such as maximum and minimum grades, number of lanes, lane and shoulder widths, and cross slope. The majority of these items are found in the road's functional classification and the FHWA's list of controlling criteria. Where special site circumstances or other conditions exist, normal criteria may be modified or new criteria may be prepared during this portion of the design.

At the close of the preliminary design, the centerline alignment has been prepared, preliminary curves and grades have been specified, design criteria have been selected, and the stage has been set for the formal design process.

Detailed Design

This portion of the design is sometimes called preparation of construction drawings and project specifications. It involves the comprehensive application of design criteria throughout the length of the proposed roadway, using a series of sequential and overlapping design steps. Many of these steps have to be repeated if one of the subsequent design activities requires changing an original design assumption. For example, if

exact utility locations are not known, the highway agency sometimes finds at the end of design that relocation expenses are so great that it is worthwhile to redesign a portion of the roadway rather than relocate the utility.

The general steps in the design process are displayed in Figure 4-2. The design process moves from the upper left to the lower right portion of the drawing. The figure shows how highway design proceeds from information gathering and criteria formation through individual design decisions to the final product. Some decisions must be made before others can be contemplated. For example, it does not make sense to design traffic signs until intersections have been designed. It does not make sense to design intersections until the horizontal and vertical alignment have been chosen. It does not make sense to design the alignment until the functional classification has been selected.

In final design, the preliminary centerline is used as a starting point. Horizontal curves are selected by specifying the degree (or radius) of the curve, stopping sight distance, rate and run-out distance for superelevation, curve transitions, and other design values. These values are controlled by AASHTO criteria or by local criteria that are based on AASHTO documents.

Vertical alignment is considered next. It involves establishing the profile grade and the vertical curves, and is sometimes considered the most important aspect of plan design. The amount of earth to be moved and the amount of right-of-way to be purchased are both directly tied to the profile grade. Deep cuts or high fills greatly increase both earthwork and ROW. Designers usually try to make the profile grade match the existing ground as much as possible to minimize expense, within the limits of safety considerations and drainage.

After the profile grade has been established, a variety of other design activities may begin. These include the hydrology analysis to locate drainage basins and design drainage structures,

the identification of borrow pits and spoil areas to facilitate earthwork, and pavement design. Intersection or interchange design can begin at this stage. After the intersections are completed, signs, pavement markings and signals can be designed.

Design Reviews

Throughout the design process, there are periodic reviews and coordination activities. Two important SHA review actions are inspections conducted in the field. The first of these is called the Plan-in-Hand (PIH) inspection. A team of designers walks from one end of the project to the other, checking the preliminary plans to see if the design will fit the existing situation. They are looking for additional data that was not gathered previously, errors in the plans, or improvements to the design.

The second field review is called the Plans, Specifications and Estimate inspection (PS&E). It comes near the very end of the design sequence to determine if the final plans adequately represent a roadway that can be built efficiently and economically.

Complexity of Design

The discussion in the previous paragraphs is simplistic in nature. The actual design process involves 3 to 5 years with countless agency work units and scores of personnel involved. To illustrate the complexity of roadway design for a typical SHA, the Alabama Highway Department procedures have been outlined in Table 4-1. These procedures are called the *Guide to Development of Construction Plans*. They contain 65 distinct steps, beginning with the receipt of field data and concluding when the final plans and specifications are ready for advertisement for bids.

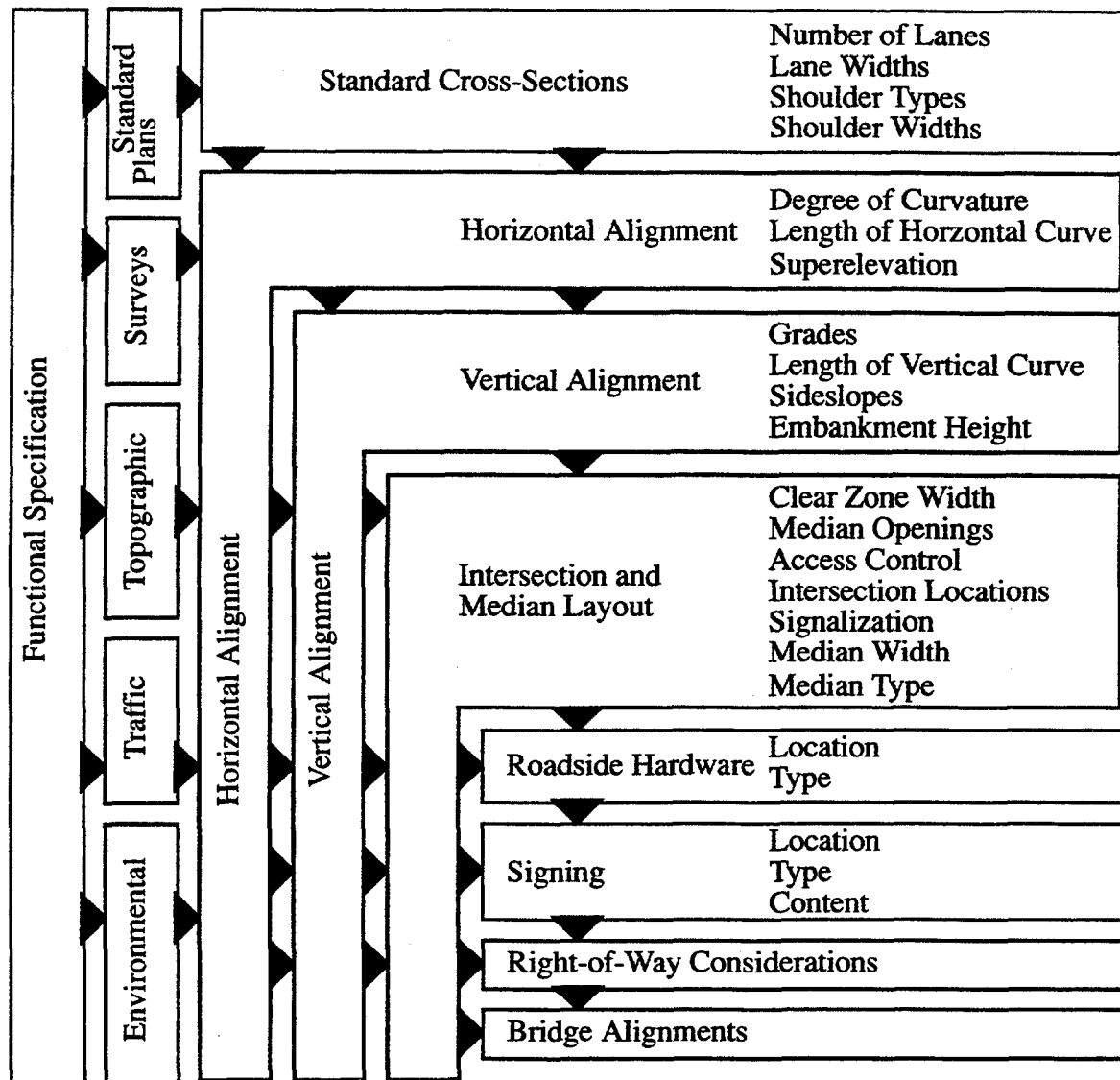


Figure 4-2. General Overview of Highway Design Process.

Source: Malcolm H. Ray, *Quantifying the Safeness of Highway Designs*.

This sequence of activities is probably typical of those used by SHA's for design of new roadways or for major rehabilitation projects. For any individual project, some additional steps may be needed, or some of these steps may be omitted.

UTILITY INTERACTION WITH HIGHWAY DESIGN

A point of conflict between highway agencies and utilities is often the late hour at which the utility receives notice of a highway construction project affecting its facilities, and the compressed time period available for design and construction of a relocation project. Failure of the utility to complete the relocation before highway construction begins sometimes leads to claims for additional compensation on the part of a highway contractor.

Good coordination calls for early notification of the utility agency. This notice is not always easy, because roadway projects take a long time to design and frequently involve delays, cancellations, changes in alignment or other factors that can alter the involvement of utility firms. Highway agencies generally prefer to wait until later in the design process to involve utilities, to prevent unnecessary work on the part of utilities. On the other hand, if utilities are not involved in the project at an early stage, they may not have adequate time to do the job, relocation costs may be high, or portions of the roadway might have to be redesigned.

Some highway agencies routinely notify utility companies when the preliminary roadway design has been completed. If utility information has not already been received, detailed horizontal and vertical data is requested on utility locations.

Later, the utilities are asked to review the highway plans to determine the precise effect that the intended design will have on their

facilities. Utilities look for possible conflicts with ditches, water table, overhead and underground clearances, retaining walls, lateral and vertical clearances, pole locations, traffic control plans, attachment to structures, and many other possible conflict items. This process gives the utility firms two early reviews, and an opportunity to begin planning and preliminary design for any relocation work that may be required. It also allows the utilities input into the highway design, and unusually expensive or difficult relocations can often be avoided.

Example Interaction

An example of SHA and utility design coordination is illustrated by the Alabama Highway Department procedure in Table 4-1. The first utility interaction occurs at Step 7 where the Department's Utility Engineer reviews the preliminary work for obvious utility problems. At Step 19 the preliminary design is largely finished. Plans are sent to utility firms that are asked to verify the locations of their facilities or add them to the plan sets. They are also asked to begin their preliminary or concept engineering work. The utility's "concept design" is called Phase I of utility work.

The next utility interaction is Step 30, when possible utility conflicts are considered while preparing the sequence of construction events. In Step 33, the Bridge Bureau begins design, after including utility considerations. In Step 34, drainage design begins, including coordination with the Utility Engineer.

In Step 37, the Utility Engineer identifies space and ROW needs, and determines whether the utility work should precede the highway contract or be conducted simultaneously with it. In Step 38, the Plan-in-Hand inspection is conducted. Utility representatives may attend this inspection. Following the PIH, revisions are made to the plans and they are sent to utility

Table 4-1. Guide to the Development of Construction Plans.

No.	Work Step	No.	Work Step
1.	Review and check in all field data	33.	Send plans to Bridge Bureau for design and clearance review including all utility conflicts
2.	Transmit documents to ROW Engineer	34.	Plot drainage sections, design channels and structures; notify ETS if 404 permits needed for channel changes; check with Utility Engineer
3.	Determine that project is listed in the construction program	35.	Send plans to Hydraulic Unit for review and revision prior to the PIH review
4.	Determine that project has PE funding	36.	Coordinate with FHWA, Division, and others for any needed geometric changes
5.	Check PMS project cross reference list	37.	Conference with Utilities Engineer for utilities space or ROW needs, find if utility work precedes or coincides with highway contract
6.	Review PMS list of target dates	38.	Send plans for PIH inspection for FHWA input, TCP review, topo review, easements review, and typical sections review
7.	Preliminary ROW, utility , and construction cost estimates (check for utility problems)	39.	Study and resolve PIH review comments
8.	Begin work on roadway plans	40.	Send updated mylars to Utilities Section to send to Division to begin Phase II of utility work
9.	Send plan sheets to State Planning or Urban Planning for traffic information	41.	Send plans to ROW Engineer for ROW acquisition
10.	If alternate design options are needed develop them	42.	Review Division TCP and send to Traffic Engineering Section for approval
11.	Establish highwater and bridge elevations to determine profile and balance earthwork	43.	Send prints to Hydraulic Specialist of Location Section for risk assessment, Hydraulic Engineer; ETS for 404 Permits and noise study, Federal Energy Regulatory Commission Permit if in power company impoundment backwater, & to ETS if within the Tenn. River Watershed of TVA
12.	Send prints to Materials and Tests Engineer for slope and shrink-swell studies	44.	Send plans to Office Engineer for railroad agreements
13.	Send prints to Traffic Engineering Section for preliminary design of traffic control devices	45.	Get traffic updates from State Planning Engineer or Urban Planning Engineer
14.	Begin earthwork computations	46.	Complete soils studies and check historical & archaeological clearances
15.	Send level books and print set to Computer Section for earthwork computations	47.	Send plans to Traffic Engineering Section for review of traffic control devices
16.	Plot cross sections for connecting roads	48.	Make box and pay sheets and develop quantities
17.	Adjust grades to balance earthwork, return to Computer Section	49.	Prepare index sheet
18.	Establish construction limits and ROW requirements	50.	Confirm with ROW Engineer all known ROW commitments
19.	Send mylars with in-place utility topo to Utility Section, which sends prints to Division to begin Phase I utility work	51.	Develop estimates for PS&E and send to Office Engineer and PMS Coordinator
20.	Begin hydraulic design	52.	Place mylars of standard sheets in the plan assembly
21.	Send plan set with drainage structures to Hydraulic Location Specialist	53.	Send plans to PIH Engineer for PS&E inspection
22.	Coordinate with Bridge Bureau of proposed structure designs and estimates	54.	Resolve PS&E comments
23.	Send ROW requirements to ROW Engineer to prepare ROW map	55.	Incorporate additional sheets into plan assembly; Utilities Section initiates Phase III of utility work
24.	Review plans and estimates with affected designers to select preferred design (especially utilities)	56.	Revise estimates and send to Office Engineer and PMS Coordinator
25.	Obtain FHWA approval of geometrics	57.	Send plans to ETS for final review
26.	Update estimate of FHWA-approved design	58.	Traffic Engineering Section obtains signal and lighting agreements from Division
27.	Send plans to Environmental Section for permit application, to ROW Bureau for 12B relocation study, and to Division for design hearings	59.	Prepare forms for City and County resolutions
28.	After any design hearing obtain FHWA plan approval	60.	Final check of plan assembly
29.	Send plans to Materials and Tests Engineer for soils profile borings, shrinkage values and materials report	61.	Send finished plans to Checking Section before they go to the Office Engineer
30.	Send plans to Division for Traffic Control Plan; Traffic Engineering Section for sign design and railroad review; Bureau of Office Engineer for railroad review; Electrical Section for power and lighting; Traffic Engineering for signal power source and maintenance agreements; Utility Section and Electrical Section for rest area utilities ; Division for County Maintenance Agreements on roadways left after relocation of Department routes; include construction sequence in plans after considering utility conflicts	62.	Make required corrections
31.	Complete earthwork balance with confirmed shrinkage values	63.	Submit plans to Office Engineer
32.	Develop slope transitions and ditches to fit computed roadway cross sections.	64.	Resolve comments from Construction Bureau, Office Engineer, Division, and FHWA
		65.	Send final plans to Office Engineer

Source: Alabama Highway Department.

firms to begin Phase II of utility work: the detailed design of utility relocations.

The highway design proceeds until Step 53 when the PS&E inspection is conducted. Following this inspection and any consequent revisions, the utility firms are notified to begin Phase III of their work, which is the relocation construction.

This example illustrates three distinct phases of utility work: the preliminary concept design,

the detailed design, and construction. It allows the SHA to involve the utility at an early stage of the project, yet terminate utility work after Phase I if no other actions are needed or if the road project is canceled. Phases II and III are separate and distinct work items which are only authorized after the design project has proceeded to the appropriate steps in the highway design sequence.

UTILITY DESIGN

The complete design of a utility's physical plant requires a special knowledge of the engineering, economic, and use factors associated with each particular type of utility. For that reason, it is rare for an individual to be knowledgeable in the design of more than one type of utility. It is even rarer for a highway employee to have a detailed understanding of the types of utilities that might occupy highway ROW. This portion of the *Guide* was prepared to help highway personnel obtain a feel for utility design practices,

and to help utility personnel understand the interface between the design of a highway and of their particular utility.

Good design starts with an understanding of codes and standards. Several were introduced earlier in this chapter, but the most prominent is probably the *AASHTO Guide for Accommodating Utilities Within Highway Right-of-Way*. It will be mentioned often in the following discussion.

GENERAL UTILITY DESIGN CONCEPTS

Advice for the general design of utilities may be taken from the *Guide for Accommodating Utilities Within the Highway Right-of-Way*. It indicates that ultimate responsibility lies with the utility for design of any of its facilities which will be installed within highway ROW or attached to highway structures. The highway agency's responsibility is to review and approve the utility's proposed facilities, especially the location and manner of installation or attachment.

The utility is responsible for obtaining any necessary permit, including accommodation, environmental, ROW, or other types of permits. Permit application should be considered part of the utility design process, since it occasionally requires a change in some design feature of the installation.

Materials used in a utility's physical plant should be durable, designed for long service life, and relatively free from routine servicing and maintenance. Ground-mounted utility facilities

should be designed to be compatible with the visual quality of the highway—a topic discussed later in this chapter.

On new installations or during adjustments of existing utility lines, known or planned utility expansions should be considered. Advance planning will minimize hazards and traffic interference when the additional overhead or underground lines are installed at some future date.

AASHTO has both general and specific recommendations for utility designs in its *Guide for Accommodating Utilities* booklet. There are provisions for pipeline location and alignment, cover, encasement and allied mechanical protection, appurtenances, restrictions against varied use, installation techniques, utility tunnels and bridges, and adjustment. Overhead power and communication lines are addressed, including types of construction, vertical clearance, and location. Underground electric power and communication lines receive similar treatment, with additional discussions for encasement.

Examples of additional topics are irrigation and drainage pipes, ditches, and canals; preservation, restoration, and clean up after utility work is completed; safety and convenience. The reader is referred to the AASHTO utility guide document for additional details.

DESIGN FOR DIFFERENT TYPES OF UTILITIES

Utilities come in different types and sizes, are composed of different materials, and are placed in varied locations (see Table 4-2). The scope of this *Guide* is too limited to address the design of each utility even in the broad tones adopted previously for overall descriptions of highway design. Instead, the remainder of this chapter

will address general design concepts applicable to all utilities, with some information pertinent to individual utilities (electric power and communications, water, pipelines, fiber optics, and gravity-flow facilities). It will also present a sample of design criteria for two types of utilities as an illustration to highway personnel of the complexity of these concepts.

COORDINATION AND COMMUNICATION

One of the dominant themes running throughout the *Highway Utility Guide* is the need for open and continuous coordination between the users of highway ROW. The scheduling of the highway design and construction dictates the time available for utility design. Since highway design generally begins several years before actual construction, utilities find it very desirable to receive an early alert. They wish to be advised of the type of proposed highway and of the design alternatives under consideration. If the utilities receive this information during the concept stage of highway design, they can begin their own conceptual designs in concert with the highway project.

During the planning stage, utilities may become deeply involved. In some parts of the United States, cooperative efforts are made to provide the highway designers with the precise locations of existing utilities. Early planning and information exchange is considered to be an essential part of cost avoidance. It minimizes the chance of extensive and costly delays, and provides the highway engineer with a network of counterparts in the utilities industry.

In short, both the highway designer and the utility designer benefit from early and continuous coordination. It makes sense that both designers recognize the benefits and make concerted efforts to provide information to other parties involved in the relocation effort.

Table 4-2. Typical Subsurface Facilities

Item	Typical Dimension	Typical Materials	Typical Cover	Typical Locations	Other Clues
Water Mains	100 to 1200 mm (4 to 48 in.)	Steel, cast iron, plastic wood, concrete, asbestos, cement, stone work	3.0 m (to 10 ft)	Under street and sidewalks	Manholes, shut-off valve plates, hydrants, knowledge that buildings use piped-in water, water company records
Water Distribution Lines	12 to 150 mm (0.5 to 6 in.)	Steel, cast iron, plastic, asbestos, cement, copper	2.4 m (to 8 ft)	From streets toward buildings	Shut-off valve plates, knowledge that buildings use piped-in water
Gas Mains	50 to 750 mm (2 to 30 in.)	Steel, cast iron, plastic	1.8 m (to 6 ft)	Under streets and sidewalks	Manholes, shut-off valve plates, knowledge that buildings use piped-in gas, gas company records
Gas Distribution Lines	12 to 150 mm (0.5 to 6 in.)	Steel, cast iron, plastic, copper	1.5 m (to 5 ft)	From streets toward buildings	Shut-off valve plates, knowledge that buildings use piped-in gas, visible service entrance or meter, gas company records
Sewer Mains	150 to 1200 mm (6 to 48 in.)	Cast iron, vitrified clay, asbestos cement, plastic coated steel, bituminized fibre, concrete, stone work	6.1 m (to 20 ft)	Under streets and sidewalks and along property lines	Manholes and cleanout openings, knowledge that buildings are served by sewers, lift stations, municipal records
Sewer Lines	75 to 150 mm (3 to 6 in.)	Cast iron, vitrified clay, asbestos cement, plastic coated steel, bituminized fibre, concrete	1.8 m (to 6 ft)	From buildings toward mains	Cleanouts, traps, knowledge that buildings are served by sewers
Electric Power Lines in Conduit	Conduit: 25 to 125 mm (1 to 5 in.) Cable: 25 to 50 mm (1 to 2 in.)	Conduit: asbestos cement, steel, concrete, plastic Cable: insulated copper or aluminum	1.5 m (to 5 ft)	Under streets and sidewalks and along property lines	Manholes, transformers, visible connections to aerial plant, electric company records
Buried Power Lines	12 to 50 mm (0.5 to 2 in.)	Insulated copper or aluminum	13.1 m (to 4 ft)	Along streets, under sidewalks, along property lines, toward buildings	Visible connections to poles, to buildings, to underground transformers, electric company records
Telephone Cable in Conduit	Conduit: 90 to 125 mm (3.5 to 5 in., commonly 4 in.) 100 mm, Cable: 10 to 100 mm (0.3 to 4 in.)	Conduit: plastic, clay, asbestos, cement, steel, concrete, wood Cable: insulated copper or aluminum, lead sheath, coaxial	3.6 m (to 12 ft)	Under streets and sidewalks, along property lines	Manholes, visible connections to aerial plant, telephone company records
Buried Telephone Cable	12 to 100 mm (0.5 to 4 in.)	Insulated copper or aluminum, coax	1.2 m (to 4 ft)	Along streets and roads, along rights-of-way	Pedestals, closures, visible connections to aerial plant, telephone company records
Buried Wire	10 mm (0.3 in.)	Insulated copper, or aluminum	0.6 m (to 2 ft)	Between buildings and cables	Pedestals, service entrances on buildings, telephone company records
Cable TV Cable	1.3 cm (0.5 in.)	Insulated copper, or aluminum	0.5 m (to 2 ft)	Between buildings and cables	Service entrance on buildings, visible connection to distribution, cable TV company records

Source: APWA Subsurface Utility Facilities Detection Techniques and Detection Devices.

PRE-DESIGN TECHNIQUES

The procedure believed to offer the greatest promise for cost avoidance and conflict resolution is the effective use of predesign conferences. These meetings are held between the highway designer and utility representatives. During these meetings, the utilities learn about the type and extent of the roadway project and the probable time period for its construction. The highway designer learns about existing utilities

and special conditions or needs of the utilities. Site visits can also be part of the predesign meeting, yielding further opportunities to save money and time for utility firms (and the highway agency).

In especially difficult circumstances, the SHA may establish priority of location for utility facilities. This control may be necessary if several utilities are competing for the same prime location within the ROW, or if space is severely limited.

GENERAL LOCATIONS FOR UTILITIES

The *AASHTO Guide for Accommodating Utilities Within Highway Right-of-Way* suggests several general criteria for the location and alignment of utilities. For instance, utility lines should be located to minimize the need for later adjustment if future highway improvements are made. They should also be located so that they can be serviced with minimum interference to highway traffic.

Utilities installed longitudinally along the ROW should have a uniform alignment as near as practicable to the ROW line. This maximizes the clear recovery area, provides a safe environment for traffic operations, and allows room for future highway improvements or additional utility installations. Where utility lines cross the ROW, the angle of the crossing is controlled by the highway alignment and should be based on economic considerations of the practical alternatives. SHA's often call for crossings to be perpendicular to the highway alignment where practicable.

Utility alignment (both horizontal and vertical) should conform to the applicable clear recovery criteria for the type of highway system and to other conditions for the particular section of highway under consideration. Above-ground

utility facilities are subject to lateral clearance and other clear zone criteria, as will be outlined in greater detail in Chapter 9 — *Safety*.

AASHTO indicates that in all cases, full consideration should be given to measures reflecting sound engineering principles and economic factors that are also necessary to preserve and protect highway safety, maintenance efficiency, integrity, and visual quality.

On urban streets with closely abutting improvements, especially in older built up areas, the location of a utility installation is often a special case. When this occurs, the type and location of installation must be resolved in a manner consistent with the prevailing conditions and limitations.

PREFERRED UTILITY POLE LOCATIONS

Some pole locations are more likely to be involved in traffic accidents than others. Ivey and Mak of the Texas Transportation Institute discussed such locations in their paper, *Recommended Guidelines for New Utility Construction*, presented at the 1991 Annual Meeting of the Transportation Research Board.

Curves

Poles on the outside of curves have higher exposure to vehicle impact, especially true where the curve follows a long straight section of road, or where it is sharper than previous curves. When this occurs, consideration should be given to placing the pole line on the inside rather than on the outside of the curve. If the curve radius is less than 600 m (1,700 feet) it may be necessary to place strain poles on the outside of the curve to brace the line. If so, the strain pole should be of breakaway design. Breakaway design should not be used if it will collapse in an area that poses a hazard to traffic after being struck. An alternative is to use compression struts, sometimes called push braces or stub poles, instead of breakaway strain poles or down guy wires.

Lane Drops and Roadway Narrowing

Where a roadway narrows or where the outside lane of a multilane roadway ends, inattentive drivers are more likely to run off of the road. It is better not to place poles down stream from such narrowing or lane drops. If they must be placed in these locations, breakaway poles, protection with barriers or crash cushions, or reflective markers on the poles should be considered.

Traffic Islands

Because traffic islands are adjacent to the roadway and drivers are constantly performing turning maneuvers around them, placement of poles on traffic islands should be strongly discouraged. Where poles must be placed on these islands, it is better if they are limited to large islands, and marked with reflective signs or other high visibility material. Where there is

a strong probability of collisions, consideration might also be given to using crash cushions to protect vehicles.

Medians

Placement of poles on a median should be strongly discouraged, unless the median is so wide that a normal clear recovery area can be provided on both sides of the pole, or unless a barrier is used to protect vehicles from striking it.

Placing Poles Behind Other Structures

Where guardrails, bridge rails, crash cushions, retaining walls, large ditches or other structures exist, consideration should be given to placing the poles behind them. This placement will protect vehicles from hitting them, and construction in these locations is often at little additional cost to placement closer to the roadway.

Traffic Conflicts

Areas where there are high numbers of traffic conflicts are more likely to be involved in accidents. For example, a heavy urban right-turn movement involving large vehicles may find these vehicles jumping the curb and striking adjacent poles. Therefore, it is important to use large radii and appropriate pole setbacks for this situation.

Another example of traffic conflict involves the typical intersection in which vehicles experience right-angle accidents. Two corners of the intersection will experience higher numbers of secondary collisions than the other two corners—a situation illustrated in Figure 4-3. It is better not to place poles on the two corners that are most likely to be hit.

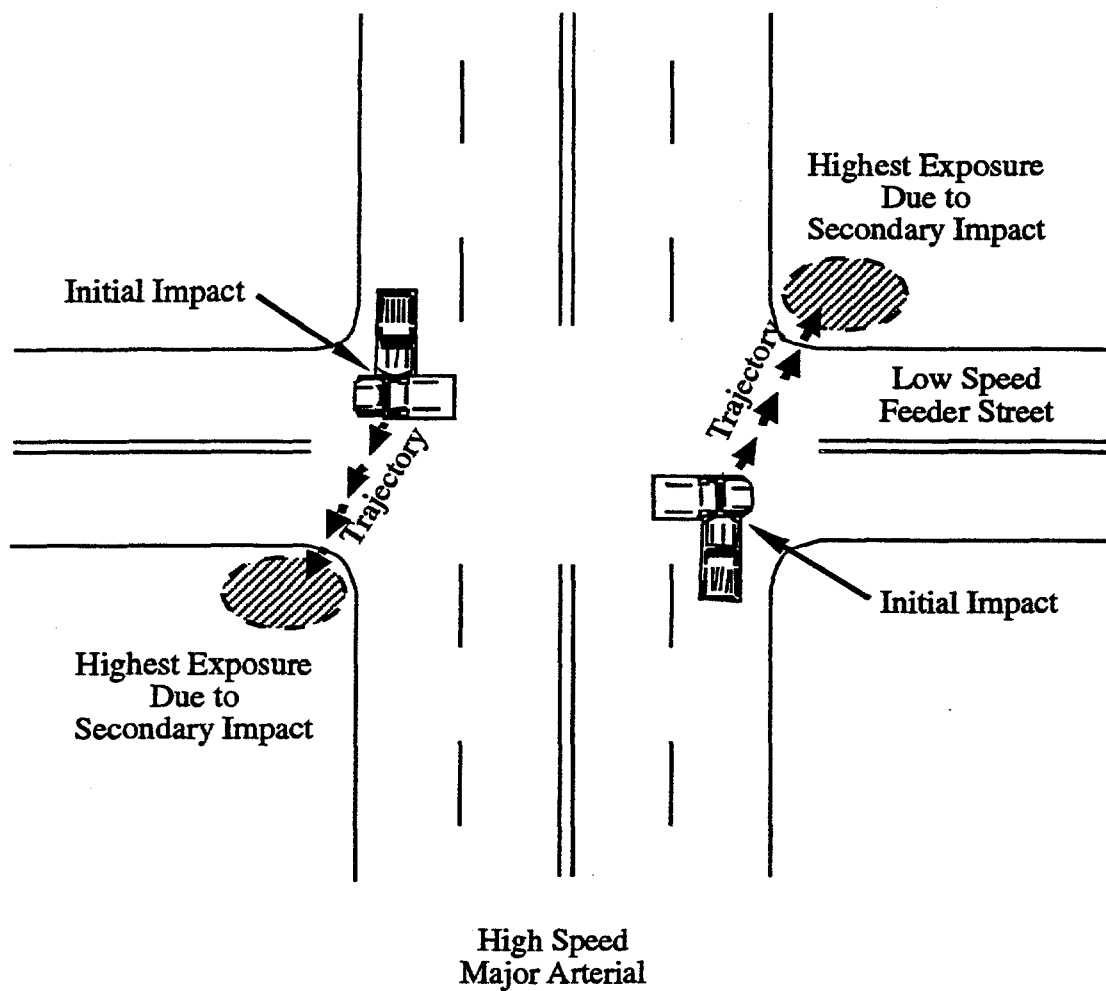


Figure 4-3: Intersection Zones Having Highest Exposure to Secondary Collisions.

Source: Ivey and Mak.

PREFERENCE IN LOCATION FOR GRAVITY FLOW FACILITIES

SHA's often give preference in location to sanitary sewers, storm sewers, and other gravity flow lines. They must lie in straight lines between designated terminal points (e.g., man-holes, inlets). The middle of the line cannot be moved to allow room for another utility without moving the entire line. In crowded ROW, this can sometimes cause problems. It is not unusual for the SHA to first assign a location to the

gravity flow pipe and then allow other utilities to occupy locations in the remaining ROW.

There are also instances for which it is not possible to change the elevation of the end of a pipe. The volume and velocity of flow in a gravity line are dependent on pipe size and slope. Moving one of the pipe termini causes a change in the pipe slope and consequently changes the velocity, which may cause the velocity to exceed maximum or minimum limits. Gravity flow pipes are often sensitive to slope and even minor changes may not be possible.

RESOLVING CONFLICTS

The best time to identify and address potential conflicts is during the design phase. Time and money can be saved if a project can be reasonably redesigned, either horizontally or vertically, to eliminate a direct conflict or potentially hazardous situation resulting from the close proximity of utilities to highway structures. The Florida DOT has identified several typical points of conflict and some suggested solutions that may be applied during design. These conflicts include, but are not limited to, those in the next few paragraphs.

Bridges

If bridges are involved in the project, review the structural plans and check substructure details to identify possible conflicts with utilities. For utilities close to structures, locations should be confirmed through a field survey. Mark pile locations. If retaining walls require piles, make necessary adjustments to avoid damage to underground or overhead utilities.

Roadway Excavation and Muck Removal

Determine which options are going to be used on the project prior to construction and how the base and subbase of the roadway will impact the utilities. Check the soil survey.

Paving

Adjust boxes and utility access covers to the final grade.

Signalization

Cross check signalization plans with roadway plans for buried facilities and overhead line clearance. Locate the service point and show it on the plan.

Lighting

Place poles to clear all other utilities. Review service points and maintenance requirements for possible conflicts.

Signing

Check utility alignments so that pole clearance is satisfactory.

These are a few examples of possible conflict areas that may be identified and resolved prior to construction through design reviews by the highway agency, preconstruction conferences, close coordination between the highway agency and utilities, and other activities that promote good communication.

SUBSURFACE UTILITY ENGINEERING

Subsurface Utility Engineering (SUE) is a relatively new discipline that provides accurate information on the location of underground utility facilities. Typically, it is used during the early development of a highway project so that cost-effective design decisions can be made. Savings can be substantial, and it is fast becoming good practice during the preliminary engineering phase of projects where utility conflicts are likely to occur. SUE has three major components:

- (1) *Designating.* Utilizing surface techniques, including electromagnetics and sonics, the existence and approximate horizontal location of underground utility facilities is determined.
- (2) *Locating.* Test holes are dug using vacuum excavation or comparable non-destructive equipment at critical points along a subsurface utility's path, exposing underground utility lines and allowing precise measurements of the depth and horizontal position to be made.
- (3) *Data Management.* Data management is the process by which

designating and locating information are surveyed and entered into state-of-the-art data management systems, such as the Computer-Aided Design and Drafting (CADD). Utilizing this information, a design engineer can examine the feasibility of project options and plan ahead to eliminate conflicts. The final result will be a set of plans containing accurate locations of underground utilities.

SUE benefits both highway agencies and utilities by providing big cost and time savings. For example:

- *SUE benefits highway agencies* by significantly reducing delays and subsequent contractor claims caused by unexpected conflicts with utilities during construction. Such conflicts have virtually been eliminated where SUE is routinely used because the exact location of utilities is known and accurately shown on the construction plans.

- *SUE benefits utilities by significantly reducing required and costly relocations necessitated by highway construction projects. Accurate utility information is available to highway designers early enough in the development of a project to design around many potential conflicts. Also, fewer utility relocations means fewer delays in beginning construction while waiting for the utility work to get out of the way.*

The Virginia DOT has been using SUE since 1984. They have found that adjustments to utility facilities can be eliminated or decreased by making minor adjustments to the design elements of a highway facility, thus significantly reducing the cost of utility relocations on a project. These minor adjustments typically involve storm sewer or drainage facilities.

On a major highway project in Richmond, the VDOT avoided almost 80 percent of the utility

relocations that would have been required had the SUE information not been available, and in doing so realized a savings of almost \$7 for every \$1 spent on SUE. Statewide, SUE has helped the VDOT reduce the time needed to design highways from 5 years to 4 years, a 20 percent reduction in time.

In addition to Virginia, State highway agencies in Pennsylvania, Delaware, North Carolina, Arizona, Maryland, Utah, and Rhode Island routinely pay for SUE services on projects where unexpected underground utility conflicts are anticipated. Local highway agencies and some utilities (e.g., city and county highway agencies in Phoenix and utility companies in Georgia, just to name a few) routinely pay for SUE services. Other highway agencies and utilities are moving in this direction.

The FHWA hopes at least 50 percent of the States will be using SUE routinely by 1998. They believe the routine use of SUE in all States will result in nationwide savings of \$100 million per year.

ATTACHMENTS TO STRUCTURES

It is sometimes cost effective for a utility to attach its lines to a structure to cross a body of water, a canyon or a freeway. It may be quite expensive for the utility to place its facilities anywhere except on a highway bridge. Another type of attachment to a structure occurs when a utility sometimes receives permission to place its lines inside existing culverts under the roadway.

Highway agencies have varying policies regarding attachments to structures. Some SHA's discourage the practice because of the negative aspects of some attachments. For example, a large diameter water main can be quite heavy and can produce large dead loads on a bridge structure. Some types of bridges do not

have suitable locations to attach utility lines, or the best places for attachment may interfere with bridge inspection and maintenance activities. Other aspects of utility attachments also have potentially negative effects.

With careful planning, many of the negative aspects can be minimized. For example, a bridge can be designed with extra structural capacity, and specific locations can be assigned for utility attachments. Figure 4-4 was taken from the Kansas Department of Transportation *Utility Accommodation Policy 1990* to illustrate locations and procedures for attaching utilities to bridges. Another state provides a "utility tunnel" on long span structures. The utilities

pay for the use of the bridge to offset any additional cost of the structure.

SHA policies toward attachment to structures are summarized in Table 4-3. This information was obtained by the International Right-of-Way Association during a 1992 survey. The table shows that virtually all SHA's allow attachment of water and communication facilities. Seven States prohibit any type of electrical utility attachment, and three States prohibit any type

of gas utility attachment. Those States that do allow attachment usually control it through the permit process. There is often some sort of restriction as to location, maximum voltage, maximum pressure, type of attachment, or other provision. Table 4-3 indicates that 18 SHA's have prominent restrictions for maximum voltage or maximum pressure for utilities attached to a structure.

ENCASEMENT

The SHA's are not unified in their policies toward encasement of utility lines under the highway. About one-third of the states require encasement of all types of line crossings, while two-thirds allow crossings without encasement under certain conditions.

SHA's that require encasement do so for a variety of reasons. The most common reason is so that the roadway does not have to be excavated for repair or replacement of the pipeline. If a leak develops, the line is simply removed from the casing and a new line put in its place. Other reasons are to ensure the structural integrity of the roadbed and pipeline, and to remove any leaking fluids and gases from the vicinity of the pipeline.

There are also reasons why encasements may not be necessary. The most prominent is that the encasement makes it more difficult to protect the pipeline from corrosion; that is, cathodic protection may be lost if the pipeline touches the casing. Instances of devastating pipeline explosions have been traced to loss of cathodic protection in an encased crossing. A second reason to allow crossings without encasement is that procedures have been developed to ensure adequate wall strength in the pipeline to handle

the additional stresses produced by the roadbed and traffic impact, while maintaining a high factor of safety.

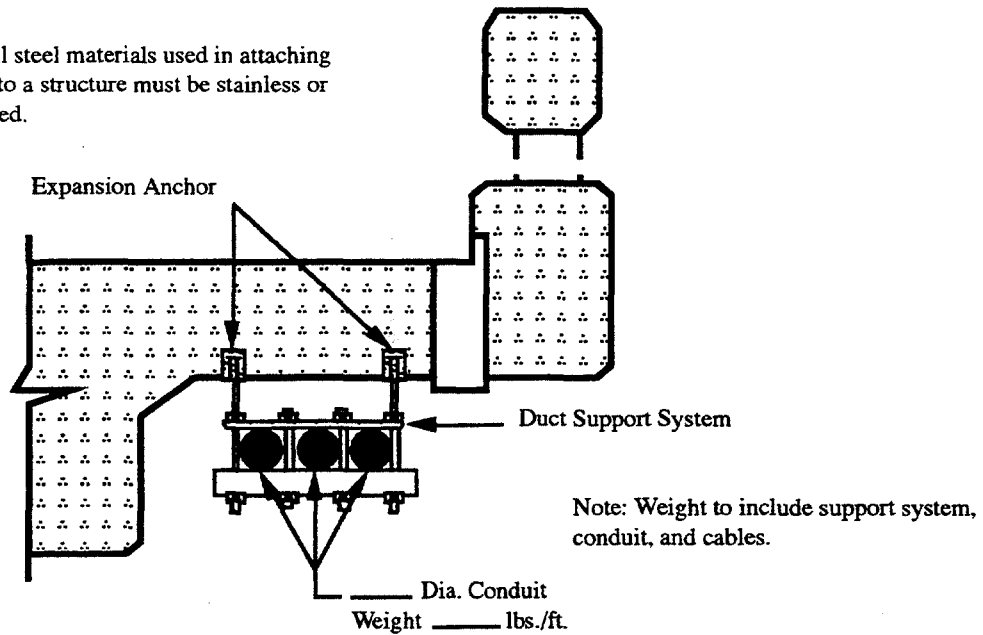
The Gas Research Institute *Topical Report Guidelines for Pipelines Crossing Highways* outlines provisions to ensure public safety. These include investigation of pipe wall thickness, pipe circumferential stress resulting from internal pressure and circumferential stress from earth load, external live-load including impact factor, cyclic circumferential stress, effective stress, wall fatigue, and other factors. These procedures provide additional pipe wall thickness to produce a factor of safety equivalent to encasement.

Alternate methods are sometimes adopted instead of encasement. These include deep burial, concrete barrier slab, heavy wall thickness pipe, slip boring, and open ditch/concrete slurry.

The *AASHTO Guide for Accommodating Utilities Within Highway Right-of-Way* devotes several pages to a description of encasement and allied mechanical protection. The discussion includes reasons for casings, installation techniques, drainage and venting, and similar topics.

For bridge with concrete handrails.

Note: All steel materials used in attaching a utility to a structure must be stainless or galvanized.



For steel bridge with cross frame diaphragms.

Note: All steel materials used in attaching a utility to a structure must be stainless or galvanized.

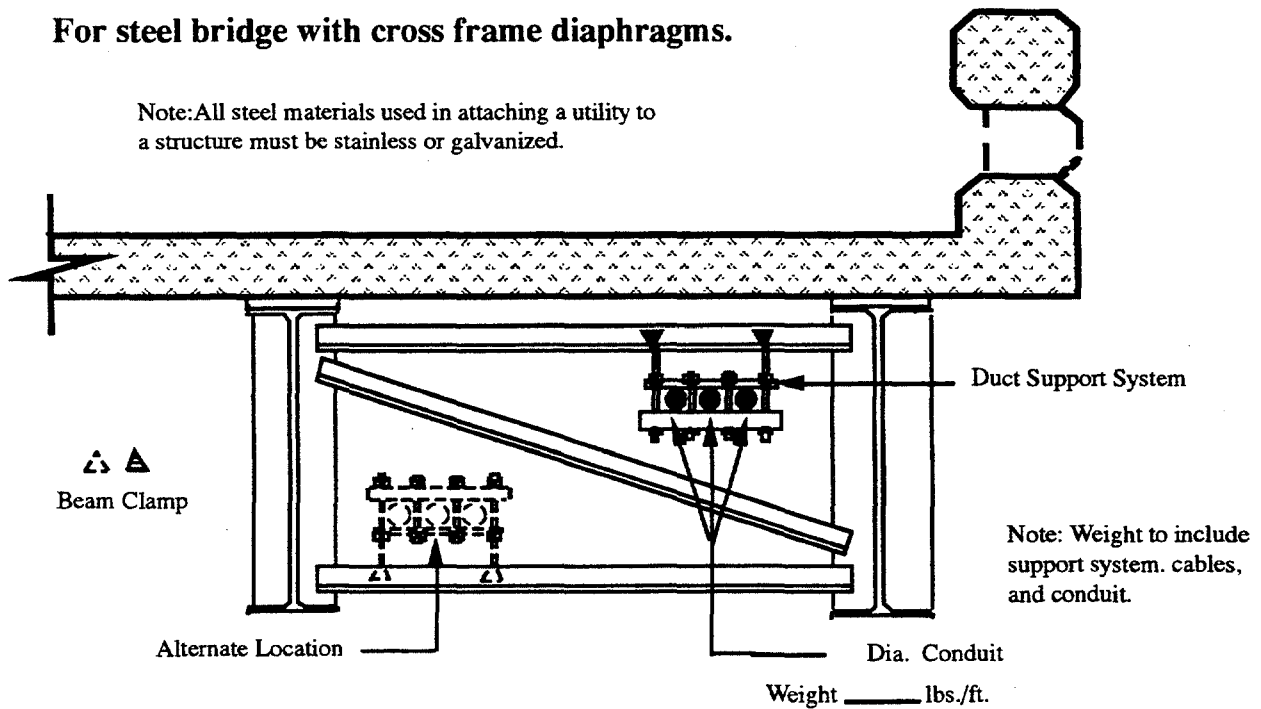


Figure 4-4. Kansas DOT Bridge Attachment Drawings.

Table 4-3. SHA restrictions for utility attachments to structures.

Type Utility Attachment	Number of States
Water attachment not allowed	1
Communication attachment not allowed	1
Electrical attachment not allowed	7
Gas attachment not allowed	3
Other utility attachment not allowed	2
Limits placed on pressure or voltage	18

Example Provisions

Each SHA and local government develops its own provisions for encasement of utilities under the ROW. The following example provisions

were taken from the Kansas Department of Transportation *Utility Accommodation Policy 1990*. They illustrate many of the treatments typically found in SHA utility manuals.

A. GENERAL

1. Casings are oversized load bearing conduits or ducts through which a utility is inserted:

a. To protect the roadway from damage and to provide for repair, removal and replacement of the utility without interference to highway traffic.

b. To protect the carrier pipe from external loads or shock, either during or after construction of the highway.

c. To convey leaking fluids or gases away from the area directly beneath the traveled way to a point of venting at or near the right-of-way line.

d. The casing shall include necessary appurtenances, such as vent, drains, and markers. Casing pipe shall be sealed at both ends with a suitable material to prevent water or debris from entering the annular space between the casing and the carrier, in accordance with pipeline industry standards.

2. Utility lines crossing highway rights-of-way will, in general, require casing from right-of-way line to right-of-way line. In certain instances, minimum casing may be allowed, requiring encasing from toe of backslope to toe of backslope in ditch sections and from toe of fill slope to toe of fill slope in fill sections.

3. Utility lines installed parallel to highway right-of-way require casing at certain locations. Such locations include, but are not limited to, crossings of sideroads and major entrances.

B. CASED LINES (AND WAIVER OF CASING)

1. Underground electric service lines must be placed in conduit or ducts from right-of-way line to right-of-way line and must be clearly marked by the owner at the outer limits of the right-of-way.

2. Lines carrying high pressure natural gas, liquid petroleum products, ammonia, chlorine, or other hazardous or corrosive products need not be cased provided they are:

a. Welded steel pipelines

b. Cathodically protected

c. Coated in accordance with accepted industry standards

d. Meet requirements of the Pipeline Safety Regulations—Code of Federal Regulations, Title 49—Transportation (Part 191 and 192 Natural Gas) or (Part 195 Liquid Petroleum Gas) with respect to wall thickness.

e. Designed for operating stress levels in accordance with Federal Pipeline Safety Regulations

3. When a waiver of casing is requested the utility company will provide, as a part of the permit, a statement of certification that their pipeline will comply with the conditions and provisions contained in items (a) through (e) in Section B-2 above.

4. Gas pipelines not meeting conditions and provisions (a) through (e) above must be cased within the right-of-way limits and shall be vented and marked at the outer right-of-way limits. The markers shall give the name and address of the owner and a phone number to contact in case of an emergency.

5. Sanitary sewer lines must be encased from right-of-way line to right-of-way line, except that gravity flow lines placed prior to highway construction, properly bedded, and constructed of heavy duty cast or ductile iron pipe with suitable mechanical joints and seals may remain in place.

6. Water lines must be cased, from toe to toe of backslope in ditch sections or toe to toe of fill slope in fill sections. Venting and sealing of casement is not required. Casement is not required provided:

a. Such line is placed prior to highway construction utilizing extra strength cast iron or ductile iron pipe with mechanical joints and seals, and is properly bedded. The extra strength pipe is to be used from right-of-way line to right-of-way line

b. Any copper, steel, or plastic water line has an inside diameter of two inches or less

7. All plastic pipe with inside diameter greater than two inches must be cased from right-of-way line to right-of-way line and meet minimum ASTM specifications and all applicable laws and codes. In certain instances, minimum casing may be allowed requiring encasing from toe of backslope to toe of backslope in ditch sections and from toe of fill slope to toe of fill slope in fill sections.

C. UNCASED LINES

1. The following type utility lines will not require casement:

a. Natural gas distribution and service lines with maximum pressure of thirty pounds per square inch (PSI) of copper, steel or plastic which have an inside diameter of two inches or less. Such lines are to be protected and installed in accordance with industry requirements and standards. The permit is to include a statement of certification that such standards will be met

b. Direct buried telephone and communications cable

c. Welded steel lines which are coated and cathodically protected and meet other requirements noted in previous Section IV-B-2

d. Water lines of two inches or less inside diameter of copper, steel, or plastic

2. Uncased utility installations, which by reason of shallow depth or location make them vulnerable to damage from highway construction or maintenance operations, should be protected with suitable bridging, concrete slabs or other appropriate measures

3. Where it is acceptable to both the utility company and the KDOT, underground utility installations not listed in this section may be installed without protective casing. These will be determined on an individual basis and limited to:

a. Open trenched construction

b. Small bores

JOINT USE

AASHTO, NESC, and ASCE all have publications calling for joint use and construction. They stress that it is better to have pole lines on one side of the road than on both sides, and it is desirable for all utilities' lines to be strung on the same set of poles. This reduces the number of poles in the ROW, provides a safer roadside, and minimizes the

number of utilities that might have to be moved during subsequent roadway widening projects.

The same considerations apply to underground conduit and in some instances to trenching. Where joint use practices are adopted, they require extended coordination among and between utilities and the highway agency.

DESIGN OF TRAFFIC CONTROL PLANS

Traffic control plans (TCP's) are becoming increasingly important in highway and utility work. Construction, rehabilitation, maintenance, inspection, and other activities are carried out on or near the highway under active traffic conditions. In urban areas there are usually large volumes of traffic. Interrupting traffic or requiring detours may be very difficult because of high traffic volumes. Under these conditions, any interference with traffic may increase the opportunity for accidents. Thus, it is important to have a good design for the TCP.

In rural areas, there is usually less traffic, but the vehicles are moving at higher speeds so the drivers require longer warning times and more distance to maneuver. When collisions do occur, they result in higher severities. This also makes it important to have a good design for the TCP.

The authoritative document for design of TCP's is the *Manual on Uniform Traffic Control Devices* (MUTCD). One of the specific statements in the MUTCD requires that TCP's be prepared and used for highway/utility activities.

Chapter 10 of this *Guide* contains information on the application of TCP's in highway/utility construction. The reader is referred to that

chapter for greater detail. The topic is covered briefly in this chapter because TCP's should be included in the normal highway and utility design processes.

Standard TCP's are encouraged. It is very helpful if a utility firm develops several standard TCP's that cover many of their routine, repetitive operations. For example, one TCP could cover a utility vehicle stopped on the roadway shoulder while employees work on an adjacent utility pole. Another could be developed for work in an open manhole in the pavement. Others could be developed for other situations. Having standard TCP's (which have been preapproved by the SHA) decreases the time associated with permit approval, makes training of employees easier, and encourages fuller understanding and use of the principles of traffic control.

Many utility firms and highway agencies have developed pocket size guides that cover traffic control plans and highway work zones. These may be kept on the job site by supervisors and managers for handy reference.

In addition, some utilities have developed comprehensive manuals for work zone traffic control. The Atlantic Electric Company, a New

Jersey utility, published a laminated loose-leaf guide and made it available to all their crews. The Wisconsin Electric Power Company has developed a comprehensive manual that provides

detailed work zone information for three types of employees: administrative, engineering, and construction personnel. The contents of the Wisconsin manuals are outlined in Table 4-4.

SCENIC ENHANCEMENT

Utility facilities can substantially alter the scenic quality, aesthetic appearance, and view of the highway roadside. For this reason, highway agencies frequently apply special controls. SHA's typically base their controls on Federal policy. New utility installations are not allowed on highway ROW acquired or improved with Federal highway funds if they are located in (or adjacent to) areas of natural beauty or scenic enhancement. This includes public and recreation lands, wildlife and aquatic refuges, historic areas as described in 23 U.S.C. 138, scenic strips, overlooks, rest areas, and landscaped areas.

Under Federal policy, new underground or aerial installations may be allowed only when they do not require extensive removal or

alteration of trees or terrain features visible to the highway user, or when they do not impair the aesthetic quality of the lands through which the roadway travels.

New aerial installations are not allowed at locations where there are feasible and prudent alternatives. When there is no such alternative, they are allowed, but only when extreme conditions exist, such as unusual difficulty or expense; underground placement is not feasible; or suitable locations, designs, and materials are used that give greatest weight to aesthetic qualities of the area.

If utilities desire to place their facilities in areas of scenic enhancement, they must demonstrate that extreme conditions exist to justify their installation.

OTHER SPECIAL TOPICS

ENDANGERED OR THREATENED SPECIES

Both highway and utility agencies must cooperate with the U.S. Fish and Wildlife Service to minimize vegetative management impacts for endangered or threatened wildlife or plants.

WILD FLOWER PRESERVATION

Many SHA's and local highway agencies now have programs designed to encourage native wildflower growth in the ROW and enhance the

aesthetic quality of the roadside. These programs involve special plantings, delayed mowings, and limits on chemical herbicide treatments. At the same time, there are locations where these flowers must be considered a weed, especially where agricultural row crops are adjacent to the ROW. In this case the wildflowers may have to be controlled so that they do not compete with crops for the farmer's fertilizer.

Utilities are expected to comply with the highway agency's policies for the treatment and protection of wildflowers. Care should be exercised in digging and herbicide application, and if

Table 4-4. Utility Traffic Control Practices Manual.

<u>General</u>	<u>Engineering Practice</u>
<p>The Utility Traffic Control Practices Manual is divided into the following three Practices:</p> <ul style="list-style-type: none"> • Administrative Practice • Engineering Practice • Construction Practice <p>All construction or engineering work activity within a freeway right-of-way generally requires a State utility permit.</p> <p>Municipalities or highway agencies may require that Traffic Control Plans (TCP's) be included as part of the permit application.</p> <p>TCP's are generally required whenever utility work will affect the free flow of traffic.</p> <p>Some highway agencies require permits for any traffic control that include TCP's. Emergency repairs may begin in advance of obtaining a permit. If a permit would ordinarily be required, it shall be requested as soon as practical. Some highway agencies require telephone notice that emergency repairs are underway.</p>	<p>The Engineering Practice portion of the manual provides work zone traffic control guidance for engineering activities and for utility construction activities. Engineering activities within streets or highways may require traffic warning or temporary traffic control. Where unique or more complicated traffic control is involved at a utility work site, development of a unique TCP may be appropriate or required.</p>
<u>Administrative Practice</u>	The following documents are provided:
<p>The Administrative Practice portion of the manual is intended for use in utility Headquarters' offices.</p> <p>The following documents are provided:</p> <ul style="list-style-type: none"> • Training Guide. This document is intended for those who must occasionally train new employees or contractors in work zone traffic control requirements. It is based on Part VI of the Manual on Uniform Traffic Control Devices (MUTCD), the national standard on which all requirements for work zone traffic control must be based. • Purchase Guides. This document provides guidance for ordering approved devices and a general knowledge about the devices that a signing contractor is expected to know about and provide. It lists traffic control devices that should be available through utility company storerooms (i.e., stock devices). It also lists traffic control devices that usually are not stocked by utility companies (i.e., non-stock devices). If required for a unique TCP or utility permit, non-stock items should be provided, placed, maintained, and removed by a signing contractor. • Signing Contractor Specifications (i.e., typical specifications for a signing contractor). This document consists of a specification to be included in every contract with a signing contractor for temporary traffic control, including signing, barricading, and flagging. 	<ul style="list-style-type: none"> • Traffic Warning. This document includes the minimum requirements for traffic warning to be used in the performance of utility work in or near the travel lanes, usually by a lone employee, when the work does not involve closing a travel lane on a heavily traveled highway or arterial street. All work where traffic warning applies should take place outside the roadway. Work on or beyond the shoulder does not usually affect the free flow of traffic, but some warning is required. Survey type activities should be performed without interfering with traffic. If a travel lane must be closed, temporary traffic control comes into play. • Temporary Traffic Control. This document is based on the MUTCD. It provides typical TCP's for use in situations where the free flow of traffic is affected by utility work. • Traffic Control Planning. This document contains the requirements and guidelines for work zone traffic control whenever utility work will or could affect the free flow of traffic or whenever utility work occurs along, within, or across any street, highway, or road. It includes several TCP's for typical situations where the flow of traffic could be affected.
	<u>Construction Practice</u>
	<p>The Construction Practice portion of the manual provides work zone traffic control guidance for utility construction activities.</p>
	The following documents are provided:
	<ul style="list-style-type: none"> • Traffic Control Planning. This document is based on the MUTCD. It contains the requirements and guidelines for traffic control whenever utility work will or could affect the free flow of traffic or whenever utility work occurs along, within, or across any street, highway, or road. It includes several TCP's which should fit most situations where the flow of traffic could be affected. • Temporary Traffic Control. This document is based on the MUTCD. It contains TCP's to be used when utility work affects the free flow of traffic.

Source: Wisconsin Electric Power Company.

there is doubt about a particular plant, the highway agency should be contacted.

WETLANDS

The installation of lines or conduits on highway ROW of Federal-aid or direct Federal highway

projects to drain adjacent wetlands on highway ROW is prohibited. This practice is inconsistent with Federal Executive Order 11990, Protection of Wetlands.

EXAMPLE UTILITY DESIGN CRITERIA

Although it is not possible to present detailed criteria for all types of utilities in this *Guide*, the design criteria and practices of two industries (communications and gas distribution) are discussed in the next several pages as illustrations of current practice. These discussions are based on information provided

through the courtesy of BellSouth Telecommunications and Atlanta Gas Light Company. The reader is cautioned to remember that although these materials are illustrative of current practice, many parts have been specialized to fit the specific needs of BellSouth and Atlanta Gas Light Company.

TELECOMMUNICATIONS DESIGN

The operating purpose of a telephone company (other than to be profitable for its shareholders) is to provide a transmission signal to single-line residential customers and to multi-user businesses. It is no longer only a standard telephone. The customer must be connected to the central office via metallic cable (twisted pair of copper wires), fiber optic cable (hair-thin glass fiber), or some combination through the use of electronics. The transmission signal originates in the central office, which contains the switching equipment to connect one call to another. All types of outside facility cable are physically terminated at this office.

OUTSIDE FACILITIES

Outside facilities are all telephone equipment placed outside the central office building to serve

a customer or to connect one central office to another. They consist of a wide range of equipment types and sizes. Typical components include conduit, manholes, cable, pole lines, and other equipment associated with these items. A conceptual illustration of typical telephone facilities is shown in Figure 4-5.

LINE FACILITIES

Unlike utilities that are limited to primarily aerial or strictly underground facilities, telecommunications facilities can be installed on a pole line, placed in an underground conduit run, or directly buried. Existing physical conditions often determine which type of placement is appropriate for new installations or relocations of existing facilities.

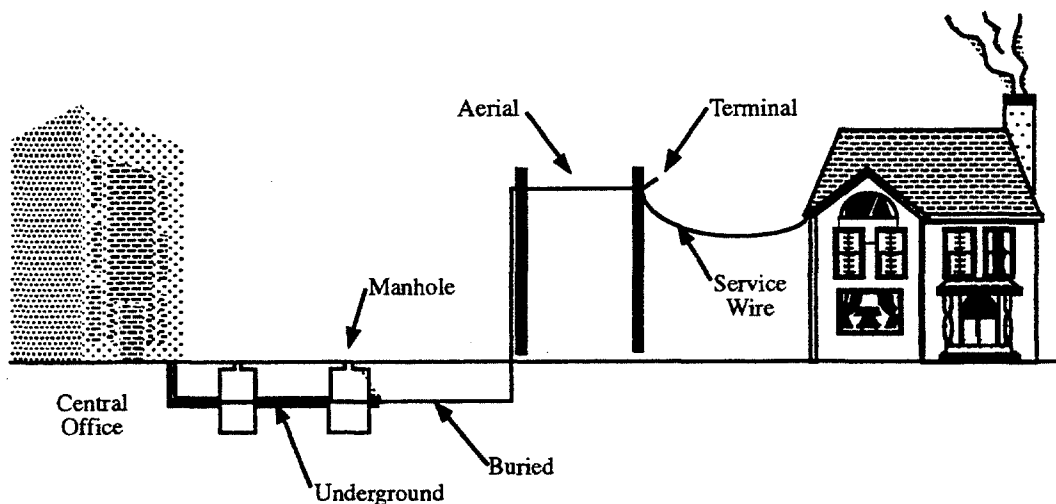


Figure 4-5. Typical Telephone Facilities.

Source: BellSouth

The types and locations of telecommunication lines are governed by the engineering guidelines developed by individual telephone companies, within the provisions of the NESC, SHA utility manuals, and other controlling documents. Economic feasibility is a second important factor to consider in determining the type of installation. More on this topic will be provided later in this chapter.

A third factor is safety. The clear roadside concept has become increasingly important, and telecommunication lines must be installed with the clear zone in mind. This requirement provides a reasonable margin of safety for the motoring public, telecommunications workers, and the employees of other utilities.

UNDERGROUND CONDUIT

In general the installation of telephone facilities in conduit is a more costly method of placement but may be needed for extra protection of its

value or function, or if route congestion dictates. By the same token, if a conduit run exists along a route and contains vacant ducts, it is better to use this underground investment for new installations—rather than adding a pole line. New conduit construction has declined as a result of the introduction of fiber technology. However, joint construction with power companies is still a good choice, provided that clearance and separation requirements can be met.

Most urban areas prefer placement of telephone facilities in underground conduit because of safety factors and congestion of the ROW. The initial installation of conduit may be more expensive and time consuming but generally evens out expenditures and delays over time.

Underground conduit constitutes a major investment and must be designed for long and efficient life. Because of the investment and the subsequent placement of cables, the conduit location must be planned as permanent.

Careful consideration must be given to the placement of conduit on public ROW, since it is extremely costly and cumbersome to relocate. It is in the best interest of the industry to place this type of facility at the very back of the ROW or even outside the ROW to avoid relocation or "entombment" of the investment. Given the nature of progress, even the most wisely placed telecommunications facilities may, in all likelihood, eventually be relocated for highway improvements.

Conduit route can be classified in two basic groups: new routes where no conduit exists at present, and existing routes where conduit exists and is to be reinforced, extended, or both. Various materials have been used in the construction of conduit systems. Clay, C-transite asbestos fiber cement, and pine conduit were used in the past. Currently, 100 mm (4 in) C plastic PVC and C polypropylene single-bore conduit are used in single or multiduct construction.

Sizing

The initial factor that influences the size of a conduit structure is the fundamental route planning for conduit relief and extension. Additional factors influencing the number of ducts are local exchange and long distance pair requirements (existing demand and projected growth—20 to 50-year forecast) and transfers, cable wire gauge-size requirements, projected construction costs for future conduit, and timing of future conduit relief.

Urban distribution cables are sized for ultimate requirements (for the expected service life of the facilities being placed). This is based on a minimum of two lines per living unit.

Cost Factors

Each conduit route is a unique and separate design. Common factors that contribute to the cost of conduit construction are

- (1) Engineering;
- (2) Material (including transportation);
- (3) Digging conditions (type surface, subsurface congestion—hand digging or relocation of other structures, soil makeup, shoring requirements, and street opening restrictions—length of trench or work hours);
- (4) Use of concrete encasement, reinforcing concrete slabs or select backfill;
- (5) Trench width and depth;
- (6) Spoil removal;
- (7) Manholes; and
- (8) Work operation inspection.

Manholes

Manholes provide space in the conduit system for joining main cable sections, splicing subsidiary cables, splicing in stub cables, and installing items of equipment that are necessary for the efficient operation and maintenance of the cable plant. All utility access locations should provide suitable space for installation of the cables and associated equipment, and additional space for a person to work.

Manholes facilitate the installation of main and subsidiary cables. For economy, conduit section lengths are as long as practical to take advantage of the maximum lengths of cable that can be placed on a cable reel. Manholes should

be strong enough to support the heaviest anticipated traffic loads and to withstand the hydrostatic loads of subsurface soil conditions.

Manhole Locations

Manholes should be located to provide a safe working area and a suitable location for placing, splicing, and maintaining cables and associated equipment. Associated work should not jeopardize vehicular or pedestrian traffic flows.

Safety is a prime consideration, and work locations are selected to avoid or minimize hazardous situations. Advance consideration must be given to the protection of telephone company personnel and the general public by locating manholes where traffic control can be provided when the manhole is open. Space must be provided for cable trailers, pulling trucks, and other equipment for placing underground cable. During the early stages of conduit planning, it is a good idea to visit the highway agency to obtain locations of planned future highways so future access can be designed in through the selection of good locations for manholes.

Section Lengths

The lengths of conduit sections vary, influenced by the following considerations:

- (1) frequency and location of subsidiary ducts, branch cables, and so forth;
- (2) location of load coils, build-out capacitors, and carrier equipment;
- (3) subsurface obstructions located along the conduit route;
- (4) intersections of conduit routes;
- (5) need for intermediate manholes due to excessive cable-pulling tensions—studies have shown the feasibility under proper conditions of pulling

full-sized plastic sheath cables for distances up to 540 m (1750 feet);

- (6) need for splicing manholes based on the maximum available reel length of cable; and
- (7) safe manhole environment.

CROSSINGS—GENERAL

Steel casing pipe provides an effective housing for underground conduit and is recommended for railway and highway crossings since it can be installed without interference to traffic. Pipe specifications are determined by AASHTO and the American Railway Engineering Association (AREA).

Bridge Crossings

Make bridge crossings as aesthetically pleasing as possible. Conduit may be embedded in the bridge deck, located in a void in the bridge structure, suspended under the bridge deck, or attached to a structural member (using steel hangers for support).

Make sure conduit will not be damaged by normal bridge use, vandalism, or bridge traffic. For bridges over navigable waterways, the supporting structure should not project below flood level. Design of conduit assembly and associated support structure should be consistent with AASHTO specifications.

Highway Crossings

Crossings of interstate and express highways and many major arterial highways are placed in steel casing pipe. Cased crossings should span the entire roadway, cross section and embankment, as shown in Figure 4-6. It should be

below the base, subbase, and compacted earth under the roadway. The casing should have at least 1 m (3 ft) of cover in nonpaved areas, and 0.6 m (2 ft) of cover under a paved gutter or ditch. Extra depth is needed in areas where surface activity or subsequent construction can impact the casing. The clearance between the telephone plant and any highway structure should permit access to and maintenance of the telephone plant without interfering with traffic flow. Casings should be avoided in deep cuts, near bridge footings or retaining walls, and in wet or rocky terrain.

Railroad Crossings

Crossings under mainline railway tracks must normally be cased. A typical crossing is shown in Figure 4-7. Whether or not casing is required is determined during the early stages of planning a railroad crossing. Crossings should never be at an angle of less than 45 degrees to the track. They should extend the full width of the present roadbed plus any anticipated roadbed widening. Also, they should extend at least 1 m (3 ft) beyond any ditch and a minimum of 7.7 m (25 ft) beyond the centerline of the outside track. Crossings are at least 1.7 m (5.5 ft) below the base of the rail for mainline tracks and 1.4 m (4.5 ft) for other tracks, and a minimum of 1 m (3 ft) below any ditch or ground area not directly supporting track.

Separations from Nontelephone Structures

The minimum desirable separations between nontelephone structures and telephone conduit or manholes should be as follows:

- (1) From telephone conduit—at least 75 mm (3 in) of concrete, 100 mm (4 in) of brick masonry, or 300 mm

(12 in) of earth are needed for separation from light, power, or other conduits. Other foreign pipes such as gas, water, and/or oil mains, need at least 150 mm (6 in) clearance when crossing and 300 mm (12 in) when paralleling.

- (2) From telephone manholes—at least 75 mm (3 in) from the outside edge of a manhole wall or roof are needed for separation from electric light, power, or other conduits. Other foreign pipes such as gas, water, and/or oil mains, need at least 150 mm (6 in) clearance when crossing and 300 mm (12 in) when paralleling.

POLE LINES

Planning

While planning new lines, extensions, or major reconstructions, representatives of other utilities and highway departments are consulted. Items like route selection, ROW use, and pole spacing are reviewed so plans and methods can be coordinated, and so that safety, service, and economy can be promoted.

Unique considerations occur with each type of telephone line installation. Specifically, for aerial placement, the engineer must take into account the type of road design, (e.g., urban or rural, curb or no curb), the speed limit, the slope, and the type of ditches, to name a few considerations. In urban areas, it is usually recommended that poles be placed behind the sidewalk or at certain distances behind the curb. In rural areas most SHA's require utilities to follow AASHTO guidelines for pole locations and clearances.

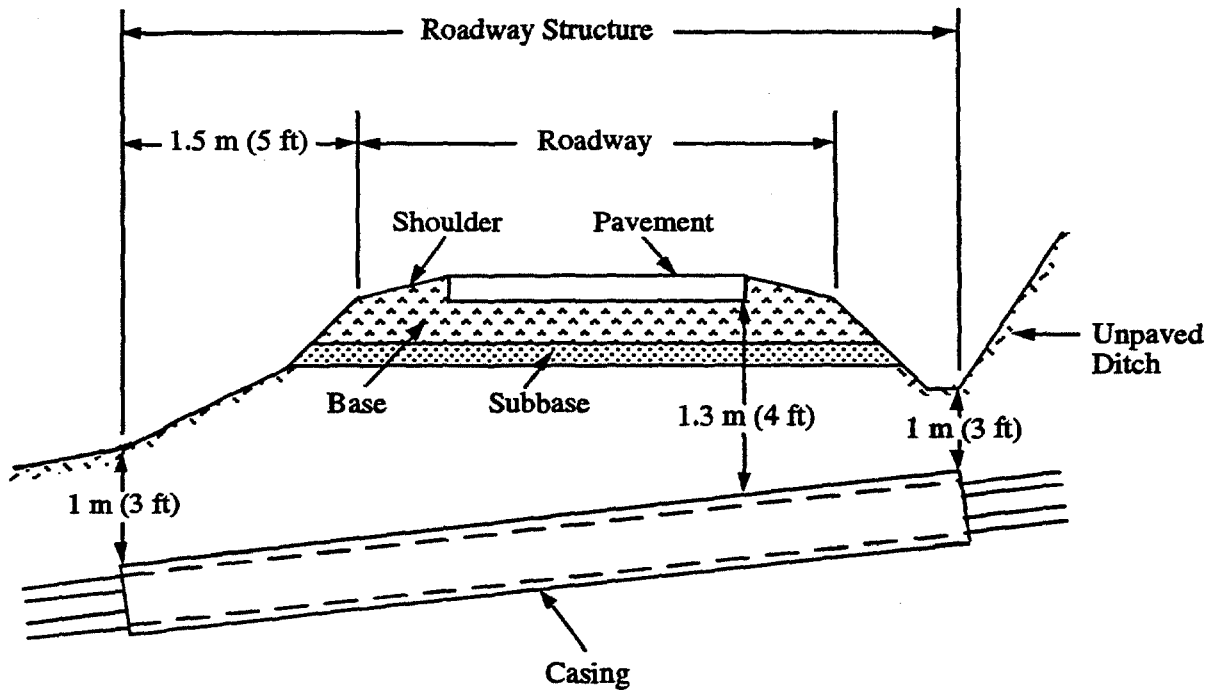


Figure 4-6: Minimum Highway Crossing Encasement Dimensions.
Source: BellSouth

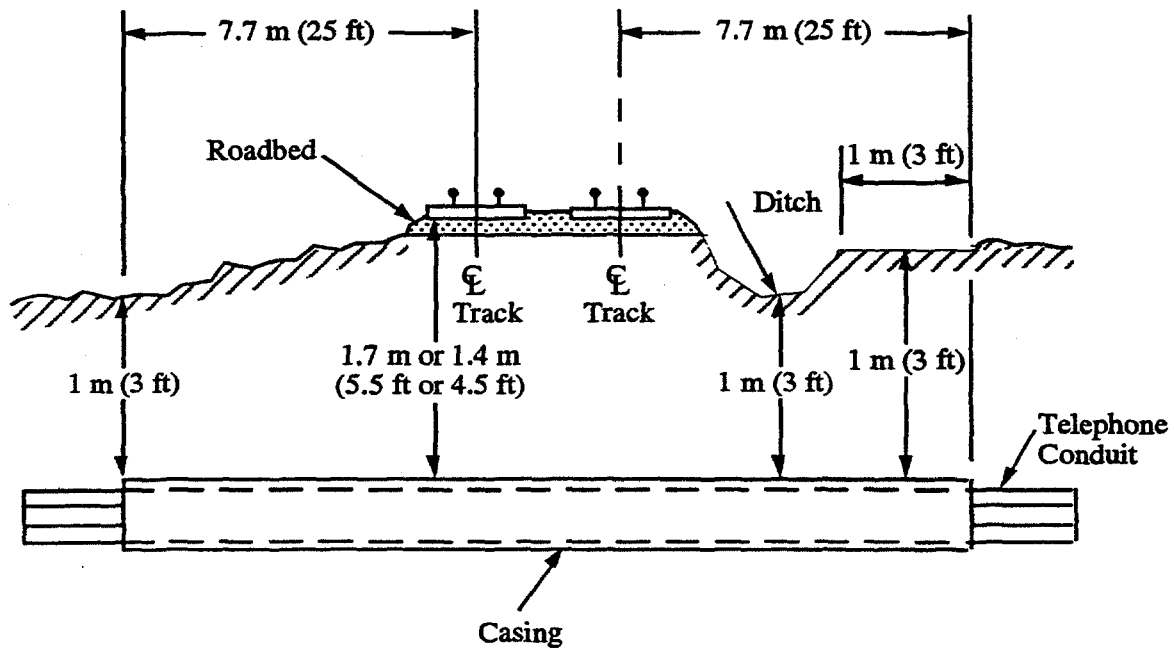


Figure 4-7: Minimum Railroad Crossing Encasement Dimensions.
Source: BellSouth

Route Selection

In selecting a route, the function of the pole line is considered in regard to the plant as a whole. Also considered are the requirements for which the cable is initially designed, and its adaptability for future use (attachees such as power and other carriers such as MCI and Sprint).

Right-of-Way

ROW for pole lines may be on public or private property. Public ROW offers lower first costs. Private ROW reduces transmission trouble by eliminating proximity to power circuits. It also reduces the probability of tree interference and allows for the complete removal of undergrowth and trees during construction of the line. It is comparatively permanent and avoids pressure for removal of physical plant to improve highway appearance. However, it has the disadvantage of increased first cost.

Pole Spacing

The average pole spacing for new lines depends on:

- the type of overhead construction;
- storm loads likely to be experienced;
- mechanical characteristics of the aerial cable or its supporting strand;
- initial costs; and
- desired margins against cable breakage, service interruptions, and undue maintenance expenses.

Pole spacing in cable lines is affected by the desirability of setting poles on property lines, the need to provide poles at limited intervals to allow service distribution, and economics. Use of

relatively long spans reduces the number of poles, decreases pole hole costs, provides ROW advantages, has a better appearance, and reduces cable bowing and sheath troubles at poles.

Pole Classes

The strength of a pole is indicated by a class number, with the strongest rated at 1 and the least strong rated at 10. All poles of the same class, regardless of length and timber species, must be able to withstand the same horizontal load, applied 0.6 m (2 ft) from the top of the pole. The minimum breaking loads are given in Table 4-5. These loads are computed with the assumption that the break would occur at the ground line.

Markings and Timber Species of Poles and Stubs

Since 1974, poles and stubs have been marked as indicated in Figure 4-8. Between 1964 and 1974, the markings were the same except that the AT and AT-R designations were not used. Prior to 1964, only poles (not stubs) were marked. The marking codes adopted to indicate tree species used for poles are shown in Table 4-6.

Wood Preservatives

To obtain satisfactory physical life for pole timbers, they are given a full-length preservative treatment. The preservatives are chemicals that make the timber uninhabitable or unpalatable to wood-destroying organisms. Preservatives must be highly toxic to fungi and poison or repel insects. The most common types of preservatives used for timber poles are shown in Table 4-7.

Table 4-5. Characteristics of Poles.

Pole Class	Breaking Load 2 Ft From Top (Lb)	Longest Available Pole (Ft)	Weight of Longest Pole (Lb)
1	4500	125*	10850
2	3700	125*	9510
3	3000	110*	6610
4	2400	80*	3430
5	1900	70*	2400
6	1500	60	1620
7	1200	50	1040
8	(This is not a standard class.)		
9	740	30	340
10	370	25	210
Notes: Weight is for the heaviest species (SP); the lightest species (WC) is 30 to 40 percent lighter. *The longest JP, LP, or NP pole is 60 feet. 1 m = 3.28 ft, 1 kg = 2.2 lbs			

Source: BellSouth.

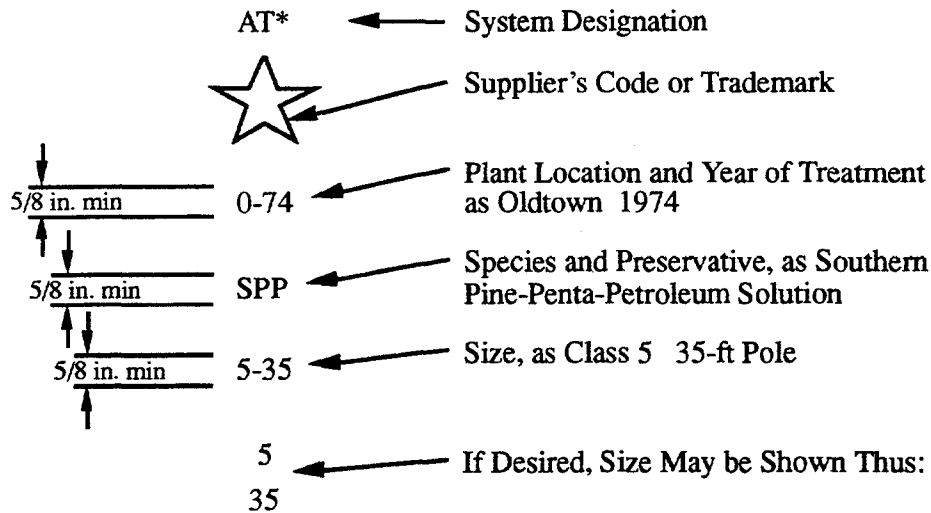
Clearance

Clearance requirements for aerial cable apply under conditions of maximum storm loading and may occur because of high temperatures or ice loadings. Clearances detailed in Table 4-8 are based on specifications of the 1990 edition of the National Electric Safety Code (NESC, Table 232.1). The NESC is a voluntary standard. However, some editions and parts of the Code have been adopted, with or without changes, by state and local jurisdictions. If there are questions about the legal status of the NESC in any particular state or locality, the authority having jurisdiction should be contacted.

Joint Use

Experience has shown that safer and more satisfactory conditions can often be secured if the power and telephone circuits are carried on the same pole lines rather than separate poles. Joint use of poles by power and telephone companies results in fewer poles and better appearance of aerial lines. It also conserves pole timber and is normally more economical for both classes of utility compared to separate pole lines.

Pole allocation space has been established when more than one "authorized licensee" is attached to the same pole. This applies to power companies, cable TV companies, and other



*At R for Retreated or Reconditioned Poles

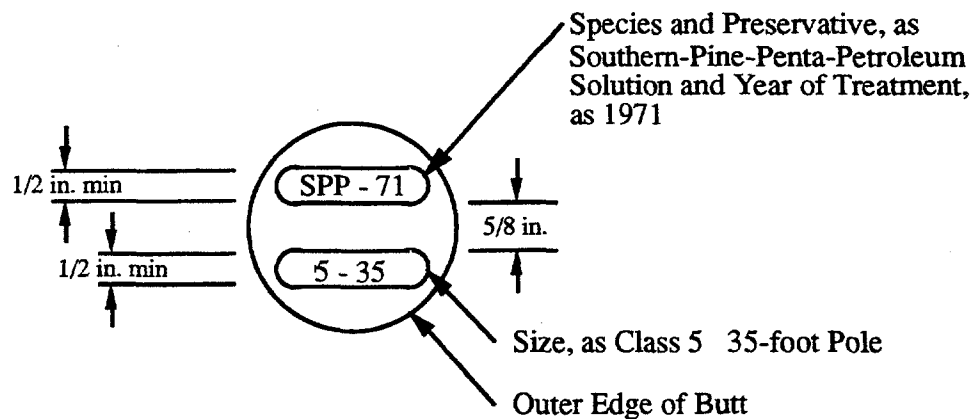
Note Location of Lowest Part of Markings is 10 feet from Butt, Except:

10-foot Stubs 9-1/2 feet from Butt

55-foot and Longer Poles Since 1964 14-feet From Butt

80-foot and Longer Poles From 1955 to 1964 15 feet From Butt

Poles Purchased and Placed by Other Companies



Note The Butt Marking Should be Located with Respect to Outer Edge of Butt, Approximately as Shown

Markings May Also Be Branded

Figure 4-8. Marking Codes Used on Poles and Stubs.
Source: BellSouth.

Note: 25 mm = 1 in

Table 4-6. Pole Timber Species.

WC	Western Red Cedar	WP	Ponderosa Pine
JP	Jack Pine	LP	Lodgepole Pine
NP	Red Pine	DF	Douglas Fir
SP	Southern Pine	WL	Western Larch

Source: BellSouth.

alternate access providers. Where poles are to be jointly used, line requirement information includes the number of foreign wires and cables expected during the design period. In addition to these general line requirements, specific poles may be required to provide space for the attachment of terminals, loading pots, transformers, street lights, and other items.

A standard joint-use pole is a 12.3m (40 ft) class 5 pole. The pole must be high enough to permit differences in levels of attachments of power wires and telephone cables. This prevents power wires from sagging on the telephone cables when both are subjected to storm loads. Space allocation per attachee is shown in Figure 4-9.

BURIED CABLE

Buried cable is both feasible and desirable for telephone service. It is the method of choice because it provides durable, trouble-free, economic, and aesthetically pleasing telephone facilities. Economic factors such as first costs, maintenance costs, potential service disruptions, and service life are considered when evaluating potential buried cable situations.

Cable Size

The size of buried cables is determined by analyzing each case. Initial size requirements,

rate of growth, maximum fill, and (in particular) the ease or difficulty of relief are considered. Future buried cable relief is important since greater difficulty will be encountered in placing and maintaining each succeeding cable.

Cable Route

Selection of the physical location, determination of the materials to be used, application of technical design, and layout of the route are important considerations in the design of buried facilities. Additional considerations critical to the route selection include the

- (1) location of all other utilities (power, gas, water, sewerage, drainage, and cable TV);
- (2) costs of placing and maintaining the cable;
- (3) susceptibility to damage (nontelephone workmen, induced voltages, cathodic reactions, and contact with power); and the
- (4) availability or usability of ROW (rear lot easements; public and private ROW).

Buried facilities must not be placed on private property without a legally binding permit or easement to ensure the right to place and maintain the telephone facilities. All ROW (private, public, railroad, waterway, and any

Table 4-7. Common Timber Pole Preservatives.

Codes	Preservative Treatment	Used For Species Type
A	Creosote Pentachlorophenol	SP
C	Creosote*	SP
G	Pentachlorophenol in LP Gas (Cellon Process)	WP, LP, DF, SP
P	Pentachlorophenol in Petroleum	All
S	CHEMONITE# or greensalt	Discontinued code
SB	Ammoniacal Copper Arsenate (ACA-CHEMONITE)	All
SC	Chromated Copper Arsenate (CCA) Type A	All
SK	CCA Type C	All
Note: * Furnished only on specific authorization of operating company. # Registered trademark of the J.H. Baxter Company.		

Source: BellSouth.

other specialty permits) should be secured and recorded prior to the release of construction drawings.

In selecting the locations for above-ground telephone hardware, the site must be the best combination of the ideal theoretical location and the ideal physical location. It must provide a safe environment for the craftspersons working at the site at various times and the general public. Other site selection factors include

- (1) keeping public inconvenience to a minimum;
- (2) ensuring access to the facilities;
- (3) accommodating the ultimate requirements for telephone facilities;
- (4) having legal right to place and maintain facilities;
- (5) minimizing the possibility of relocation because of public improvements; and

- (6) minimizing the possibility of damage from flooding or being hit by vehicles.

Coordination with developers, highway engineers, planning commissions, and other utilities will make builders and subcontractors aware of cable locations, and help prevent future conflicting construction activities. Coordination with developers and local planning authorities in the early stages of subdivision planning can establish easements to be indicated on plot plans as new subdivisions are recorded.

Method of Placement

The most economical and practical methods of cable installation are trenching and plowing. Trenching is more desirable in urban and suburban areas where there are obstacles such

Table 4-8. Minimum Clearance Requirements Under Maximum Sag Conditions.

Crossing Above	Clearance (ft)	Remarks
Railroad tracks	23.5	
Public roads	15.5	
Public alleys, non-residential driveways, parking lots	15.5	
Residential driveways	15.5	Service drop wires may be 11.5 ft.
Walks and lanes (pedestrian)	9.5	
Other lands	15.5	Including grazing, orchards, forest, cultivated land
Waterways	Must be shown on plans—consult engineer	In some cases, under the jurisdiction of the US Army Corps of Engineers
Running along: Public roads in non-rural areas Rural (light traffic) roads unlikely to have vehicles passing under the line. (see note 2) - Back of obstruction - Not back of obstruction Public alleys	15.5 9.5 13.0 15.5	
<p>Notes: The required clearances from signs and buildings are not included in this table.</p> <p>Unpaved country lanes only. If paved, consider this as an urban even in rural areas.</p> <p>The above clearances are minimum; additional factors must be considered when evaluating the relationship of cable attachment positions on "joint-use" poles.</p> <p>1 m = 3.28 ft</p>		

Source: BellSouth.

as other subsurface utilities and paved road crossings. Plowing is more desirable in open or rural areas where there are few obstacles to interrupt the progress of the plow train.

Joint Buried Construction

With the steady rise in labor costs and the increased difficulty of finding available space for placing buried facilities, alternate methods of placement become feasible. When several

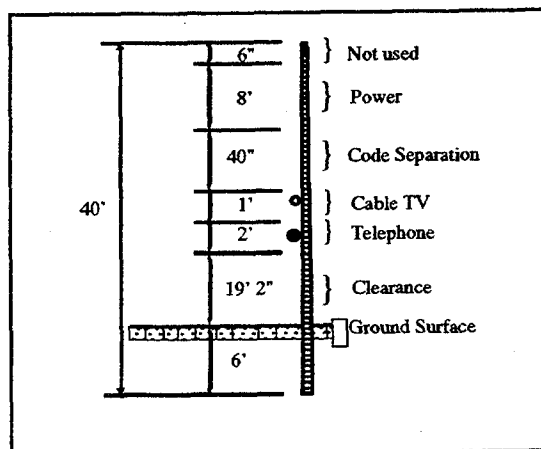


Figure 4-9. Joint Use Pole Allocations.
Source: BellSouth.

Note: 1m = 3.28 ft, 25 mm = 1in

utilities are burying facilities in an area, sharing the same trench may be appropriate. Joint use of trenches for buried cable can be both cost effective and good public relations. It is considered wherever economic savings (both initial cost and maintenance) can be realized.

The costs of safety and precautionary measures needed during construction and maintenance of the facility must also be considered. Joint buried construction could be two-party or three-party (telephone, power, and cable TV). On joint construction of buried facilities, the telephone cables are placed with a minimum vertical separation of 300 mm (12 in) from power cables. (For those interested in joint buried construction, an interesting application in Cincinnati was featured at the First National Joint Use Conference, in St. Louis, Missouri, in 1992.)

Cable Depth

The type and size of cable determine the depth at which it is buried. The type of buried cable is either filled (waterproof compound injected into all empty space in the cable core) metallic, or

fiber optic (lightguide). The minimum burial depths are shown in Table 4-9.

There are locations (e.g., ditch and canal crossings) where it may be necessary to place the cable at greater depths. In other instances, it may be impossible or extremely difficult to place cable at the desired depth because of obstructions (or the cost of trenching through rock). When desired depths cannot be attained because of local conditions or prohibitive costs, protective coverings may be used to prevent damage to the cable. Creosote planks, iron pipes, or single duct conduit may be used to provide this protection.

Service Connections

The service connection is one of the most costly portions of a telephone facility. The type of service connection (buried or aerial) is based on economics, ease of installation and maintenance.

Terminals (connect points from the supply cable) are spaced so that the total cost of providing service (cable facilities plus service connections) will be minimized. They are also spaced so that every lot has direct access to telephone facilities—which would normally

Table 4-9. Minimum cover for buried cable.

Depth of Cover (in inches) Facility		
	Normal	Under Ditches
Toll, trunk cable	30	36
Feeder, distribution cable	24	24-36
Service connection	12*	24-36
Fiber optic cable	36	42
* Minimum. Greater depth will reduce risk of trouble due to dig-ups		

Source: BellSouth.

require placing a terminal at every other property line, so that one person's connections are not placed across another person's property.

Cable Markers

Buried cable routes are identified by above-ground buried cable markers spaced uniformly. These markers notify the public of the presence of buried telephone facilities. Buried cable markers are available in various materials (concrete, wood, steel, and reinforced fiberglass); the designer can choose the type that is most compatible with the environment.

Bonding and Grounding

Buried metallic cables and buried fiber optic cables which contain a metallic shield or strength member must be bonded to an effective ground to protect personnel and telephone facilities from the effects of lightning, electrical contact, electrical induction and ground rise potential. The best source of a low resistance ground is usually the vertical ground wire of the power system multigrounded neutral (MGN).

Other typical grounding devices are manholes and ground rods. If bonding is required, it must be placed at the following locations:

- (1) at the beginning of the cable route;
- (2) within 150 m (500 ft) of the end of the cable route;
- (3) at approximately 750 m (2,500 ft) intervals along the route if a power system MGN ground is available, but at least once every 1.6 km (1 mile);
- (4) at every point where a telephone above-ground hardware device appears on or within 2 m (6 ft) of a power company pole, pedestal, or pad that has a multigrounded neutral;
- (5) at every point that a carrier repeater or terminal apparatus case is located for metallic cable; at each line repeater station and remote terminal location for fiber optic cable; and
- (6) at each splice location for interoffice and/or digital loop carrier routes for fiber optic cable.

STAGING OF WORK

Because of the nature of road improvements it is sometimes necessary for the telephone engineer to stage the company's work with the highway contractor. For example, certain grading and filling operations may dictate which sections of facilities need to be relocated early in the project. Generally speaking, for relocation of buried facilities, the "new" cable must be placed and put into service before the "old" cable can be abandoned. Moreover, telephone cables are usually placed at less depth than gas, water, or sewer facilities, and due to trench congestion may have to be placed last.

Another example of staging involves the transfer of joint use poles and the attached

facilities. In most cases the power company that owns the highest attachment, must transfer first. If cable TV is a joint user, their facilities must be transferred next. Finally, the telephone company can proceed with its relocation, but only after these two entities have completed their work. The power company first completes its transfer (by swinging lines back to the new poles), then the old poles are topped so that cable TV can swing its cable, and then the telephone company does the same. Close coordination is necessary on joint use relocations. Many states have established utility location and coordination committees to handle these activities.

NATURAL GAS DISTRIBUTION SYSTEM DESIGN

PROPERTIES OF NATURAL GAS

Natural gas is a colorless, odorless, and nontoxic gas, which is comprised of approximately 97 percent methane. A pungent odorant is added to natural gas to aid in its detection. The specific gravity of natural gas is approximately 0.6 that of air. If not confined, it will rise and dissipate harmlessly into the air. A natural gas air mixture becomes explosive if there is between 5 and 15 percent gas in the mixture. This mixture requires a spark or flame exceeding 593 °C (1,100 °F) to ignite.

CHARACTERISTICS OF DISTRIBUTION COMPANIES

Distribution companies serve residences, institutions, businesses, and industries through a system of pipes commonly known as mains and services. A main is a distribution line that serves as a common source of supply for more than one service line. Mains vary in diameter according

to the existing and expected gas loads. Common diameters for mains are 50, 100, 150, 200 and 300 mm (2, 4, 6, 8, and 12 in). Generally, gas mains are located on publicly owned ROW.

A service line is a distribution line that transports gas from a common source of supply to the customer's meter. For residential customers, typical service line sizes are 12 mm and 15 mm (1/2 in and 5/8 in) nominal diameter. These lines are usually located on the customer's property.

PIPE MATERIALS AND OPERATING PRESSURES

Materials

Typical materials for distribution piping include polyethylene (plastic) and steel pipe. To help in locating plastic main after it is installed a tracer wire is strung along the full length of the main or service. Although still used in some urban areas, cast iron systems are no longer installed.

The pipe material selected for any distribution or service line depends primarily on the operating pressure of the system. At Atlanta Gas Light Company, for example, medium pressure systems operate from 7 to 414 kPa (1 to 60 psig) and high pressure systems typically operate from 421 to 2,070 Kpa (61 to 300 psig).

Within Atlanta Gas Light Company, the use of plastic pipe is limited to medium pressure systems. Steel pipe can be used throughout the full range of operating pressures. Steel pipe and its fittings are usually coated with coal tar enamel or epoxy and must be electrically isolated to prevent corrosion of the pipe. This isolation is known as cathodic protection and is accomplished by using either a series of anodes or a rectifier system. Examples of these two methods are shown in Figure 4-10.

Pressures

Distribution systems are typically designed to operate at distinct ranges of maximum allowable operating pressures, such as 414 and 2,070 Kpa (60 and 300 psig.) A pressure regulating station controls and maintains the selected operating pressure of a distribution system. When two different pressure systems are connected, a regulator station is installed between the systems to "feed" and protect the lower pressure system. A below-ground installation in a prefabricated pit is preferred where ground conditions permit. Relief valves are installed to prevent the lower pressure system from exceeding its maximum allowable operating pressure.

INSTALLATION OF NATURAL GAS FACILITIES

All installations must comply with the Minimum Federal Safety Standards, Title 49 CFR, Part 192, as well as the responsible company's

procedures and guidelines. State laws and regulations also influence the company's operating policies.

Location and Depth of Cover

Mains are generally aligned parallel to the alignment of the highway. In Georgia, they are typically placed within the outside 1.5 m (5 ft) of the SHA ROW if space is available. A more expensive alternative is to place the main outside the public ROW through a property agreement such as an easement. Easements are commonly purchased for cross-country lines. Mains can also be placed across the public ROW, approximately normal to the pavement. Depth of cover within the public ROW is usually specified as 1 m (3 ft). If the main is under the pavement, the depth of cover is typically 1.2 m (4 ft).

Installation Methods

Facilities may be installed using trenched or untrenched methods. The method used for a specific line or system depends on the site conditions and operating policies of the company. The trenched method is direct burial of the pipe using conventional excavating equipment such as a backhoe or ditching machine. To protect the pipe, the backfill materials are thoroughly sifted and compacted.

Dry boring is one of the untrenched methods used crossing under a highway. With this method, the pipe is preceded by an auger which creates an opening not more than 50 mm (2 in) greater than the pipe's outer diameter.

Another untrenched method is directional boring. When performing a directional bore, an operator monitors the location and angle of the drill head through a magnetic guidance system connected to a surface console. The operator

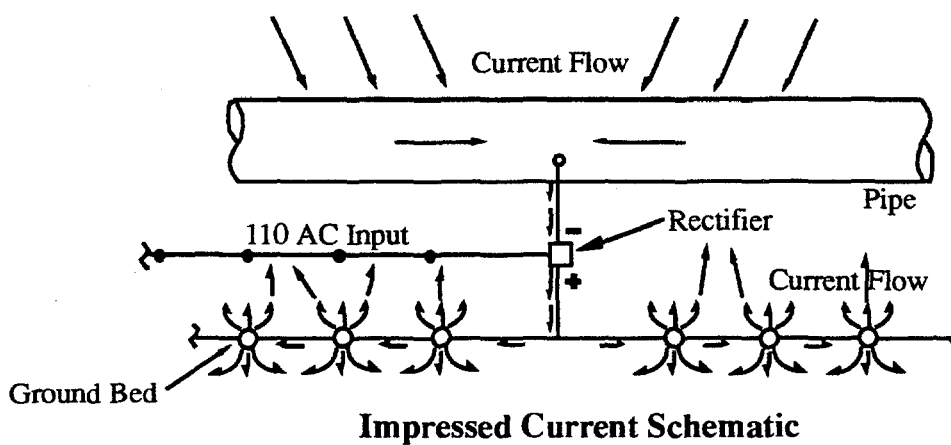
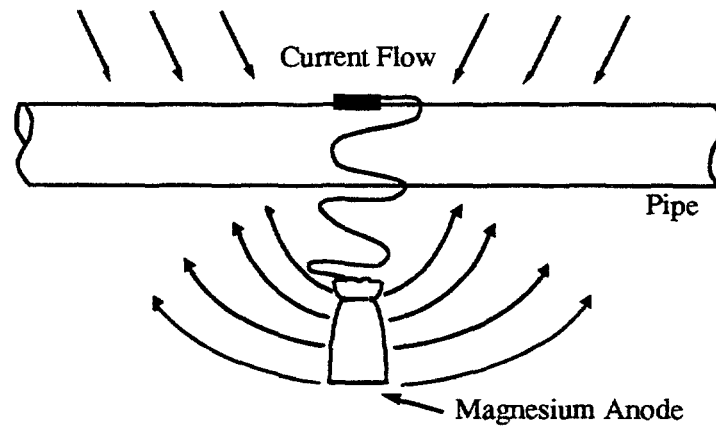
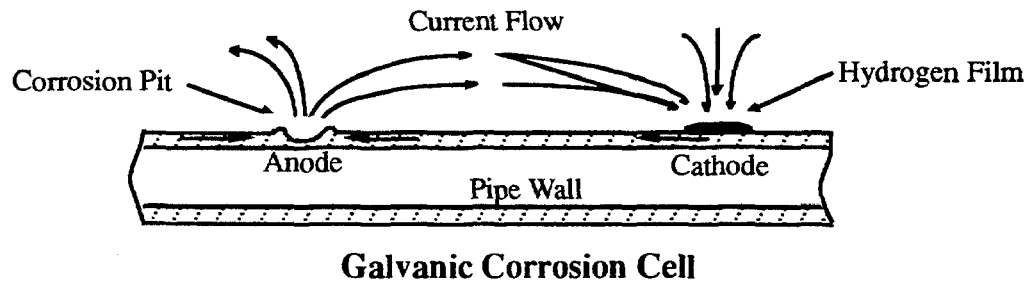


Figure 4-10. Theory of Corrosion and Cathodic Protection.
Source: Atlanta Gas Light Company.

relays the location information to the rig crew. When needed, the crew can adjust the direction of the drill head. Directional boring is useful in specialized situations such as crossing a river.

An older main can also be "replaced" by inserting plastic pipe through the existing main and connecting service lines to the new main. This method is best suited for congested urban areas where vacant property is scarce and the existing main is located under the pavement. Insertion is not, however, always the most economical method because of the amount of pavement cuts required.

Casings

In general, State regulations require encasement of mains crossing under pavement. However, research has shown that casings reduce the effectiveness of cathodic protection, while increasing the main's installation and maintenance costs. The Gas Research Institute has published guidelines and personal computer software to evaluate actual and allowable stresses for pipelines crossing under a highway. This information can be used to determine the need for casing. Under new roads, mains can be installed without a casing using the trenched method if they are installed prior to construction of the roadbed.

Bridges

Attaching natural gas facilities to bridges is normally a safe, practical, and economical means of serving customers. Compared with boring under a roadway, railroad, or body of water, attaching to a bridge is usually less expensive. When attached to a bridge, the gas main is typically supported by hanger assemblies secured to the bridge deck. Size and spacing of

the attachments are based on industry standards.

With proper notification, most highway agencies can incorporate a proposed gas main attachment into the design of a new bridge. A main can also be attached to an existing bridge if the highway agency determines that the bridge can support the pipe's weight. Steel main is used on bridge attachments (and all above-ground gas facilities) because it can withstand exposure to sunlight and other possible external forces.

Pressure Testing

Mains, service lines, regulator stations, and similar facilities are pressure tested to substantiate the proposed maximum allowable operating pressure and to ensure that no potentially hazardous leaks exist. The test is conducted by pressurizing the new facility, under controlled conditions, for an appropriate period of time. Hydrostatic testing is common for high pressure systems, whereas air is typically used for testing medium pressure systems.

EFFECTS OF HIGHWAY CONSTRUCTION

Highway construction affects the operating and maintenance functions of a natural gas distribution company. Several of these effects are summarized below.

Sequence of Operations

A typical sequence of operations starts when the natural gas company first learns of a planned highway project. It continues through several steps, and terminates when the relocated gas distribution system becomes operational. The following is a typical sequence:

- (1) Review highway agency's long-range work program when planning improvements to the gas distribution system;
- (2) Review highway project plans for impact on company facilities and determine the required adjustments;
- (3) Return information to the highway agency for approval;
- (4) Obtain formal approval to fund the project from gas company management;
- (5) Secure a contractor to perform the work;
- (6) Order pipe and materials;
- (7) Receive final plans and the notice to proceed with required relocation work;
- (8) Install, adjust, and test the facilities as needed;
- (9) Tie-over new main to existing mains and services and purge gas from abandoned mains and services;
- (10) Restore ROW to an acceptable condition; and
- (11) Operate and maintain the distribution system.

Maintenance of Service

The ability to maintain gas service to a customer is affected by highway construction. New mains have to be installed and tested before the existing mains can be abandoned. In addition, service lines must be connected to the new main with minimum disruption of service. If the relocation is done during highway construction, the work should be scheduled (both gas company schedule and highway contractor schedule) so that disruptions to service are minimal.

In addition, a project sometimes requires that a main be abandoned temporarily to avoid a construction conflict. If gas is supplied from

both directions (two-way feed), temporary abandonment is possible provided the operation of the gas system will not be hindered. During the winter months or any time when gas use increases, the practice of temporarily abandoning facilities is discouraged to prevent loss of service. Temporary abandonment of a one-way feed system is usually not practical.

Coordination

Coordination between utilities is essential for orderly installation of facilities. In addition, staging utility relocation work with the highway contractor is often necessary to reduce the utilities' operation and maintenance costs. Staging is important in construction areas with deep cuts or large fills. For example, to obtain 1 m (3 ft) of cover in a 3 m (10 ft) cut section, the main would have to be buried 4 m (13 ft) deep after construction. Likewise, in a 3 m (10 ft) fill section, the main would be 4 m (13 ft) deep after construction. The impacts of these two situations can be lessened if a utility company's work is staged with the highway contractor.

ADVANCED PLANNING

Advanced planning between the highway agency and utility companies can reduce expenses for all parties. Planning includes project concept meetings held prior to detailed project design. These meetings give utility companies an opportunity to identify conflicts with the proposed construction.

In Georgia, the major utilities and the DOT have established the Cooperative Locating and Staking Program (CLASP) as a way to avoid costs and improve the efficiency of information exchange. Under the CLASP concept, the utilities affected by highway construction employ

a single contractor to locate and survey existing utility facilities during the preliminary design stage. To aid in the survey, the highway agency provides reference points corresponding to the State Plane Coordinate System. The utility information is given to the highway agency in a digital format. Using this detailed information,

the highway agency can avoid many conflicts. This practice has been adopted by the Georgia DOT.









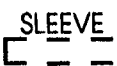


























Using standard symbols and markings on plan sheets helps during information transfer. Typical standard markings used by natural gas utilities are shown in Figure 4-11.

SUMMARY

This chapter has introduced design concepts for highways and utilities. For highways, geometric design, controlling criteria, and overall design sequence were outlined. Interactions between highway and utility design were also reviewed.

The discussion of detailed design concepts for all types of utilities is beyond the scope of this *Guide*. However, general utility facility design

was introduced in this chapter. Utility design criteria, coordination and communication, subsurface utility engineering, and other common design concepts were discussed. Additionally, criteria and practices of two utility industries (telecommunications and gas distribution) were used to illustrate current design practices.

Anode	 OR  3# ANODE OR  OR 
Border Station / City Gate Station	 OR  OR 
Casing or Sleeve	 OR 
Compressor Station	
Drip	 OR 
Gas Line Marker	
Gas Meter	 METER OR  METER SET OR 
Line Crossing	
Odorizing Station	
Pig Trap	
Rectifier	 OR  OR 
Regulator, District /Pressure	 OR  OR  REGULATOR STATION OR  OR 
Regulator, Service	 OR  NO SERVICE REGULATOR
Tee, General	
Tee, Saddle Branch	
Test Point or Station	 OR 
Valve	 OR 

Services & Mains

MAIN = Gas main

SERV = Gas service line to customer

LP = Low pressure or standard pressure

MP = Medium pressure

HP = High pressure

CI = Cast Iron

CU = Copper

DI = Ductile Iron

P = Plastic

S = Steel

WI = Wrought Iron

1/2", 2", 4", etc.=size of service or main

1932, 1948, etc.=year of installation

Example: 4"LP CI MAIN 1932 = A 4 inch cast iron low pressure main installed in 1932.

Figure 4-11. Typical Mapping Symbols Used in Gas Distribution.

Source: A Guide to Controlling Natural Gas in Emergencies.

Note: 25 mm = 1 in

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CHAPTER FIVE

PERMITS

INTRODUCTION

Local and state governments regulate the use of public rights-of-way (ROW) in the interest of public safety and convenience and to operate and protect public facilities. The right of the municipality or State to control the public ROW is given by State constitution or law. A request-review-approval system is typically applied to control use of the ROW. Entities such as utilities wishing to occupy or conduct work in the public ROW make a formal request, which is reviewed by the regulating agency for conformance with adopted procedures and standards. The permit system maintains the integrity of public works facilities and enhances

coordination among users of the ROW. Approval is given in the form of a permit (or other form of agreement) to use the ROW on a temporary or long-term basis. As applied to utilities, a permit is normally a use and occupancy agreement that allows the utility facility to exist within the highway ROW.

This chapter reviews types of permits, why they are issued, who issues them, and typical procedures for issuing them. Topics like general requirements for the contents of permits, provisions for emergency situations, inspection of work, traffic control, fees, and indemnification will be covered.

PERMITS, AGREEMENTS, AND FRANCHISES

A utility enters into a written accord with the regulating agency before locating any utility installation on or over the public ROW. Terminology used to describe these written records varies. This accord may be an agreement, which usually covers utility relocations that occur during a highway construction project, or a permit, which is usually to accommodate utility activities other than during a highway improvement project. An agency may also use the term permit to describe any use and occupancy agreement with utilities.

PERMITS

A permit is required for virtually all utility actions in the public ROW. The utility company initiates the permit process. Utility actions typically requiring a permit are: (1) additions to or upgrades of existing facilities; (2) installing new facilities in existing ROW; or (3) changes in voltage or pressure of existing facilities. To ensure efficient and safe operation of the roadway, the requirement for a specific permit to perform work in the ROW should apply to every

entity involved in any work that will affect the public way, including privately and publicly owned utilities, private contractors, and individuals. Permit purposes include the following:

- (1) Register the utility's intention to work within the ROW, in accordance with its franchise or other legal authorizations, to install and maintain plant in the ROW;
- (2) Stipulate the nature and extent of such ROW work;
- (3) Provide an administrative means for the government permitting agency and other agencies to coordinate use of the ROW space, to hold the utility responsible for the authorized work, and to perform necessary reviews, inspections, and enforcement actions in connection with such ROW operations; and
- (4) Grant formal approval for the intended work, establish records of all ROW utility operations and plant, and document orderly allocation of space.

Permits may not be required for items such as routine maintenance, subsurface service connections not crossing the travel lanes, aerial service connections not requiring additional supporting structures within the public ROW, substituting or adding wires to existing poles, or placing facilities in existing conduits or encasements that do not disturb the surface or subsurface or change the type, nature, or operating conditions of the originally approved facility.

The 1992 IRWA Survey of State Highway Agencies (SHA's) indicated that only three States do not use a standard permit application form. SHA's typically require a permit for all activities, with some States excepting routine

maintenance work, service connections, and emergencies.

The regulating agency determines whether a permit is required, so procedures vary from state to state. The scale and complexity of a utility project and the location of the work (congested underground area, high traffic volumes, use of travel lanes, etc.) may mean that in some instances this type of work requires a permit; in others it does not. Some agencies require permits whenever the utility is in the ROW.

AGREEMENTS

In a typical SHA, an agreement is required whenever proposed highway construction conflicts with existing utility ROW or facilities, or when the utility intends to add new facilities during an ongoing highway construction project. Agreements are typically initiated by the SHA for utility relocation projects.

FRANCHISES

When a utility plans to lay a pipeline or run a transmission line across private property, the utility must either obtain the property outright or condemn an easement. The most logical and cost-efficient method of running a pipeline or an electric or telephone cable is frequently along publicly owned property, city streets, alleys, sidewalks, or other public ROW. Recognizing that the use of public ROW is necessary for the efficient delivery of utility services, cities and utilities enter into franchise agreements that grant access to public ROW.

In general, a unit of government may grant authority to a utility company to use the public streets, alleys, and other public ROW on a continuing basis, particularly for a public utility business, such as electric, gas, telephone, or

water service. This franchise agreement allows the utility to be within the ROW, but does not typically allow unrestricted use of the ROW. The general approval to use the ROW does not prevent the municipality from controlling specific uses. These specific uses or activities (such as excavating to install or maintain a utility facility in the ROW) are authorized by individual permits. Further authorization beyond the franchise agreement is usually needed before a utility can perform specific work in the ROW. While franchise agreements vary, most provide for

- (1) Right of utility access to city streets, alleys, and other public ROW's;
- (2) Indemnification safeguarding the city from any liability resulting from the utility's use of city property;
- (3) Authority for the city to inspect utility work in the public ROW;
- (4) Compensation under the franchise; and
- (5) Timing of utility compensation payments.

WHY REGULATE?

Many public and private uses of the streets are for purposes other than vehicular and pedestrian traffic. Governments typically place sewer mains, storm drains, street lighting, fire and police signals, and traffic control systems in the ROW. Utilities may have gas, telephone, CATV, alarm systems, steam heating, electric, water, and pipelines in the ROW. Private interests may use the ROW for sewer laterals, driveway approaches, walkways, retaining walls, basements, landscaping, private communication

systems or even parades. Common concerns are

- (1) Safety. No one wants damage to facilities or accidents resulting in injuries or fatalities. Procedures are defined to avoid disruption of facilities and provide for safe working environments during construction and maintenance operations, both for the workers and others using the ROW.
- (2) Costs. Whether paid for by taxpayers or ratepayers, the expense of relocation and adjustment of facilities after they are in place should be minimized.
- (3) Inconvenience. The uncoordinated (and uncontrolled) actions of one user after another digging up the same street is inconvenient for all.
- (4) Traffic flow. If a project is planned with traffic impacts in mind, many unnecessary disruptions, delays, and complaints can be avoided. This may also permit the work to be completed in a more timely, efficient manner and at a lower cost.
- (5) Disruption. Both government and industry want their vital public services to be dependable and uninterrupted.
- (6) Public image. A sound program for protecting the public investment in infrastructure reflects good stewardship as well as business management.
- (7) Aesthetics. Utility cuts made to access underground facilities are not only detrimental to the street, but aesthetically annoying. Well-maintained facilities are a credit to the agency to which they belong.

Permits and franchises are issued for occupancy or use of highway ROW when the applicant does not have property rights. These agreements define the responsibilities of parties using the public ROW. Permit procedures should incorporate standards to preserve the integrity, visual quality, operational safety, and function of the public ROW. Industry codes and standards for construction and maintenance of utilities provide for safe, reliable, and economical installations of individual facilities. The public agency responsible for the ROW ensures the same protection for the roadway and other facilities that may exist in the ROW. Failure to adequately regulate the ROW can result in liability to the controlling agency and additional cost to the utilities.

WHO REGULATES?

At least three distinct groups use public ROW's: governmental agencies, public or private utility companies, and private contractors or individuals. To control joint use of these areas and ensure that all necessary safety measures are taken to protect the users, a single agency typically has responsibility to control use of the ROW.

Generally, the permitting agencies are public works departments, road or transportation departments, or SHA's. With primary responsibility for protecting the public interest in the ROW, these agencies coordinate the permitting process with other departments and agencies affected by the use of the ROW.

FEDERAL REGULATION

The Federal Highway Administration (FHWA) requires that a utility's use of a Federal-aid highway project ROW be covered by a written

agreement between the highway authority and the utility. A permit is the typical form of the written agreement. Franchise agreements may also be used.

A standard permit format has not been advanced by FHWA because local and State highway agencies are in the best position to establish permit formats for their needs and requirements. FHWA requirements for use and occupancy permits are summarized as follows:

- (1) The highway agency's standards for accommodating utilities should describe the requirements for location, construction, protection of traffic, maintenance, access restriction, and special conditions;
- (2) The general description of utility facilities being located in the highway ROW should include size, type, nature, and extent;
- (3) Drawings or sketches should show existing and/or proposed location of utility facilities and include their relation to existing and/or planned highway improvements, traveled way, ROW lines, and where applicable, control of access lines and approved access points;
- (4) Extent of liability and responsibilities associated with future adjustment of the utilities to accommodate highway improvements should be included;
- (5) Action to be taken in case of noncompliance with highway agency requirements; and
- (6) Other provisions necessary to comply with laws and regulations.

SHA's develop their own policies on the utilities' authority to use and occupy the ROW of State highways, the power of the SHA to regulate such

use, and the relevant policies for accommodating utilities within ROW's. Such policies are submitted to FHWA for approval.

STATE REGULATION

For projects on State ROW's, permit applications are typically submitted to a district office of the SHA for review and approval. Depending on the scale and scope of the project, the permit application may be reviewed by district personnel in engineering and maintenance, or submitted to a central office for review and approval. Application and review procedures vary from State to State. FHWA approval of a permit application may be necessary if the proposed installation is not in accordance with the policies and procedures of the State's utility manual.

SHA's typically have a permit officer, regulatory inspector, or other designated person to administer the permit process, usually at a district or subdistrict level. The responsibilities of this position typically include (1) reviewing submitted permit applications; (2) circulating the applications to other appropriate departments (maintenance, design) when necessary; (3) conducting field investigations; (4) negotiating provisions for the permit; and (5) processing the application package. The permit forms with

standard and special provisions are forwarded for departmental approval and then executed copies are returned to the permittee. The permittee must typically notify the highway agency before field work begins.

Utility permits consistent with the State's utilities manual may be approved at the district or regional level. Installations requiring a variance from the manual must also typically be reviewed by the central SHA office.

LOCAL REGULATION

Municipalities and counties regulate use of their public ROW's. Almost universal practice places the responsibility for ROW utility accommodation in the hands of the public works departments or works-related agencies. This places the regulatory powers in the department also responsible for designing, constructing, and maintaining public works facilities in the ROW.

The permitting agency coordinates the application review with other departments, such as sewer, water, power, ROW, traffic and transportation, zoning, planning, flood control, police, and fire. Single-agency authority over the issuance of permits eliminates unclear responsibilities.

PERMIT PRACTICES AND PROCEDURES

Permit procedures are established by State and local agencies to regulate the public ROW. These procedures ensure smooth and effective operations by use of standardized permit forms, fees, specifications, and inspections. Each agency establishes policies on recording permits and preserving records.

NEW INSTALLATIONS

New utility installations or modifications to existing utility facilities in the public ROW require a permit or some form of written agreement with the regulating agency. This permit process is initiated by the utility. Some

States provide special forms for these types of projects.

RELOCATING EXISTING FACILITIES

Highway improvement projects often require relocation of utility facilities existing in the ROW. These utility relocations, although initiated by the highway agency, also typically require a permit. This permit process may be administered by the highway agency as part of the development of the highway project. When a permittee finds it necessary to relocate existing facilities of another utility, this work may be done by the owner of those facilities, with the cost borne by the permittee.

PERMITTING PROCEDURES

State or local permit procedures generally include the following steps:

- (1) **Submit Permit Application.** The utility or contractor submits an original application with required copies to the regulating agency. Appropriate engineering drawings and specifications are included, as are descriptions of the proposed project and statements providing indemnification protection from any damage claims arising from the proposed installation and operation of the utility.
- (2) **Review Permit Application.** The regulating agency circulates the permit application to affected departments and utilities for review. Emphasis is given to possible ROW conflicts, current or

proposed road construction, planning of future projects, and other utility programs. Proposed installations and modifications to existing facilities are compared to maps of other infrastructure in/or abutting the public ROW.

- (3) **Determine Permit Requirements.** After thorough review of the permit application, the regulating agency determines required procedures and specifications to be followed by the permittee. These specifications are typically standardized and incorporated by reference. Additional requirements or variances may be specified. Items to be addressed include final location of the facility; standard or special methods of installation; requirements for detours, haul routes, and coordination with other agencies; and necessary fees, bonds, deposits, and indemnification requirements.
- (4) **Establish Permit Fees.** A standard fee schedule is used to identify required application fees. These may cover administrative costs, inspection costs, performance bonds, protected street fees, emergency cuts, etc.
- (5) **Issue Permit.** A permit is issued to the utility or contractor. All normal or supplemental procedures, instructions, and any other requirements such as tree trimming and removal are listed as an integral part of the permit or incorporated by reference to the appropriate Federal, State, or local document.
- (6) **Enforce Provisions.** The permitting agency inspects field work at

appropriate stages of construction. Joint inspections may be conducted with the utility.

- (7) Final Inspection. At completion of the project, a final inspection is held to confirm compliance with permit requirements. This inspection is the basis for either releasing the performance bond or requiring remedial action.

STANDARD FORMS

Most agencies use their own standard permit application forms to process requests. A standard form provides a consistent means to review requests for work in the ROW and ensures that complete information is obtained for keeping records. Standard forms also formally advise the applicant of the standard conditions that must be addressed as part of the permit.

While the use of standard forms is common, the format and content of the forms vary widely. Some agencies use one basic form for all types of requests, while others have a specific form for each major use. Many communities use forms that look very much like legal agreements, with the relevant information to be inserted in blanks in the text. Others use a checklist approach where specifics on type of activity and location are checked off or filled in. The permit form may also indicate the review of the permit by other agencies or departments. Forms are usually submitted in multiple copies for distribution to the regulating agency, other reviewing departments or agencies, the applicant, and sometimes the police department. They usually contain a place for the applicant's

signature and title and for the regulating agency's approval.

GENERAL PROVISIONS

Permit forms typically include a listing of standard or general provisions that apply in all instances. These may include providing advance notice (three to five days) before beginning work; having complete permit forms and drawings at the worksite; complying with adopted standards and specifications; not working on weekends or specified holidays; incorporating the Manual on Uniform Traffic Control Devices (MUTCD) for traffic control procedures; providing notice of completion of work; and indemnifying the highway agency. Some regulatory agencies also specify the content of plan sheets and construction drawings to be provided for review and require as-built drawings at the end of the project.

Special provisions for certain types of utility projects, such as installing pole lines or cutting the pavement, may be standardized and provided as an attachment to the basic permit form. Typically, space is also allotted for noting special provisions or conditions that may be unique to the particular project. A sampling of permit forms are included in Appendix C.

BLANKET PERMITS

The permit process may be streamlined to allow the utility to obtain an annual or long-term blanket permit. Blanket permits allow the utility to perform minor activities without filing a formal application each time. The utility may need to notify the permitting agency prior to initiating work. SHA's and local agencies vary on the use of blanket permits.

ROLE OF UTILITY LOCATION AND COORDINATION COUNCILS

Public works utility coordinating committees can perform an effective public service by ensuring continuous formal exchange of information on planning, designing, and scheduling all major projects and significant ongoing maintenance operations. These committees provide a mechanism for regulating agencies to inform utilities and other agencies of the permitting process and to report on major projects. Local utility coordinating committees may also serve as a forum for reviewing permit procedures and provisions and recommending changes.

ONE-CALL CENTERS

One-Call Centers coordinate requests for marking underground facilities before excavations. In most locations, the call must be placed at least two working days before the excavation is to begin. Information is collected on the company doing the work, the type of work, the starting date, the exact location, and a contact person. A caller receives an identification number to verify the call. Notices are then provided to those utilities that may have underground facilities in the area of the excavation. A locator arrives at the jobsite and marks the surface with a standard color code to identify the approximate location and type of buried facilities. Some communities require that

the identification number provided by the one-call center be included on the permit application to insure that this important step is taken in a timely manner. They may also require that existing utilities be marked or staked before permit approval. Local and state laws vary on damage prevention requirements and one-call systems.

MAINTENANCE OF RECORDS

Complete and current records of all work that occurs in the public ROW should be maintained. The development and maintenance of records on the location of underground facilities can be a time-consuming and expensive effort, though critical for management of the ROW. These records are used to plan new facilities, replace or relocate existing facilities, and handle emergency repairs. If records are not kept current, their value decreases over time as agencies have less confidence in their completeness and accuracy.

Applications for major installations, relocations, enlargements, or other underground work should be distributed to participating governmental agencies for review and approval before issuing permits. Applications should be checked against master maps of all existing underground utilities to minimize utility interference. This also serves as a reminder for updating utility records at the local regulating agency.

PERMIT PROVISIONS

BONDING/DEPOSITS IN ESCROW

Bonding or deposits in escrow may be used to ensure full compliance with all provisions of the permit. Bonds are held in escrow and are

returnable when the regulating authority releases them, typically after final project inspection. This final inspection may be several months after the completion of field work to allow trenches to settle. Regulating agencies'

bonding/deposit practices are based on past experience with permittees. Franchised or publicly owned utilities may be exempt from bonding requirements.

EMERGENCY WORK

Emergency work is typically permitted without prior application, but after-the-fact applications should be submitted immediately after the agency office has reopened, and permit procedures should be followed in the same manner used for nonemergency work. Notification is typically given to the highway agency and police department at the time of the emergency work. The survey of SHA's conducted by IRWA found that 16 States allow permit exemptions only for emergencies.

SPECIAL RESTRICTIONS

Many communities assess added fees for cuts made on recently paved streets, such as those surfaced within the past three to five years. Additional fees may reflect the additional inspections conducted to ensure the quality of restoration. The added fee is intended to serve as an incentive for coordination. Agencies and companies with underground facilities are encouraged to inspect and upgrade or repair their facilities as part of major street rehabilitation projects. Emergency repairs may or may not be assessed the added fee for protected streets.

One protected street program, in Billings, Montana, requires that applications for cuts in protected streets (any street newer than five years) be approved by the appointed city administrator. Additional requirements may be made for resurfacing the street. Because of this

action by the City Council, utilities have given greater attention to the condition of their facilities in the ROW before resurfacing streets, alternative methods (access from side streets, trenchless technology) are being used to provide service; and public good will and support towards city government has increased.

Springfield, Oregon, protects three-years-old or newer public improvements by requiring boring or jacking whenever possible. When cutting three-years-old or newer public pavement is necessary, a maintenance surcharge is required. The surcharge is three times the cost of restoring a one-year-old pavement surface, two times the cost of restoring a two-years-old pavement surface, and equal to the cost of restoring a three-year-old surface. The surcharge is in addition to normal fees and security deposits. The surcharge does not apply (1) when the city fails to inform the utility or property owner before the paving or resurfacing is done; (2) for emergency utility work; or (3) for repair or replacement of utility lines servicing those structures existing at the time of the new paving.

Restrictions may also apply to cutting across the pavement of major or key streets. Tunneling, jacking, or boring may be required to avoid conflicts with traffic. The additional cost of these construction methods may be compared to the impacts (traffic delays, inaccessibility to businesses, emergency routing, detouring of traffic through residential neighborhoods, etc.) of closing critical streets.

Many communities enact restrictions on issuance of permits during holiday seasons or special events. Typically the restrictions apply to designated shopping or event areas, where blockages of travel lanes would compound seasonal traffic problems and affect commercial establishments. Only emergency work is allowed in the restricted areas during the season.

INSPECTION

Permit verification and inspection may be performed by a qualified inspector employed by the permitting agency, utility, or both. Some level of inspection by the permitting agency is usually done to ensure that all specifications and prejob commitments are observed. The inspector also provides written notification of acceptance of the utilities' work and releases the bond requirements for the permit. One good arrangement is found in Springfield, Oregon, which conducts inspections while work is in progress, at the completion of the project, and 11 months after completion.

The road agency may use an inspector to ensure that the utility observes prejob commitments. Prejob commitments involve planning the size of the trench, safety, backfill material, postjob cleanup, notifying the one-call service, and more. The inspector may convene a prejob conference with all interested parties to discuss prejob commitments. Interested parties include the contractor, affected utilities, and public agencies.

Inspectors are responsible for making sure that all work is performed in accordance with the agency requirements and seeing that all efforts are made to provide safety to all citizens, pedestrians, and vehicular traffic. They check the completed work and cleanup. Inspections may be held well after the project (one to two years) to ensure that failures have not occurred. Typical items of concern are settled trenches, erosion, and exposed pipe lines. Some agencies may include space on the permit form for the name and telephone number of the utility owner's inspector.

PREJOB CONFERENCE

To fulfill the requirements on complex projects, the inspector may request a prejob conference

with the contractor, all affected utilities, public agencies, and other interested parties. This coordination session allows all parties to clarify requirements and special conditions of the project.

INDEMNIFICATION

Permit applications will generally contain a clause, either on the permit form or included as a general provision, that indemnifies the regulating agency against damages or injuries related to the permittee working in the public ROW. A typical indemnification clause states that the applicant holds harmless the governmental agency and its employees from any liability or responsibility for any accident, loss, or damage to persons or property occurring as the proximate result of any work undertaken under the terms of the permit application, and that all said liability is assumed by the applicant.

PERMIT FEES

A wide variety of permit fee practices are used by SHA's and local public works departments. Some charge little or nothing for processing permits, while others seek full cost recovery. A 1992 IRWA survey of SHA's found that 20 States charge some type of fee for permits, either on an annual basis or a one-time amount. The fee may pertain only to processing costs or may cover more specific items. The fees charged range from \$5 for administrative processing to more than \$400 for permits involving removal of pavement.

Fee schedules used by municipalities vary widely in complexity and scale. Variation exists in whether a fee is charged at all; whether it applies to public, private, or all utilities; the amount charged; what the fee covers; and

whether it includes additional assessments (i.e., inspection, performance, protected streets, re-inspection, emergency cuts). Permit fees typically cover the administration and inspection of pavement cuts. The utility may be charged a fixed amount for every foot of cut pavement and for every inspection. Potential elements of a permit fee program are summarized as follows:

- (1) *Administration* costs may be based on the average cost of processing a permit or on actual costs for each project. These costs may be non-refundable, even if a cut is not made. A fee for support of the One-Call Center may be included.
- (2) *Inspection* costs may be included and could be based on average, projected, or actual cost (staff time, automobile mileage, overtime, etc.), or on the size of the cut area.
- (3) *Performance* may be addressed by a deposit or bond to ensure completion of an adequate repair. While the deposit or bond will be returned with satisfactory performance a nonrefundable fee may also be charged to reflect the adverse affect of the cut on the pavement.
- (4) *Protected street* programs assess substantial fees for pavement cuts in newly surfaced streets (three to five years). The fees may reflect the cost of additional inspections to insure the quality of the restoration. They are intended primarily as an incentive for coordination. Emergency repairs may or may not be assessed this penalty.

- (5) *Re-inspection* fees may be assessed for additional inspections if defective pavement restorations are found.
- (6) *Emergency* work may be charged a special fee.
- (7) *Summons* cost is included in some communities for those that violate the terms of the permit. A summons may be issued to bring the case to court. The cost of issuing the summons is assessed to violators.

Fees associated with permits should recoup the regulating agency's expenses for operating the process. The fee schedules and total amount of money generated should be reviewed periodically and adjusted as necessary so that the process is self funding. Proposed adjustments to permit fee schedules should be developed in consultation with those affected by the system.

Permit fees should be equitable. The same fee should be charged for comparable work regardless of the individual, company, utility, or contractor who performs the work. Performance bonds may be required, depending on the history of the permittee. A bond or other financial instrument or agreement should be required to ensure that proper pavement restoration is made and maintained. Additional use charges may be assessed to applicants not having franchise or other rights to occupy the street ROW.

Fees are controversial. While it is generally accepted that fees will cover administrative costs for processing permit applications, questions sometimes arise when costs for related activities, such as agency inspection, plan checks, and pavement maintenance cost, are included.

EXAMPLES OF STATE PERMITS AND PROVISIONS

Permits are issued by the SHA to regulate the safe and efficient use of valuable corridors along State highways. Permit requirements vary among SHA's. A survey conducted by the IRWA in 1992 found that most States use standard permit forms, though the content of the forms varies. Several examples of provisions are included on the following pages.

ALABAMA HIGHWAY DEPARTMENT

The permit application package required by the Alabama Highway Department includes a permit form; written assurance that the application complies with policies and procedures contained in the State's Utility Manual and other appropriate documents; a general description of the size, nature, type, and extent of the utility installation in the State ROW; and plan drawings (plans, profiles, and cross-sections) and specifications of materials signed by the utility's engineer of record or responsible official. The plan drawings and specifications are to show

- (1) The proposed utility facility;
- (2) Other existing utilities in the immediate vicinity of the proposed installation;
- (3) The traveled way (edge of pavement or back of curbs);
- (4) ROW lines;
- (5) Controlled access lines;
- (6) Approved access points;
- (7) Horizontal and vertical locations of proposed facilities;
- (8) Types of materials to be used;
- (9) Extent of liabilities and responsibilities for future relocation of the utilities to accommodate highway improvements;

- (10) Action by utility in case of non-compliance with the Highway Department's requirements;
- (11) Name and phone number of person to contact in case of emergency during and after construction; and
- (12) Other provisions necessary to comply with applicable laws and regulations.

The permit application must be on an original form and contain the original signatures of the district and division engineers. The original and three copies of the application are submitted to the district engineer for review. With the approval of the district engineer, the application goes to the maintenance engineer at the central office for final review and action. Upon final approval, one copy goes to the division office, one goes to the central office, and two go back to the utility. One copy returned to the utility is used in the field to record any field deviations from the initial drawing (deviations require approval). This copy is forwarded to the SHA to serve as a record of the facilities "as-built."

INDIANA DEPARTMENT OF TRANSPORTATION

The Indiana Department of Transportation (INDOT) uses one basic ROW permit form to cover requests for work in the public ROW. The one-page form is included with other examples in Appendix C. The Indiana permit form lists the type of activity across the top, provides for the project description in the body, bonding and fee requirements, and utility and highway agency approvals at the bottom. The right margin is also used to note specific information such as application and permit numbers, dates, and road

and county numbers. The back of the form includes general provisions for the permit. Depending on the type of installation or work, additional provisions, such as for pole lines or cut roads, may be attached.

The INDOT permit fee is \$40, with typically no charge to governmental agencies, schools, or churches. Such organizations can file a waiver to set aside the permit fee and/or the bond requirements. A \$5,000 bond is required for each permit to ensure adequate performance. Utilities performing frequent work in the public ROW can provide a blanket bond, which is cited on each permit application. The application must be filed by the utility or property owner. Permit applications from contractors are not accepted. This ensures that the responsibility for work being conducted in the ROW is clearly defined.

The permit application is processed at the district level, with field checks conducted by inspectors. The permit is usually valid for 12 months, with a possible extension of 12 months with proper justification. Utilities give five days' notice before initiating construction activities. Field changes must have the prior approval of the district regulatory supervisor, and an as-built drawing must be submitted at the conclusion of the project. A Permit Inspection Report (see Indiana Inspection Report Form in Appendix C) is used to document final inspection action on the surety bond. This action is typically taken 12 months after the work is completed to allow for one freeze-and-thaw cycle and to identify any corrections that are necessary. INDOT does not use blanket maintenance permits, except for tree trimming work in the ROW. Permits are filed by state route and date. Utility relocations done in conjunction with State highway projects are permitted during the development of the construction plans.

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

The Washington State Department of Transportation (WSDOT) uses three documents for approving occupancy or use of the highway ROW when the applicant does not have a property right. Utility permits grant occupancy of ROW for utility line crossings and for utility line installations 300 feet or less longitudinal to the highway. Utility franchises are granted for utility line installations that exceed 300 feet longitudinal to the highway. General permits are used for highway purposes such as road approaches and temporary use of the ROW for nonhighway purposes, including geophysical testing or placement or removal of fencing or grading.

An application for a utility permit or franchise agreement is processed by the district utilities engineer, who typically reviews the application for completeness and consistency with legal and policy criteria and distributes the application to affected departments and other agencies. Field reviews may be required by highway personnel to examine location and operating issues such as maintenance of traffic and clear zones. Figure 5-1 is a flowchart of the permit review process used by the WSDOT.

A checklist has been developed by the WSDOT to enhance the initial application review. A list of items is included for consideration in review of the application form, exhibit maps, during field review, and for control zones. The contents of the *WSDOT Checklist for Utility Permits and Franchises* are summarized as follows:

Application Form

- Is a reproducible map provided?
- Is map color coded to show facilities?

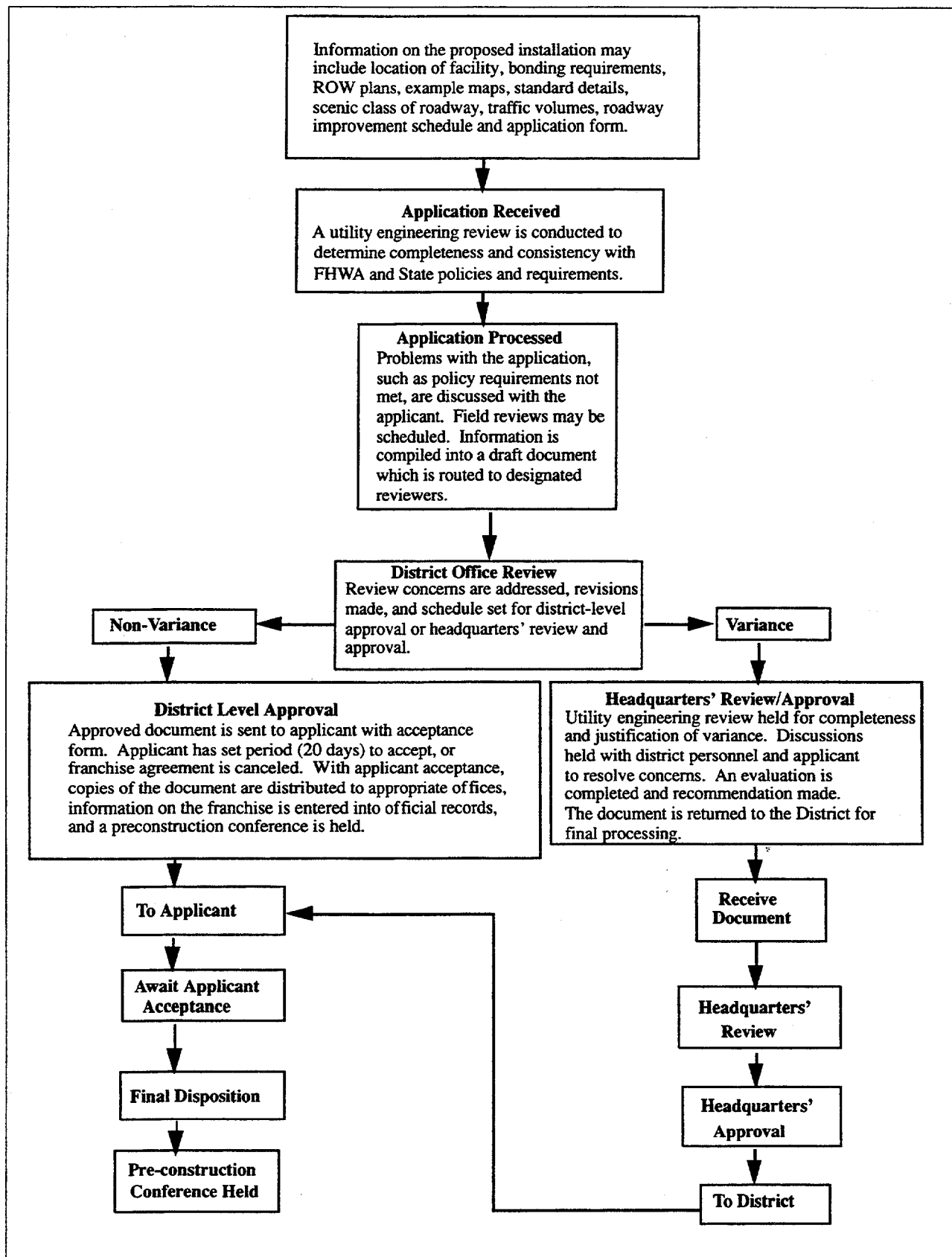


Figure 5-1. Washington State Department of Transportation Franchise Review Process.
Source: Derived from information in the WSDOT Utilities Manual.

- Is complete, typed, and legal description included?
- Is check for processing fee in correct amount enclosed?
- Does utility have blanket surety bond?
- Are the utility representative's name and phone number on application?
- Is application appropriately signed?
- If a variance to policy, is acceptable letter of justification enclosed?

Exhibit Maps

- Are exhibit markings reproducible?
- Are State highway mileposts computed to the nearest hundredths of a mile?
- Are mileposts noted on the exhibit for significant locations?
- Does the exhibit include section; township and range lines; hundred-foot station increments and offset distances; connections to existing facilities; facilities labeled as existing, proposed, joint, etc.; and facility and appurtenances types and sizes?
- Are facilities shown to scale?
- Is lettering appropriate size for reproduction?
- Are typical cross-sections included?
- Are bridge attachment details complete, if required?
- Are locations of any variances specifically defined?

Field Review

- Are all facility locations the same as shown on exhibit?
- Are all existing and proposed facilities located on exhibit map?
- Does this proposed facility replace an existing facility?

- If a replacement, will the existing facility be removed or abandoned?
- Where is replaced facility located, and when will it be removed?
- What are the size, type, and permit number for the existing facility?
- Does this facility require routine maintenance? How often?
- From what points of access will the facility be served?
- Do cross-sections indicate the actual field situations?
- Based on offset distances on exhibit map, is the location of proposed facilities feasible?
- If buried crossing, will the crossing be jacked, bored, or tunneled?
- What will be the maximum depth of the pit to make the buried crossing?
- What will be the minimum distance from edge of traveled pavement to beginning of pit?
- Are bridge attachment details and locations indicated correctly?
- Will the proposed facility be installed by the utility's own forces or by contract?
- If proposed facility is a variance, have alternatives been examined?
- Have other utilities in the area been identified?
- Are the proposed facilities on joint-use poles?
- What is the proposed date of completion for this project?

Control Zone Guidelines

- Is information available to determine control zone distance?
- Is control zone distance shown?
- Is recovery area distance shown when fill section slope is 3:1 or steeper?
- What is ROW width?

- Are there reasons facility should not be located outside control zone?
- Have cost comparisons been made?
- Does this location have a history of accidents involving utility objects?
- Have alternative countermeasures been addressed?
- Does cross-section show pertinent measurements and computations?
- What are locations of objects with respect to horizontal curves?
- What is the scheduled replacement date of object or remaining life expectancy?
- Do any terrain features limit placement of objects?
- Are other existing objects in the control zone?

EXAMPLES OF LOCAL PERMITS AND PROVISIONS

Utilities apply to the public works department or local road agency for a permit to install facilities or work in the ROW. Applications are typically made on standard forms and include necessary drawings and descriptive information defining the nature of the proposed work, the location, and the estimated duration of the project. According to APWA's *Guidelines for Regulation of Excavations in/or Adjacent to Streets*, the application form should include the items shown as follows:

- Permittee's name, address, and phone number.
- Dates permit requested and approved.
- Signature of representative applying for permit.
- If fee not paid at the time of issuance, indicate a work order number to be billed.
- Other agencies issuing permits for this job, including permit number, or indicate if this is a concurrent application.
- Certification that location has been checked with other utilities to ensure noninterference.
- Notification of any special conditions required or attached to the permit,
- including traffic control and public safety provisions.
- Space for inspectors' comments. Reverse side of form may be used.
- One-call center ticket number or a requirement that the permit is not valid if the one-call system is not notified.
- Approximate date construction is to commence.
- Expected duration of construction and work hours.
- Permittee's file and/or job number, if applicable.
- Grid or map book number, if applicable.
- City substructure map number as well as other reference maps that may pertain (i.e. street lighting, traffic signal, etc.).
- Exact location of proposed construction (frontage street and any intersecting streets).
- Type of installation and reason for work.
- Location, size, type, and number of pavement cuts. Work to be done should be highlighted with a key to symbols used.

- Total square footage of proposed street cut.
- Backfill requirements.
- Resurfacing requirements.
- Any subdivision, use permit, or variance related to this work.
- Space for rejection with an explanation.
- Enough copies as required for agency distribution and to allow permittee to retain two approved copies, one for files and one for the job site.
- Verification of proper insurance coverage, including worker's compensation and liability. The issuing agency may wish to be named as additionally insured by the permittee.

The regulating agency—along with other departments such as zoning, traffic and transportation, fire, and public services—typically reviews the permit application.

SPRINGFIELD, OREGON

The Springfield, Oregon, Public ROW Encroachment Application is included with other examples in Appendix C. Springfield's Encroachment Permit is required for

- (1) The extension, repair, replacement, relocation, etc., of underground utility lines within the pavement or travel portion of the public ROW including the curb, gutter, sidewalk, or driveway;
- (2) The installation of tees or any connection to existing sanitary and storm sewer lines requiring excavation of the public ROW, exclusive of new subdivisions;

- (3) Street oiling projects;
- (4) Temporary storage of articles within the public ROW during construction; and
- (5) Any other work for which a permit is deemed necessary by the Director of Public Works.

Permits are not required when the utility work is conducted in conjunction with public improvement projects behind sidewalks where the pavement is not cut, bored, or jacked. In such cases notification to the city's utilities coordinator is required before starting work. A copy of the permit must be kept at the work site while work is performed. If a permit is required but not obtained, the Director of Public Works can halt work and double the amount of the permit fee. If the permit holder fails to comply with the requirements of the permit, the city may halt work, remove material from the site, and/or complete the work and charge the permittee at three times the city's labor, equipment, and material cost plus 40 percent overhead, or \$200, whichever is greater.

Permit applicants are required to provide cash, check, or surety bonds in an amount equal to the estimated replacement cost of the public ROW used, together with the cost of re-excavation and filling with proper materials, if necessary. The minimum security deposit is \$200. The deposit is returned when the Director of Public Works determines at the 11-month inspection that the work area in the public ROW is in as good a condition or better than before issuance of the Encroachment Permit. A utility or contractor doing more than occasional work in the ROW can obtain a blanket surety bond to cover a period of one year in an amount dependent on the anticipated number of projects.

CINCINNATI, OHIO

Cincinnati, Ohio, developed *The Street Restoration Book* to document its rules and procedures for contractors working in the public ROW. It is a very readable document, with liberal use of margin notes to clarify procedures and reinforce key items, like calling-before-you-dig. Information is provided on authorization for performing work, applications and permits, general and special requirements, construction procedures, fees and charges, and drawings.

WELLESLEY, MASSACHUSETTS

This town has condensed the requirements for working in the public ROW into a single-page flyer that is easily distributed. The one-page summary identifies why permits are necessary and when they are required, and explains permit procedures and requirements. Permits are required for any street excavations. The application fee is \$25 for all permits. Additional fees are levied depending on the type of activity in the ROW. For excavations, an inspection and maintenance fee, dependent on the area of the street opening, is assessed. The fee is \$140 for openings up to 150 square feet, plus \$25 for each additional 150 square feet of opening. For non-excavating obstructions, a daily (\$15) or monthly (\$150) fee is used. The permit must be available at the jobsite during construction for inspection by town personnel. A copy of the Town of Wellesley Street Occupancy Permit is included in Appendix C.

The applicant must have adequate insurance for worker's compensation, general liability, automobile insurance, and umbrella coverage. Governmental agencies and public utility companies are exempt from the insurance requirement. A \$1,000 irrevocable letter of credit or certified bank check is required before

issuance of a permit for excavations. The Public Works Director is authorized to draw funds from this amount necessary to cover any costs (including administrative) associated with repairs made by the town. This is done only after a permittee has failed to complete the necessary repairs and failed to pay an invoice for work done by the town. No new permits are issued until the permittee has restored the full amount of the letter of credit. Governmental agencies and public utility companies are exempt from this requirement. For non-excavation permits to place material, equipment, or obstructions in the public way, a \$1,000 bond may be required of the applicant.

Three days' notice to the public works department is required before starting work. For emergency actions, excavations are made as necessary, with a permit application being filed on the first business day after such work is commenced. Notification must be given to the public works, police, and fire departments at the start of emergency work.

Permit applicants are required to notify utilities before excavating. State law specifies the requirements for providing this advance notice through the underground plant damage prevention system called Dig Safe. Wellesley assesses an extended maintenance fee for cuts made in newly constructed or recently reconstructed pavements less than three years old. For pavement that is less than 12 months old, the fee is four times the standard cost; for 13 months to 24 months, the fee is three times the standard cost; and for 25 months to 36 months, the fee is two times the standard cost. This does not apply to emergency actions or to public or private utilities that do not receive at least 60 days' advance notice before pavement work begins. This 60 days' advance notice allows the utilities to make necessary repairs before the paving. If extensive work is necessary, a utility can request a 60-day extension.

SUMMARY

This chapter has reviewed permit programs and provided examples from SHA's and municipalities. Adoption of good permitting practices by regulating agencies improves operations, provides for adequate interagency reviews, guarantees greater control of ROW work, maximizes the value of records, speeds up the

permitting process, improves public and utility relations, and protects the public interest in all matters relating to the safety and convenience of the use of the ROW. Recommendations for good permitting practices are summarized in Figure 5-2.

- (1) The agency that has power, authority, and responsibility for the construction, operation, and maintenance of roads and streets should be designated as the permitting authority for all ROW utility permits.
- (2) Publicly owned utilities should make application for ROW work and be issued permits in the same manner as privately owned utilities.
- (3) Applications should be made on standard forms, provided by the regulating agency.
- (4) All applications for major installations, relocations, enlargement, and other work that could affect other utilities should be distributed to these utilities and other public agencies for review before permits are issued.
- (5) Permit applications should cover only one location.
- (6) Permits should be issued on official forms.
- (7) Rational and equitable fees should be charged for permits.
- (8) Bonding of privately owned utilities, contractors, and others should be required, or deposits in escrow used, to assure the effectiveness of ROW operation and restoration.
- (9) Emergency work should be permitted with application during hours when application cannot be processed.
- (10) Review of applications and issuance of permits should take place as rapidly as possible, with consideration for the need for proper interagency review and coordination.
- (11) Project engineers and designers should determine all potential utility conflicts during the design stage.
- (12) Permit applications should be checked against all system maps or file records of existing underground utilities and facilities in the ROW.
- (13) Permit applications and records should be reviewed by the utility coordinating committee, if one exists.
- (14) Permit applications for new major utility installations should be reviewed in light of future plans.
- (15) Owners of property or businesses abutting utility projects should be advised of permit applications that may affect their convenience and economic well being.

Figure 5-2. Methods to Improve Permitting Practices.

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CHAPTER SIX

INFORMATION MANAGEMENT AND MAPPING

INTRODUCTION

Effective information management and mapping programs are critical items for any agency that has infrastructure responsibilities. Engineers and project planners must often pull together a variety of data for the successful development, design, construction, maintenance, or emergency repair of a highway or utility project. This information may be housed within different departments of the same agency, or it may be spread among many other public and private organizations. Tracking down the most current and accurate information can take a lot of time. Modern computing technology has made possible major improvements in this area.

Topics discussed in this chapter include records and maps typically used by highway and utility agencies, issues associated with maintaining this material, and applications of current technology for information systems and facilities management. Frequently used terms are defined and related to sample applications and practices. Uses of computer-aided drafting systems and electronic storage of maps are discussed, as are electronic transfer of files and maps, incompatibility of files among agencies, and maintenance of electronic maps.

Information Management

All types of organizations, large and small, public and private, rely on information of all

types to conduct their business. That information is obtained from investigation or study, contained in data and records, or shown on maps. It is processed and used to make decisions affecting each organization and the larger community. Having access to the right information, in the right form, and in a timely manner facilitates good decisions.

Information is a valuable resource, in much the same manner that physical facilities and equipment are assets or resources used by a community or business to perform its functions. Managing information requires organization and a focus on how to provide and maintain an accessible, reliable, and credible system.

Information management can be enhanced and expanded through the use of computerized applications. Even in small offices, personal computers have the capability to manage files that relate facts to their geographical location and street address; to retrieve data concerning local physical features; and to correlate these with selected socio-economic data. For example, a "street master file" could include utility type records as well as records of street pavements, sidewalks, curbs, street lighting, traffic density and signalization, refuse collection, landscaping, fire alarms and hydrants, police telephones, and parking meters. Data concerning the parcels of property, buildings, and other occupancies bordering the streets can also be incorporated into such a master file.

TYPES OF INFORMATION

As-built plans, property descriptions, construction plans, aerial photographs, and utility permits are among the types of information used by highway agencies and utilities. Records concerning right-of-way (ROW) limits, locations of all underground facilities, and permitted uses are needed for the planning of new facilities (whether highways or utilities), for replacement or relocation of existing facilities, and for emergency repairs.

MAPS

Among the most important records of a State highway agency (SHA), local public works department, or utility company is a detailed map of the facilities for which they are responsible. Having maps that accurately inventory and present the significant characteristics of the roadways, ROW's, and utility lines and associated features is essential for agencies responsible for infrastructure.

Many types of maps are used to plan, design, and operate highways and utilities. Some of the more common types of maps in use are cadastral base maps, geographic maps, utilities system maps, transportation network maps, land use maps, assessors' maps, and topographic maps.

Facility maps show the network of pipes and cables that move electricity, water, gas, oil, telecommunications, cable television and so on. Most facility operators are regulated by some level of government. Many also pay taxes on their facilities and must keep an inventory of their facilities for tax assessors. Facilities are usually surveyed and mapped in the construction phase. The accuracy of on-the-ground surveys must not be lost in the paper shuffle that can occur after a project is complete.

Right-of-way maps delineate the highway facility and the boundaries of the reserved strip of land. The map typically outlines the ROW to proper scale and includes some means of identifying its location. This might include stationing along its length and the relative location of benchmarks and intersecting features. Items that could be included are described as follows:

- (1) Gas, electric, telephone, water, sewer, CATV, and other utilities may show the location, size, features, and types of their facilities;
- (2) Assessors may show the location, boundaries, dimensions, building outlines, and street addresses of individual properties;
- (3) Planners may show land types, slopes, and zoning;
- (4) Highway engineers may show pavement types and widths, medians, and curb and sidewalk details; and
- (5) Traffic engineers may show traffic lanes, lighting, signalization, signage, and parking.

Most ROW maps have been developed to serve the needs of a single agency. As a result, most municipalities are served by a multitude of separate map systems that illustrate the same ROW's but use different scales, levels of accuracy, and orientations. Information concerning a particular street is scattered among many different agencies. Gathering all of the information and maps necessary for a project in the ROW may require visiting a number of different agencies and converting the acquired

information into a common data base or map. This obviously increases the likelihood of introducing errors or omissions into the planning and design work, as well as duplicating efforts done by other agencies.

A natural extension of ROW mapping involves the use of computers. The base map and various details can be digitized one time and shown on video display terminals or plotted. Once this is done, modifications can be more easily made. Features can be added, removed, or reconfigured depending on the requirements of the specific project.

A common scale for a community map is 1:600 (1 inch equals 50 feet). These maps usually show lot sizes, street ROW dimensions, lot and block number, street names, and subdivision names. As the information becomes available, survey monuments, house addresses, and names of property owners may be added to the record. These maps may be maintained by the assessor's office for the city or county. Information on property owners requires constant revision, and research may be needed for specific areas.

Maps are used for many purposes. For example, Boston Edison Company produces and distributes a customized street map to show its underground high voltage transmission system. The map graphically portrays the transmission system, including lines in service and under construction. The map is distributed widely to contractors and governmental agencies to make potential excavators aware of where these facilities are located and the type of structure and the potential hazard (personal, financial, environmental) of a dig-in. Copies of the map are also distributed at the municipality's permit desk with excavation permits.

AS-BUILT DRAWINGS (RECORD DRAWINGS)

Utilities and highways are seldom constructed exactly as planned. Major deviations may be made during construction to address unforeseen obstacles or obstructions, to incorporate better ideas developed on-site, or to use alternate materials or change project requirements. Mapping systems that do not reflect these field changes may be a significant liability. They may mislead future designers and excavators into a false sense of security about their knowledge of the project. SHA's often maintain original as-built plans of highway projects as a basic map record. These maps show the characteristics of the constructed roadway as well as ROW limits. Special mapping of highway improvement projects is conducted project-by-project.

A mapping system is only as good as the information from which it is built. Accurate as-built drawings are an absolute necessity for a useful map program. The term "as-built drawings" is giving way to use of the term "record drawings" because of professional liability concerns.

AERIAL PHOTOGRAPHS

Aerial photographs are used to obtain information and measurements related to topographical features. Pictures taken from aircraft allow the preparation of planimetric and topographic maps and provide a picture of roadway features and their relative proximity. Information derived from these maps includes contours, parcel boundaries, terrain and watercourse features, and locations of buildings, highway facilities, and other structures.

PHOTO OR VIDEO LOGS

These provide a visual record of the roadway and its environs. This detailed, pictorial record of the roadway provides dimensional and locational reference information.

UTILITY PERMITS

Other important ROW records maintained by local and State agencies are utility permits and franchise agreements. Often these contain plans and specifications for location, relocation, or modification of underground facilities. This information may not be directly incorporated in public agency maps of the ROW, but it is available in files for review when other projects occur in the area.

Permit records for all utility ROW operations, whether publicly or privately owned, should be maintained. This benefits future maintenance and planning efforts by providing a complete source of detailed drawings of underground facilities that can be used to avoid underground conflicts.

DATA

Highway agencies have generated numerous independent data collection activities and data files. The collection of highway-related data involves a wide variety of activities, including

- traffic counts;
- sign inventories;
- skid resistance measurements;
- photo-logs;
- accident investigation;
- recording of construction and maintenance projects and funding;
- ROW surveys;

- inventories of roadside obstacles, bridge inspections, and rail-highway crossings;
- speed monitoring;
- pavement condition surveys; and
- geometric design inventories.

Coordinating Data Collection

Collection activities have often been conducted by separate divisions, with the data stored in paper files or in single-purpose computer files accessible to only a few people. Lack of coordination or narrow interpretation of data limits sharing of information and can lead to duplication of data by different departments. Achieving a coordinated program requires resources and often involves compromises with respect to data specification, editing, and maintenance. But as systems grow and the cost of data collection rises, integrated data collection and storage systems become more necessary. Many SHA's are pursuing the development of computerized mapping systems that will dramatically change the way maps and record keeping have traditionally been done.

CHANGES IN TECHNOLOGY AND METHODS

Development, application, and maintenance of information used in planning, designing, constructing, and regulating facilities such as public highways have traditionally relied on manual methods to collect data and prepare corresponding maps and reports. Data are collected and either posted on maps, incorporated in written reports or filed in cabinets or libraries. These paper or mylar and ink documents are updated and revised as information becomes available (if drafting staff are available) or highway projects occur in a given area.

More than 90 percent of all data collected or used by local and regional organizations has a direct relationship to geography and can be assigned a geographic identifier. Facility maps are used daily for planning, design, construction, maintenance, assessment of revenues, and other critical applications. They form the nucleus of a permanent and ever-changing record system, yet it is difficult to quantify the importance and value of good maps to a municipality or utility. Many municipalities and utilities are using maps that are inaccurate, out of date, or physically deteriorating. Duplication of effort also exists in maintaining maps both within organizations and between organizations within the same geographical area.

As interactive computer graphics systems became more readily available in the early 1970's, many municipal organizations and utilities began to apply this technology to their record and mapping systems. A computer assisted mapping system is a tool that allows organizations to enter geographic information into a digital base and readily access any selected subset of the data to produce customized maps and printed reports based on attributes of facilities shown on the map. This type of system also provides the power to add or update map features and facilities quickly without duplication of effort.

The state of this automated mapping/facilities management technology has evolved dramatically over the last several years. The capabilities and applications of this technology continue to evolve in dynamic fashion. More and more, it is not lack of technology that prevents implementation of sophisticated geographic information systems, but institutional issues such as sharing development of a common system, funding, changing the way things have always been done, ownership of data, control of the new system, etc. It is incumbent on agencies to take control of the available technology and

apply it to better operate and manage their facilities.

RECORD SYSTEM REQUIREMENTS

Record systems typically consist of a database (e.g., system inventory, utility permits); a retrieval system (manual or computerized by route number, milepost, XY coordinates, etc.); analysis techniques (pin map of excavation permits, summary of maintenance expenditures by segment, etc.); report generation (capital improvement program); and updating procedures (entry of new installations, modifications, etc.). These activities are conducted by the agency regulating the ROW, the agency responsible for the highway facility, and each agency or utility that has facilities in the ROW.

As part of its Utility Accommodation Policy, the Indiana Department of Transportation (INDOT) requires that the utility maintain records that describe the utility usage, size, configuration, material, location, height or depth, and any special features such as encasement, manholes, and valves. These records are to include all service lines that enter or cross the highway ROW. The information must be in a reproducible form available to other utilities and highway agencies.

Maintenance of Maps

Utility coordination can benefit from the maintenance of common, up-to-date, accurate, readily available maps. Base map maintenance is more difficult than might be assumed, especially when many different agencies are involved. Diligence is needed to make sure that updates are incorporated for all features shown on the base map, especially when responsibility for these features is divided among a number of agencies.

Permit Map Requirements

Some States and municipalities specify the format and content of maps and exhibits provided with utility permits. This helps to ensure that adequate information is consistently provided. The Washington State Department of Transportation (WSDOT) specifies the format and content of exhibits and maps provided with permit or franchise applications. These requirements include using the department's official ROW plans to show the installation when possible. Aerial photo strip maps or the applicant's plans may be used if they better portray the location for the proposed installation. Other requirements of the map exhibits are shown in Figure 6-1.

COMPUTERIZED DATABASES

Maintaining inventories of the physical and geometric attributes of highway and utility systems are basic functions of responsible agencies, whether a State highway agency, county public works department, or local utility company. Handwritten inventory sheets and centerline diagrams have been, and continue to be, used to represent and store information on these systems.

In the last several years, most States have made a large effort to replace, or at least supplement, their manual, paper-oriented inventory files with more sophisticated computer files, resulting in highly structured data storage.

Highway Information Systems

An integrated highway information system typically contains computerized files of geometric, traffic, accident, roadway features, and other data related to the planning, design, construction, maintenance, and operation of a highway system. Computer hardware and software have evolved to the point where integration of large data sets can be handled with some ease.

FHWA provided an impetus for computerization of roadway inventory files with the implementation of the Highway Performance Monitoring System (HPMS) and its forerunner, the Mileage Facilities Reporting System (MFRS) in the middle and late 1970's. FHWA's move to annual inventory data reporting in a computerized format greatly influenced the States' development of computerized inventory data procedures. Figure 6-2 contains data commonly included in many State and local highway facility inventory files.

Other inventory efforts conducted by highway agencies include traffic data (volume, vehicle mix, etc.), traffic accident data, maintenance and pavement data, finance and project history data, railroad grade crossing data, structure data, and photologs. States use a highway location reference system to store, maintain, and retrieve location information about points or segments on the highway.

MAPPING ISSUES

COMMON BASE MAPS

A common base map used by all agencies in a community can avoid duplication of effort and

errors that may occur when each agency does its own map system. A common base map permits the consolidation of different sources of information on a single map system. This can

Mileposts

- At least one per page (preferably two), matchlines if facility is on more than one sheet.
- At breaks in distance or facility type.
- At major crossings. Service drops, side connections, or minor (size, voltage, etc., less than that of major facility) crossings must be itemized on the description exhibit.
- At the location of manholes, vaults, valves, junction boxes, and buried side connections.

Crossing information

- Show major crossings on map exhibit.
- Minor crossings (service, guy wire, etc.) may be shown, but must be itemized.
- Include type, size, milepost, and casing, if any.

Side connection information

- Show major connections on map.
- Minor connections may be shown, but must be listed.
- Include type, size, milepost, etc.

Typical section where applicable.

Typical crossing detail when buried crossings are involved.

Figure 6-1. WSDOT Map Requirements.

include lot lines, building outlines, addresses, gas, electric, water, sewer, telephone and cable TV facilities, trees, poles, signage, and contours. A set of maps may be produced for special purposes. For example, all underground facilities could be shown on one map to assist designers in routing new facilities with minimum disturbance to those that already exist.

Although municipalities have jurisdiction over the public ROW, only a handful know completely what is under the streets and where it is located. A consolidated mapping program can help agencies identify such information. A comprehensive program can also aid in determining where new facilities should be located. This can benefit utilities by providing an area where the obstacles to construction are minimal. More important, however, is that it can protect facilities already installed by ensuring that one utility is not placed directly over another, causing a maintenance nightmare. Relocation of existing facilities necessitated by surprises during construction would be reduced.

The base map is the foundation of all computerized mapping applications. The base map consists of the coordinate system, the control monuments, and those basic features that change infrequently and are used by all organizations in the same geographic area. These features serve as reference points to locate each organization's facilities and include street, block and parcel lines, hydrography, and street names and addresses.

A major advantage of computerization of the map systems is the ability of some programs to provide an attached inventory. Individual features of the map can be identified, and reference can be made to an attached data file that provides more information on that feature. For example, a particular utility pole could be identified on the map, and the data displayed could show the type of installed equipment, date of installation, ownership, original cost, and maintenance history.

The consolidated map and data can be retained as separate layers. The base map is one layer, while lot lines, gas lines, electric and

functional class	shoulder type
Federal-Aid System	shoulder width
state system	median type
route type	median width
signed route number	right-of-way width
inventory route number	horizontal curve information
governmental control	vertical grade information
domain	sight distance information
toll considerations	speed limit
special route (such as truck route)	use of artificial lighting
length	capacity information
number of through lanes	traffic control device information
type of surface	parking information
type of pavement section	drainage information
access control	terrain
lane or traveled way width	interchange and intersection number
approach width	

Figure 6-2. State and Local Highway Inventory File Data.

water service, etc., can each be kept as separate layers. Any one of these layers, or any combination of them, can be displayed and plotted. When two or more layers are plotted, they can be assigned different colors so they can be viewed without imposing too many confusing details.

The development of multiparticipant computerized systems can provide integrated information storage, analysis, and reporting capabilities for various functions. These functions may range from parcel data, to permit tracking, to facilities management, and automated mapping.

MAP SCALE

The map scale used for geo-based information is a function of two variables: the accuracy requirements of the user and the density of the area being mapped. In addition, because users have different accuracy requirements for their systems, maps are often drawn to different scales for the same area. The scales typically being specified by current and potential users of

computerized systems in residential areas are shown in Figure 6-3.

User	Inches	Feet	Metric
Gas	1 =	50	1: 600
Public Works	1 =	100	1:1,200
Electric	1 =	100	1:1,200
Telephone	1 =	200	1:2,400
Planners	1 =	400	1:4,800

Figure 6-3. Map Scales by User.

These scales also change, depending on the density of the area being mapped. In rural areas, 1:4,800 (1 inch = 400 feet) or greater is often specified, while in highly developed urban areas, the same organization will require a scale of 1:600 (1 inch = 50 feet). The sheer volume of facilities information that must be portrayed on a base map influences the size and hence the scale of the drawings produced.

State Highway Agencies have typically elected to use a highway base map scale of 1:24,000 or 1:100,000, corresponding to the U.S.

Geological Survey's topographic maps. The highway base maps are usually a digital version of these maps.

COST VERSUS ACCURACY

The introduction of any map program requires careful planning in order to select the best compromise between cost and accuracy. The scale of mapping, the degree of accuracy in field measurements, and their reflection in the mapping program, as well as the extent of detail and legend provided, determine the value of the system. A program should not be expensive beyond the value of its use, but a program that does not satisfy long-term needs, requiring premature replacement, is also a poor bargain. Therefore, the balance between cost and accuracy/detail must be carefully weighed in the program definition process.

In determining accuracy requirements, the base map, which consists of property lines, streets, roads, and other earth-related features that are the foundation of the computerized system, is of key concern. All other data are related to the base map; therefore, accuracy of this base map is a critical factor in determining the accuracy of the overall system. The accuracy of the database is a principal factor in the usefulness of the system. The accuracy level of the data is usually the largest single variable cost in determining the ultimate cost of acquiring a computerized database.

SURVEYING

Surveying is the science and art of making the measurements necessary to determine the relative positions of points above, on, or beneath the surface of the earth or to establish such points. Surveying has two basic functions:

- (1) To measure what exists, to determine where it is located, and usually to prepare a map to show the results of these data from which a plan or boundary description can be made; and
- (2) To establish marks in the field to guide construction according to a plan or to show the boundaries according to a description or other data.

As virtually no project of any significance can be designed or built without a map and survey control, surveying is vital to nearly every public works activity. Today's sophisticated electronic equipment allows land surveyors to measure and map the earth and describe its features efficiently and accurately. Compiling geographic information requires the accurate assignment of attribute data to its corresponding location on the face of the earth. Reference systems such as the Public Land Survey System (PLSS), the North American Datum of 1983, and State Plane Coordinate Systems are used to establish a horizontal geodetic reference framework on which other information can be placed. This framework links the earth's physical features and human's reference information.

Global Positioning Systems

Global Positioning Systems (GPS) is a new way to provide ground control for mapping projects. Instead of setting up a tripod and transit over a point, the modern surveyor may set up a tripod with a special antenna receiver to monitor satellite signals. The satellites broadcast coded signals containing satellite identification, orbit information, and precise time. The receiving antenna transfers the signal to an attached computer that decodes and stores the

information. By tracking three or more satellites at once, the computer triangulates the antenna's position from the known positions of the satellites.

Typically, two or more antennas are set up at once in order to obtain an accurate measure of the distance between sites. And if one antenna is over a National Geodetic Survey control point, the entire set of new GPS points can be tied to this national control network. While the cost per control point using GPS is greater than by using conventional ground survey methods, far fewer points are needed. And line of sight is not required between the GPS points.

THE RANGE OF MAPPING TECHNOLOGY

A wide range of computer graphics technology is now available for use by highway agencies and utilities. Sorting through all of the options, applications, hardware, and software to implement the appropriate technology can be overwhelming. Just understanding the distinctions among the technologies is a challenge. As the technology has evolved, the differences between these various tools has begun to blur.

Computer-Aided Design and Drafting

Most state highway agencies have, or plan to implement, Computer-Aided Design and Drafting (CADD) to improve their design, drafting, and mapping operations. Benefits of implementing this are reducing or eliminating existing or future costs, ability to look at more design alternatives, shorter production schedules, improved quality of drawings, and better coordination among technical disciplines.

CADD is the most common application of automated graphics systems in the public works/engineering community. This tool is used to prepare drawings, such as plan and profiles,

ROW alignments, cut and fill, drainage structures, earthworks, survey field notes, roadway cross-sections, project locations, site drawings, and equipment drawings. CADD has been described as "picture processing," comparable to word processing in that it is easy to revise a drawing, change the size or scale, share the file, and place symbols.

The Washington State Chapter of the American Public Works Association has developed a set of standard symbols and line types for use in automated mapping. These CADD standard symbols were developed by public works agencies, utility districts, and consulting engineers throughout the State. Although they are designed primarily for use on computer-generated drawings, they are also encouraged for use on manually drawn plans to maintain consistency. Symbols are defined for water system related features; gas, power, and telephone systems; surveying, signalization, sanitary/storm systems, surface and landscaping features; and line types (e.g., building line, contour, railroad, property line, right-of-way line). A diskette and hard copy of the symbols are distributed on request by the Washington State Department of Transportation.

Automated Mapping/Facilities Management

Automated Mapping (AM) is a graphic information management system for display of maps and map-related data. This tool provides different layers for presenting detailed information, has many display scales, and is updatable. Facilities and Asset Management (FM) is a nongraphic information management system for the specific purpose of operating a facility or managing assets. This may be as simple as a list of data attributes about an item, such as a sewer line, or may include the work-order processing and material inventory control functions.

AM/FM is the merged capabilities of automated mapping and facility management. It refers to the computerized creation, storage, and updating of infrastructure/utility maps and related databases. AM/FM provides a powerful data analysis tool that produces a product that is greater than the sum of its parts. The system consists of an automated map with related database attributes. These maps can display a variety of information such as building locations, paved areas, topography, utilities, vegetation, groundwater flow, communication systems, historical sites, ambient noise levels, and other items.

A well-planned AM/FM reduces duplicate maps and records, drafting labor, information access time, research time, work-order processing time, and asset operation and maintenance costs. Entering both graphic and descriptive information about an installation's infrastructure into the database is time-consuming and costly. The cost of a fully digitized municipal map, including utility data, can run to \$30 to \$40 per parcel. Significant cost reductions can be achieved through advanced data conversion processes, data sharing, and scanning techniques. These costs can compare favorably to the costs incurred through the inefficiency of manual updating procedures, especially if gains in productivity are considered

Geographic Information Systems

Geographic Information Systems (GIS) provide computer-based capabilities to store, edit, display, combine, and manipulate multiple sets of spatial data registered to a common base map. A GIS uses hardware and software for the input, storage, analysis, and display of spatial and related text information. This tool can assemble and process data from a diversity of sources and present it in an easily understood graphical

format. Information is usually arranged in individual layers, and multiple layers can be combined to create a variety of maps.

The major components of a GIS are hardware, software, data, and people. Of these components, hardware and software are subject to rapid technological advancements and to replacement as new products and their advantages justify the expense. The data component is the most expensive feature, both to incorporate into the system and to maintain, as the data can be dynamic and require continuous updating. The people component includes the technical staff necessary to develop, implement, and operate such a system, as well as the decisionmakers who must approve significant investments and the end users who apply the tool in their daily work.

The database of the GIS is tied into a geographical coordinate system, such as State Plane Coordinates, and it contains both geocoded spatial data (such as a segment of a roadway or transmission line) and attribute data (capacity of the segment, age of the facility, historical maintenance expenditures by segment, etc.).

GIS-T

The term GIS-T has been coined to denote the application and capabilities of a GIS in the transportation field. A GIS-T permits the assimilation, integration, and presentation of data collected and stored by each of the divisions within a highway agency.

AM/FM/GIS Applications in Public Works

The potential applications of these technologies in managing and operating public facilities is endless. Following are some examples of applications in public works:

- *Base Map Generation and Maintenance.* A GIS base map helps governments operate more effectively and efficiently by providing a common scale and eliminating inconsistencies between maps. In addition to being the foundation for later applications, the base map is itself an application.
- *Property Addressing System.* Computerized inventory of addresses for property covering the entire jurisdiction and containing information on land parcels, buildings, or units. This information could be used to reference the relative location of some infrastructure problems such as a watermain break or pothole.
- *Pavement Management System.* Pertinent data include ROW width, pavement type, design sections, skid rating, serviceability index, and maintenance history. Pavement management provides graphic answers to questions such as, Which road should be repaired first? and What type of repairs are needed? GIS also can be used to make more accurate cost estimates.
- *Routing.* Using GIS to plan routes for garbage trucks and snow plows can help deliver these highly visible services more efficiently. This is an easy application because not much accuracy is needed (compared to, say, trying to find a buried pipe).
- *Facilities Location.* GIS can help determine where fire stations, public works equipment yards, and other municipal facilities should be located. Again, a high level of accuracy is not needed.
- *Preliminary Road Engineering.* Although few systems are precise enough for final engineering, which

usually requires accuracy levels of plus or minus 0.3 m (1 foot), GIS can be used for preliminary engineering on projects.

- *Accident Location Mapping.* Identifying high accident locations is the first step in correcting traffic hazards. Statistics and graphics can be compiled for the whole network or for specific locations.
- *Water Main Break Analysis.* By dividing the system by nodes and attaching attributes such as pipe diameter, year of construction, and maintenance records, a water department can determine priorities for preventive maintenance efforts. Water mains may be color-coded and plotted to denote age, condition, etc.

Implementing AM/FM/GIS

Fort Wayne, Indiana, a city of 170,000, is using a consortium approach to develop a GIS. Partners include the local gas utility, Northern Indiana Public Service Company, and the Indiana-Michigan Electric Power Company. The identification of existing resources in Fort Wayne highlighted both similarities and duplications of effort in various city departments' cartographic resources. Quarter-section street ROW maps were used by several departments, including engineering, water pollution control, and street lighting. But, when changes occurred, every department had to update its own maps manually. In addition to being time-consuming, this led to discrepancies between maps, because the departments did not update their maps simultaneously. Identifying this type of duplication of effort is the first step toward a standard, citywide base map, which Fort Wayne calls the Common Land Base Map.

Fort Wayne created tables listing the maps and geographic data files reported by a survey of eight departments and established three sets of criteria to determine applications and priorities. These included technical parameters, conversion costs, and payback periods and logistics. Based on these criteria, and input from the departments, which all listed their existing maps and cartographic problems, high-priority applications were determined.

For the city engineer, these applications were base map and utility map updating and linkage to the information systems management database. For Community and Economic Development, County Plan Commission, and Street Engineering, the key applications were related to map updating. For Street Light Engineering, the key applications were association of street address with light poles, geographic query to street light maps, and street light map update. Traffic Engineering cited traffic volume analysis and traffic sign and signal mapping. Water Engineering had several prime applications, including hydrant scheduled maintenance, link to network analysis model, water quarter-section map update, and valve operation program. Water Pollution Control Engineering cited sewer map updating.

Fort Wayne settled on nine initial data layers. This important decision was made before choosing GIS hardware or software. The nine initial data layers are listed as follows, along with their respective map features:

- (1) Base Map. Street pavement edges, building symbols, street ROW, ROW centerlines, section lines and corners, quarter-section lines and corners, municipal boundary lines, state plane coordinate system grid, school district lines, and waterbodies;

- (2) Property. Lot/parcel boundaries, sub-division boundaries, and utility easement boundaries;
- (3) Administrative Boundaries. City Council districts, city annexations, census tracts, neighborhoods, and utility service districts;
- (4) Sewer. Mains, manholes, pump stations, treatment plants, catch basins, drainage ditches, and culverts;
- (5) Streets. Traffic signals and signs;
- (6) Streetlighting. Poles;
- (7) Water. Distribution mains, service lines, hydrants, treatment plants, pump stations, and valves;
- (8) Land Use. City and county land use boundaries, commercial sites, industrial sites; and
- (9) Zoning. City and county zoning boundaries.

TIGER

The Topologically Integrated Geographic Encoding and Referencing System (TIGER) was developed by the U.S. Geological Survey (USGS) and the U.S. Bureau of the Census to aid in taking the 1990 Census of Population and Housing. TIGER provides computerized files nationwide that can be used to identify, locate, and map all roads, railroads, rivers, political boundaries, and other features that can be digitized from maps at a scale of 1:100,000. The USGS captured the water and transportation features of the nation, such as rivers, roads, railroads, and major power lines and pipelines from its 1:100,000-scale maps. Potential benefits that TIGER can provide for highway agencies are

- (1) a digitized base map;
- (2) a common denominator between highway location referencing systems and geographically referenced social, economic, and environmental data sets;
- (3) a link between statewide, multistate and urban networks; and
- (4) a common denominator for highway location referencing systems across State lines.

Efficiencies

Keeping facility location maps and records accurate and up to date is a difficult task, whether for an SHA, public works department, or utility company. This in turn creates problems in operation, maintenance, and construction activities that depend on these maps and records. Automating the production and maintenance of construction drawings and map records can yield efficiencies in conducting these activities by eliminating duplicative mapping, reducing research time, and producing maps that meet the specific needs of the project without major commitments of drafting staff.

Electronic Transfer of Files and Maps

To avoid losing the accuracy of surveys done during construction projects, a good practice is for surveyors to submit maps and plats of facilities to owners in standard formats on

magnetic media. This digital form could be more readily incorporated in a computerized system, such as an AM/FM system.

With increasing numbers of public and private agencies implementing AM/FM/GIS, the opportunities for sharing and exchanging information are also growing. Many communities have approached the development of this technology as a partnership, with public agencies and private utilities working together to develop a common system to be used by all. This facilitates the ready exchange of data files and facility maps, not only in the development of a regional AM/FM/GIS, but also on a project-by-project basis. Construction plans developed by an electric power company may be electronically transferred to a public agency for review and eventual incorporation in a community map of facilities.

STAKING

In most states, anyone who excavates in a public ROW must notify operators of underground facilities in advance. The facility owners mark the location of their facilities in the area of the excavation. In many areas of the country, each of the utilities sends a representative to the site for this purpose. It is not unusual for five or 10 different employees to be involved in staking one project. One reason for all of these individual representatives is the difference in map and record systems. A common base map and consolidated information would allow one crew to locate all facilities in the field.

SUMMARY

This chapter reviewed records and maps as they pertain to public ROW's. This is an area of significant and rapid change, as new technology

has enabled many communities and State agencies to automate their record and mapping programs. The following observations summar-

ize good practices in the area of information management and mapping:

- A single common base map should be used by all to coordinate the activities of the many users of the public ROW.
- A central repository should record all of the facilities within the ROW.
- This central repository would simplify and economize the planning and design of construction repairs, minimize construction delays due to unforeseen conditions, and reduce construction damage.
- This central repository would also provide a consolidation of mapping that would avoid duplication of map maintenance and facilitate consolidated stakeout.
- The expenses avoided by use of a common base map and consolidation of stakeout would be substantial in comparison to the cost of developing a consolidated mapping system.
- Map programs can be combined with an inventory in a computerized system with a separate layer for each utility.

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CHAPTER SEVEN

NOTIFICATION

INTRODUCTION

This chapter deals with the topic of notification. Two types of notification are discussed. One type concerns the need for highway agencies and utilities to notify others before commencing activity within the public right-of-way (ROW). The second involves the use of one-call systems to notify utilities before beginning excavations. Both types of notification require communication and coordination. They are also both basic elements of effective damage prevention efforts for utility facilities.

NOTIFICATION

Highway agencies and utilities must communicate and exchange information on their plans affecting the public ROW to ensure smooth, safe, and efficient operation of this resource. Adequate notification procedures facilitate effective communication. This communication should be two-way from highway agency to utility, and from utility to highway agency.

Most States require utility agencies to obtain permits for any extensive work within highway ROW's, whether for maintenance or new installation, and to give notice before actual field work. Some cities require notification in advance of any street closure for any amount of time so that the public can be notified and detours set up. These cities also usually require immediate notification when emergencies occur and put traffic police on the scene to assist.

Those responsible for highway or street ROW and those that occupy these public ways need to keep each other notified of operations within those ROW's. An exchange of information early in the planning stage of any major project proposed for consideration sets the stage for orderly project completion with a minimum of conflicts and delays.

ONE-CALL SYSTEMS

Formalized damage prevention programs that make use of a one-call notification system have been cited as the most widely accepted approach to reducing excavation damage, or "dig-ins," to underground facilities. A one-call notification system provides a communication link between excavators and operators of underground facilities. One telephone number is provided to excavators (contractors, homeowners, utilities, public agencies, or others). They can use this number to notify of their intent to use equipment for excavating, tunnelling, demolition, or otherwise disturbing the subsurface of the earth. This below-ground protection service provides an opportunity for utilities to identify and mark their facilities in the area of the proposed activity. The notification also allows the owners of underground facilities to provide any necessary information about the facilities and to post a construction watch, if desired. Benefits of one-call systems include

- (1) Prevention of underground damages, which reduces monies spent on repairs and decreases customer service outages;
- (2) Protection from loss of or damage to life, property, or equipment;
- (3) Reduction of excavator downtime;
- (4) Protection of the environment and natural resources;
- (5) Establishment of a watch over unauthorized excavation;
- (6) Assistance for excavators in complying with OSHA regulations

and other State and Federal laws and regulations; and

- (7) Promotion of coordination among utilities, governmental agencies, and other owners and operators of underground lines for placement and preservation of below-ground facilities.

The one-call system is a valuable tool to use in the prevention of facility dig-ins. It is a communication link between excavators and owners and operators of buried utilities.

NOTIFICATION PROCESS

THE FIRST STEPS

Major highway or street projects begin with an information-gathering phase. At this stage, a roadway or a general route has been identified for construction or upgrading, but the exact alignment or geometrics have not been determined. Information on the location, value, and relocation cost of existing overhead and underground utility service and transmission lines at this stage is essential, and it may become a major factor in determining the selected route. Sometimes, utility location and cost information is provided at a project concept conference. Other times, the utility owners may be asked to send information about their facilities in the area to be considered. In a similar manner, utilities should advise the road agency as early as practical of major projects being planned within or along highway corridors to provide the best chances of joint planning.

OBTAINING UTILITY INFORMATION

After a specific route is selected for a roadway or a utility line, coordination can minimize conflicts between the planned facility and existing facilities. Sometimes utility owners are asked to add the location of their facilities to roadway plans. Other agencies ask for utility record information, interpret it, add it to plans, and return it for review by the utility owners. The developer of plans should be provided with record information to interpret or to incorporate relevant information in the project plans. Whenever possible, information about existing facilities should be used, and the plans should be prepared to avoid conflicts to the extent possible. A detailed proposal is sometimes necessary to determine if a conflict could be created. Conflicts might involve topics like physical interference or a reduction in clearances to unacceptable levels. The location of all existing

underground lines should be shown on the project plans. Utilities to be relocated or abandoned in conjunction with the project should be identified.

LOCATING UTILITIES

Physically determining the location of an underground line may be necessary to plan the proposed facilities to minimize conflict. This information is useful in the detailed design stage of a proposed facility to decide whether to adjust the existing utility facilities to accommodate the proposed facilities or to revise the design of the proposed facilities to accommodate existing utilities. When deemed necessary after reviewing utility record information, the utility should mark the location of the underground line on the earth's surface. Requirements for the accuracy of marking underground facility locations vary from State to State. If the markings indicate a potential conflict, physically exposing the line may be necessary. This is particularly desirable if design alternatives can prevent the conflict. Where the utility owner would be responsible for the relocation cost if a conflict were created, that utility should expose the facility to facilitate a design that eliminates or minimizes the potential conflict.

UTILITY RELOCATION

After unavoidable conflicts are identified, the utility is requested to prepare relocation plans and estimates if relocation is at the road agency's expense. The utility may also be requested to begin the process of securing rights to place replacement facilities and to develop a work schedule.

When project construction activities are about to begin, the location of all existing underground utilities should again be requested at least three

days before excavation is to start. The clearance requirements for each utility should also be requested. The project engineer and the excavation contractor should compare the subsurface markings with the project plans. Any differences should be resolved with the utility before excavation begins. When an existing line is to be abandoned or relocated in conjunction with the project, the utility owner's schedule for completion of that activity is essential. If two or more excavators are to work in the same area, the project engineer should arrange to preserve or recreate the line owner's markings. After excavation activities are completed, the excavator should remove markings that are no longer necessary. On extensive projects, line markings may need to be performed in stages as work progresses. Arrangements to achieve this result are best arranged directly between the project engineer or excavator and the utility owner's marking personnel.

Throughout the project development process, highway and utility personnel are exchanging information and communicating, or notifying the other of proposed actions, plans, facility locations, and alternatives.

NOTIFICATION METHODS

Direct telephone or in-person conversation between the developer of a project and the owners of utilities that may be in conflict is often the only satisfactory method of communication. The project developer should either have access to records that identify utilities in specific areas or contact all possible utilities to determine if a conflict would be created.

Some underground line-protection, one-call systems accept and encourage calls to obtain planning information. One significant advantage is that the identity of utilities need not be determined by the planner before calling. A second advantage is that one-call can serve to

notify multiple-line owners, saving the planner considerable time.

The principal purpose of line protection one-call systems is to prevent excavation damage to existing lines. Some one-call centers are organized and operated solely for this purpose. Operational changes to accept additional calls, which often must be routed to a second location in the utilities office, may seem counterproductive, particularly if those involved are responsible only for maintaining existing lines. When the potential for engineering involvement in utility relocation plans and the potential to avoid relocation by appropriate design are added to the equation, one-call services can be expanded to provide this vital service. Those that do so find it valuable in cost avoidance as well as damage prevention.

Another method to get information is the planning conference. Utilities that may be affected by a project are identified and invited to a joint meeting. They are asked to bring their record information and be prepared to discuss the need, value, and approximate relocation costs for their lines that may be in or near the project area. Meetings of local utility location and coordination councils are another mechanism for providing notification of proposed activities. Attention must also be given to notification requirements specified in State or local permitting procedures.

TWO-WAY NOTIFICATION

All parties should keep each other notified of impending operations within highway or street ROW. Utilities should notify the highway agency, and highway agencies should notify utilities of proposed work that may affect their facilities.

Some State agencies notify and send plans of impending work to utility agencies, but usually after the planning phase is well underway. Utility agencies often do not discuss plans with highway agencies until they need to request a permit. In many instances, no notification is given; the crews just go to work. The best course would be for both agencies to interact at the earliest stage possible. However, certain conditions require confidentiality (such as how to serve a major industry seriously considering a site that for some reason cannot reveal its intentions). In such cases, the more individuals involved, the more likely confidentiality will be breached. Either the highway agency or the utility agency may be the confidant. All parties should be brought together as soon as possible so that the most expedient and least disruptive approach possible can be developed. One problem that occurs with regularity is that individuals in both the highway agency and utility agencies are notified, even in the early stages, but for various reasons the information is never incorporated in the planning phase or plans.

Good cooperative effort on both sides is needed first. Approaches need to be developed to pass information up and down and across lines in both agencies. Both agencies should be notified of impending work at the earliest possible date. As plans progress, the information should be passed on. As little secrecy as possible should be permitted to creep into plans. Both agencies should notify the other of all operations, whether impending, at the implementation stage, or emergencies. In any event, an individual whose identity and function is known to all should be designated as the coordinator and disseminator of information.

REGULATIONS REQUIRING NOTIFICATION

FEDERAL REQUIREMENTS

Federal regulations require each State to adopt, or seek to adopt, a one-call damage prevention program as a condition to receiving full funding for the State's pipeline safety compliance program. The intended effect of this requirement is to reduce the incidence of excavation damage to gas and hazardous liquid pipelines and other underground facilities.

Operators of gas pipelines must perform required duties either by themselves or by participation in a public service program, such as a one-call system. Similar damage prevention requirements have been proposed for hazardous liquid pipelines.

STATE DAMAGE PREVENTION LAWS

Approximately 42 States and the District of Columbia have damage prevention laws designed to protect underground facilities from damage by excavation activities. Although State damage prevention laws are not uniform, they most often require persons engaging in defined excavation activities to provide operators of specified underground facilities advance notice, with relevant details, of their intended excavation. Common provisions of State laws include

- definition of excavation activities;
- specification of underground facilities;
- notification and response times;
- accuracy of temporary marking;
- color code for identification of temporary marking;
- protection of underground facilities;
- emergency clauses;

- exemptions;
- excavation permits; and
- penalties for violation.

Penalties for violation of provisions of State damage prevention laws range from \$500 to \$50,000, dependent on the State.

An excavation activity is defined in an American Public Works Association (APWA) publication on damage prevention laws as

...an operation for the purpose of the movement or removal of earth, rock, or other materials in or on the ground by use of mechanized equipment or by blasting, and including auguring, backfilling, drilling, grading, plowing in, pulling in, trenching, tunnelling, and plowing for agricultural purposes in excess of 18 inches in depth. The movement of earth by tools manipulated only by a human or animal power shall not be deemed an excavation; nor shall plowing for agricultural purposes less than 18 inches in depth be considered an excavation.

The One-Call Systems International Committee of the APWA conducts an annual survey of one-call centers and State damage prevention laws. These are presented in an annual *Excavator's Damage Prevention Guide and One-Call Systems International Directory*.

STATE HIGHWAY AGENCY NOTIFICATION REQUIREMENTS

SHA's also have notification requirements for entities desiring to work in the public ROW.

These notification requirements are usually identified in the State's utilities manual, typically as part of the permitting procedure. Standard permitting procedures usually require that, with approval of the permit application, advance notice is necessary before beginning work in the ROW. The amount of time required for notification before beginning work varies among States. The IRWA Survey of SHA's found the most frequently cited notification times were either 24 or 48 hours.

Beyond beginning field work, many types of activities may require special notice: use of explosives, abandonment of facilities in the ROW, emergency situations, weekend or holiday work, spills of hazardous materials, and variation in use of utility facilities (such as change in pressure). More than one-half of the SHA's and a number of local agencies require notification of the one-call system as part of the permit process.

ONE-CALL SYSTEMS

One-Call Systems were developed in response to damage to underground facilities that increased considerably following the building boom of the 1950's, 1960's, and early 1970's, when the trend was to go underground with utilities. Thousands of miles of underground facilities were vulnerable to excavating machines such as backhoes, and the resulting damage interrupted utility service and threatened life, health, and property.

A COMMUNICATION LINK

A one-call notification system provides a communication link between excavators and owners and operators of underground facilities. A contractor planning an excavation notifies the

LOCAL AGENCY NOTIFICATION REQUIREMENTS

ROW permit procedures for local agencies may require advance notice before work begins in the public way. As part of its general provisions for issuing a permit for street excavations, Wellesley, Massachusetts, requires that the permittee give notice to public utility companies before making an excavation. The general requirements of the State's damage prevention law are cited, along with the identification and phone number for the one-call center.

The Kansas City, Missouri, Public Works Department requires that permittees for an excavation permit notify all utilities through the one-call center before digging. The Missouri damage prevention law is cited in the provisions of the permit. The permittee is also to notify the inspection office one day before beginning work.

local or statewide one-call center of the location and other relevant characteristics of the proposed work. This call must usually be made at least two days in advance of the activity. The one-call center notifies all utility owners with underground facilities in the area of the proposed excavation. A crew then visits the site and identifies and marks the location of underground facilities in close proximity to the excavation site.

REQUIREMENTS OF A ONE-CALL NOTIFICATION SYSTEM

The level of sophistication of one-call centers varies across the country. Some one-call centers use complex communications and information

systems to conduct their mission, while others use a more basic system of notification and tracking. Minimum requirements for establishing a cost-effective one-call notification system have been developed by the One-Call Systems International Committee of the APWA and are listed as follows:

- One telephone number should be established for excavators to use to notify participating utilities within a predetermined area of coverage (i.e. state, county, township).
- The service should be provided during normal working hours, Monday through Friday.
- Off-hour calls should at least reach a recording, which explains emergency procedures.
- All telephone calls should be mechanically voice-recorded.
- The system should identify for the caller those utilities that will be notified of the excavation activity.
- The system should provide a permanent file number for each request.
- The system should provide, for a statutory period, a printed copy of all location requests, which can be easily retrieved through use of the file number.
- The system should provide a timely method of notifying the affected utilities. This method is to be determined by each individual system.
- Primarily, the system should service planned excavation activity. The system may handle in progress and emergency work, but it should always stress to its users the need for advanced notification of excavation work.

- The system should provide periodic administrative reports as required by the participating utilities.

The system should provide and document excavator education programs on an ongoing basis, document association contact, and otherwise be involved in a public relations campaign to broaden awareness of the need to call before you dig.

HISTORICAL PERSPECTIVE ON ONE-CALL

Over the last 200 years in North America, the use of underground space for utility-type facilities has progressed from hollowed logs used as drainage pipes to facilities placed for water, sewer, natural gas, petroleum, electric, steam, telephone, cable television, and fiber optics. As more and more facilities were placed underground, the number of interruptions to existing services from accidental "dig-ins" or "hits" naturally increased. Each new underground system required excavations that posed danger to facilities already in place. The problem compounded, as more and more underground systems were trenched or plowed into earth.

Call Before You Dig

Utilities initially responded to the service interruptions with appeals to excavators to "call before you dig." Many utilities added departments to handle mapping, marking, and protection of underground networks. But excavators were faced with calling an increasing number of facility owners whenever digging was required. In many cases, this was an unsystematic catch-as-catch-can effort with the occasional missed call and cut utility line.

An early attempt at solving the problem was made by the City of Chicago in 1912, when officials set up a clearinghouse for excavation activity. Notifications of dig locations came into the city permit office and were announced to major facility owners, who then picked out sites affecting their lines. Only a few facility owners were involved, and their lines were at virtually every dig site within city limits. Therefore, notifications required little screening before locators were sent to mark lines for excavators.

The First One-Call Center

The real implementation of modern one-call came in 1964 when a group of utilities in Rochester, New York, decided to pool their efforts. They set up what is generally regarded as the nation's first one-call center. This operation was based at the Rochester Gas & Electric Corporation. Stakeouts were handled by customer service representatives along with regular service calls. When an excavator called to report a pending excavation, the company sent the information to other local utilities through a teletype network.

In nearby Syracuse, New York, the first one-call center not run by utilities was formed, based

on principles used in the answering service industry. This center also developed a specialized database that allowed screening of calls in areas where members did not have buried utility lines. The one-call concept worked so well that one-call service is now available in all but three states (Hawaii, North Dakota, and South Dakota).

One-Call Systems International

In 1976, an informal group of one-call center managers, meeting to compare notes and improve damage prevention practices, evolved into the One-Call Systems International Committee (OCSI) within the American Public Works Association. As part of this national association, one-call was connected to municipalities and urban counties and positioned to involve these operators of quasi-public utilities in effective damage prevention efforts. Eighty-six one-call centers now operate in the United States. In many cases, one center covers an entire State, while States such as Washington, Oregon, and Wyoming have eight or 10 one-call centers serving smaller geographic regions within the State.

ONE-CALL USERS

Users of one-call notification systems include private firms, municipalities, utility companies, and anyone who needs to excavate or work with the soil in such a manner as to contact or cause possible damage to subsurface structures. State damage prevention laws identify the types of activities that require notification and how much advance notice is required. Users of one-call

systems include operators of underground facilities such as

- *Communication Carriers.* Telephone, telegraph, cable TV, fire, police, traffic control, military, airport and other signal system operators;

- *Electricity Providers.* Transmission and distribution, private, cooperatives, municipal, traffic control, street lighting and others;
- *Gas and Petroleum Product Carriers.* Transmission, distribution, municipal, cooperative, private and others;
- *Water and Sewer Suppliers* (public and private). Transmission, distribution, sanitary, storm, flood control, and others;
- *Transportation.* Railroad, rapid transit, shuttles, roadways, and similar facilities; and
- *Others* that own or maintain substructures.

One-call users also include excavators, such as utilities and their contractors, general contractors and subcontractors, highway, street and road builders, plumbers and steamfitters, landscapers, forestry groups, lawn services, fencing companies and similar groups, well drillers and miners, recreational builders, real estate developers and home builders, engineers and project originators, homeowners (including farmers), blasting contractors, and all others who excavate the earth's surface. One-call systems accept calls from anyone needing to determine the location of underground facilities due to impending excavation. Most one-call centers use toll-free telephone numbers.

OPERATING PROCEDURES FOR ONE-CALL CENTERS

The call to the one-call center is initiated by anyone, particularly contractors working around utility facilities or cutting into the ROW. This notification may be required as part of obtaining the necessary permit from the regulating agency. The call is made for all digs around utility facilities and in any highway or street ROW, or

when working under or around overhead facilities. Each one-call center has its own unique operating procedures. These procedures respond to the local characteristics and legislative requirements of their area.

THE CALL

Typically, when the call is made, the one-call center operator completes a computer-generated location request form, identifying pertinent callback information about the caller and the location of the work. In some cases, such as in urban or suburban areas, this is a simple process. The caller provides a street address, road name, or intersection at which the excavation is being performed. Information about rural sites is somewhat more time-consuming to obtain because of the remoteness of location or lack of reliable geographic references.

After establishing the jobsite location, callers are generally informed which utility companies participate in the call center in their work area. The one-call center computer then assigns a unique ticket number to the location request for reference, tracking, and accountability.

SCREENING PROCEDURES

A variety of procedures are used to process the calls once received. Screening is the term applied to how the center determines which members (owners/operators of underground facilities) need to know about a particular dig. The most widely used methods of screening are

- *Mass Dispatch.* Probably the least desirable method because all organizations participating in the one-call program receive every message, regardless of how few or scattered

their facilities or the proximity of the dig to any of their underground facilities.

- *County or Township Identification.* Political boundaries are used to help determine which members receive the dig site notification. This method is more selective and reduces the number of needless notifications generated by the mass dispatch system.
- *Grid System Identification.* This selective screening method uses a geometric boundary to determine who receives notifications. Members register their facilities according to predetermined grids (these can be local grids or grids prepared by various mapping companies). Generally, the grids range in size from 0.4 to 1.6 square kilometers (1/4 to 1 square mile). The grid where the excavator will be working is identified, and only those members with facilities in that single grid are notified.

Each of these screening systems may be used manually, or they may be incorporated in a

computer-automated system. Notification is provided to each of the affected utilities. Notification may be oral in smaller utilities, but many times it is an automatic transmission to a computer at the utility. At the end of each day, the one-call center delivers a summary report to each of the utilities in the system. This report lists ticket numbers and the total number of messages transmitted to that receiving location, thus providing a positive accounting for each ticket number issued by the one-call center.

Once the utility receives location requests, a determination is made regarding the need to dispatch locators. Records are consulted to determine the proximity of the proposed excavation to existing utility lines.

WHEN TO NOTIFY

State damage prevention laws typically specify a certain number of days advance notice to the one-call center before excavating. This allows minimal time for the utilities to have their underground facilities marked in the area of the proposed excavation.

FIELD LOCATING AND MARKING

After the one-call center has been notified, locating crews are dispatched to the jobsite to locate and mark underground facilities. The crews may be dispatched from each of the utilities in the affected area, or a single contractor may provide this service for all utilities.

LOCATING FACILITIES

The personnel assigned to locate the underground facilities use maps of the utility

lines and check the area for visible signs of other utilities (e.g., fire hydrants, transformers, pedestals). The appropriate locating instrument is selected for the target utility. For example, an audio-frequency locator is used if the utility is a good conductor — electric, telephone, cable TV because the signal can travel far with less bleed-off. If the utility is a poor conductor — such as cast iron or bare steel — a radio frequency locator is used, because the signal can jump over the joints, valves, and service taps associated with that type of conductor. The signal is traced

to the target utility and the location marked with paint, flags, or stakes in the appropriate color code.

Even with advanced technology common in locating devices, locating underground facilities can be complicated by ghost signals, soil conditions, interfering conductors, insulators, dead-end cables, and abandoned utilities. The use of these sophisticated electronic devices requires thorough knowledge of their proper application and field conditions to discern true locates. Table 4-2, *Typical Subsurface Utilities*, presents information on typical subsurface facilities and clues to aid in their field location.

MARKING FACILITY LOCATIONS

Once the facilities have been located, color-coded surface marks (spray paint or chalk) are placed over every buried facility to indicate the location, change in direction, and dead ends of buried lines. The type of spray color media is selected to fit the longevity requirement of the job. Spray chalk would be used only when extremely short-term markings are required. Spray paint is available in short- and long-life types.

To increase visibility, color-coded vertical markers (temporary stakes or flags) are used to supplement the surface marks. All surface marks should indicate the name, initials, or logo of the company that owns or operates the line.

UNIFORM COLOR CODE FOR TEMPORARY MARKING

Guidelines for Uniform Temporary Marking of Underground Facilities have been developed by the Utility Location and Coordination Council of the American Public Works Association. These guidelines use a uniform color code to identify the type of underground facility. The color code identifies a color used to designate a group of

utilities of similar characteristics. The uniform color code adopted by members of APWA is listed as follows:

Red	Electric power lines, cables, conduit, and lighting cables.
Yellow	Gas, oil, steam, petroleum, or gaseous materials.
Orange	Communications, alarm or signal lines, cable TV, or conduit.
Blue	Water, irrigation, and slurry lines.
Green	Sewers and drain lines.
Pink	Temporary survey marking.
White	Proposed excavation.

The guidelines also state that the width of the facility should be shown if it is more than 50 mm (2 inches). If the surface over a buried line is to be removed, supplemental offset marking may be used in addition to usual marking. Offset markings should be on a uniform alignment and must indicate clearly that the actual facility is a specific distance away in a certain direction.

TOLERANCE ZONE

Damage prevention laws usually specify a location tolerance zone (if none is specified, the APWA guidelines suggest a 0.5 m ([19 inch] tolerance zone). All excavation within this zone must be performed with hand tools until the facility is exposed or the maximum depth of the excavation is reached. The tolerance zone includes the width of the underground facility and the specified tolerance (e.g., 0.5 m [19 inches]) measured horizontally from each side of the facility. As an example, for a facility that is 250 mm (10 inches) wide, hand excavation is required across the area of the facility and 0.5 m (19 inches) on both sides for a total of 1.25 m (48 inches).

To reduce confusion between markings for existing underground facilities and those for proposed excavation, the guidelines suggest that white should be used for the new excavation. Some utilities use color-coded flags to indicate sites of proposed facilities. These flags consist of the utilities' color and white. Red-and-white-striped flags would indicate a proposed electric facility. An orange flag imprinted in white with the words Proposed NBT would indicate the route of a proposed telephone line for the NB Telephone company.

JOINT UTILITY FIELD LOCATING

Economies can be achieved with a one-locates-all approach to identifying underground facilities. In an area congested with underground facilities, a number of different locate crews may show up on site to mark their utilities. These crews may be service personnel with the utility or a contractor hired to perform the locates. One alternative is to use a common locate contractor to locate all facilities in the area.

SUMMARY

This chapter has reviewed why notification is such an important issue for highway agencies and utilities. Two types of notification were discussed. One concerns highway agencies' and utilities' notice before undertaking work in the

public ROW, and the other concerns notification to the one-call center for location and marking of utilities before excavations. The bottom line in both cases is that timely communication is vital for safe and efficient operations.

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CHAPTER EIGHT

LEGAL ISSUES

INTRODUCTION

Legal issues are becoming increasingly important in highway/utility work. Questions about acquisition of right-of-way (real property), reimbursement issues, and tort liability arise frequently. It is important for the highway/utility manager to have a general understanding

of the law and know when to call an attorney for assistance and advice when dealing with legal issues. This chapter provides a simple overview of the important legal issues that affect highway utilities and serves as a starting point for understanding the legal system.

HISTORICAL DEVELOPMENT

The legal relations of the civilized world are governed today by two distinct systems of law: civil or Roman law, and the Common Law of England. The growth of Roman law began with the growth of the Roman state, and the first authentic Roman legal records date to about 450 B.C. This form of law was so instilled in the civilizations that were governed by the Roman Empire that it still serves as the basic law of all European countries except Great Britain.

In America, laws of most States derive from English law, although some have Spanish and French origins. These legal systems grew out of a monarchy. The king needed people to defend his kingdom, so he gave parts of the kingdom to lords to oversee. As long as these lords were faithful, they could establish their own small kingdoms and literally rule their own subjects. With many rulers and many small kingdoms, it became important that common laws be developed. These laws were often based upon long-standing customs. Over the centuries they

involved into the Common Law of England, the basis of much of the United States legal system.

After the battle of Hastings in 1066, William the Conqueror declared that all land would be held in service of the king. The king had unquestioned authority and power, and would often dispose of any lord who did not show complete loyalty to him. As the lords gradually obtained more power, they began to band together and to stand against the king. This faction became so strong that the lords forced a change in the king's rights. In 1215, King John granted a charter to the Barons at Runnymede which was to become the foundation of English constitutional liberty. The charter (Magna Carta) took away the concept that all land was held in service of the king, and gave property rights to individuals.

Beginning with the Year Books of 1272, English courts began to keep a record of their decisions. It became standard practice for judges to search through these records to see if a

question before the court had already been decided. This practice expanded and strengthened the common law by establishing the concept of using precedent to decide subsequent cases.

These brief examples show that England originated the common law concept, gave property rights to the people, and began the use of precedent to decide cases. American law is founded in large part on these principles.

DIFFERING LEGAL SYSTEMS

Legal systems exist at every level of government, and they often differ in purpose and application. With few exceptions, Federal laws are administered uniformly throughout the country in the Federal court system. However, State legal systems vary from location to location, as do local government legal systems. Although the basic legal principles are much the same throughout the country, differences develop through local conditions and customs.

For any legal issue, the highway/utility manager must first determine the appropriate level of law. This determination may be difficult, because Federal, State, and local laws may be tightly intertwined for any one issue. It is often appropriate to seek the advice of an attorney; even a lawyer may have to research the law to determine which code and regulations cover the situation and how these legal documents should be interpreted.

TYPES OF LAW

Law in the United States may come from legislative enactment, judicial decision, or administrative regulation. More particularly, types of law include the following:

- (1) Constitution of the United States;
- (2) laws passed by the U.S. Congress;
- (3) regulations adopted by Federal boards and commissions;
- (4) Constitutions of the States;
- (5) laws passed by State legislatures;
- (6) regulations adopted by State and municipal boards; and
- (7) ordinances passed by cities and villages.

LEGISLATIVE ENACTMENT

Legislative enactment is sometimes called the "written law." It is the direct expressed command of the government, and it supersedes and nullifies any common law already established, if the common law is in conflict with the written law.

There are two broad forms of legislative enactment: constitution and code. A constitution is relatively difficult for a legislature to adopt or change. It is the highest form of law and establishes fundamental concepts. Any other legislative enactment is void if it is in violation of the express principles or prohibitions of a constitution.

A law adopted by Congress or by a State legislature is called a statute. A collection of statutes is called a code (e.g., U.S. Code or State code). The term "code" can also mean a collection of statutes and regulations, arranged in a convenient manner so that particular topics can be easily located and reviewed.

ADMINISTRATIVE REGULATIONS

Units of government are given authority through constitution and statutes to establish rules to carry out the law and to conduct their daily operations. These are called administrative rules or regulations. Typically, they provide the details for administering the provisions of the code. In the highway/utility field, this might be the State highway agency utility manual, which contains items like the prescribed rules for placement of utilities in the right-of-way, forms

and procedures for making application for a permit, and other administrative details.

COMMON LAW OR CASE LAW

The third and most far-reaching source of law in America is common law, or case law, which is formulated by judicial decision. Each time a case ends, a new precedent may have been set. This practice can be traced to the early development of English law, where judges researched cases and used precedent to guide their decisions.

In America, judges have great authority and great freedom to interpret and apply the law. They depend upon the binding precedent of previous cases. This is often called the "unwritten law." Without it there would be no predictability in the application of the law and no one would know his rights within the legal system.

FEDERAL HIGHWAY/UTILITY LAW

The various forms of Federal law that deal with highway issues are outlined briefly for the convenience of the reader.

FEDERAL LAWS

Laws adopted by Congress have been collected in the United States Code. Those laws applicable to highway/utility matters are principally contained in sections 109(1) and 123 of Title 23 of the United States Code [cited 23 U.S.C. 109(1) and 23 U.S.C. 123]. In order to carry out the provisions contained in the law, the Secretary of Transportation is given the authority in 23 U.S.C. 315 to promulgate regulations.

FEDERAL REGULATIONS

The Code of Federal Regulations (CFR) contains regulations promulgated by the administrative and regulatory agencies of the Federal government. Changes in the regulations are published in the Federal Register, which is the daily journal of official publications of the administrative agencies of the Federal government. Regulations relative to utilities are contained in Section 645 of Title 23 of the Code of Federal Regulations (cited 23 CFR 645).

FEDERAL DIRECTIVES

Directives are generally written to clarify the laws and regulations by providing background

information or implementation instructions. Part 645 of the Federal-Aid Policy Guide (FAPG) is an example of a directive applicable to the highway/utility area. Because the CFR and

FAPG provisions that address highway/utility matters are essentially the same, the FHWA has provided further instructions and clarification in a nonregulatory document, the Program Guide.

LEGAL TERMINOLOGY

The law, as practiced in the United States, has evolved primarily from Roman and English law. Many of the terms commonly used in legal transactions or in the courtroom are derived from Latin. Other terms have been in existence for hundreds of years and have antiquated meanings, which can be very confusing to a lay person. Additionally, legal procedures can be very complicated, have many steps, and follow carefully crafted rules of procedure. This poses an additional complication for the lay person. In short, the legal system can be overwhelming.

Lay persons often underestimate the importance of understanding legal terminology and procedure. Consequently, they blunder in legal transactions or in helping to defend tort cases, with devastating results. These same individuals may "blame the system" or moan that a "technicality" cost them the case. In reality, their own naiveté was the root of the problem. It is very important for highway/utility managers to have a general understanding of the legal system, and most important that they know when to consult an attorney during the course of ordinary business.

LOCATING UTILITY FACILITIES IN THE ROW

The Federal and State governments recognize that it is in the public interest for utility facilities to jointly use the ROW of public roads and streets, when such use does not interfere with the primary purpose of the highway. Joint use saves the utility money because it does not have to buy separate ROW. In turn, this use saves the citizen rate payers the cost of the ROW. Another advantage of joint use is that it reduces the amount of ROW that would otherwise be taken from property owners.

To ensure that the highway ROW continues to meet its primary purpose and that safety is not jeopardized by utility facilities, appropriate laws, policies, and practices have been developed to govern when and how utilities may use public

highway ROW. Examples are outlined in the next several paragraphs.

CODES AND REGULATIONS

Federal

Both the Federal and State governments enact statutes and adopt regulations to govern the highway/utility process. The pertinent Federal law is contained in the U.S. Code. FHWA regulations, policies, and practices dealing with utility relocation and accommodation matters are found primarily in the Code of Federal Regulations, Title 23, Chapter I, Subchapter G,

Part 645 (utilities), Subpart A (utility relocations, adjustments, and reimbursement), and Subpart B (accommodation of utilities). These are cited as 23 CFR 645A and 23 CFR 645B. They are based on provisions of the U.S. Code, and are explained and emphasized through Federal directives as explained earlier in this chapter.

States

Almost all States have adopted general (or specific) statutes to govern utility placement and accommodation in highway ROW. Using data from a 1992 survey by the International Right-of-Way Association, a State-by-State tabulation of statutory provisions for accommodation is presented in Table 8-1. It is readily apparent from a review of the table that the forms and provisions of these statutes vary across the nation.

Perhaps the area of most diversity is terminology, which complicates any attempt to classify or compare the types of statutes and regulations from State to State. What is called a "State highway system" in one State may be all roads eligible for Federal or State funding, while in another State it may have a completely different meaning. Phrases like "on-system," "off-system," and "trunk-system" have varied meanings from State to State. In spite of the differences in terminology, some general conclusions can be drawn about the statutes and regulations that govern utility accommodation in the various States.

State Accommodation by Statute

Sometimes, accommodation is covered by specific statutes. California is a good example, where all rules governing highways are acts of the

legislature. There are only a few States with such specific statutes.

State Accommodation by Regulations Issued Under General Statutes

For most of the States represented in Table 8-1, statutes give an officer (or agency) of the government general powers to do what is necessary to operate the roadway system and to oversee the safety of the public using the roadways. In such situations, the officer (usually the DOT Secretary) prepares a system of regulations that spell out the specifics governing accommodation. A good example is Virginia, where a statute empowers the Commonwealth Transportation Board with rule-making authority. The Board has established rules, which have been codified. The Virginia Department of Transportation uses these rules as the basis for its utility accommodation policies.

State Accommodation by Policy or Procedure

In some States, neither statutes nor regulations specifically address utility accommodation. An example is Colorado, where the Transportation Commission has broad rule-making authority, but has not exercised it with respect to accommodation. The Colorado DOT controls utility use of the ROW through procedures and policies associated with its permit process.

FHWA Approval of State Policies (SHA Utility Accommodations Manual)

All SHA's have adopted highway/utility regulations and policies, usually in the form of official utility manuals. The content and

Table 8-1. Authorization for Accommodation of Utilities.

	Inter-state Highways	Other Fully Controlled Access Highways	Other Fed-Aid Highways	Other SHA- Controlled (Non- Fed-Aid)	Legal Basis for Accommodation
AL	X	X	X	X	P Code of Alabama § 23-1-4,5
AK	X	X	X	X	P Alaska Stat. § 19.25.010
AZ	1	2	X	X	R Ad. Rule R17-3-702
AR	X	X	X	X	P Ark. Stat. 27-67-218 & 27-67-304
CA	3	3	X	X	S Streets and Highway Code § 660 et seq.
CO	4	4	X	X	P Colo. Rev. Stat. § 38-5-101, § 43-1-225
CT	X	X	X	X	P Conn. Gen. Stat. 13a-98F, 126
DE	6	6	X	X	P Del. Code Ann., Title 26
FL	5	5	X	X	S Fla. Stat. Ann. 337.401, 402, 403
GA			X	X	P Ga. Code § 32-6-174
HI	X	X	X	X	S HI. Rev. Stat. § 171-95, § 264-13
ID	X	X	X	X	S Id. Code § 40-312 (3)
IL	X	X	X	X	R Highway Code § 9-113
IN		X	X	X	P Ind. Code 8-13-4-3
IA	X	X	X	X	P Ia. Code Ann. §§ 306A.3, 319.14, 314.20
KS	1	5	X	X	R KSA 68-404, 415; KAR 36-11-6
KY	4	7	X	X	P KRS 416.140 & 177.106
LA			X	X	P La. Rev. Stat. 48:381
ME	9	8	X	X	S 35A M.R.S.A. § 2503
MD		1	X	X	S Md. Ann. Code 8-646
MA	X	X	X	X	S Mass. General Laws, Ch. 81 § 21
MI			X	X	P MCL 247.651a, MCL 691.1402
MN	X	X	X	X	R Minn. Rules § 8810
MS	X	X	X	X	R MND-03 to MND-10
MO	X	X	X	X	P R.S. Mo. § 227.240
MT	X	X	X	X	R Ad.R. of Montana, Rules 18.7.201-241
NE	1	X	X	X	P R.S. Neb. § 39-1304.02
NV		X	X	X	P NRS 408.423, 408.210

Table 8-1. Authorization for Accommodation of Utilities. (Continued)

	Inter- state Highways	Other Fully Controlled Access Highways	Other Fed-Aid Highways	Other SHA- Controlled (Non-Fed- Aid)	Legal Basis for Accommodation
NH	1	5,12	X	X	P N.H. RSA §§ 249, 254-256
NJ			X	X	R N.J. Administrative Law 16:25
NM	X	X	X	X	S N.M. S.A. 67-18-15
NY	11	11	X	X	R Highway Law § 52
NC	1	1	1	X	P N.C. Gen. Stat. 130-146
ND	X	X	X	X	P N.D. Century Code § 24-01-03, 39-42
OH	6	6	X	X	P ORC 5515.01-02
OK	1	1	X	X	P Okla. Stat. 69 § 1401, 1403
OR	X	X	X	X	R Ore. Ad. Rule 734-55
PA	X	X	X	X	P PA C.S. §§ 2702, 2704
RI	X	X	X	X	P Based on AASHTO Policy on Utilities Within Freeway ROW (no statutes)
SC			X	X	P S.C. Code §§ 57, 58
SD	1	1	X	X	R ARSD 70:04:05
TN	1	X	X	X	R TCA § 4-3-2303(2)
TX	X	X	X	X	R Texas Admin. Code, Title 43, § 21.31-21.55
UT	X	X	X	X	S Utah C. A. 27-12-(11,88,111-116, 133-144)
VT	X	X	X	X	S 24 VSA 3342,3603,3673 30 VSA 2502,2902
VA	1	1	X	X	R Code of Va. § 33.1-12, § 9-6.14.1
WA	X	X	X	X	S R.C.W. 47.44
WV	1	1	X	X	P W.Va. Code, Ch. 17-2a
WI	X	X	X	X	S Wis. Stat. 86.16
WY			X	X	P Code of Wy.
P.R.	10	X	X	X	S 9 LPRA § 2004, 3 LPRA § 411
LEGEND FOR TABLE: 1 Crossings only 2 Official utility corridors only 3 Crossings, very restricted 4 Limited, according to AASHTO policy 5 Crossings, or special cases 6 Approved crossings only 7 Under special conditions 8 Limited 9 Fiber/optics only 10 No interstates 11 Limited 12 Turnpike lights S = Statute R = Rule (codified) of transp. agency P = Policy of SHA, based on reference statute					

complexity of these policies vary widely, as might be expected. Each SHA is required to submit its utility policies to the FHWA for review. Once the FHWA has approved the policies, the SHA administers them. FHWA is not involved in day-to-day decisions regarding application of the policies to highway/utility

projects. The only direct involvement by FHWA, after policy approval, is when an SHA requests an exception to its policies.

State highway agencies have discretionary authority to implement their own highway/utility laws, regulations, and policies as long as their actions are in compliance with 23 CFR 645.

LOCAL GOVERNMENT

Local governments normally cannot adopt statutes, but other forms of law are available to them. Typical legal procedures used by local governments when dealing with highway/utilities include ordinances, resolutions, franchises, and permits.

Ordinance

An ordinance is the municipal equivalent of the legislative statute. It is usually passed by a city council (or an equivalent body) and governs matters not already covered by Federal or State law. In addition to highway/utility issues, ordinances are frequently used to govern zoning, planning, building safety, and other matters.

Resolution

A resolution is less formal than an ordinance. In general, it is the expression of an opinion of a council regarding an administrative matter. A resolution passed by a council is in substance no different from a motion. Councils and county governments use resolutions to conduct official business. For example, a council might pass a resolution authorizing a contract with a utility firm.

Franchise

A franchise is a special privilege conferred by a government on an individual or a corporation, when the same privilege is not generally available to the citizens or the government. As an illustration of its use in the highway/utility arena, a city might award a franchise to a utility firm to supply cable TV service. The franchise allows the utility to accommodate its facilities in the ROW and to conduct its business in accordance with methods and procedures prescribed by the franchiser.

Permit

A permit is any document that grants a person the right to do something. In the highway/utility field, it empowers the utility to locate and operate its facilities in the highway ROW in accordance with certain terms and conditions specified in the permit.

Each unit of local government chooses the form of legal control most appropriate for the circumstances. It may be an ordinance, franchise, resolution, permit, or other device. The size of the utility operation, the type of utility activity, the State enabling legislation which gives authority to the local government, and many other issues affect this decision.

ACQUIRING ROW

Acquisition of ROW for highway/utility purposes involves the transfer of interests in real property. Most highway agencies and utility firms that purchase ROW employ attorneys to handle these transactions. The attorneys are experts in property law. They can

- interpret complicated statutes and regulations dealing with ROW acquisition by public agencies;
- research property issues to determine who owns the title to a parcel of land; and
- prepare legal descriptions of the property and deeds.

These skills are necessary when dealing with the transfer of interests in property.

Either a State or a utility may purchase property as replacement ROW as part of a utility adjustment. If a State (or a unit of local government) purchases the replacement ROW, it must follow the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act). If a utility firm purchases the replacement ROW, the provisions of the Uniform Act do not apply. Understanding when and how the various parts of the legal system control ROW requires the assistance of an attorney.

TYPES OF PROPERTY RIGHTS

The rights to property come in several forms. The most complete is called fee simple, that is, complete and total ownership of all interest in the land, without a time limit. Another type of interest is an easement, either temporary or permanent. An easement is a right to use the property of another in a particular way, where

the use is spelled out in the easement document. In the highway/utility field, an easement might allow for the placement of a sanitary sewer or storm drainage. Another type of property interest is a lease, which gives certain temporary and limited interests in property for a fixed time period. Many other types of interests in real property exist, including mineral rights and air rights.

EMINENT DOMAIN

A special form of ROW acquisition is sometimes used in the highway/utility field. Eminent domain is the power to take private property for public use or public purposes without the owner's consent. It is an inherent power of the Federal and State governments. The States usually make this power available to local governments through statutes. The power of eminent domain may be — and has frequently been — delegated to private corporations that provide public service, such as railroad and utility companies. For example, the Alabama Constitution, Article XII, § 235, provides for the exercise of eminent domain by cities, counties, and other corporations and individuals who are then vested with the right to take property for public use. Alabama Code specifically gives the power of eminent domain to public utility corporations.

The courts seem to have defined four elements that must be present before eminent domain can operate:

- (1) Private property. The government must do something that takes or affects an owner's property.
- (2) Must be taken. In common use, taking involves a transfer of a

condemnee's title, easement, or other interests. Occasionally it does not involve the actual transfer of property, but only the loss of a certain right, such as access to the land.

- (3) Public Purpose. This term imposes some limitations on how condemned property may be used.
- (4) Just Compensation. This is the fair market value of the property right, usually in cash.

Enabling Legislation

The Federal government and all States have adopted statutes that govern the eminent domain process. This means that differences may be expected from one State to the next.

Eminent domain is used after a property owner has refused the purchase offer of a highway agency or a utility. It is placed into operation by following the appropriate administrative procedures of the Federal or State government.

The Federal procedure will be used as an example. The Federal Declaration of Taking Act requires that the condemnor file a petition with the court, along with a declaration. The declaration must have at least the following prescribed elements:

- (1) a statement of the authority under which the lands are to be taken, and the proposed public use of the lands;
- (2) a description of the lands;
- (3) a plan showing the lands;
- (4) a statement of the interest in the lands; and

- (5) a statement of the sum of money that the condemnor feels to be just compensation.

After the declaration of taking has been filed in court, and a deposit has been filed to cover the estimated compensation, the title to (or the interest in) the land vests in the United States.

After transfer of title, there may be other legal activities involving the condemned property. The case may be heard by an arbitration panel or a claims court. The case may also be tried before a jury. A decision is reached when facts are presented to support the reasonableness of the decision to take the desired property by eminent domain. Factors which are considered in reaching a decision include availability of alternative routes, cost, environmental factors, long-term planning, safety, and, if relevant, whether the use is compatible with previous land use.

Eminent Domain Among Competing Government Land Uses

The general rule is that a public property devoted to one use cannot be condemned for another public use unless the second use is of superior rank of public necessity, or unless the second use is compatible with the prior use. Property used for one public purpose may not be taken for a second public purpose if the second use would destroy the prior use.

In general, other levels of government cannot condemn Federal land, nor can utility firms condemn any type of public land. There are some exceptions to these general rules, particularly when they are expressly allowed by statute. The exceptions are factual issues and usually have to be resolved by the court.

LIABILITY ISSUES

Highway agencies and utility entities have two major reasons to be concerned about utility pole collisions: (1) improved safety for motorists (see Chapter 9 — *Safety*) and (2) the threat of liability in the court system. The threat of liability is significant, and it is increasing.

NEGLIGENCE AS THE BASIS FOR TORT LIABILITY

Negligence is the leading basis for suits in highway liability cases. The plaintiff usually alleges that the highway agency or utility firm failed to act in a reasonable manner and thus caused (or contributed to) a traffic accident. In order to win a negligence suit, the plaintiff must demonstrate the following conditions:

- (1) the defendant had a duty;
- (2) the defendant breached that duty;
- (3) the plaintiff suffered damage; and
- (4) the defendant's breach was the proximate cause of the damage.

In some States, the plaintiff is barred from recovery if found guilty of contributory negligence. In other States, the plaintiff's recovery may be reduced if found guilty of comparative negligence.

In laymen's terms, negligence is the failure to use reasonable care in the treatment of others. The key issue in a negligence trial is demonstrating what action would have been reasonable in the circumstances of the case. The defendant's actions are measured against the standard of care to determine if they were reasonable. The standard of care may be a written set of instructions, a policy, a guideline, or the accepted normal practice. As an example, for obstacles located in the clear zone, the

standard of care might be the AASHTO Roadside Design Guide.

In a typical case, the defendant (highway agency or utility firm) has a duty to provide a reasonably safe roadway. Breach of this duty could be, for example, requesting or issuing a permit to install a utility pole too close to the road. A vehicle striking this pole could be severely damaged and a motorist severely injured. The motorist in such a case may have the elements of a winning negligence case, especially if the installation of the pole was in violation of the standard of care (accepted clear recovery area guidelines).

NUISANCE AS THE BASIS FOR TORT LIABILITY

The legal grounds for nuisance suits are simpler than those for negligence issues. A nuisance is a public hazard simply because of how and where it exists. To prove nuisance, the plaintiff must merely show that the utility structure posed a threat of injury to public travelers. The *Law and Roadside Hazards*, published by the Insurance Institute for Highway Safety, summarized the nuisance issue as follows:

Governments as well as private parties are liable for public nuisances which endanger travelers. First, they may be liable for failing to order private parties to remove privately owned public nuisances. Secondly, governmental bodies are liable for their own public nuisances. The general rule is that any artificial device, structure, or excavation adjacent to a highway which poses a threat of injury to travelers can be considered a public nuisance.

MAGNITUDES OF JUDGMENTS AND SETTLEMENTS

Tort suits against highway agencies are a relatively recent trend. Before the 1960's, there were almost none; however, claims and suits have grown at an alarming rate since then. A tidal wave of liability suits began to hit State highway agencies in the late 1960's and has continued to grow.

Comprehensive data on highway tort liability are not readily available. No national agencies keep complete records of suits against either utility firms or transportation agencies. The best data available in which to estimate the number of cases and financial losses due to suits have been collected by AASHTO. These data are restricted to State highway agencies, but they outline some eye-opening statistics:

- (1) Between 1978 and 1987 the number of States reporting that they possessed full sovereign immunity dropped from 31% to 12%. This meant that more State highway agencies could be sued.
- (2) By 1990, tort claims had grown to 33,000 to 35,000 per year against SHA's (see Fig. 8-1). This represented a compound growth rate of about 16 percent per year. The reported number of claims and the growth in claims in any state may be found in Table 8-2.
- (3) The growth of tort actions left a staggering backlog of pending claims. At the beginning of 1991, there were 25,000 to 28,000 pending tort claims and suits. The value of these claims was a staggering \$12 to \$14 billion.
- (4) The amount of money invested in settlements and judgments had also grown rapidly. In 1990, between

\$400 and \$600 million was devoted to tort claim payments and settlements at all levels of government.

- (5) Claims vary from State to State, and an analysis of data from eight States showed that there was little consistency in the types of claims filed. An examination of the data from one State showed inconsistency between the number of claims and the dollar value of claims for any one type of incident.

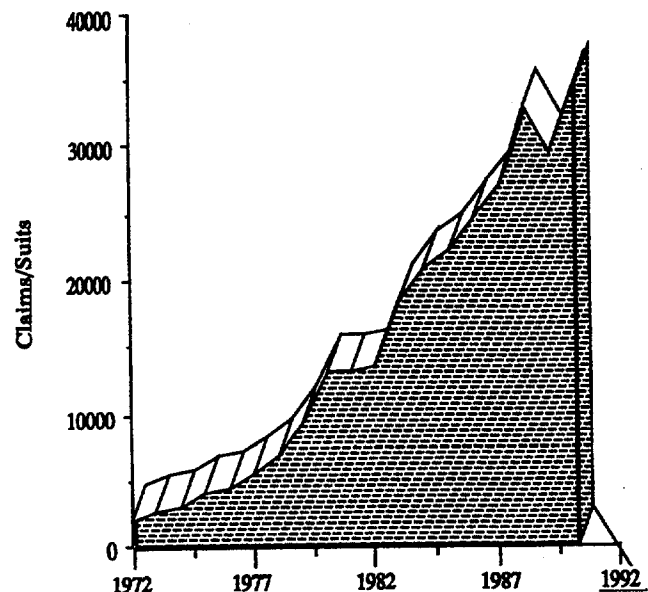


Figure 8-1. Tort Claims & Suits Filed Against State Transportation Agencies.

Even where utility firms and highway agencies have not yet experienced major financial losses due to tort liability suits, the threat of these suits is a major factor. Employees dread being involved in liability suits and are often leery of making decisions because of the possibility of being sued. One way to overcome this difficulty is to establish agency or company policies for accident reduction programs and for clear zone

Table 8-2. Tort Claims and Suits Filed Against State Transportation Agencies.

STATE	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Alabama	262	172		173	265	311	342		502	555
Alaska	37	63								
Arizona	293	214		319	359	412	517	500	674	758
Arkansas	170	165		148	137	182	125	473	507	514
California	523	444	3390	4068	5099	4934	6012	3831	3639	3269
Colorado	89	126				950		829	890	718
Connecticut	900	1200						785	743	963
Delaware							2			
Florida	92	73	625	726	766	810	1822	2808	1192	1347
Georgia										
Hawaii								62	50	41
Idaho	223	193	233	273	328	243		241	261	276
Illinois	45	114			1357	1299	1251	1148	1158	1184
Indiana	607	773	881	256	135	136	147	685	936	1163
Iowa	184	182	211	256	242	371	319	397	329	321
Kansas	11	12		18	16			11	15	8
Kentucky								647	616	
Louisiana	448	514		517	585	623	593	3298	431	416
Maine	28	6				16	6	4	14	6
Maryland										
Massachusetts	150	166						212	212	212
Michigan								171	173	219
Minnesota	133	181	507	244	285	277	262	220	243	326
Mississippi			7	12	8	10	10			
Missouri	27	39	29	28	32	34	31	404	464	712
Montana								387	431	396
Nebraska	63	92								
Nevada								164	176	223
New Hampshire	26	24		12	21	16	16	13	34	27
New Jersey										
New Mexico	20	30						524	596	532
New York	326			344	384	364	363	472	374	484
North Carolina								2185	1830	
North Dakota								0	0	0
Ohio	130	128	143	202	258	294	229	228	221	281
Oklahoma	8	7	11	15	15	307	427	658	595	
Oregon	466	588		504	730	594	557	599	872	876
Pennsylvania			6502	6368	6100	6082	5941	5763	6256	6013
Rhode Island	100	100								
South Carolina	319	372						412	418	443
South Dakota	0	0				3	3	207	212	168
Tennessee		400			45	111	552	89	118	128
Texas	58	69	81	75	92	106	125	137	119	108
Utah	16	4		805	791	969	1004	434	588	4934
Vermont	90	90						97	122	95
Virginia				24	28	41	57	548	651	742
Washington	64	88						900	888	841
West Virginia	308	228	176	234	285	311	350	767	900	659
Wisconsin				125	136	129	80	212	199	165
Wyoming	55	72		16	28	21	22	95	121	114

Note: Blank entries indicate State did not respond to AASHTO questionnaire.

treatments, then to operate within these policies. Safety and clear zone guidelines are identified and discussed in Chapter 9 of this *Guide* to help agencies and firms establish their own policies.

INDEMNIFICATION

Because liability is an important issue, highway agencies and utility firms are intent on minimizing its impact. One way to do this is through indemnification compensation to the person who has suffered a loss (the plaintiff). Two simple forms of indemnification involve the use of "hold harmless" clauses and the purchase of insurance.

Hold Harmless Clauses

One way for an agency to protect itself from being sued because of a contractor's negligence is to include a hold harmless clause in its contracts. Such a clause stipulates that the contractor agrees to hold the public agency harmless from any liability occurring as a result of the contractor's negligence for work performed for the public agency. Normally, this protects the agency from any judgments assessed against it, and requires the contractor to pay for legal services the agency must use because of a claim regarding the contractor's negligence.

In some jurisdictions, hold harmless agreements are not applicable. Even where they are applicable, a contractor may go bankrupt or go out of business, rendering the hold harmless clause useless if a claim is later filed against the agency. (It is a good idea to require that the contractor provide a surety bond or third-party insurance to ensure that the terms of the hold harmless agreement are adhered to.) Additionally, even when the hold harmless clause is valid and enforceable, it does not

protect an agency whose own employees committed the acts that led to the suit.

Several example indemnification clauses are listed in the following paragraphs. These clauses, which were taken from highway/utility documents, are of varying complexity. They illustrate a key point: All legal documents must be prepared within the framework of the appropriate statutes and regulations that govern the immediate situation.

The Alaska Administrative Code (17 AAC 15.061) contains the following clause regarding indemnification on utility projects:

The permittee shall indemnify and hold harmless the state from all liability for damage to property and injury or death of persons arising wholly or in part from any action taken by a permittee in relation to the permittee's facilities on department rights-of-way or other permitted locations.

The Louisiana Department of Transportation and Development includes the following statement in its utility permit provisions:

. . . that the applicant agrees to defend, indemnify, and hold harmless the Department and its duly appointed agents and employees from and against any and all claims, suits, liabilities, losses, damages, costs or expenses, including attorneys' fees sustained by reason of the exercise of this permit, whether or not the same may have been caused by negligence of the Department, its agents or employees, provided, however, that the provisions of this last clause (whether or not the same may have been caused by the negligence of the Department, its agents or employees) shall not apply to any personal injury or property damage caused by the sole negligence of the Department, its agents or

employees, unless such sole negligence shall consist or shall have consisted entirely and only of negligence in the granting of a project permit or project permits.

Utilities obtaining a permit from the Idaho DOT find this statement:

In accepting this permit, the permittee, its successors and assigns, agrees to indemnify, save harmless and defend regardless of outcome the State from the expenses of and against suits, including costs, expenses and attorney fees that may be incurred by reason of any act or omission, neglect or misconduct of the permittee or its contractor in the design, construction and maintenance of the work, which is the subject of this permit.

Prior to using any hold harmless clause in a contract or permit, the agency should have the clause reviewed by a competent attorney. The attorney can revise the wording to ensure that it complies with applicable codes and regulations.

Insurance

A normal construction contract stipulation is that the contractor must carry an adequate amount of insurance for the job conditions. The contractor should also be required to name the highway agency, or utility firm, as one of the insured parties. Then, if a liability suit is filed against the contractor or the agency, or both, the contractor's insurance company will be required to protect the agency. In the event that a judgment is awarded against the agency during the litigation, the contractor's insurance should pay that judgment.

The use of personal vehicles for job-related tasks by employees with permission should be

another agency concern. In this situation, employees should be required to carry adequate insurance and to name the agency on the insurance policy as one of the insured parties. The agency might place these stipulations in the employee's job description.

There are many forms of insurance. Selecting the appropriate type and amount of insurance is always a matter to be determined by local officials and local conditions. It is a good idea to discuss insurance with the agency legal authority, risk manager, or insurance agents before purchasing insurance.

Highway agencies often purchase a comprehensive insurance package that covers liability, company or employee actions, vehicle collisions, and professional liability for managers. A large agency or a large utility firm might find it more efficient to self-insure. This practice involves setting aside a reserve of funds from which to pay claims. Administration of self-insurance requires a system for carefully tracking the number and amounts of claims and estimating the probable sizes of future claims payouts.

Some agencies prefer to purchase "over and above" or catastrophic insurance coverage. Such insurance only comes into play when an agency must pay a disastrously large claim. For example, an agency may be self-insured for small claims, but purchase a catastrophic policy to cover any claim loss over \$1 million. This would prevent such a claim from bankrupting the self-insurance program.

One example of insurance coverage is illustrated by the State of Connecticut Department of Transportation. An application for a utility permit must be accompanied by a certificate of insurance and a permit bond. The Connecticut DOT requires that

Prior to the issuance of permits to any firm or corporation other than public utility companies, the submittal of a certificate of insurance (form Con No. 32) indicating

minimum coverages of \$750,000 (each accident or occurrence), \$1,500,000 (aggregate) for bodily injury liability and property damage liability in conjunction with the following hazards will be required:

- A — Protective Liability for and in the name of the State of Connecticut*
- B — Contractor's Public Liability*
- D — Contractor's Liability (1)-(2)*
- K — Workmen's Compensation—by Statute*

Hazard "F" — Explosion, collapse, or underground damage liability shall also be required when applicable (any excavating within Bureau of Highways property)

An umbrella policy used to provide the required coverage must cover all items and it must be so stated on the certificate submitted.

CONTRACTS

Highway agencies and utility firms frequently execute contracts. A few general principles of contract law and several types of contracts specific to the highway/utility field are reviewed in this chapter. The purpose is to illustrate the need for advice and assistance from legal counsel when executing contracts.

Generally, an oral contract is as valid as a written contract. However, an oral agreement may be more difficult to enforce because of the difficulty in presenting specific evidence in court, or because of potential misunderstandings between the parties about the terms of the oral agreement. Individuals should be aware that they can enter into oral contracts and be held to them. At the same time, they should recognize that written contracts are more desirable.

A contract is an agreement that the law will enforce. The central ideas in a contract are the mutual assent of the parties and the resultant obligation. Specific components must be present to constitute an agreement and to make the agreement enforceable. Two of these components, offer and consideration, are reviewed to illustrate the complexity of contract law.

OFFER AND CONSIDERATION

A contract is an agreement between two parties consisting of a promise from one party in exchange for a consideration from the other party. Both components must be present.

The Offer

An offer is a promise. The person making the offer must do so with a present, serious, contractual intent. The courts have prepared a series of tests to determine whether an offer is valid. For example, the words used must clearly be an offer and not merely a statement of future intent or an invitation for an offer, and the terms of the offer must be definite and its language must not be ambiguous.

Advertisements do not qualify as offers. They are normally interpreted as dealing with future intent rather than present contractual intent. A special case of advertisement is an advertisement for bids. It is usually interpreted as an invitation for offers, with the bids themselves

being the offers. Catalogs and similar documents are not offers. However an offer does occur when a customer places an order from the catalog.

Another issue is the duration of the offer. The offer may expire with the passage of time stated within the offer. It may also expire with the passage of a reasonable time, in which case the courts determine the length of "reasonable time" based on the circumstances of each case. There are several other ways in which an offer can expire. In addition, at any time before an offer is accepted, the offeror can terminate the offer by communicating a revocation to the offeree.

The Consideration

A second requirement of a contract is that the promise must be given for a consideration. The consideration is the price bargained for and given in exchange for the promise. To be sufficient, a consideration must have some legal value and it must have been requested by the offeror as the agreed price for the promise.

As with promises, the court will impose many conditions to determine if a consideration is sufficient to bring about a contractual condition. A common example is that a gift promise is not sufficient. A person receiving the gift would be no worse off than before if the promise were not kept and the gift not delivered. In other words, the person gives nothing for it, loses nothing by it, and in breach of the promise suffers no recoverable damage.

The promise must be either a benefit to the promisor or a detriment to the promisee. Whether or not the promise is fair and adequate may be immaterial. The courts do not feel a duty to ensure fairness in the exchange. In general, so long as the parties get what they bargained for, the courts will not invalidate the contract.

The preceding paragraphs have but introduced a complicated subject. The reader should not think that this brief discussion explains the principles of contract law. The subject is too complex. In addition to statutes, thousands of cases have contributed volumes of precedents to the common law. Utility managers would be well advised to seek the assistance of legal counsel before entering into contracts. Agency attorneys can prepare appropriate wording and standard forms for the types of contracts that it uses frequently. These attorneys can also review agreements for compliance with Federal and State codes, and for fairness and enforceability. Such assistance can reduce frustration, financial losses, and hours spent in the courtroom.

HIGHWAY/UTILITY CONTRACTS

Several types of contracts are typically drawn up between highway agencies and utilities. Three obvious examples are

- agreements for relocation of utility facilities,
- permits for accommodation of utilities, and
- utility construction contracts.

Agreements for Utility Relocations

The provisions of 23 CFR 645.113 cover agreements to relocate utility facilities on projects where Federal funding is involved. These provisions are expanded in the FHWA Program Guide, which requires that the highway agency and utility agree in writing on their separate responsibilities for financing and accomplishing the work. The following specific items must also be addressed by the agreement:

- (1) the basis of the State's authority, obligation, or liability to pay;
- (2) the scope, description, and location of the work;
- (3) the method used by the utility for developing relocation costs;
- (4) the method to be used for performing the relocation work, either by utility forces or by contract;
- (5) assurance that the relocated facilities will be accommodated in conformance with 23 CFR 645B;
- (6) plans and drawings accompanying the agreement, to show the type, location, and capacity of the project, the limits of the right-of-way, and other detailed information (A list of these requirements may be found in the Program Guide); and
- (7) a detailed cost estimate for the proposed work.

A complex, formal document for each project is unnecessary. The FHWA provisions may be met through simpler methods, such as an exchange of correspondence, if this form is appropriate for the project size and scope.

Permits

The FHWA requires that utility accommodation within the ROW of a Federal-aid highway project be covered by a written agreement between the highway authority and the utility. This is normally called a permit, although it may also be called a use and occupancy agreement. Occasionally, other types of agreements are used for accommodation contracts, especially when a local government is involved. The key is that the written agreement must cover the topics listed in 23 CFR 645.213. More information about this topic may be found in Chapter 5 — *Permits*.

Utility-Let Contracts

When utility relocation work is to be performed under a contract awarded by the utility through the competitive bidding process, the SHA is required to verify that the utility has awarded the contract to the qualified responsible bidder with the lowest bid using an appropriate solicitation process. The utility may choose to use a continuing construction contract or to let bids for individual relocation projects.

SUMMARY

This chapter reviewed a few of the legal issues involved in the highway/utility field. Multiple sources and types of law; complex statutes, regulations and directives; legal terminology; legal procedures; and many other topics have

been shown to complicate highway/utility business. This chapter has illustrated the complexity of legal involvements, and the benefit of using an informed attorney when dealing with these issues.

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CHAPTER NINE

SAFETY

INTRODUCTION

A respected transportation safety official wrote in 1946, "There is little question that the public will not tolerate for long an annual toll of 40-50,000 fatalities." The official was wrong. The public not only tolerated it, but apparently accepted this loss of life as a normal byproduct of travel. During the decade of the 1980's, almost one-half million people died on our nation's highways (see Table 9-1). In a typical year, about 7 million accidents were reported causing approximately 3.5 million injuries, 45,000 fatalities, and \$50 billion in economic losses.

In the face of rapid increases in travel, the number of fatalities would have mushroomed had it not been for steps taken by the U. S. safety community. The highway death rate dropped 60 percent in a little over 20 years, from 5.5 fatalities per hundred million miles of travel in 1966 to 2.4 per hundred million by 1987. This safety improvement did not occur by itself. It was a result of carefully planned, concerted efforts by both the private- and public-sector safety communities at all levels. In spite of the large number of annual fatalities, the United States was developing a very good highway safety program. Currently, it has by far the best highway safety program in the world.

UTILITY POLE ACCIDENTS

Utility pole collisions account for only a small portion of all accidents. However, they are one

of the most severe types of accidents. A research study performed in the early 1980's examined records for sample highways in four states and identified 9,583 utility pole accidents. The researchers found that the severity distribution for these accidents was 1.0 percent fatal, 46.3 percent injury, and 52.7 percent property damage only. This confirmed that pole collisions were more likely to cause injury and fatalities than most other types of accidents.

Substantial numbers of utility pole collisions occur across the United States each year. For the past decade, it has been the third largest cause of fixed-object fatalities, trailing only trees and longitudinal barriers (such as guardrails) as a roadside killer. This is illustrated by Table 9-1, which shows the number of fatalities attributed to poles and other roadside objects for several years. No State has been immune to this problem. A summary of fatalities on a State-by-State basis is shown in Table 9-2.

Enough is known about utility pole accidents that they may be characterized. They are six times more likely to result in a fatality and three times more likely to result in an injury than the average highway accident. The driver is the most frequently injured person, while the front seat passenger is the most likely to become a fatality. Approximately 80 percent of utility pole accidents cause frontal impacts that result in injuries. The remaining 20 percent are side impacts that frequently result in a fatality.

As might be expected, the consequences of a utility pole accident involving a small car are

Table 9-1. Fatalities by First Harmful Event for Specified Fixed Objects.

Object	1980-1990	Ave/Yr	Low Yr - High Yr
Trees	35,460	3,224	2,841 - 4,000
Longitudinal Barriers	17,973	1,634	1,497 - 1,905
UTILITY POLES	16,222	1,475	1,277 - 1,928
Culverts, Ditches	15,314	1,392	1,198 - 1,618
Embankments	14,762	1,342	1,211 - 1,525
Signs and Other Supports	11,231	1,021	914 - 1,175
Curbs, Walls	10,509	955	843 - 1,192
Bridges	7,712	701	519 - 1,106
Buildings, Fences	6,388	581	475 - 796
Other Fixed Objects	<u>7,564</u>	<u>688</u>	<u>539 - 959</u>
Total Fixed-Object Fatalities	143,135	13,012	12,091 - 15,937
Total Fatalities	504,662	45,878	42,589 - 51,091

Source: Compiled from Fatal Accident Reporting System data,
National Traffic Safety Administration.

Table 9-2. Utility Pole Fatalities by State for 1980-1989.

State	80-89	Max Yr	State	80-89	Max Yr	State	80-89	Max Yr
Alabama	253	37	Kentucky	208	27	North Dakota	4	2
Alaska	12	3	Louisiana	181	26	Ohio	1,143	158
Arizona	93	14	Maine	168	22	Oklahoma	88	17
Arkansas	115	16	Maryland	382	57	Oregon	184	26
California	1,116	124	Massachusetts	639	104	Pennsylvania	1,228	161
Colorado	71	14	Michigan	348	45	Rhode Island	110	19
Connecticut	322	39	Minnesota	98	15	South Carolina	229	36
Delaware	59	13	Mississippi	156	24	South Dakota	10	4
D.C.	16	3	Missouri	224	33	Tennessee	588	70
Florida	986	125	Montana	19	6	Texas	627	83
Georgia	479	61	Nebraska	67	12	Utah	37	10
Hawaii	77	13	Nevada	26	9	Vermont	49	13
Idaho	32	6	New Hampshire	81	15	Virginia	305	39
Illinois	404	54	New Jersey	776	100	Washington	324	52
Indiana	414	55	New Mexico	46	8	West Virginia	208	34
Iowa	121	16	New York	1,055	160	Wisconsin	280	41
Kansas	85	16	North Carolina	393	53	Wyoming	9	3
						Decade Total 14,945		

Source: Compiled from Fatal Accident Reporting System data,
National Highway Traffic Safety Administration.

more severe than a similar accident involving a standard-sized car. There is an overrepresentation of utility pole accidents within 50 feet of an intersection. There is also an overrepresentation of utility pole accidents on the outside of horizontal curves. This is especially true for left-hand curves.

A utility pole safety program should be part of an agencywide highway safety effort. An excellent utility pole safety treatment may be wasted if inherent safety defects are allowed to remain in the roadway, and if trees, billboards, and other fixed objects are not subjected to safety scrutiny. Although this Guide discusses only highway/utility safety (and deals primarily with poles), the reader should accept it as one important element in an overall safety effort.

The type of utility hardware most frequently involved in highway accidents is the utility pole. Other appurtenances such as pedestals, manhole vents, valves, transformers, and similar structures are also involved in collisions. The remainder of this chapter deals primarily with utility poles. The reader should understand that other types of utility facilities, although struck less frequently than utility poles, should receive similar safety considerations and treatment.

NEED FOR HIGHWAY/UTILITY SAFETY PROGRAMS

Fifty thousand deaths per year is not a socially acceptable byproduct of travel. It is a significant problem one that deserves continued attention, more emphasis, and increased safety efforts. Utility poles are one part of the problem that should be addressed because they are involved in over 1,200 fatal accidents and over 100,000 injury accidents each year. The Code of Federal

Regulations (23 CFR 645.209) emphasizes the need for a strong highway/utility safety program in the statement:

"Highway safety and traffic safety are of paramount, but not sole, importance when accommodating utility facilities within highway right-of-way."

AASHTO and FHWA have developed detailed plans to address highway safety and both plans include major components that deal with reduction of off-road accidents with fixed objects like utility facilities. The FHWA plan goes so far as to establish ways to work with utility companies to relocate or eliminate utility poles that have a history of being involved in accidents.

Utility pole safety programs can be conducted during many aspects of SHA work design of new roads, rehabilitation of existing roads, minor spot improvements, safety projects for hazard elimination, and maintenance improvements are examples. Utility firms can also make safety enhancements under a variety of programs.

Provisions in the Intermodal Surface Transportation Efficiency Act of 1991 link approval of resurfacing, restoration, and rehabilitation (3-R) projects with the SHA's highway safety management system. This means that more emphasis will be placed on topics like utility pole safety programs. Any SHA that wishes to take advantage of provisions for new 3-R work must have a systematic program to remove or mitigate roadside safety hazards, including utility poles.

This chapter reviews several current highway/utility safety practices. It addresses topics like work zone traffic control, accident reduction programs, the clear roadside policy, and roadside safety treatments.

COMPREHENSIVE SAFETY PROGRAMS

Comprehensive highway/utility safety programs must address a wide range of topics, including employee safety, pedestrian safety, accident reduction programs, clear roadside areas, safety treatments for existing poles, and construction of safer facilities in the future. These and other topics are covered in the remainder of this chapter.

EMPLOYEE SAFETY

The Occupational Safety and Health Administration (OSHA) covers all employers in all 50 states and territories under Federal jurisdiction, except where they are regulated under other Federal statutes. Highway agencies, utility companies, contractors, and other employers are responsible for knowing and complying with all OSHA standards appropriate for the work they are performing. Individuals or agencies desiring to learn more about OSHA may review the appropriate standards in the Code of Federal Regulations (29 CFR, Parts 1900-1999). The regulations are broad and complex, but are indexed by topic to make it easier to find specific pieces of information. For example, Subpart C, Section 1926.21, deals with safety training and education. Subpart P, Section 1926.692, Appendix C, deals with timber shoring for trenches. Subpart V, Section 1926.955, deals with overhead power transmission and distribution lines.

OSHA continually reviews and refines its standards, and employers need to keep up with changes. The *Federal Register* is one of the best sources of information on changes, since all OSHA standards are published there as they are adopted. Other sources of information are the OSHA Subscription Service, available through

the U.S. Superintendent of Documents, and the *Occupational Safety and Health Reporter*, published by the Bureau of National Affairs.

Most agencies conduct educational programs to inform managers and employees of OSHA regulations. Each of OSHA's ten regional offices is a full-service center offering a variety of informational services, training aids, and technical advice. In addition, the OSHA Training Institute in Des Plaines, Illinois, provides educational programs at various levels of complexity.

PEDESTRIAN SAFETY

Highway/utility construction in urban areas sometimes fails to include adequate provisions for pedestrians. When work zones cut off normal routes for pedestrian flow, where open excavations are left without adequate warning or safeguards, where moving equipment swings across a sidewalk, or where construction materials or equipment block pedestrians' view of oncoming traffic, accidents are likely to occur.

Pedestrians are more difficult to handle in work zones than are vehicles. Several rules of thumb may be applied when dealing with pedestrians:

- (1) Pedestrians consider themselves outside the law. They often feel that signs, crosswalks, or other traffic-control devices do not apply to them.
- (2) Pedestrians walk paths of minimum resistance. That is, they do not like circuitous routes and prefer to walk directly from point A to point B whenever possible. A traffic

control plan that calls for pedestrians to go out of their way will often be ignored. Instead, pedestrians may walk directly through construction areas to save themselves time and energy.

- (3) Pedestrians resist walking uphill. It takes extra energy to walk up hill, and human beings seek to minimize energy loss while walking.
- (4) Pedestrians are not likely to choose a route for which they cannot see their destination. Pedestrians who walk around the corner of a building and find a highway/utility work zone blocking their route may become very frustrated if they cannot clearly see the route and determine that it leads to their destination.

Pedestrian routes that are continuous, as short as possible, level, and that seem logical to pedestrians are likely to be accepted and used. Awareness of pedestrians when setting up a work site or when preparing a traffic control plan will do a great deal to enhance their safety.

The *Manual on Uniform Traffic Control Devices* includes excellent guidelines on design of pedestrian facilities. Among other things, it indicates that there are three threshold considerations:

- Do not lead pedestrians into direct conflict with work site vehicles, equipment, and operations.
- Do not lead pedestrians into direct conflict with mainline traffic.

- Do make the travel path convenient and replicate as nearly as possible the desirable characteristics of the sidewalk or footpath. A review of the *Manual* and its provisions is appropriate prior to establishing a work zone that might interfere with pedestrian movements.

The Americans With Disabilities Act may affect highway utilities. Of concern are utility poles, communication pedestals, fire hydrants and other hardware that may block handicapped ramps or clutter sidewalks, especially in older urban areas where no ROW is available.

WORK ZONE TRAFFIC CONTROL

Traffic control in work zones is an issue of great concern. Work zones bring employees, pedestrians, equipment, supplies, and other objects into close proximity with moving vehicles. Motorists driving through work zones may face narrow lanes, confusing signs, unusual turns, and plenty of distractions. Driver expectancy may be violated; that is, what the driver expects to occur may not be what actually happens. For these and other reasons, traffic accidents are more likely to occur in work zones than in normal highway situations.

Basic principles and minimum standards for work zone traffic control are contained in Section VI of the *Manual on Uniform Traffic Control Devices*. Highway/utility work zones are specifically addressed by the manual. Chapter 10 — *Construction* deals with work zone traffic control; the reader may refer to it for more information on this topic.

IMPORTANCE OF THE CLEAR ROADSIDE

One of the most important principles in minimizing utility pole accidents and promoting roadside safety is to provide a clear area on each side of the road, so that a driver has a reasonable chance to recover control of an errant vehicle and return to the roadway without having a collision. In Federal documents this is called the "clear recovery area," although many practitioners call it the "clear zone." The clear roadside policy is now defined in 23 CFR 645.207(c) as follows:

That policy employed by a highway agency to provide a clear recovery area in order to increase safety, improve traffic operations, and enhance the aesthetic quality of highways by designing, constructing and maintaining highway roadsides as wide, flat, and rounded as practical and as free as practical from natural or manufactured hazards such as trees, drainage structures, non-yielding sign supports, highway lighting supports, and utility poles and other ground-mounted structures. The policy should address the removal of roadside obstacles which are likely to be associated with accident or injury to the highway user, or when such obstacles are essential, the policy should provide for appropriate countermeasures to reduce hazards. Countermeasures include placing utility facilities at locations which protect out-of-control vehicles, using breakaway features, using impact attenuation devices, or shielding. In all cases full consideration shall be given to sound engineering principles and economic factors.

This definition stresses wide and flat roadways, free from roadside hazards. It specifically names

utility poles, highway lighting supports, and other ground-mounted structures as hazards. It calls for removal of these roadside obstacles or where the obstacles are essential and must remain, it calls for treatment of them with appropriate countermeasures to reduce the degree of hazard.

HISTORICAL DEVELOPMENT OF THE CLEAR ZONE

The concept of the clear roadside, now frequently called the clear zone, first emerged in a 1967 report of the American Association of State Highway Officials. This report, later known as the Yellow Book, indicated that on high-speed highways, a width of 9.1 m (30 ft.) or more from the edge of the traveled way would permit about 80 percent of the vehicles leaving a roadway out of control to recover. The 9.1 m (30 ft.) clear zone called for by the AASHTO Yellow Book was somewhat arbitrary. This dimension did not reflect differences in types of roads, speeds of vehicles, traffic volumes, horizontal curvature, steepness of roadside slopes, or other features now known to affect off-road accidents. Research into these factors gradually led to a number of publications which gave better definition to the clear zone. Several applicable AASHTO documents are reviewed in the next portion of this chapter.

In 1969, AASHTO issued *A Guide for Accommodating Utilities Within the Highway Right-of-Way*. The 1981 edition of this document contains criteria and guidance that affect the location of utilities within the clear zone. Sample statements taken from the "general considerations" portion of the booklet include the following:

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

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

Location of utility installations on urban streets with closely abutting improvements are special cases which must be resolved in a manner consistent with the prevailing limitations and conditions.

The AASHTO document also contains guidance on clear roadside treatments for specific types of utilities. For example, it indicates that overhead power communication lines, poles, and guywires should not be located in a highway median, and that these kinds of facilities should be located outside of the clear zone.

In 1977, AASHTO published the *Guide for Selecting, Locating, and Designing Traffic Barriers*. This report was the first document to

present detailed criteria for selecting appropriate safety treatments within the clear zone. Vehicular speeds, traffic volumes, heights of fill/cut embankments, and horizontal curves were shown to affect the roadside recovery area.

This document provided tables, charts, and formulas for clear zone width determinations and for evaluations of specific clear zone circumstances. It contained example calculations of hypothetical roadside situations. It also indicated that a cost-effectiveness methodology was appropriate for evaluating and comparing various safety treatments.

The authors of this booklet recognized that it was a significant change from previous guidelines and that it would have a profound effect upon the highway industry. At the same time, they wished to make it clear that they were not issuing rigid criteria that had always to be followed. Their work was a guide (by far the best criteria provided at the time) and it was meant to be applied with a sound dose of engineering judgment.

In 1984, AASHTO published *A Policy on Geometric Design of Streets and Highways*, known as the Green Book. The second edition was published in 1990. This book increases the emphasis on safety. Significant portions are devoted to the clear zone, and specific statements are made about utilities such as, "longitudinal installations should be located on uniform alignment as near as practicable to the right-of-way line."

Throughout the Green Book, horizontal clearances are specified according to the type of roadway, vehicular speed, and other factors. For many situations, it relies upon the *AASHTO Roadside Design Guide* to determine lateral clearances at each site. Several minimum lateral clearances from the Green Book are listed in Table 9-3.

Table 9-3. Selected Horizontal Clearances From 1990 AASHTO Green Book.

Type Facility	Horizontal Clearance	Page Reference
1. Fixed objects or non-traversable slopes in clear zone	Use AASHTO <i>Roadside Design Guide</i>	343-344, 473
2. Freeways, rural arterials, and high-speed rural collectors	Use AASHTO <i>Roadside Design Guide</i>	343-344, 476-477, 498-499, 515, 586
3. Low-speed rural collectors and local rural roads	Min 10'	344, 429, 462, 476-477
4. Urban arterials, collectors and local streets:		
With curb, no shoulder	Min 1.5' behind face of curb, with wider clear zone where possible, 3' desirable for urban arterials near turning radii	344, 486, 534-535
With curb, parking lane	No clear zone, but min 2' obstacle setback so car doors can open	486
Without curb, with shoulder	Use commensurate rural clearances	344, 486-487
5. Rural collector, with design speed		
At or below 40 mph	Min 10'	476
At or above 50 mph	Use AASHTO <i>Roadside Design Guide</i>	476
Between 40 and 50 mph	Desirable to use clear zone widths for 50 mph, but if road conditions more nearly approach those of lower speed, may use clear zone widths for 40 mph	476-477

Note: 1 m = 3.28 ft., 1 kmph = 0.62 mph

The general criteria in Table 9-3 might serve as a useful set of introductory guidelines for highway or utility agencies that have not yet formulated clear zone criteria. However, these very general criteria might yield to the more specific criteria of other guidelines and standards, especially when the more specific criteria are more restrictive.

AASHTO ROADSIDE DESIGN GUIDE

The *AASHTO Roadside Design Guide* was published in 1989, replacing the 1977 AASHTO document on barrier design. It is intended to be used as a reference document from which individual highway agencies can develop their own standards and policies. FHWA has recognized that the procedures in the *Roadside Design Guide* are appropriate for determining the widths of clear roadside areas. SHA's are expected to utilize these procedures or to develop their own procedures using similar and compatible methodology.

Section 4.7 of the *Roadside Design Guide* directly addresses utility poles. The following sample statements were extracted from it:

...the most desirable solution is to locate utility poles where they are the least likely to be struck...

For new construction or major reconstruction, every effort should be made to install or relocate utility poles as far from the travelway as possible.

For existing utility pole installations identified for corrective action, the decision on what corrective measure is to be taken should be based on a site-specific benefit/cost analysis.

Determining Clear Roadside Widths

For normal highway situations, simplified charts and tables in the *Roadside Design Guide* assist in selecting appropriate lateral clearances. The primary figure used in these determinations has been reproduced as Figure 9-1. For combinations of design speed, traffic volumes, and roadside slopes, the figure yields appropriate clear zone distances. The figure does not dictate the exact values that must be used. Instead, it suggests the approximate center of a range of dimensions to be considered for each site. Engineering judgment of other factors affecting the site should be applied to determine the most applicable value within the range.

Sometimes the normal procedures may not be sufficient. For horizontal curves, the minimum clearance shown on Figure 9-1 may need to be increased by using a table of expansion factors found in the *Roadside Design Guide*. The normal clear zone dimensions are multiplied by these factors to provide increased clearance widths. This modification is especially applicable where accident histories or site investigations show that accident potential can be significantly lessened by using the increased clear zone widths, and that such an increase is cost effective.

Other factors that affect clear zone widths are handled through similar procedures found in the *Roadside Design Guide* or through cost-effectiveness studies.

Desirable Versus Minimum Horizontal Clearances

It is desirable that utility facilities be placed as far from the travelway as practicable. The optimum position is near the ROW line, and many SHA's require such placement in normal

EXAMPLE #1

6:1 SLOPE
(FILL SLOPE)
60 M.P.H.
5000 V.P.D.

ANSWER:

CLEAR ZONE
WIDTH = 30 FT

EXAMPLE #2

6:1 SLOPE
(CUT SLOPE)
60 M.P.H.
750 V.P.D.

ANSWER:

CLEAR ZONE
WIDTH = 20 FT

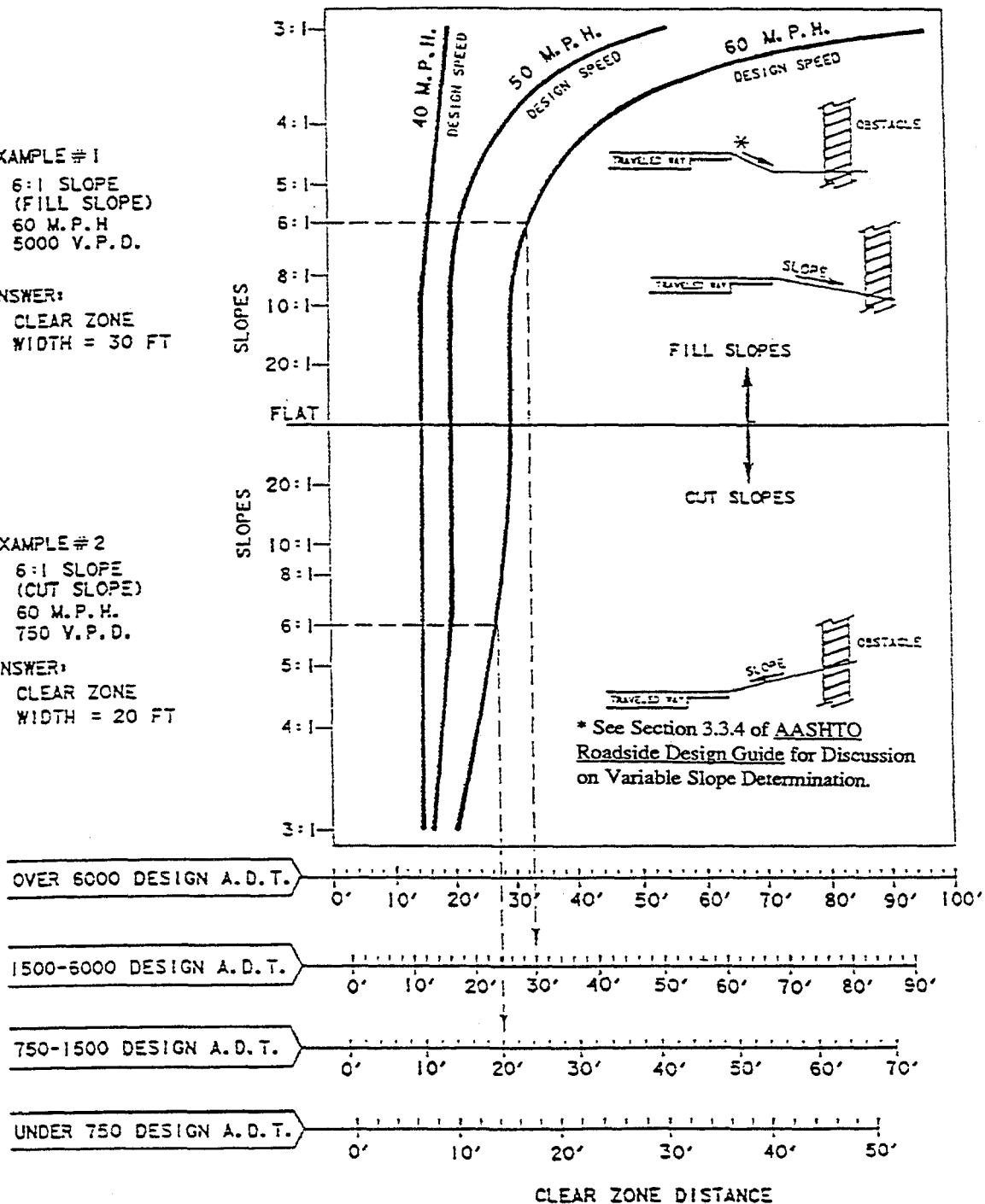


Figure 9-1: Clear Zone Distance Curves

Taken from AASHTO Roadside Design Guide. Copyright 1989 by the American Association of State Highway and Transportation Officials. Reproduced with permission

Note: 1m = 3.28 ft, 100 kph = 60 mph

situations. At the same time, it must be recognized that under some situations it is not realistic to place utilities near the ROW line and that lesser clearances may be appropriate. Where reduced clearances must be used, then the minimum clearances are determined through *Roadside Design Guide* procedures.

Sometimes it is not possible to obtain even the minimum clearance, such as at sites with restricted ROW. The FHWA position is that the clear recovery area extends only to the ROW line. Where the distance between the travelway and the ROW line is less than the clear recovery width, alternative safety treatments may be necessary for utility facilities. States have the right to ask utilities to remove existing facilities off the highway ROW but should not use the clear recovery area as the reason. Utilities might be allowed to stay through the use of alternative safety treatment, if needed, to abate hazardous conditions.

Sample Lateral Clearance Calculations

Two sample lateral clearance calculations are shown in Figure 9-1. The first is for a roadway with a 100 kph (60 mph) speed limit carrying 5,000 vehicles per day. At the point in question, the road is on a fill embankment and has 6:1 (run = 6, rise = 1) side slopes.

An appropriate clearance distance may be taken directly from the figure by starting with the 6:1 fill slope and moving horizontally to intersect the 100 kph (60 mph) design speed curve, then moving vertically downward to intercept the appropriate ADT (average daily traffic) line on the chart. This yields a clear zone distance of 9.1 m (30 ft.).

The second example is similar to the first, except that the traffic is only 750 vehicles per day, and the roadway has a 6:1 cut slope. Solving the second example in the same manner

as the first yields a clear zone distance of 6.1 m (20 ft.).

Several conclusions may be drawn from Figure 9-1. First, wider clear zones are needed for greater traffic volumes. The greater the number of vehicles for a given roadway, the greater the probability that a vehicle will leave the travelway and strike a roadside object. Therefore, clear zones are widened as traffic volumes increase.

Second, higher speeds produce more accidents and more severe accidents than lower speeds. The higher speeds give drivers less reaction time between leaving the travelway and striking an object. Higher speeds also create more structural damage to vehicles and higher severity accidents for occupants. Thus, greater width clear zones are needed for higher speeds.

Third, cut slopes are generally less hazardous than fill slopes. This is because a vehicle that exits a travelway and enters a side slope in an area of cut will be pushed back toward the roadway by the side slope. A vehicle exiting onto a fill slope will be ushered away from the roadway toward the bottom of the fill embankment. Slopes of 4:1 or flatter provide drivers some opportunity to steer their vehicles. Slopes of 3:1 or steeper do not allow drivers the opportunity to steer and to dodge roadside obstacles.

IMPLEMENTING THE CLEAR ROADSIDE CONCEPT

Utilities that occupy a highway ROW on projects subject to 23 CFR 645.111 (i.e., projects that use Federal funds) must conform to clear roadside policies for the highway involved. New above-ground installations on these roadways must be located as far from the travelway as possible, preferably along the ROW line. When an SHA intends to permit a utility to occupy a public ROW, such potential use should be a considera-

tion in determining the extent and adequacy of the ROW needed for the project. No new above-ground utility installations are to be allowed within the established clear recovery area unless a determination has been made by the highway agency that placement underground is not technically feasible or is unreasonably costly, and that there are no feasible alternative locations. Where new facilities are allowed above ground, appropriate countermeasures are to be used to reduce hazards.

The foregoing regulations show that the clear zone is not optional; it must be implemented for roads where Federal funds are involved. However, the application of clear zone principles at a specific site must be tempered by the particular circumstances that exist at that location. FHWA believes that States should not ask the utilities to do more in the clear recovery area than the SHA plans to do. It is illogical to remove the utility facilities if sign supports, bridge parapets, trees, or other fixed-object hazards are allowed to remain. A comprehensive safety program treats all fixed objects in the clear zone, not just utility poles.

New Installations Versus Existing Facilities

For new highway projects and for major reconstruction projects, the provisions of the *Roadside Design Guide* should be incorporated in the project. The full clear recovery area should be the goal of these designs. Normally, the designer has a wide range of utility design types, materials, and locations available. The initial placement of a new line of poles may cost about the same whether the pole is placed near the ROW line or at the edge of the pavement. During the design of new facilities, greater safety for motorists may often be obtained with relatively little increase in cost to the utility. If the clear recovery area must be retrofitted to a road long after construction, it may be very

expensive, and may even cost more than the original construction of the entire roadway. It is much better to design in the clear recovery area than to retrofit it later.

For existing facilities, clear zone decisions are more difficult because this work is relatively more expensive (as compared to leaving the pole in place) and often does not provide a commensurate decrease in accidents. It may not be the best use of public funds to arbitrarily remove all existing utilities from within the clear zone in the absence of a demonstrated accident problem or accident potential.

The *Roadside Design Guide* suggests monitoring existing facilities to identify potential problem areas and using systematic upgrade programs to improve deficiencies that are noted during these investigations. This suggestion normally takes the form of an accident reduction program, including engineering analyses at individual locations. The analyses look at site-specific accident history, accident potential, safety cost-effectiveness, and other pertinent factors to determine whether existing facilities should be safety-treated or relocated outside the clear zone. Where treatments are needed, removal or mitigation of hazardous utility poles should be a cooperative effort among the FHWA, SHA, and utility firm involved. Such safety projects are eligible for Federal funding of up to 100 percent of construction costs in some instances.

Where existing facilities are completely replaced, or where utility facilities are substantially upgraded in capacity, changed in function, or otherwise significantly modified, clear zone criteria for new facilities are normally applied.

Unusual Conditions

Limited or irregular ROW, existing facilities, sharp horizontal curves, and other conditions

may make selection of appropriate clearances difficult. The *AASHTO Roadside Design Guide* and *Green Book* provide general guidance for these cases.

EFFECTIVENESS OF THE CLEAR ZONE

The benefits of the clear roadside policy have been documented in two major studies. Graham and Harwood found significant reductions in accident rates on roadways with flatter side slopes and where objects had been removed from the clear zone. Their study indicated that the clear recovery area was definitely cost-effective.

The Transportation Research Board performed a study to identify the safety effects of various roadway geometric features. A relationship was documented showing significant reductions in accidents as the clear recovery width increased (see Fig. 9-2). The study also determined the cost-effectiveness of removing various roadside obstacles, including utility poles. A sample cost-effectiveness curve for utility poles is shown on Figure 9-3.

By now, the reader should have realized that the clear zone is here to stay. It is required on projects using Federal funds, it is cost-effective, and it is a major component of a comprehensive safety program.

ACCIDENT REDUCTION PROGRAMS

A concentration of accidents at a site, or a certain type of accident that seems to occur over and over in a given jurisdiction, may indicate that the highway/utility system is contributing to accident potential. Utility pole accidents are subject to the same types of accident patterns as other types of roadway accidents. They are thus subject to traditional highway accident study procedures. Detailed study of accident records may identify high-accident locations and point out improvements that will reduce the number and severity of future accidents. Road users (the public and utility firms) can also provide input into the nature and causes of highway/utility accidents.

The steps that are normally included in a comprehensive accident-reduction program are

- (1) setting up a traffic records system;
- (2) identifying high-accident locations;
- (3) analyzing high-accident locations;
- (4) correcting high-accident locations;
- and

- (5) reviewing the results of the program.

The size of the organization conducting the program has a great deal to do with its sophistication and complexity. Small highway agencies or utility firms may find it sufficient to place pins on a city map to identify high-accident locations, then to review copies of police accident reports in order to select the best safety treatment. Large utility firms, units of local government, and SHA's may resort to computers to handle enormous volumes of data. Safety programs at this level frequently use sophisticated statistical software to select the best sites for treatment and to identify the most appropriate countermeasures.

SETTING UP THE TRAFFIC RECORD SYSTEM

The first step is to gain access to accident data containing utility-specific information. Local

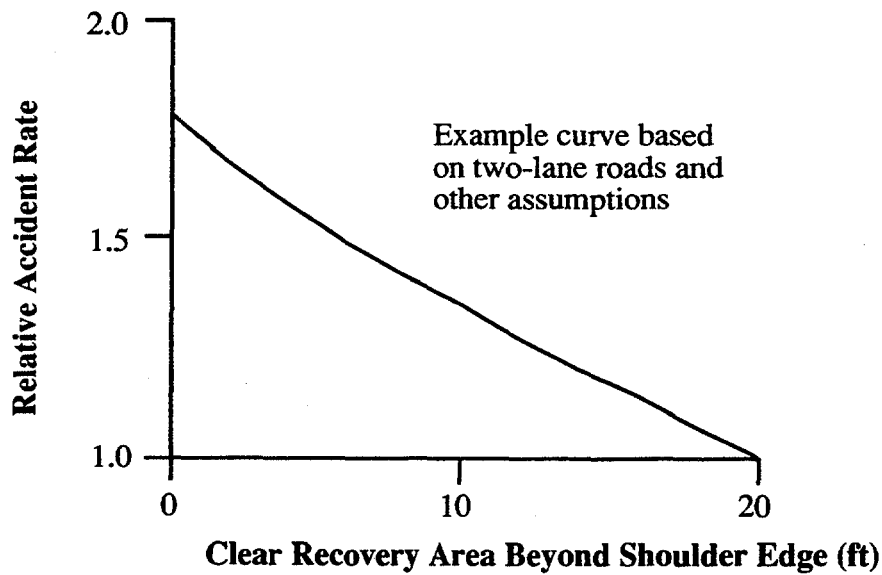


Figure 9-2. Relationship Between Accidents and the Clear Zone.

Source: TRB Special Report 214.

Note: 1m = 3.28 ft

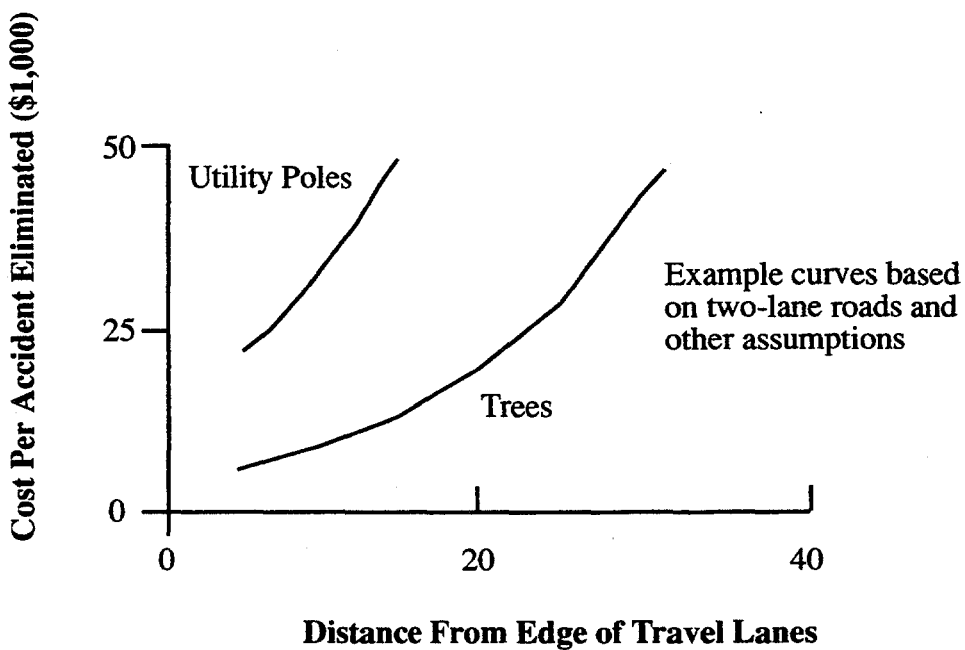


Figure 9-3. Effectiveness of Removing Roadside Obstacles.

Source: TRB Special Report 214.

Note: 1m = 3.28 ft

government units and utility companies may need to visit the local law enforcement agency to discuss their proposed safety programs and the types of data they will need to identify sites for further study. Once law enforcement officers are aware of the need to collect data on the number and types of utility devices involved in collisions, the availability of such data usually improves. Utilities may find it useful to compile their own files of accident information based on maintenance records of repair to damaged poles, observations of employees, or citizen input. For small utilities and small local governments, it may be sufficient to tabulate the accident information and to identify utility accidents on local street maps.

At the same time the accident data are being gathered, it may be appropriate to gather information on traffic volumes, street widths, and other geometric data for sites where accidents have involved utility facilities.

IDENTIFYING HIGH-ACCIDENT LOCATIONS

A high-accident location is a site that has more accidents than similar sites with similar traffic volumes. There is never enough safety money to fix every site at which accidents occur, so it is prudent to concentrate safety funds on those high-accident sites most deserving of treatment. There are at least five ways to identify high-accident sites.

The *number* method is the simplest. The number of accidents occurring at each site is identified, and the sites with the highest numbers become candidates for treatment. There is a critical weakness with this method. Sites with higher traffic volumes have higher numbers of accidents. It may be normal for an intersection used by 50,000 cars a day to have 20 accidents in a year. However, it would be unusual for an intersection used by 200 cars a

day to have the same number of accidents. This latter case might indicate a safety problem.

The *rate* method overcomes the weakness of the number method by taking into account the number of vehicles that pass each site. Accident rates are calculated and expressed as the number of accidents per million vehicles entering an intersection or per hundred million vehicle kilometers (miles) driven along a section of roadway. This method also has a crucial weakness. For very low-volume roadways, a single accident may produce a very high accident rate, which would be misleading.

The third procedure is called the *number-rate* method. The user calculates both the number of accidents and the accident rate. A site with high values in both categories is considered for further investigation. This overcomes the weakness of either the number or the rate method used individually.

The fourth procedure is called *rate-quality control*. This procedure uses statistical tests to determine if the number of accidents or the accident rate at a specific site is above the systemwide average for similar sites.

A fifth procedure is to use *accident severity* when evaluating sites. Several SHA's have incorporated this procedure. Each injury accident could be equivalent to "x" property damage only (PDO) accidents, and each fatal accident could be equivalent to "y" injury accidents. Thus all of the injury and fatality accidents at a site could be converted to the equivalent number of PDO accidents. Sites with severe injury and fatality patterns would have large conversions and would rank higher on the priority list.

The best procedure for a particular study depends largely on the size of the area being studied and the number of accidents that have occurred. For very small locations with few accidents, the number procedure may suffice. For statewide studies, the rate-quality control

feature may be best. In each instance, the choice of the method to determine the number of high-accident locations is a local decision. The objective is to identify the locations where accident experiences are above desired limits and where analysis and safety treatments will do the most good for the public.

ANALYZING HIGH-ACCIDENT LOCATIONS

A site may be selected for further study because of the number, rate, or severity of utility pole collisions, or because it fits a pattern of sites that have been designated for systemwide improvements. After a site has been identified for further analysis, the safety analyst begins looking for patterns of accident types and causes. Once the pattern has been identified, safety treatments can be selected. The following steps are found in a typical site analysis:

- (1) Prepare a collision diagram — a sketch that uses arrows to show the types of collisions that are occurring. An example is shown in Figure 9-4, where multiple hit-pole accidents have occurred on one side of the intersection. This pattern may indicate poles too close to the roadway, poles that are hard for drivers to see, turning maneuvers that are too difficult for drivers to master, or similar factors that contribute to accidents.
- (2) Prepare a condition diagram a scale drawing that shows the roadway geometry and any features that might have contributed to the accident. Typically, this diagram includes utility facilities, traffic control devices, street widths, intersection geometry, and similar features.

- (3) Tabulate available data — police accident reports can be used to tabulate type of fixed object (e.g. pole or tree), accident severity, day of week, time of day, weather conditions, and similar factors to look for patterns. Tabulating the time of day and pavement condition on Figure 9-4 reveals that most accidents happen at night. This pattern may be a clue that the utility poles are hard to see.
- (4) Visit the site the analyst can visit the site to relate the findings from collision diagrams, condition diagrams, and tabulations. For the accidents shown on Figure 9-4, the observer may find poles too close to the road, poles on the outside of a curve, turning radii that are too sharp, high-speed traffic, or other characteristics that contribute to the accident pattern.

Sometimes these steps will identify a dominant accident pattern at a site, but often it is not so simple. There may be several accident patterns. Once the pattern or patterns are determined, it is usually possible to diagnose the cause of these patterns and to develop appropriate treatments.

CORRECTING HIGH-ACCIDENT LOCATIONS

For each high-accident location, several appropriate safety treatments may be available (typical treatments appropriate for utilities are reviewed later in this chapter). Each alternative improvement is evaluated to determine its cost-effectiveness. This involves estimating the number of accidents that will be prevented by a certain treatment, then assigning cost savings due to decreased accident costs. Agencies like the National Safety Council and the National

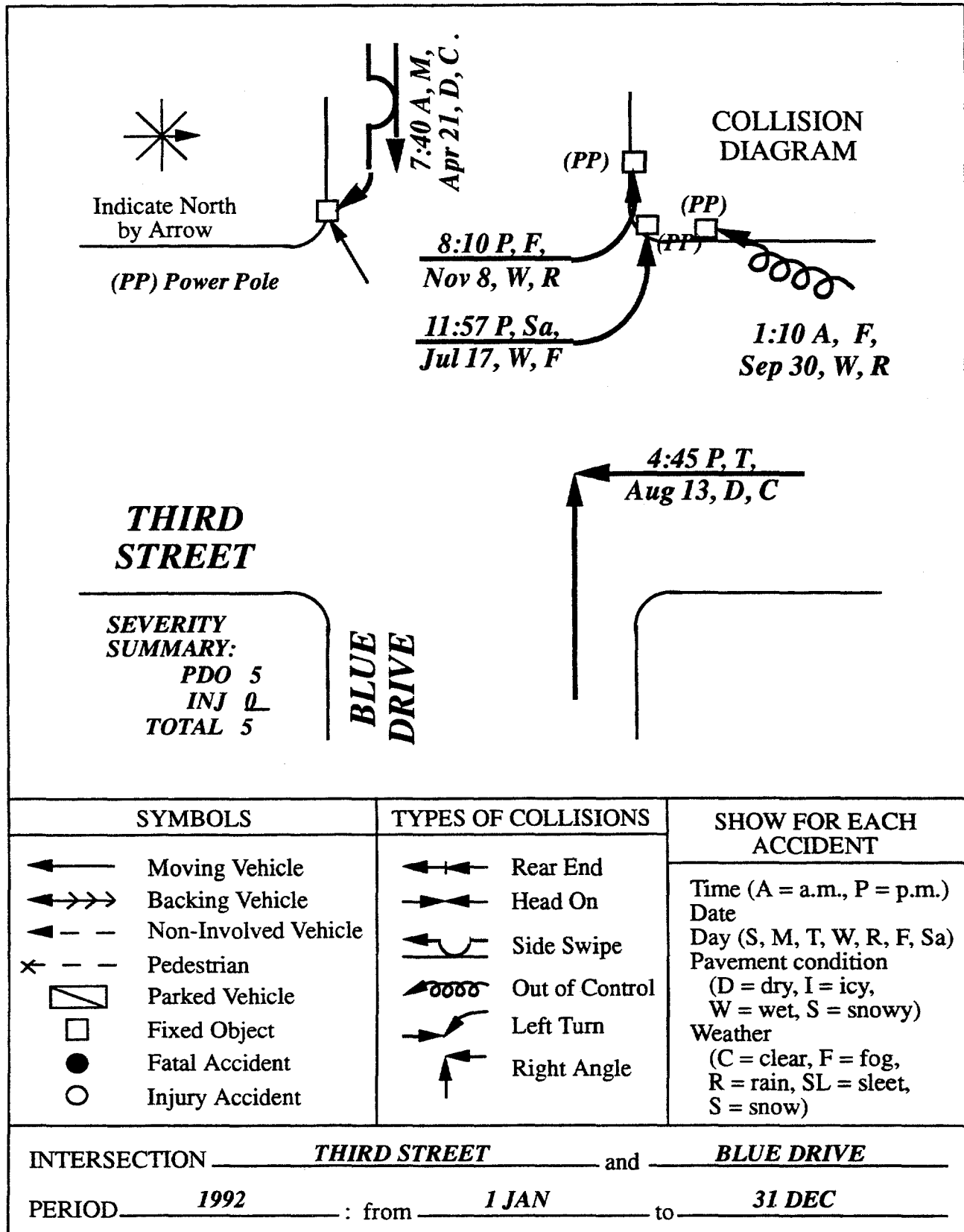


Figure 9-4. Sample Collision Diagram.

Highway Traffic Safety Administration periodically publish estimates of accident costs. An example is shown in Table 9-4. The cost savings are compared to the costs of installing and maintaining the improvement to generate a cost-effectiveness for the treatment.

Once all of the alternatives have been evaluated, the most cost-effective treatment is selected. For a study of a large system, sophisticated computer programs may be used to identify the best sites and the most appropriate treatment at each site.

The final step in selecting treatments is to set priorities; that is, to treat those sites first which would do the most good for the public, i.e., prevent the most accidents, injuries and fatalities. Highway agencies and utility firms are sometimes reluctant to identify sites needing safety treatment or to set priorities for treatment because of perceived liability. They may be afraid that a list of high-accident sites could be used in court to show that they were calloused toward safety, aware of accident problems but not concerned enough to fix them.

Federal legislation has been adopted to help alleviate this problem. Title 23, United States Code, Section 409, (23 USC 409) prevents the "discovery" or admittance into evidence of most kinds of information gathered or used to identify

sites as part of a safety program which utilizes Federal-aid safety funds. The intent is to encourage safety programs by shielding the agency or firm from spurious suits. Utility safety programs may qualify for Federal-aid, and highway agencies and utility firms will want to investigate the full provisions of 23 USC 409.

REVIEWING THE SAFETY PROGRAM

An important part of an accident reduction program is to determine whether previous treatments have worked. This involves periodic review of the sites after the treatments have been installed to make sure that they have functioned as intended. Accident data may be collected to determine if the number and severity of collisions have been reduced. A before-and-after study may be undertaken to make this determination.

Many other publications are available to provide more complete safety information to guide highway agencies and utility firms interested in implementing safety programs. Each SHA has a highway safety office that can help organize the program, provide pertinent publications, supply accident data, and otherwise contribute to a highway/utility safety program.

ROADSIDE SAFETY TREATMENTS

Ideally, the clear recovery area should be free of obstacles. Where these obstacles must be placed in the clear zone, or where an analysis has shown that an existing obstacle may need treatment, many options are available. The following list has generally been considered as the desirable order of treatment:

- (1) Remove the obstacle;

- (2) Relocate the obstacle where it is less likely to be struck;
- (3) Reduce the number of poles;
- (4) Reduce impact severity by using an appropriate breakaway device. For example, when luminaire supports must be placed near the roadway, breakaway bases may be employed;

Table 9-4. Estimated Accident Costs.

On January 8, 1993, the General Counsel and an Assistant Secretary of the U. S. Department of Transportation issued guidance on economic evaluations which involves estimates of the value of life and injuries. Several points were made in this memo:

- The collective willingness to pay (WTP) by society for reduced risks of fatalities and injuries should be the measure used by the DOT.
- The WTP value should be treated as a "threshold cost" during economic evaluations. If the calculated costs for lives saved lies below the WTP threshold, then the proposed improvement passes the benefit-cost test or cost-effectiveness test.
- Through 1993, DOT recommends using \$2.5 million as the WTP value of an averted fatality. It is anticipated that this value will change annually.
- The best current estimates for willingness to pay to avoid injury are described by Miller, Brinkman, and Luchter, "Crash Costs and Safety Investment," *Proceedings of the 32nd Annual Conference of the Association for the Advancement of Automotive Medicine*.

AIS Level Severity	Descriptor	Fraction of WTP for a Fatality Averted	Estimated Cost
AIS-1	Minor	0.0020	\$5,000
AIS-2	Moderate	0.0155	\$39,000
AIS-3	Serious	0.0575	\$144,000
AIS-4	Severe	0.1875	\$469,000
AIS-5	Critical	0.7625	\$1,906,000
AIS-6	Fatal	1.0000	\$2,500,000

AIS = accident injury scale.

When studying a potential safety treatment at a specific site, the analyst matches AIS levels to the fatalities and injuries in the site accident history to predict the cost of future accidents if no treatment is applied. If a treatment is applied to the site, a certain percentage of these accident costs will be saved. The analyst can find the cost to avert one fatality, and can compare this cost to the WTP threshold value to determine if the treatment is cost effective.

- (5) Redirect a vehicle by shielding the obstacle with a longitudinal traffic barrier or crash cushion; and
- (6) Warn of the presence of the obstacle if the alternatives above are not appropriate.

These are general treatments, and many variations or combinations may be used. Several examples of countermeasures are discussed in the next portion of this report.

COUNTERMEASURES

Researchers have identified the factors that contribute most substantially to accidents along utility pole lines. The most prevalent of these seem to be lateral clearance to the pole, volume of traffic, and pole density per mile. Lists of countermeasures have been developed to address these factors in utility pole accident problems.

Underground Utility Lines

By burying utility lines, poles can be removed, greatly reducing accident potential. This alternative also saves the utility company the cost for removing and replacing a pole damaged in a collision, and for repairing the utility line after an accident. The primary disadvantage of this treatment is the additional initial expense.

Even with underground utility lines, there still may be a need for safety treatment of surface transformer pads, switching cabinets, and other associated hardware. Street lighting standards may also be present. When these devices are installed, they should conform with the applicable clear zone guidelines.

Underground installations are not the only acceptable treatment, and other types may be preferred for some sites. Rock formations and

similar site conditions may make underground treatment too expensive. It may also be difficult to handle unanticipated local growth, or it may be impossible to tap some underground facilities to add customers. In spite of these and other difficulties, an underground installation is often the best design solution.

Increased Lateral Offset

Both accident rate and accident severity will decrease when utility poles are moved further from the travelway. Ideally, the poles can be placed at the ROW line and outside the clear zone. Vertical construction can sometimes be used instead of cross-arm construction to provide more lateral clearance. This treatment is illustrated in Figure 9-5.

The full effectiveness of moving poles away from the roadway cannot be achieved if other fixed objects are allowed to remain in the clear zone. A utility pole safety program should be part of a comprehensive plan that removes all types of objects from the clear recovery area.

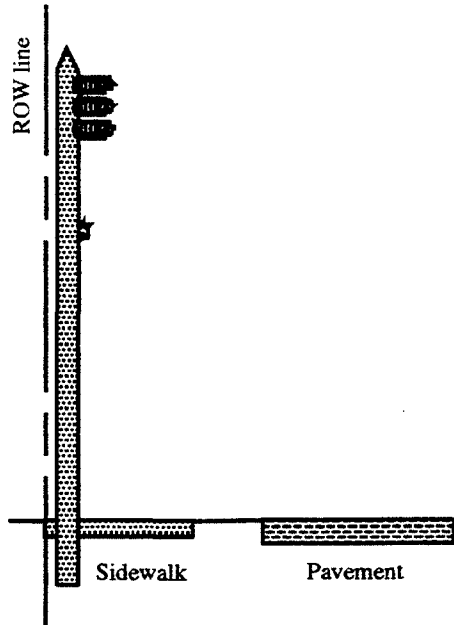
Locations Less Likely to be Struck

There are many fewer off-road accidents on the inside of horizontal curves than on the outside. Consideration should be given to placing pole lines on the inside of curves. On winding roads, this placement may not be feasible, because the wires would have to cross the road each time sequential curves changed directions. For sharp curves, utility poles would need lateral bracing from compression struts or guywires. With limited ROW, this might not be possible.

Where ditches, retaining walls, guardrail, or similar features exist, pole lines can be placed behind them. Errant vehicles cannot travel past them to strike the poles.

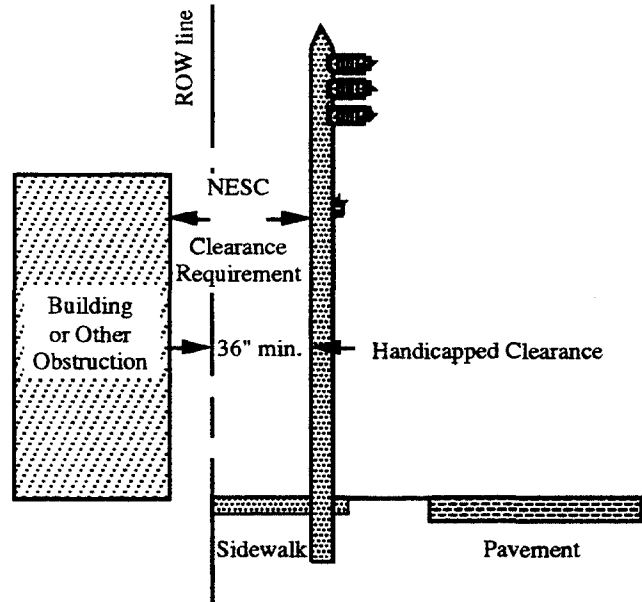
Vertical Construction

Pole will be field faced at ROW line.



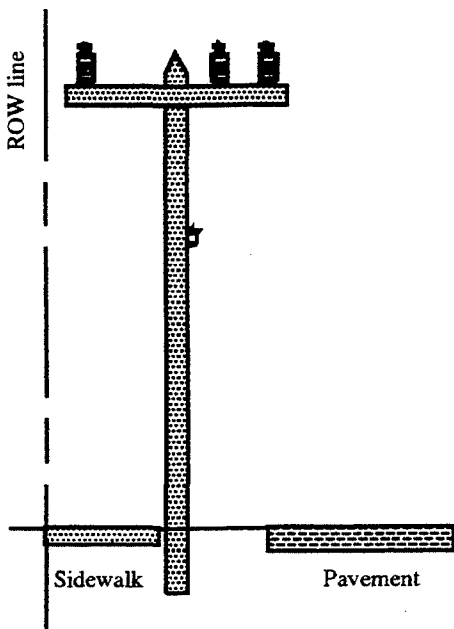
Building or other obstruction located within the NESC distance from the ROW.

The pole shall be located a minimum of the National Electrical Safety Code (NESC) distance from the building/obstruction, and shall provide a minimum of 36" for handicapped clearance.



Crossarm Construction

Edge of crossarm will be located as close as practical to the ROW line. Pole must be located within 6.5' from ROW line.



Vertical Construction w/Tx

Outside edge of any appurtenances (Tx, capacitors, . . . , etc.) will be located as close as practical to the ROW line.

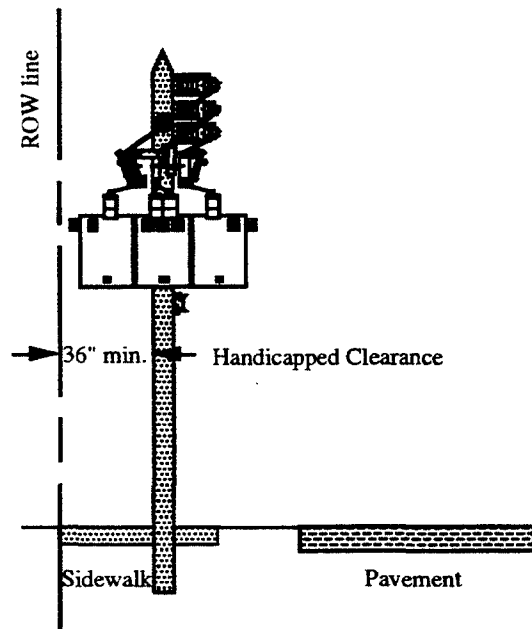


Figure 9-5. What Is Considered as Close as Possible to the ROW Line?

Source: Florida Power & Light Co.
Note: 1 m = 39.4 in.

Reduced Number of Utility Poles

An obvious way to decrease utility pole accidents is to decrease the number of poles beside the roadway. There are several methods available:

- (1) encourage joint use of existing poles, with one pole carrying street lights, electric power, telephone, cable TV and other utility lines;
- (2) place poles on only one side of the street;
- (3) increase pole spacing by using bigger, taller poles; and
- (4) selectively move poles away from hazardous locations.

Before adopting any of these procedures, an engineering study should be conducted to determine whether the changes would be cost-effective and appropriate for the specific site. For example, decreasing the spacing of poles requires that the remaining poles be larger and taller than the previous ones. These larger poles will be struck less frequently because there are fewer of them. However, they may cause more severe accidents because of their larger size and thus cancel any savings that might have accrued because of the decreased number of accidents.

Removing or relocating a few poles in areas of high hazard may be used as a treatment after several accidents have occurred. This counter-measure requires no formal economic analysis and may be particularly appropriate in rural areas.

Breakaway Devices

When a pole must remain in place, it can be modified to break upon impact and to swing out of the path of the vehicle, reducing the severity of an accident. Breakaway sign supports and breakaway luminaire supports have been used

for many years. Breakaway wooden utility poles have been made available through research conducted for the Insurance Institute for Highway Safety in the 1970's and for the FHWA in the early 1980's. An example is shown in Figure 9-6.

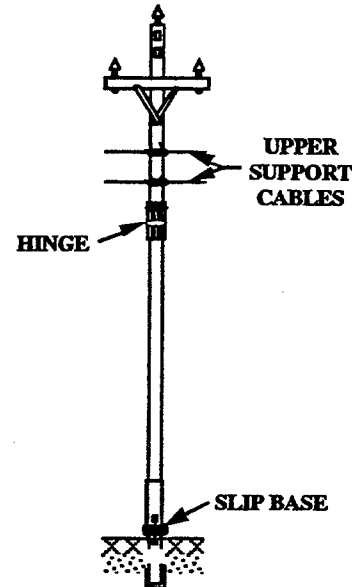


Figure 9-6: Breakaway Utility Pole

The breakaway utility pole cannot be used at every location. However, there are instances and circumstances for which it may be the most appropriate safety treatment. A following portion of this chapter has been devoted to breakaway poles to provide more information about this valuable safety device.

Guywires for utility poles can also cause accidents. They snag and flip vehicles that strike them, and can cause severe injuries to cyclists. Guywires that are closer to the travelled way than the structure they support should be avoided. Research is being conducted to develop a breakaway guywire coupling. Once developed, the breakaway coupling must function safely during impact, and the release of lateral tension in the utility structure should not

cause serious consequences, such as structural failure or release of the suspended load onto the travel path.

Roadside Barriers and Crash Cushions

If it is not feasible or practical to remove utility structures, move them, or place them underground, then other treatments may be necessary. One type of acceptable treatment is to shield the vehicle from striking the fixed object. Roadside barriers perform this function by redirecting the vehicle away from the utility structure, allowing the driver an opportunity to recover control of the vehicle. The *AASHTO Roadside Design Guide* may be used to determine whether a barrier is an appropriate treatment and, if so, what design is suitable for site conditions.

There are instances in which a guardrail is not appropriate. One example is when there is not enough room between the guardrail and the fixed object for the guardrail to fully deflect during impact. Also, a guardrail should not be closer than 0.6 m (2 ft.) from the edge of the travelway. If possible, it should be placed at least 3.1 m (10 ft.) away. Other helpful guardrail design information can be found in the *Roadside Design Guide*.

Another way to shield a vehicle from striking a utility pole is to use a crash cushion, which functions by collapsing upon impact and slowing the vehicle at a controlled rate. A cushion is normally used where there is an isolated fixed-object hazard. If there are several objects, a guardrail is probably a better safety device. Crash cushions are typically much more expensive than guardrail.

Crash cushion design is more complex than guardrail design. The type of crash cushion and its dimensions must be designed to fit site conditions and to absorb energy (from the impacting vehicle) at the appropriate rate. The

Roadside Design Guide is the source of information for the design process.

Guardrail and crash cushions should not be used indiscriminately for at least two reasons: they are expensive to install and to maintain, and they are closer to the road than the objects they are shielding. They are involved in more accidents than unshielded objects. They should be used only when they are warranted by the reduction in accident severity.

Warning the Motorist of the Obstacle

The number of accidents or the severity of accidents may be decreased by warning motorists of the presence of poles adjacent to the roadway. This may be done through warning signs, through reflective paint, sheeting, or object markers placed on utility poles, or through roadway lighting. Poles on the outside of a horizontal curve, where a lane becomes narrow, at the end of a lane drop, or in other locations where vehicles are likely to travel close to them, are candidates for such warning where more comprehensive treatments are not justified.

Keep the Vehicle on the Roadway

One obvious way to prevent utility pole accidents is to assist the driver in staying on the roadway. This may be done by positive guidance, for example, using pavement markings, delineators, advance warning signs, and other visual cues to tell the driver what to expect and to provide a visual path through a site. Physical enhancements such as improving the skid resistance of the pavement, widening the pavement travel lanes, widening or paving shoulders, straightening sharp curves, decreasing the speed of vehicles, or adding lighting in areas where accidents frequently occur at night, may also

diminish accident potential by decreasing the number of vehicles that accidentally leave the travelway.

Sample Utility Safety Treatments by State Highway Agencies

Examples of good highway/utility safety practices may be found in SHA documents. The following samples were taken from the Wisconsin State Highway Maintenance Manual:

Appurtenance facilities such as pedestals, manholes, vents, drains, markers, valve and regulator pits, etc. should be located outside the clear recovery area and near or at the right-of-way line. Manholes, valve pits, etc. should be installed so that their uppermost services are flush with the adjacent undisturbed surface.

Appurtenance facilities such as buildings should not be located on the highway. Cabinets should not be located on the highway. When cabinets are allowed on the highway, they shall be placed on a location not vulnerable to an errant vehicle and at or as near as practicable to right-of-way line.

When the rebuilt highway includes utilities, above ground utilities should be located as far as practical beyond the face of the outer curb and where feasible beyond sidewalks and beyond paved areas.

The Delaware Department of Transportation prohibits poles on the outside of horizontal curves if there is less than 9.1 m (30 ft.) of available ROW. This treatment addresses the overrepresentation of utility pole accidents on the outside of curves.

Neither the Delaware DOT nor the Illinois DOT allow poles in a ditch line. Once an out-of-control vehicle goes into a ditch, it slides along the ditch until it comes to a stop. A utility pole in the bottom of a ditch has a very high probability of being hit by an out-of-control vehicle.

The Massachusetts DOT requires that poles within 1.8 m (6 ft.) of the pavement have reflective markers affixed. This provides more visibility for approaching drivers and diminishes the number of accidents.

The Washington State DOT has an extensive utility safety program. Examples of statements found in the its *Control Zone Guidelines* — Utilities include the following:

If it is not necessary, do not place utility objects on the outside of horizontal curves.

If possible, design the facility to place utility objects outside the turn radius of public grade intersections. If this is not possible the facility should be placed outside of the control area.

Allow a minimum of 3.5 feet from face of guardrail to face of utility object. This allows the guardrail to function properly if struck (3.5 ft. = 1.1 m).

Many other examples could be given. These illustrate that the SHA's are aware of highway/utility safety problems and are attempting to address them.

BREAKAWAY TIMBER UTILITY POLES

Development

Following many years of research and testing, the FHWA issued a research report in 1986

outlining the conditions under which breakaway wooden utility poles might be used, and establishing the criteria for their design. The breakaway utility pole was in an experimental status from 1988 through 1992. In January 1993, it was upgraded to operational. Even after the upgrade, its performance is still being field-tested.

The Kentucky Utilities Company, working in conjunction with the Kentucky Transportation Cabinet, retrofitted ten existing poles in the Lexington area between January 1988 and October 1989. The typical retrofit involved six to eight hours of work in the field to modify a class 3 pole. For an average cost of about \$2,700 per installation, safety hardware was installed to make the pole breakaway.

The Massachusetts Electric Corporation and the New England Telephone Company installed 19 breakaway poles near Boston. Instead of retrofitting the hardware to existing poles, the Massachusetts installations used completely new poles to eliminate the unknown variables associated with older existing poles. Additional analysis and testing resulted in several improvements in the initial design. The typical installation involved 6 to 8 hours in the field to install a new class 4 pole equipped with breakaway hardware. The average cost per pole was \$5,600.

Additional Federal monies have been made available for additional States to participate in the field evaluation process.

Evaluation of Experimental Installations

The ten retrofitted poles in the Kentucky area have been evaluated. They were inspected quarterly for two years after their installation. During this period, there were no accidents and no severe weather. No problems were observed other than a need for minor re-alignment of some poles.

The initial Massachusetts evaluation has also been completed. The breakaway poles were struck five times by vehicles that left the roadway. The poles performed as intended. No fatalities or serious injuries occurred; telephone and electric services were unaffected, and the poles were promptly restored. Pole performance under wind and ice loads was also satisfactory.

Operation of the Breakaway Timber Pole

The recommended breakaway design is a 40-foot class 4 pole with three basic components: a lower slip base connection, an upper hinge connection, and overhead structural support cables. The pole is designed so that upon impact the bottom slip base detaches, the pole swings about the upper hinge, and the vehicle passes under it. A breakaway timber utility pole is illustrated in Figure 9-6. The impact sequence and function of the pole are shown in Figure 9-7.

The slip base for a utility pole is essentially the same as for a highway sign support. It consists of two metal plates (one attached to the underground portion of pole, and one attached to the above-ground portion.) When struck by a vehicle, the bolts holding the two plates pop loose, and the plates slip or yield.

The upper hinge is placed approximately 6.1 m (20 ft.) above the ground. During installation the pole is cut, and a metal band and strap connection is placed across the cut. When the bottom of the pole is struck by the vehicle, the metal straps act like a hinge and allow the pole to swing up and away from the impacting vehicle.

Two steel wire cables run along the utility line from the breakaway pole to the adjacent poles on each side. These cables provide structural strength during the impact sequence, allow the hinge to function, stabilize the pole segment, and minimize damage to the utility lines. In some instances, a more secure

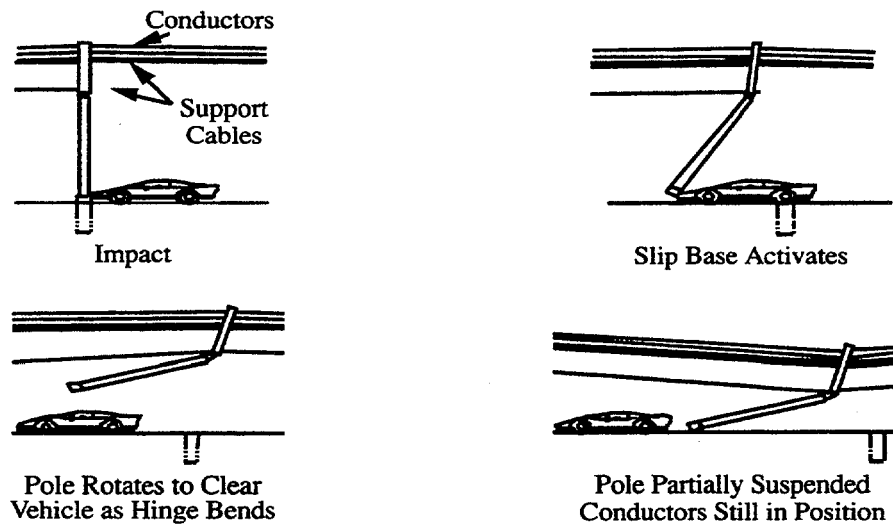


Figure 9-7. Operation of Breakaway Timber Utility Pole.

attachment of telephone support strand can serve the same purpose. A power cable of sufficient strength has also been used by dead-ending the cable on both sides of the crossarm, then installing a jumper to connect them.

Costs

Ten existing utility poles were retrofitted in Lexington, Kentucky, in 1988 and 1989 at a cost of slightly over \$2,700 per pole. Nineteen new poles were installed near Boston, Massachusetts, in 1989 and 1990 at a cost of about \$5,600 per pole. The Massachusetts installations were more expensive partly because they used new poles rather than existing poles.

The cost of replacing one of these poles after a collision is normally limited to the cost of bolts, hinge straps, other minor hardware, and labor. This is less expensive than the initial cost of installing the safety hardware, or the cost of replacing a normal pole damaged in a collision.

Design Considerations

Breakaway timber poles cannot be used in all types of installations. For example, if there are other fixed objects adjacent to the pole, it does little good to make the pole breakaway. A vehicle would strike the pole, activate the breakaway mechanism, and pass through, but would strike the next fixed object. Another restriction on the use of breakaway poles is when the downed pole or the utility line, after having been struck by an errant vehicle, might cause a hazard to motorists or to pedestrians. Transformers on the pole, heavy guywires, and service lines crossing over the roadway might bar use of breakaway poles. Other information about the design, location, and operation of breakaway utility poles may be found in the FHWA report on this topic.

Selection of a breakaway utility pole for a particular location might be simplified by consideration of the following questions:

- (1) Is it feasible to remove the utility pole, place the utility pole underground, or move it to a location away from the roadway that is less likely to be struck?
- (2) Does the utility pole have an accident history? Has it been previously hit?
- (3) Does the utility pole have high accident potential? Is it located on the outside of a horizontal curve? Is it located near an intersection? Is it on a hill or close to the road?
- (4) Where is the impacted utility pole likely to fall? Will pedestrians, vehicles, or nearby buildings be endangered by the falling pole?
- (5) Are there tap lines off the pole which create side tensions?
- (6) Is there a clear recovery area behind the pole to allow it to swing free, or will objects hinder its operation when struck by an errant vehicle? Will it allow the errant vehicle to come to a safe stop without hitting another object or going down a steep embankment?
- (7) Is there equipment on the pole, such as transformers, reclosers, or capacitors, that will affect the reaction of the breakaway pole?

In answering these questions, the designer will establish whether the breakaway pole is an appropriate safety countermeasure at each site. There are no complete answers. The breakaway utility pole is not appropriate for all locations, but it may be the most appropriate treatment for a specific situation or an individual site. The FHWA does not require the use of breakaway poles, but anticipates that the breakaway pole will fill an important future role in overall highway/utility safety programs.

The breakaway pole is not a solution to all pole safety problems. So far, it has been tested in only a few states, and more time and data are needed before its widespread application. However, the concept bears great promise as the best safety treatment for certain types of poles in troublesome locations.

SELECTING COUNTERMEASURES

The method used for selecting countermeasures depends upon the size and complexity of the safety project. For an individual site, the selection may be made through the judgment of an informed individual or a group of individuals. For a systemwide safety project or for a series of sites, the decision may be based on a cost-benefits analysis or a sophisticated, computer-aided optimization procedure. There is also a methodology specifically designed by FHWA for utility pole treatment determinations.

DIAGNOSTIC REVIEW TEAM

The experience of several agencies and the knowledge of informed parties may be brought together to review an accident problem at a particular site. SHA's do this routinely as part of the Federal-aid Safety Program. Once a site has been identified for investigation and possible treatment, a diagnostic review team is appointed. The composition of the team is matched to the particular safety problem. For

utility poles, FHWA encourages the SHA, the utility, and FHWA representatives to work together to identify hazardous sites and evaluate the various countermeasures being considered. Utility staff members should be invited to join field reviews. They may be able to supply information about the planned upgrading of the utility line, replacement options, and alternative designs that would assist in making a decision about the most appropriate countermeasures. Whenever possible, utility corrective work should be handled in conjunction with highway or utility upgrading, or during utility rehabilitation projects to minimize the overall cost of the program.

Typical results of a field review are a series of recommendations for potential treatments. For small projects, there may only be one or two recommendations. For large projects, the recommendations may be complex and require further analysis.

COST-EFFECTIVENESS STUDY

The second procedure for selecting countermeasures is to perform a cost-effectiveness analysis. This involves comparing the costs of various treatments to determine the most effective use of limited funding. Costs include items like potential future accidents, initial construction costs, ongoing maintenance, and similar items. Benefits include a reduction of the number of accidents with a commensurate savings of accident costs, reduced maintenance costs, possible savings in travel time for motorists, and the salvage value of the facility at the end of the useful service life.

The time value of money is considered by applying the net present worth procedure (or a similar method) to the costs and benefits. Comparisons of benefits and costs are made to determine if an improvement is cost-effective

and to set priorities among the many projects competing for limited safety funds.

The appendix of the *Roadside Design Guide* contains a good cost-effectiveness methodology. Example calculations are provided to illustrate the methodology. This procedure has also been adapted to the computer. Instructions about ordering the software for the cost-effectiveness procedure may be found in the *Roadside Design Guide*.

For large projects or for a statewide safety program, comprehensive computer programs perform many of the calculations. They may also use advanced statistical techniques to optimize funding and to produce master lists of acceptable projects.

UTILITY POLE COST-EFFECTIVENESS PROCEDURE

Zeeger and Parker developed a cost-effectiveness procedure specifically for selecting utility pole countermeasures. This methodology has been published as an FHWA report. This report is full of tables, graphs, and charts that can predict the number of traffic accidents involving utility poles of different configurations. Once an agency has decided to undertake a treatment program, it can use this methodology to test alternative designs to see which yields the most cost-effective safety treatment.

This procedure normally requires a field inspection program to gather the data necessary to perform the methodology. The FHWA report provides data sheets for this purpose, along with step-by-step instructions for performing the field inventory.

A research project conducted for the FHWA developed a computerized version of the utility pole cost-effectiveness model. This program was called UPACE. It performs the drudgery of calculating the anticipated number of accidents;

making adjustments for the various types of accidents in the clear zone; and estimating the expected cost of treatment, expected total reduction in accidents, expected cost savings and other predictions needed to evaluate the effect of the treatment. The software is now marketed by the McTrans Center in the Civil Engineering Department at the University of Florida.

BEST METHOD

There is no such thing as a method that is always the best. The best method for selecting countermeasures depends on the local conditions, size of program, funds available, and other factors. The techniques presented in this part of this *Guide* are tools that illustrate how these decisions might be made.

FUNDING

Under some conditions, Federal-aid highway funds may be used to pay for utility safety treatments. It is important to note that no Federal-aid categories of funding have been specifically set aside for utility safety work. Funds for this purpose come from State or local governments, or from the formula Federal-aid programs provided to SHA's for overall construction and safety improvements. The SHA determines its own priorities and decides how it will use its Federal-aid highway funds. Utility work and safety programs associated with utilities are eligible for these funds, if allowed by State code and regulations, and if the character of the work falls within Federal regulations for reimbursement. One important note is that the

1991 Intermodal Surface Transportation Efficiency Act allows payment for breakaway utility poles at a 100 percent Federal share if the SHA so chooses.

A key requirement of the Federal-aid highway program is that these funds be used to reimburse an SHA for the cost it has incurred in building an approved highway project. Federal-aid funds are not grants; that is, they are not simply given to States. A State only receives Federal-aid funds for utility safety work as reimbursement after the work has been done. More information on reimbursement may be found in Chapter 12 — *Relocation Reimbursement* of this Guide.

SAMPLE SAFETY PROGRAMS

Several sample safety programs are discussed below to illustrate good practices. These sample programs include local government, State highway agencies, and utility company programs.

CITY OF HUNTSVILLE

The City of Huntsville, Alabama, desired to implement a clear recovery area program.

Rather than arbitrarily remove utility poles from the clear zone, the city decided to take a comprehensive approach to the problem. Studies were made to identify the best treatment for poles, trees, mailboxes, drainage devices, and other fixed objects.

Accidents involving utility poles were examined for patterns and other indications that might be used to develop a rational safety program. Investigations were made at the sites of 310 pole-related accidents that occurred over a 30-month period. Factors like day of week, time of day, roadway geometry, speed limit, class of road, road surface condition, horizontal and vertical curvature, lateral clearance to pole, pole size, and pole material were examined during the study.

A literature review and a field investigation yielded several clear patterns. An example is found in Figure 9-8 which shows the relationship of accidents to horizontal curves. The figure indicates that 18.7 percent of the pole accidents occurred on the outside of horizontal curves, and that another 8.7 percent of the accidents occurred outside of and just downstream from curves. This means that 27.4 percent of the accidents were related to the outside of horizontal curves. Much less than 5 percent of the city's street mileage was curved, so 27.4 percent of the collisions happened on less than 5 percent of Huntsville streets, a definite over-representation.

Findings like those displayed in Figure 9-8 were used to design a treatment program with two components: existing poles and new/rehabilitated poles. For new and rehabilitated pole lines, the goal was to provide the full clear roadside area. The city decided to use accident data as the basis of treatment for existing poles. A cost-effectiveness methodology (like that advocated by the *Roadside Design Guide*) was used to find the situations and sites that deserved treatment, and to start work at those sites where treatment was most cost-effective.

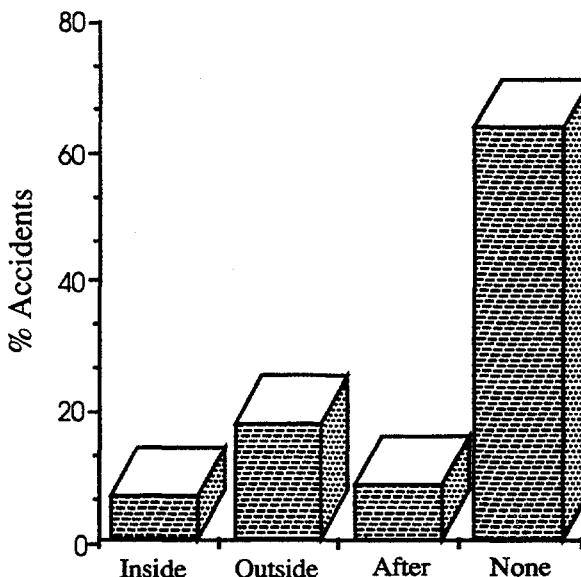


Figure 9-8. Pole Accident - Curve Relationship.

This analysis indicated that only a limited number of existing sites needed comprehensive treatment. Accident data can be monitored in the future to identify more sites for safety treatment.

GEORGIA UTILITIES COORDINATING COMMITTEE

In Georgia, a Utilities Coordinating Committee has been formed to increase communication and coordination, and to address utility problems. It is composed of representatives of the Georgia DOT, utilities, railroads, and utility contractors. The committee recently appointed a Clear Roadside Subcommittee to establish a systematic approach to reduce or eliminate unsafe utility facilities in the clear recovery area. The subcommittee is composed of the DOT Utilities Engineer and six engineer-managers from large utility companies. The subcommittee has encouraged the DOT to establish guidelines for

determining the clear recovery area. Additionally, the subcommittee adopted the following goals:

- (1) establish which utility obstacles need to be moved;
- (2) establish criteria for relocation priorities;
- (3) determine a time frame for relocating utility obstacles;
- (4) address the need for alternative safety treatments and deadlines for their application;
- (5) address criteria for leaving a utility obstacle in the clear recovery area;
- (6) define potential liabilities and determine how to prevent them; and
- (7) establish and address the concerns of utilities.

JACKSONVILLE ELECTRIC AUTHORITY

The Jacksonville Electric Authority, Jacksonville, Florida, contracted with the Texas Transportation Institute to develop a safety program that would have the following components:

- (1) utility placement guidelines;
- (2) a comprehensive accident data file;
- (3) computer programs to prioritize cost-effective safety treatments;
- (4) a comprehensive set of safety improvement methods along with guidelines for their use; and
- (5) example safety improvement sites, including design and implementation of specific improvements.

In the first year of operation, ten sites were identified and modified, and a goal was established to use accident data to identify and improve at least five more per year.

NEW YORK STATE DOT

Perhaps the first comprehensive program addressing the utility pole accident problem was developed by the New York State Department of Transportation (NYSDOT) in the early 1980's. NYSDOT noted that nearly 8,000 utility pole accidents occurred in 1982, resulting in 100 fatalities and 6,600 injuries, and that 84 percent of these accidents involved injuries. Further study showed that the utility pole accidents were probably occurring because of poor highway alignment and narrow ROW's associated with old highway systems, compounded by high levels of traffic.

The steps in the NYSDOT plan fit the classic description of a highway safety program. Computers were used to search accident records and to develop two customized reports dealing with utility poles and light supports. The first report was a listing of all such accidents and the second report was a listing of "bad actor" locations with the most severe utility pole accident problems. The bad actor locations were selected based upon the severity and frequency of pole collisions.

A two-pronged approach was used in the safety program: (1) The awareness of NYSDOT staff was heightened through a widely disseminated "war on utility pole accidents" package of information, and (2) the computer reports and other information were provided to personnel to implement a grass-roots safety program.

Each of NYSDOT's capital projects was checked against the list of utility pole accident sites to see if pole treatment could be accomplished during a highway project. Engineers in the field reviewed accident reports to determine the nature of accident problems. Specific offending poles were accurately pinpointed, field investigations were conducted by NYSDOT staff and utility company engineers, and treatments were devised.

WASHINGTON STATE DOT PROGRAM

The Washington State Department of Transportation (WSDOT) has developed Control Zone Guidelines (CZG) which probably constitute the most comprehensive State utility pole safety program now being conducted. The CZG have been in place since they were approved by FHWA in 1987. Since then, modifications have added more flexibility to address the concerns of both public and private utility firms.

Classification Concepts

WSDOT has developed three classifications for roadside objects based on their location within the ROW. The classifications may be generalized as follows:

Location I Objects: Objects within the control zone that meet one of the following criteria: (a) outside a horizontal curve with advisory speed signs of 15 mph or more below the posted speed limit, (b) within the turn radius of a public at-grade intersection, (c) where a barrier, embankment, or other feature is likely to direct a vehicle into a utility object, or (d) closer than 5 feet beyond the edge of the useful shoulder. WSDOT has estimated that 20 percent of the utility objects in the State are Location I objects. (Note: 1 kph = 0.6 mph, 1 m = 3.28 ft.)

Location II Objects: All utility objects located within the control zone that are not classified as Location I or Location III objects. Approximately 32 percent of the utility objects in the state are Location II objects.

Location III Objects: Objects located outside the control zone, or within the control zone but

mitigated by an alternative countermeasure. Or objects that would have been Location II objects except that they have been classified as Location III objects using the AASHTO cost-effectiveness methodology contained in the *Roadside Design Guide*. Approximately 48 percent of the utility objects in Washington are Location III types.

Requirements of the WSDOT Program

The WSDOT CZG requires that all new utility objects be constructed outside the control zone unless they are Location III objects. Additionally, each utility is required to establish a program for systematically studying its existing utility objects located in the control zone. The results of the study will determine the utility's Annual Mitigation Target (AMT), which is set by WSDOT in cooperation with the utility. The AMT will determine the number of existing utility objects to be removed or mitigated each year.

Initially, WSDOT proposed to have utilities remove Location I and II poles from the control zone as a condition for franchise renewal. Location I objects would be removed during the first 25-year franchise renewal, and Location II objects would be removed during the second renewal. The utilities estimated that this would cost the rate payers of Washington State more than \$200 million dollars during the first 25 years. Utility companies then proposed the AMT concept to replace the franchise renewal procedure. The AMT provides a more systematic approach, and allows better planning and budgeting of the work. It also serves as an excellent example of cooperation between SHA's and utilities to develop an acceptable solution to the utility pole safety problem.

SUMMARY

This chapter of the Guide has been written to draw attention to a substantial safety problem — 1,200 to 1,500 fatalities per year from utility pole collisions. The chapter has outlined several ways to address the problem. Accident reduction programs, the clear recovery area concept, safety

countermeasures, and other methodologies were discussed to allow interested agencies and individuals to devise their own safety programs. Finally, example safety programs were cited to encourage increased safety efforts by FHWA, SHA's, local governments, and utility firms.

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CHAPTER TEN

CONSTRUCTION

INTRODUCTION

Suppose that a highway agency's contractor arrives on-site to begin a roadway widening project and utility's forces haven't finished performing relocation, making widening work impossible. The contractor has been prevented from working and plans to file a construction delay claim with the agency. Suppose the problem arose because the agency brought the utility into the project too late to meet the required relocation completion date. The project has started disastrously: the contractor is irked and behind schedule; the agency may be required to pay the delay claim; and the utility has reconfirmed its belief that the agency never considers the utility's point of view. There is a better way to work together, and that's what this chapter is about.

The objective of this "Construction" chapter is not to describe construction techniques, such as asphalt placement procedures or the proper methods of encasing pipe. Instead, it will emphasize coordination among highway agencies, utilities, and contractors before and during construction in order to avoid the type of situation described above. The basics of work zone traffic control and inspection will also be covered.

CATEGORIES OF CONSTRUCTION

There are two main categories of highway/utility interactions during construction: those projects involving only utility construction and those involving utility relocations due to a highway agency construction project. Those involving only utility construction are generally less complicated. Coordination for these activities may only involve obtaining an accommodation permit from the highway agency and notification to the agency before utility construction begins. If the work is significant enough to require a pre-construction conference, the only attendees will be the utility, the utility's contractor (if used), and the agency.

Utility relocations during highway agency construction projects can be much more complicated. Multiple utilities may be involved, along with contractors for each utility. The highway agency's contractor will also be involved and will desire to have all possible relocation work finished before highway construction begins. With many more groups involved, and with the accompanying greater requirement for scheduling, pre-construction conferences involving all parties are recommended for relocation projects. Much of the material in this chapter is aimed at combination highway construction/utility relocation projects.

GROUPS TO COORDINATE

Several groups must interact successfully to enable a highway/utility construction project to function smoothly. The interacting groups described in the following paragraphs are advised to meet together at pre-relocation and pre-construction conferences. It is good practice for highway agencies to dedicate time and manpower routinely to such conferences. By the same token, good practice suggests that utilities commit themselves to attending these meetings each time they are called. A good example of the types and number of these meetings is presented later in the chapter.

UTILITY AND HIGHWAY AGENCY

Providing many opportunities for utilities (and their contractors) and the highway agency to communicate is important. As construction nears, any final changes in the agency's project schedule must be communicated to the utility. Sitting together to review a finalized set of plans may reveal other conflicts that can be avoided. Before relocation begins, exchanging names and 24-hour-a-day telephone numbers is important for the individual from each group who will be in charge of this project.

UTILITY AND HIGHWAY CONTRACTOR

It is good practice for the utilities (and their contractors) and the highway contractor to agree upon a work schedule to avoid conflicts during construction. In most instances, it will be possible to complete all relocation work before the highway contractor begins work. This situation is highly desirable to both the utility and the highway contractor. There may be times when the utility cannot perform all relocation work before highway construction

begins. In this case, the two groups will be highly dependent on one another to complete the job with a minimum of lost time and resources. Again, a mutually satisfactory work schedule should be agreed upon. A brief example of scheduling coordination required to relocate a utility facility at the bottom of a deep cut along the route of a new roadway follows:

- (1) The utility erects a temporary facility;
- (2) The contractor performs the excavation;
- (3) The utility places its facility at the bottom of the excavation and recompact; and
- (4) The contractor resumes construction.

UTILITY AND OTHER UTILITIES

Utilities can use the pre-relocation conference to work out a variety of relocation problems among themselves. For example, in a project with limited right-of-way, the utilities can work out which of them will receive the preferred location within the limited right-of-way area. If several utilities must make relocations before the highway agency's contractor arrives, they can use the pre-construction conference to schedule their relocations to avoid interfering with one another's work forces. A variety of other previous commitments (or assumptions) between utilities may be resolved at this point. For example, a utility that assumes it will be connecting its lines to the wooden poles of a second utility may find out it must make alternative arrangements to attach to concrete poles instead. As a second example, several utilities may find that placing all their facilities in a common trench saves time and money.

SCHEDULING

Each highway agency is encouraged to formulate a schedule of highway/utility interactions for highway construction projects. Even though this chapter is mainly concerned with the construction phase, Figure 10-1 from the Texas Department of Transportation is included to show how frequently the department and utility are in contact during a typical utility relocation for an interstate highway project. Such schedules are of great assistance in showing utilities where they fit into the construction schedule.

This chapter focuses on the construction portion of the highway/utility interaction. The following section will expand on communication activities taking place at that time.

CONSTRUCTION SCHEDULING

The Arizona Utility Coordinating Committee (AUCC) "Public Utility Project Guide" provides a good model for highway/utility interaction before and during the construction phase. Figure 10-2 illustrates the planned series of interactions. It represents only the construction scheduling portion of Figure 3-2 first shown in Chapter 3 — *Planning and Coordination*.

Pre-Relocation Conference

Item 23 on Figure 10-2 is the pre-relocation conference. The utilities' relocation schedules are reviewed at that meeting to identify and resolve location and scheduling conflicts among utilities. At that meeting, the utilities might also investigate if relocation work for all utilities can be performed by a common contractor to save money.

After all utility relocations that can take place before the highway contractor begins work

have been performed, the utilities notify the highway agency in Step 24 that their relocations are complete. The notification preferably includes as-built drawings showing vertical and horizontal relocations of facilities. If some relocations must take place after the highway contractor begins work, the utility provides a schedule showing when it can complete this work. If some utilities have not submitted their notifications in Step 24, the AUCC contacts them six weeks before the scheduled bid date. At that time, the agency submits a written request to the utilities requesting confirmation of relocation completions.

Pre-Bid Meetings

The pre-bid meeting shown in Step 25 is held for the benefit of the highway contractor. At the meeting, the agency clarifies project plans and specifications. If any utility relocation must be performed during the highway contractor's work, the utilities are asked to be present to coordinate schedules with and answer any questions from the highway contractor.

Pre-Construction Conference

Step 26 shows the pre-construction meeting that is held after the project bid award. Utilities and their contractors, the highway agency, and the highway contractor are all present. This meeting allows all parties to resolve any location or scheduling difficulties described earlier. It also provides an opportunity for the highway agency or its contractor to discuss any safety programs for the project and to coordinate those programs with the utilities. After construction begins, the agency will call periodic construction

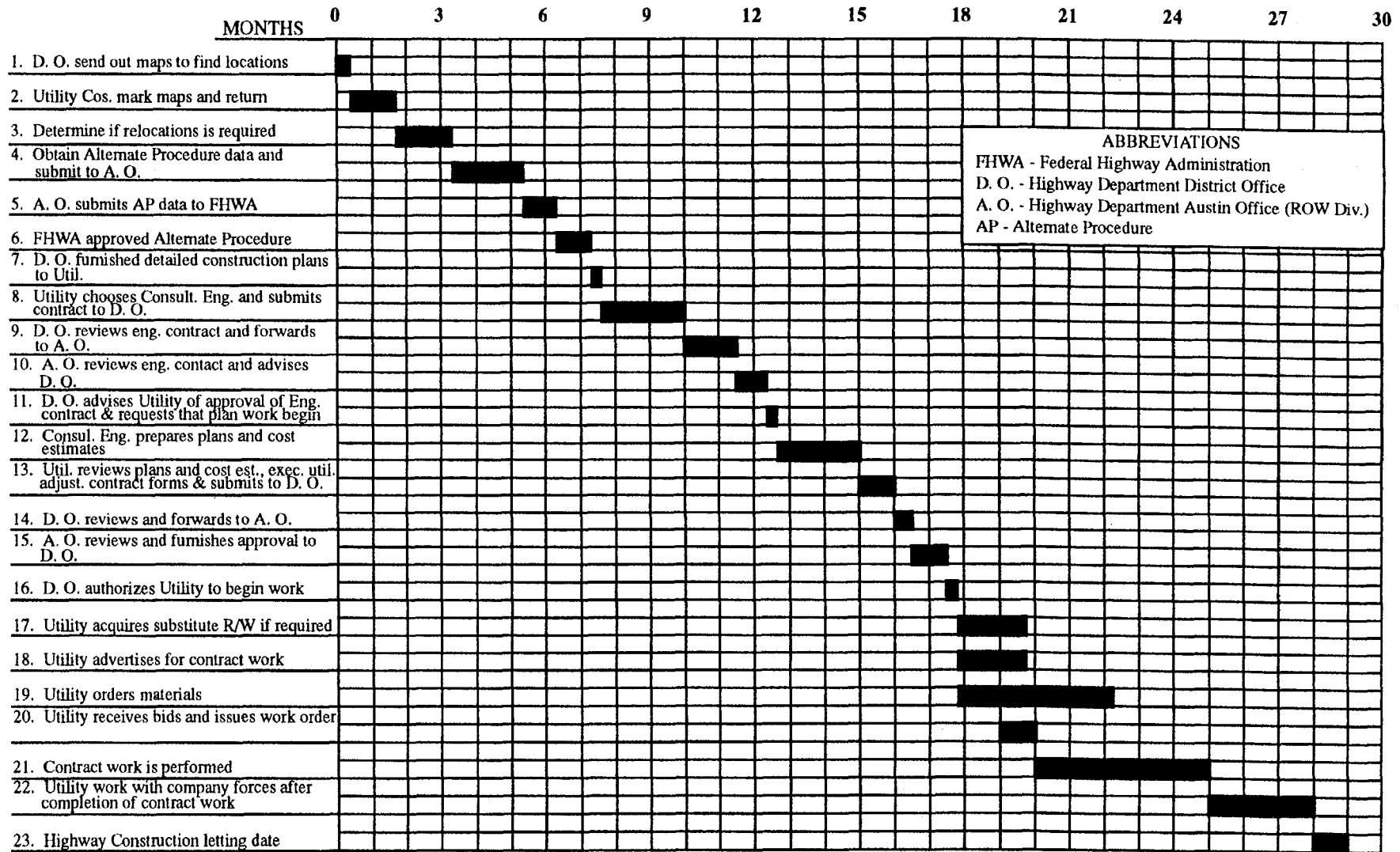
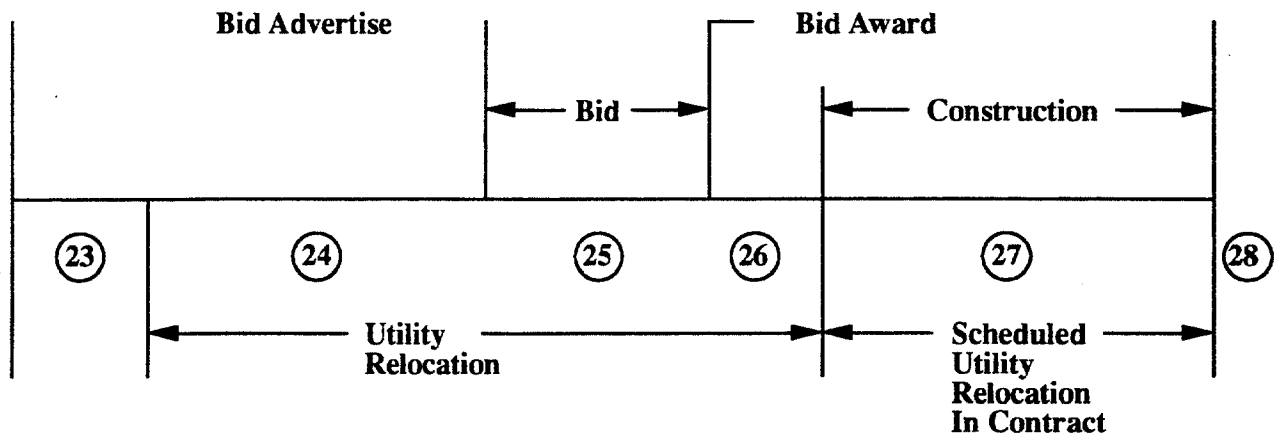


Figure 10-1. Utility Adjustment Time Schedule for Typical Interstate Highway ROW Project in Texas.

Source: Texas Department of Transportation.

Relocation & Construction Phase



Step

No. Description of Activity

- ②③ Pre-Relocation Conference
- ②④ Notification that Pre-Construction Relocations are Complete
- ②⑤ Pre-Bid Meeting
- ②⑥ Pre-Construction Conference
- ②⑦ Construction Progress Meetings
- ②⑧ Post Construction Meeting

Figure 10-2. Arizona Utilities Coordinating Committee:
Public Improvement Project Model.

Source: Central Arizona Coordinating Committee, *Public Improvement Project Guide*.

progress meetings as shown in Step 27. The agency, the highway contractor, and any utilities still involved in the construction at this point can use these meetings to resolve any remaining conflicts.

Post-Construction Conference

The agency reviews the entire project during the post-construction meeting in Step 28. During this meeting, it reviews the successful and

unsuccessful aspects of the project in order to change the overall procedure if necessary. Utilities may or may not be requested to attend this meeting. This meeting is another excellent opportunity to ensure that utilities have supplied as-built drawings to the highway agency.

Figure 10-2 is only one example of good practice; other plans may work just as well. Many of the steps shown in the figure may be eliminated, simplified, or enlarged depending upon the size of the project.

OTHER GOOD PRACTICES

In addition to the model highway/utility construction schedule presented in the previous section, several other practices may improve coordination between the highway agency and utilities and thus avoid construction delays.

PROJECT MASTER LISTS

Utilities benefit when they know the time frames for upcoming highway projects. If the highway agency makes lists of future highway projects available to the utilities, the utilities will be better able to meet relocation deadlines when they are announced. Several highway agencies make such lists available to utilities in monthly or quarterly reports. Dissemination of such lists works best when the lists are accurate and do not contain projects that are not likely to be initiated on the dates specified. If the master list is accurate, the highway agency will obtain increased credibility with the utilities, and the utilities will feel confident in making timely preparation for future projects.

RELOCATION PERFORMED BY HIGHWAY CONTRACTOR

In addition to the case where several utilities hire one contractor to perform all utility relocations, some or all relocations might be performed by the highway contractor. This type of arrangement works most easily for reimbursable projects (see Chapter 12 — *Relocation Reimbursement*). In this case, payment can be made directly from the highway agency to the contractor.

LOCATING ALL UTILITIES

Some of the most catastrophic events in construction take place when a utility or highway contractor strikes and breaks a utility line during excavation. These accidents can be drastically reduced if good locating practices are used before construction.

Subsurface Utility Engineering

As described in more detail in Chapter 4 — *Design*, subsurface utility engineering locates utilities with precision both vertically and horizontally during preconstruction. This procedure is currently practiced routinely by only a few agencies. However, it can reduce accidental utility breaks to almost zero by providing accurate information on the construction plans and is receiving widespread FHWA support.

One-Call Systems

Chapter 7 — *Notification* presents a detailed treatment of “one-call” or “call-before-you-dig” systems. These systems provide horizontal location of utilities and serve to check locations shown on the plans. “One-call” location of existing utilities is highly recommended before any construction excavation is performed.

UTILITY CONSTRUCTION METHODS

Due to the public nature of most utilities, utility relocation contractors are frequently selected on the basis of competitive bidding. On some occasions, the contract may be negotiated, e.g., emergency work or work for small, private utilities. The following list describes the methods most commonly used to perform relocation reconstruction work:

- (1) The relocation may be performed by a utility using its own forces and equipment (force account work);
- (2) A contract may be awarded by the utility or the highway agency to the lowest qualified bidder based on appropriate solicitation;

- (3) The highway agency may include the utility relocation work in the contract it lets for highway construction; and
- (4) The relocation may be performed under an existing continuing contract that the utility has with a contractor.

The selected method should conform to applicable State code and regulations, highway agency requirements, and the utility firm’s own policies. If the relocation is reimbursable, additional factors to consider are outlined in Chapter 12 — *Relocation Reimbursement*.

WORK ZONE TRAFFIC CONTROL

Companies that construct or relocate utilities within the highway ROW must give due regard to the safety of the general public. This includes providing traffic control within work areas. Traffic control devices appropriate to work zones include signs, pavement markings, channelizing

devices, lighting, signals, delineators, barricades, hand-signaling signs or flags, portable barriers, and other approved devices. These devices should not be used indiscriminately, and the utility should use the appropriate control device to send the right message to the motorist for

each application. Only those traffic control devices approved by the highway agency are allowed; utilities cannot fabricate their own special signs, markings, etc.

TRAFFIC CONTROL PLAN

A work zone traffic control plan (TCP) is a plan to guide drivers safely through a construction area. It is prepared by the utility for relocation, maintenance, or construction work to be performed on the highway ROW. On small utility construction projects, the TCP may be quite simple and may merely refer to typical applications. On a large project, the TCP may be quite detailed, and it might be entirely unique or combine elements of two or more typical applications. Judgment is needed in applying TCP guidelines to field conditions, and TCPs should be prepared by employees trained in the fundamentals of traffic control.

Traffic control plans are used whenever utility work will affect the free flow of traffic, such as when construction work takes place on or near the shoulder edge, on the median of a divided highway, or on the roadway itself. Plans must be based on the minimum requirements in FHWA's *Manual on Uniform Traffic Control Devices* (MUTCD). Many municipalities and highway agencies require that a TCP accompany permit applications for utility construction or relocation operations. The permit and the TCP must be approved before the utility can begin work. However, emergency repairs are often allowed to begin before filing a TCP. In emergency cases, the permit and accompanying TCP may be filed as soon as is practical.

APPLICABLE DOCUMENTS

A survey of the SHA's was performed in 1992 by the IRWA to determine how the States approach

traffic control for highway/utility work. Many States (e.g., North Carolina, Ohio, and Minnesota) and utilities such as Atlantic Electric publish pocket versions of their guides for easy reference at the construction site. These guides typically contain several applications from which an appropriate plan can be selected. Any State or local highway agency or utility that has not adopted a traffic control guide might find it prudent to do so.

Figures 10-3 through 10-5 are taken from the North Carolina *Work Zone Safety Guidelines*. That document is an excellent source of information concerning traffic control plans. It contains many useful figures, only three of which are presented here. Figure 10-3 defines the five parts of a traffic control zone and shows taper calculations. Figures 10-4 and 10-5 present typical applications for short-term work sites on low-traffic roadways. Those applications were specifically prepared for North Carolina and may not be applicable to other States.

TRAFFIC CONTROL DEVICES

The following are four types of traffic control devices used in work zone traffic control:

- Signs
- Channelizing Devices
- Lighting Devices
- Pavement Markings

The North Carolina *Work Zone Safety Guidelines* presents concise principles (not standards) of traffic control device use. The following information, with the exception of Figure 10-6 from the MUTCD, comes from that publication. Throughout the excerpt, the following conversion factors apply: 1 foot equals 0.305 meters and 1 mph equals 1.61 kph.

The traffic control zone is the distance between the first advance warning sign and the point beyond the work area where traffic is no longer affected.
Below is a diagram showing the five parts of a traffic control zone.

Taper Length Criteria for Work Zones	
Type of Taper	Taper Length
Merging Taper	L Minimum
Shoulder Taper	1/3 L Minimum
Two-way Traffic Taper	100 feet Maximum

Formulas for L

Speed Limit	Formula
40 MPH or Less	$L = \frac{WS^2}{60}$
45 MPH or Greater	$L = W \times S$

L = Taper Length in feet
W = Width of offset in feet
S = Posted speed or off-peak
85 percentile speed in MPH

Note: 1 m = 3.28 ft
1 mph = 1.61 kph

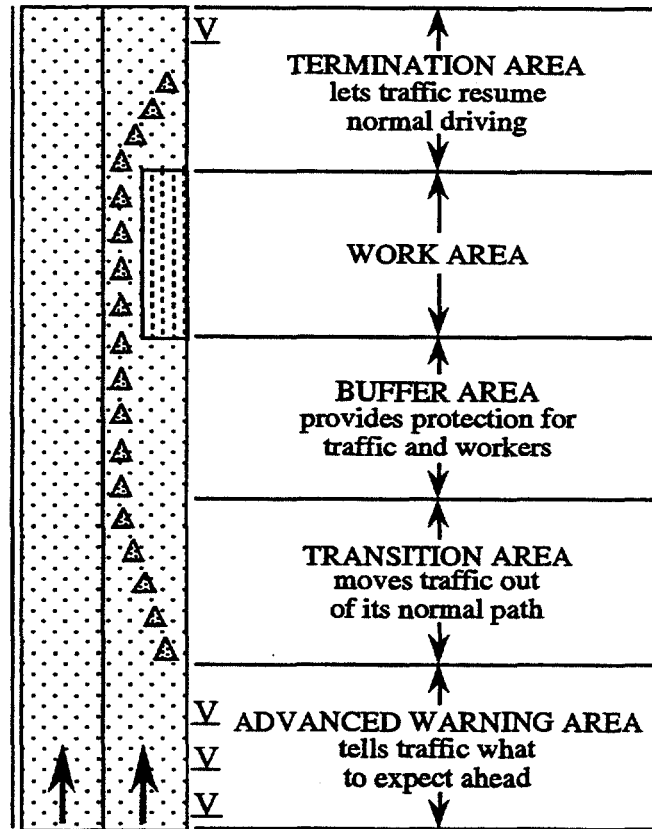
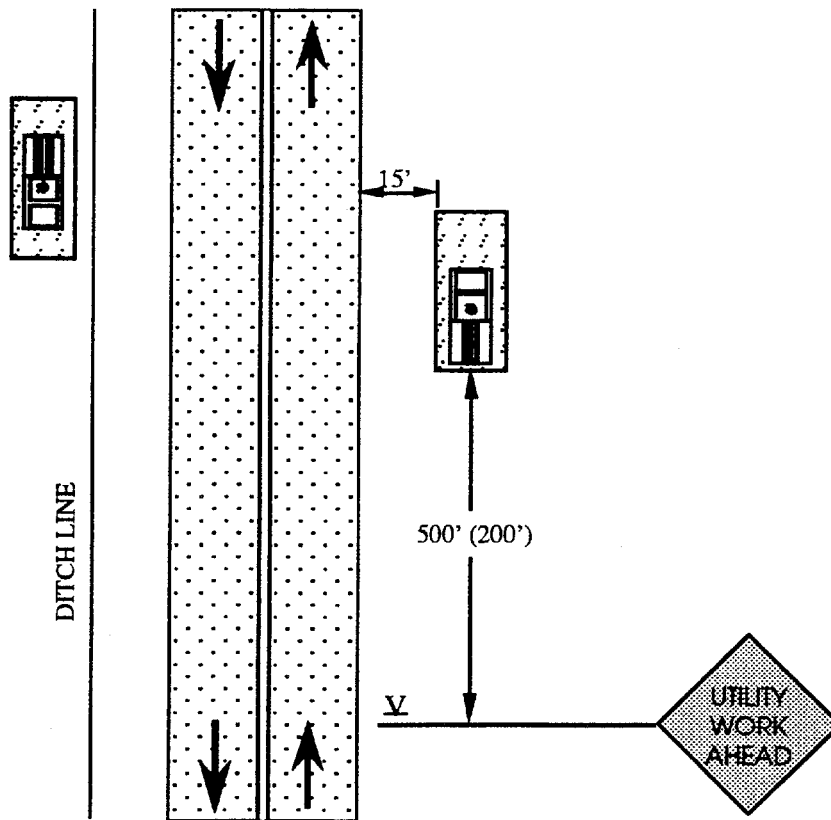


Figure 10-3. Five Parts of a Traffic Control Zone

Source: North Carolina *Work Zone Safety Guidelines for Municipalities, Utilities, and Contractors*



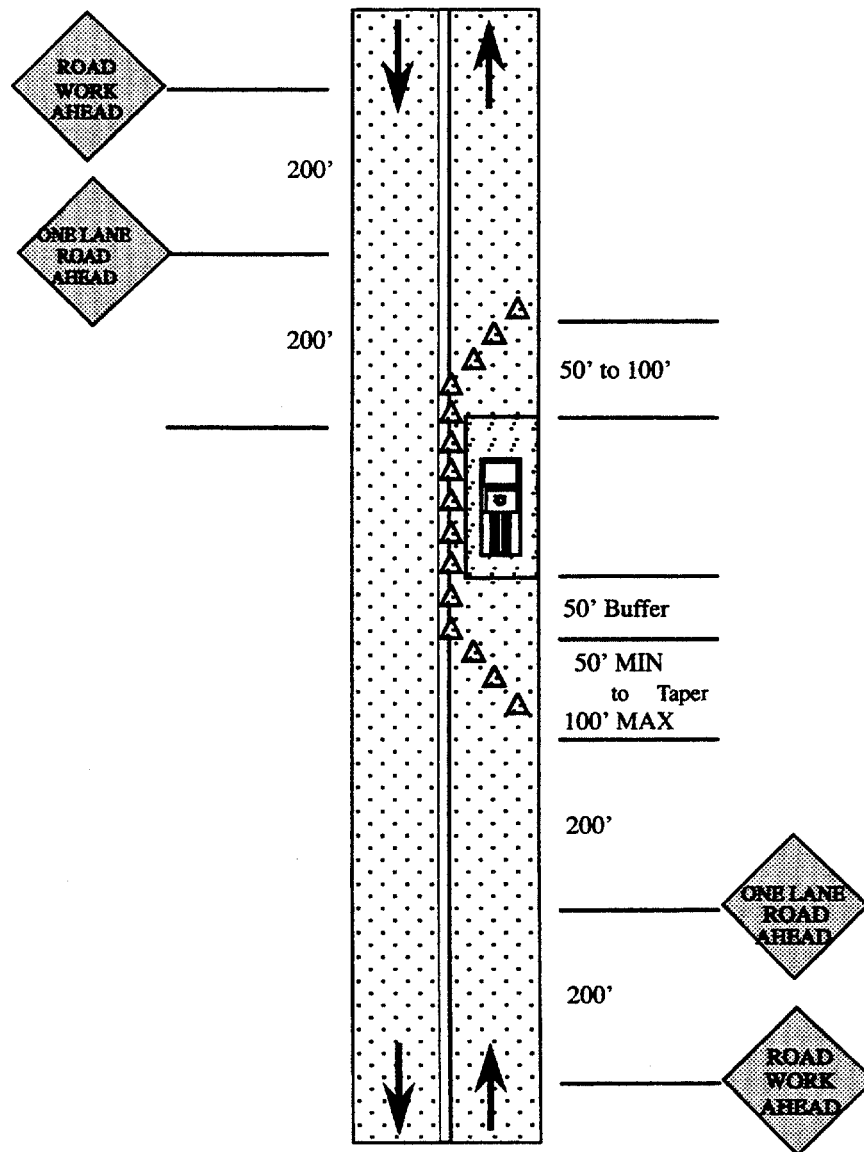
NOTES:

1. If vehicle and work activity are both outside the right-of-way, behind the ditchline, behind the guard rail, or 15' or more from the edge of any roadway, then only an activated flashing or revolving yellow light is needed.
2. For two-lane, low-speed (35 MPH or less) urban streets, a 200-foot sign spacing may be used.
3. An advance warning sign should be used if the work will be performed immediately adjacent to the shoulder, if equipment will cross or move along the roadway, or if the activity may distract motorists.
4. Other acceptable advance warning signs are those indicating shoulder work or road work ahead.

Figure 10-4. Work Outside the Shoulder (15' or More from the Edge of Pavement).

Source: North Carolina *Work Zone Safety Guidelines for Municipalities, Utilities, and Contractors.*

Note: 1 m = 3.28 ft
and 1 mph = 1.61 kph



NOTES:

1. This layout is only appropriate for low-volume, low-speed (35 MPH or less) streets, such as local residential streets. This procedure is not to be used in rural areas.
2. Traffic can regulate itself while volumes are low and the length of the work space is short, thus allowing traffic to readily see the roadway beyond.
3. Where traffic does not self-regulate effectively, use one or two flaggers.
4. A "Utility Work Ahead" sign may be used in place of the "Road Work Ahead" sign.

Figure 10-5. Lane Closure on a Minor Urban Street (No Flagger, Traffic Self-Regulating).

Source: North Carolina *Work Zone Safety Guidelines for Municipalities, Utilities, and Contractors.*

Note: 1 m = 3.28 ft
and 1 mph = 1.61 kph

Spacing of Advance Warning Signs

Sign Spacing (feet)	Area/Road Type		
	Two Lane Urban	Standard	Expressway/ Freeway
A	200	500	1,000
B	200	500	1,600
C	200	500	2,600

Signs

Signs used in work zone traffic control are classified as regulatory, guide, or warning. Regulatory signs impose legal restrictions and may not be used without permission. Guide signs commonly show destinations, directions, and distances. Warning signs give notice of conditions that are potentially hazardous to traffic.

Warning Signs

Construction and maintenance warning signs are used extensively in street and highway work zones. These signs are normally diamond shaped, with a black symbol or message on an orange background. As a general rule, these signs are located on the right-hand side of the street or highway.

Size — The standard size for advance warning signs in work zones is generally 48 by 48 inches. Where speeds and volumes are relatively low, a minimum size of 36 by 36 inches may be used (see Part VI of the MUTCD for specific sign sizes).

Mounting — Standards for height and lateral clearance of roadside signs are included in Part VI of the MUTCD. Signs mounted on barricades, or temporary

supports, may be at lower heights, but the bottom of the sign shall be not less than 1 foot above the pavement elevation. Higher mounting heights are, however, desirable.

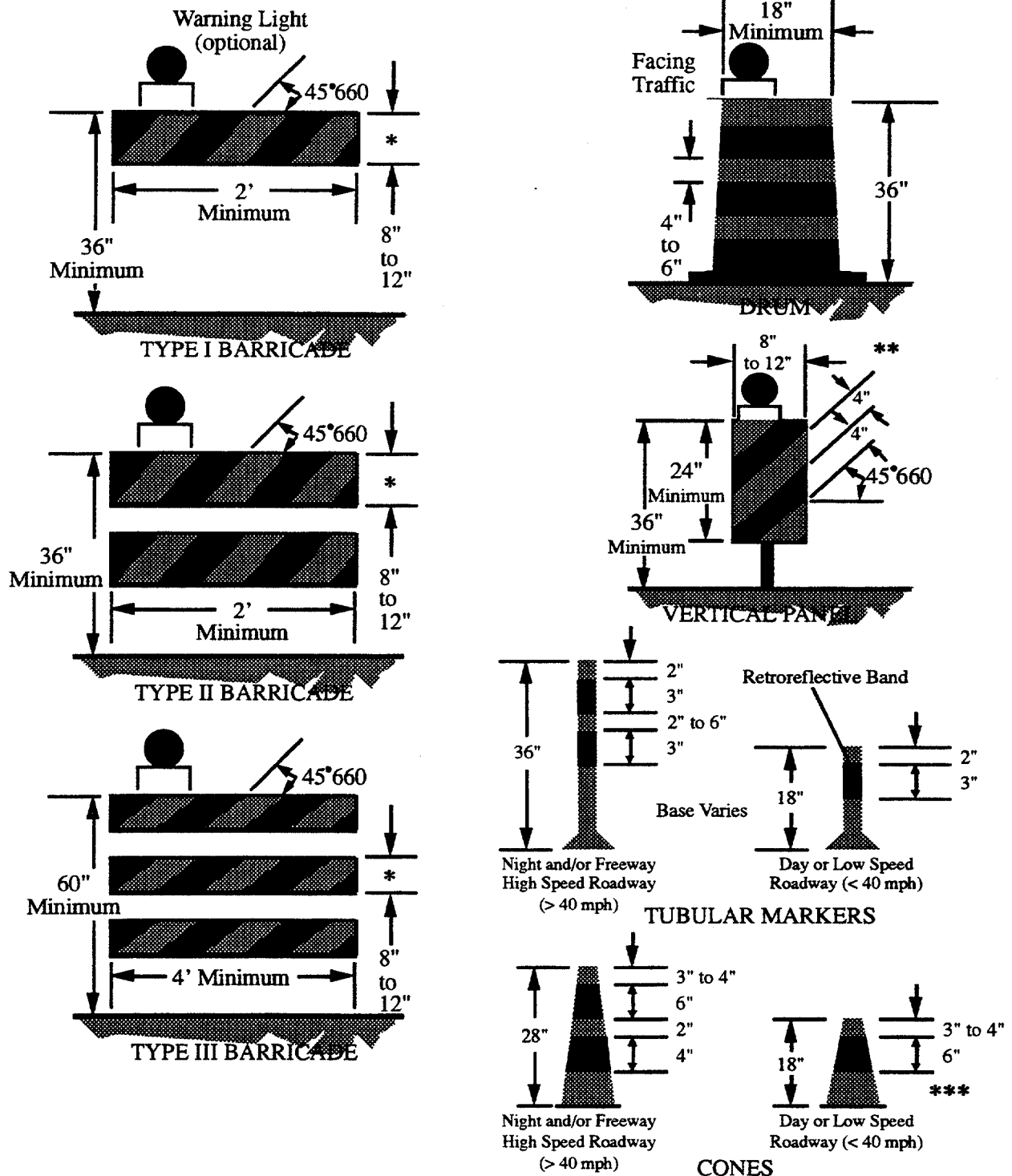
Illumination and Retroreflectorization All signs used during the hours of darkness shall be made of retroreflective material or illuminated. (Street or highway lighting is not regarded as meeting the requirements for sign illumination.)

Channelizing Devices

Channelizing devices (see Figure 10-6) are used to warn and alert drivers of hazards in work zones, protect workers, and guide and direct drivers past the hazards. Channelizing devices include cones, vertical panels, drums, barricades, and barriers. The most common channelizing device used in temporary work zones is the traffic cone.

Traffic Cones

Traffic cones must be orange in color and a minimum of 18 inches in height. Traffic cones used on freeways and other high-speed roadways and on all facilities during hours of darkness shall be a minimum of 28 inches in



*Nominal Lumber Dimensions Are Satisfactory for Barricade Rail Width Dimensions
 **Rail Stripe Widths Shall Be 6 Inches Except Where Rail Lengths Are Less than 36 Inches, then 4 Inch Wide Stripes May be Used.
 The Sides of Barricades Facing Traffic Shall Have Retroreflectorized Rail Faces
 ***Collars Are Optional on 18" Cones for Conspicuity Purposes.

Figure 10-6. Channelizing Devices.

Source: MUTCD, Part VI.

Note: 1 m = 39.4 in and 1 mph = 1.61 kph

height. Cones used at night shall be retro-reflectorized.

Spacing

Channelizing devices should be spaced so that they make it apparent that the roadway or work area is closed to traffic. There are several rules of thumb that can be used to guide you in the proper spacing of channelizing devices.

- (1) The maximum spacing between devices in a taper should be a distance, in feet, which is approximately equal to the speed limit in MPH. For example, if the taper is on a street with a 35 MPH speed limit, the devices should be spaced at about 35 feet.
- (2) All tapers should be made up of at least five channelizing devices.
- (3) The spacing between devices in a buffer or work area may be up to a distance, in feet, of two times the speed limit in MPH. For example, if the street has a speed limit of 35 MPH, the devices in the buffer and work area may be spaced up to 70 feet.
- (4) In urban areas shorter spacings between devices in the buffer and work areas may be more appropriate. For example, the spacing used in tapers could also be used in buffers and work areas.

Lighting Devices

Lighting devices for short-term construction and maintenance work zones are designed to supplement the signs and channelizing devices used in these zones. Typical lighting devices include warning lights, flashing vehicle lights, and flashing arrow panels. As a minimum, vehicles in work zones are recommended to display flashing lights.

TRAINING

Each person who directly affects safety in maintenance and construction work areas is encouraged to receive appropriate training. Some highway agencies have sponsored professional training courses in work zone traffic control. Utilities are urged to take advantage of offerings of such training courses.

Flagger Training

The MUTCD states that flaggers should be "adequately trained in safe traffic control practices." Flaggers are extremely important because they make the largest number of contacts with the public and because they hold the safety of motorists, pedestrians, and their fellow workers in their hands. A survey of utilities manuals and work zone traffic control manuals from a representative number of States indicates that many SHA's do not require such training. However, such training is strongly endorsed by this Guide. Virginia is a State that does require training. Flaggers are then certified, and only certified flaggers can work on Virginia projects.

While understanding that it does not take the place of a training course, the *North Carolina Work Zone Safety Guidelines* includes Figure 10-7, which illustrates proper flagging technique. Note the reflective vest on the flagger.

LIABILITY

Work zones are frequently the sites of accidents because such zones may violate the expectations of drivers. The highway agency, contractor, and utility may be liable for resulting damages if the TCP has not been properly designed and implemented. The *North Carolina Work Zone Safety*

Guidelines present a useful series of steps to help minimize such liability:

- Have a traffic control plan;
- Follow the MUTCD;
- Minimize traffic disruptions;
- Promptly remove devices when no longer needed;
- Train all personnel; and
- Inspect work zone sites periodically for conformance.

Tort liability is becoming a larger concern, especially for SHA's. Chapter 8 — *Legal Issues* of this Guide gives insight into the magnitude and growth of highway tort liability.

INSPECTION

Proper inspection and inventorying of work and the preparation of accurate daily records are necessities for any highway/utility construction or relocation project. These records are the documents from which invoices are prepared, verified for accuracy, and used to reimburse the utility. On Federal-aid projects, statutes require that payment of any invoice be based upon records of the contractor's work, and the importance of these records cannot be overemphasized.

There are often two inspectors at a highway/utility construction site: one inspector representing the utility and one representing the highway agency. The highway agency's inspector is present to safeguard the integrity of the roadway. For example, the inspector may wish to prevent a situation where guywires are installed in the clear zone. The utility's inspector is present to ensure that the installation is done in a safe, efficient, and reliable manner. On small jobs, a part-time or rotating inspector may be used, but he or she should visit each authorized location each day.

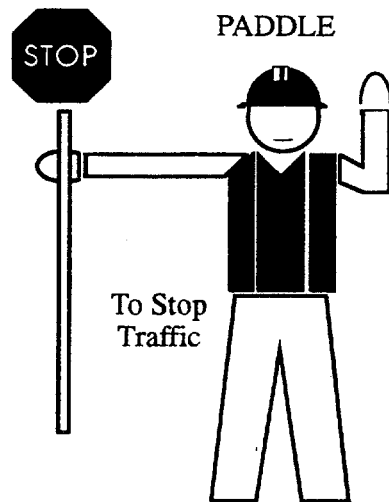
The *North Carolina Work Zone Safety Guidelines* present the following list of elements of a good inspection program:

- Routine schedule;
- Report form;
- Hazard identification;
- Adequate personnel and inventory;
- Repair verification; and
- Formal documentation.

Every element of good inspection is not expressed in the list, but new inspectors can use some or all the items to help them in their work.

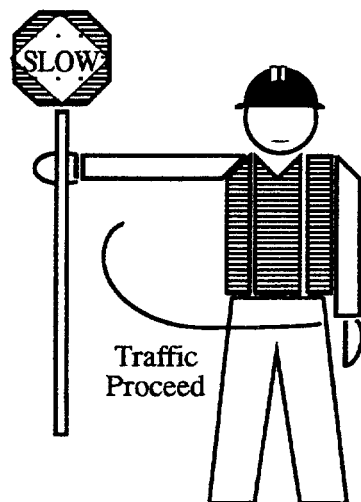
NAME AND ADDRESS

The utility should supply the highway agency with the name of its inspector, along with this person's address and telephone number. The utility should also supply the name, address, and 24-hour-a-day telephone number where a



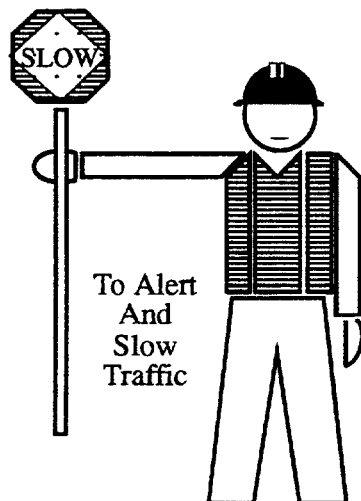
Properly Trained Flaggers

- clear message to drivers as shown
- allows distance for drivers to react
- coordinate with other flaggers



Properly Equipped Flaggers

- approved sign paddles
- approved safety vest
- reflective night equipment



Proper Flagging Stations

- good approach sight distance
- highly visible to traffic
- never stand in moving traffic lane

Proper Advance Warning Signs

- always use warning signs
- allow reaction distance from signs
- remove signs if not flagging

Figure 10-7. Flagging Procedures.

Source: North Carolina *Work Zone Safety Guidelines for Municipalities, Utilities, and Contractors*.

designated person may be reached in case of emergency. It is important that the utility and the highway agency exchange the names and telephone numbers of such contacts who can be reached at any hour of the day or night.

RECORDKEEPING

Both the utility and the highway agency are encouraged to review the construction work carefully and to keep accurate and timely records as construction activities occur. A helpful rule of thumb is to document every decision, and the facts that led to the decision, as if the inspector would be required to recall the facts five years and 40 jobs later.

On reimbursable work, the utility keeps records that show materials, labor, equipment, and incidentals applied during each construction day. These records will be used in preparing invoices to submit to the highway agency. The highway agency may or may not prescribe the format or content of the utility's daily records; if not, the following items are suggested as useful topics:

- (1) Start and end time of work;
- (2) Location of work;
- (3) Type, condition, and position of traffic control devices;
- (4) Weather conditions, including average temperature and amounts of precipitation;
- (5) A narrative description of work performed by the utility or the utility's contractor;
- (6) Conflicts, changes, problems, and instructions encountered during the day;
- (7) Periods of non-work;
- (8) Names of supervisors on the project;
- (9) Names of employees and the hours worked;

- (10) Type of work (e.g., force account, contract, or subcontract) and the hours worked;
- (11) Equipment used on the job by type and number of hours used;
- (12) Major materials consumed including quantity, size, and whether new, removed, salvaged, reused, or scrapped;
- (13) Notifications given to the highway agency's representative (by name);
- (14) Materials received and stockpiled for the project;
- (15) Actions by the highway agency, other utilities, or the highway contractor that might lead to delays in the progress of utility construction;
- (16) Damages incurred to utility facilities;
- (17) Photographs and descriptions of damages or unusual conditions, including traffic accidents;
- (18) Any unexpected conditions encountered during the construction project;
- (19) Oral instructions received from the highway agency, the highway contractor, or other officials; and
- (20) Circumstances or matters that may require further investigation, decisions, or documentation.

No list can cover all of the situations that may arise on a construction project, and the 20 items listed above may be expanded as desired.

COORDINATION

It is to the advantage of both the highway agency and the utility to compare and reconcile daily job records, to notify each other of expected difficulties, to investigate methods to save time or funds, and to pursue mutually the successful completion of the project.

FIELD CONFLICTS

In a highway construction/utility relocation project, illustrations of field conflicts include situations when two groups wish to work in the same construction area at the same time, when there is a failure to meet schedules, or when there are unapproved changes in work. For example, the highway contractor may wish to perform clearing and grubbing at the same time that a utility is still relocating its facilities in that area. Of course, many other types of conflicts occur.

PREVENTION

Field conflicts may occur even with the best of planning. In those cases, conflict identification and resolution will still be the responsibility of the highway agency project engineer or other designated representative. However, the following examples of good communication can help minimize the possibility of conflicts.

Schedule from Pre-Relocation Conference

If a plan similar to that shown in Figure 10-2 is followed, the utilities will supply relocation

schedules for work that must be performed during highway contractor construction. These schedules can be incorporated into the contract specifications and clearly spell out who has priority in the work area at any given time.

Pre-Construction Meeting

If a plan similar to that shown in Figure 10-2 is followed, the pre-construction meeting provides the opportunity to avoid field conflicts.

Construction Progress Meetings

Frequent construction progress meetings between the utilities and the highway contractor will be extremely beneficial in avoiding or resolving field conflicts.

In each of the examples just cited, a distinct advantage is provided merely because representatives of all involved parties know one another. This underscores the fact that all parties should provide one another with the names and 24-hour-a-day telephone numbers of each group's representative to this particular project.

CHANGES IN APPROVED WORK

A utility may wish to make changes in the approved work after a relocation has begun. For example, it may wish to use different materials or different amounts of materials, or place the materials in a different location than that specified in the permit.

If changes are desired, the highway agency would like to know as early as possible of any

such changes. Early notification reduces the overall delay and hassle in making the change. If notified early, the highway agency can either suggest alternatives or issue permission to make the change in the form of a change order, supplement to the contract, etc. Many SHA's require that utilities provide notification of the need for a change as soon as it becomes

apparent. This allows both parties to keep detailed records of materials and labor used in case the utility later requests additional reimbursement.

The utility may wish to make a change that involves "betterment" of its facilities. For example, the utility may wish to replace an existing 150 mm (6-inch) diameter pipeline with a 200 mm (8-inch) diameter pipe. If the relocation is a reimbursable one, the utility must understand that the proposed work change

includes betterment and the highway agency usually will not reimburse for the betterment (see Chapter 12 — *Relocation Reimbursement*).

Virtually all types of highway utility contracts, agreements, and permits (including TCP's) require highway agency approval. For minor changes, the approval may be simple or informal. For more complex changes, written submissions and detailed drawings may be required.

SUMMARY

This chapter has attempted to provide an overview of highway/utility interactions during construction and relocation of utilities. It has emphasized cooperation and coordination of efforts during pre-construction, construction, and inspection to avoid costly delays and conflicts.

The step-by-step coordination plan of the Arizona Utility Coordinating Committee has been presented as one method of ensuring good communications. Emphasis has been placed on planning and executing an effective traffic control plan for the construction zone.

REFERENCES

Central Arizona Coordinating Committee. *Public Improvement Project Guide*. November 1990.

Federal Highway Administration. *Manual on Uniform Traffic Control Devices for Streets and Highways*. FHWA-SA-89-006. 1988. Washington, DC.

University of North Carolina Institute for Transportation Research and Education. *Work Zone Safety Guidelines for Municipalities, Utilities, and Contractors*. January 1992.

CHAPTER ELEVEN

MAINTENANCE

INTRODUCTION

This chapter reviews typical operation and maintenance issues for highways and utilities. It discusses routine, preventive, and emergency maintenance. Practices pertaining to coordination and notification of work are presented.

Maintenance is an effort to preserve and repair facilities and their features so they function as designed. Maintenance is required to offset the effects of weather, vegetation growth, deterioration of the facility and associated structures, wear from use, accident damage, and vandalism. Good maintenance programs protect

investments made in public and private facilities.

A prime concern in maintenance activities is safety. Whenever work is done on or near the roadway, drivers are faced with changing and unexpected traffic conditions. These changes may be hazardous for drivers, workers, and pedestrians unless protective measures are taken. Since drivers do not make a distinction among construction, maintenance, or utility operations, proper traffic control and safety are needed for all types of work and work zones.

TYPES OF MAINTENANCE

Maintenance policies and procedures are intended to offset the effects of age, wear, loadings, and other various types of distress. The types of distress and corresponding maintenance methods are influenced by the type of structure, materials used, weather, and use. The range in these variables can be dramatic. The right combination of maintenance procedures, resources, and schedules can extend the useful life of a facility.

ROUTINE MAINTENANCE

Routine maintenance may be described as responsive maintenance. The need for maintenance

is observable, and action is required to avoid further deterioration of the facility or to return the facility to useful service. For streets, this includes patching surface holes, repairing edge failures, smoothing depressions and ruts, and other procedures that repair an undesirable surface condition. For a utility, routine maintenance may include changing bulbs in light fixtures or trimming trees that border utility poles and lines. Maintenance schedules usually consider routine maintenance, seasonal activities, or annual events. Seasonal weather variations directly affect the scheduling of maintenance work.

Maintenance managers try to ensure that activities are planned, scheduled, and coordinated.

ted. Higher productivity can be achieved with available resources when maintenance is scheduled and not done in response to accidents (which may be unavoidable) or the demands of another agency's last-minute needs (which may be avoidable with better communication).

PREVENTIVE MAINTENANCE

Preventive maintenance takes place before deterioration is obvious. Preventive maintenance prevents or reduces further deterioration by repairing small defects before they become large, such as resurfacing or overlaying a section of roadway when wear is evident but local failures are not apparent. Replacing oxidized bitumen in asphalt concrete pavements by surface treatments or slurry seal is a preventive operation when done before major deterioration sets in.

Preventive maintenance for a utility may include replacing or reinforcing facilities, such as utility poles or cables. These actions may be needed because the service life of the facility has been exceeded, maintenance costs are high, or additional capacity is required.

HIGHWAY MAINTENANCE

State highway agencies and local public works departments may be responsible for the operation of a wide range of facilities. Facilities for which highway agencies may conduct maintenance activities include pavements, shoulders, drainage facilities, bridges, tunnels, sidewalks, railroad crossings, fencing, traffic control devices, street lights, and landscaping. Activities conducted as part of operations or maintenance include pavement sealing, pothole repair, crack sealing, utility cuts, snow and ice control, mowing, street sweeping, ditch and catch

EMERGENCY MAINTENANCE

Emergency repairs are those actions in response to a sudden loss of service. This may be caused by accidents, storms, or other natural events. Prompt action is needed to protect utility employees or the public safety, or to mitigate damage to private or public property. Repairing broken utility poles (perhaps caused by automobile accidents, lightning, wind, or ice), cutting utility service in response to building fires, and repairing broken water mains are examples of emergency utility maintenance actions. For utilities in the public ROW, no prior notification is usually required in the event of emergencies. The permittee notifies the permitting agency of the location of the emergency and extent of work required by the most expeditious means of communication as soon as reasonably possible to do so. The permittee takes measures as required to protect the health and safety of the traveling public or public facility users for the duration of such emergency operations.

basin cleaning, and tree trimming or removal, to name but a few.

REQUIREMENTS OF A MAINTENANCE PROGRAM

Road and street maintenance requires establishing clear, sound policies to guide the responsible agency, others with facilities in the right-of-way, and citizens. The agency may adopt policies that assign maintenance

responsibilities, establish classifications for the roads and streets within the system, set levels of service by street classification, set response times for various types of maintenance needs, and establish personnel practices and work procedures for carrying out the program. Developing policies is a continuing and dynamic process, where policies and responsibilities are updated, revised, added, or deleted to fit changing community needs.

MAINTENANCE RESPONSIBILITIES

Maintenance responsibilities for roadways are usually dictated by both legal and practical considerations. Allocation of maintenance responsibilities among private property owners, maintenance agencies, utilities, and others should reflect the efficiencies to be achieved and the interests of the involved parties in the facilities to be maintained.

Pavements, curbs, gutters, inlets, catch basins, and drainage systems are usually maintained by the street maintenance agency when heavy equipment and work crews are available. Resurfacing, surface treatments, slurry seals, and similar production maintenance programs on pavements are usually the responsibility of the maintenance agency. They are often done under contract because material supplies, special equipment, and specialized crews are more practical for a contractor to provide than for a public agency engaged in a wide variety of maintenance activities.

Mowing grass in the ROW between curbs and sidewalks, and removal of snow from sidewalks and driveway entrances are usually the responsibility of the abutting property owners. Street lighting is installed and maintained by the electric utility company servicing the agency in about as many instances as it is owned and maintained by the maintenance agency. Traffic

signals and signal control systems are usually maintained by a special team in the highway department.

MAINTENANCE PRIORITIES

Assigning priorities in the street maintenance program is an important and sensitive area. Priorities are needed in most agencies because the limited funds available for maintenance are insufficient to meet all known needs. Also, diversion of funds to deal with emergency needs or budget shortfalls can force agencies to be selective in planning and performing maintenance. Budgets may be developed using past maintenance performance levels or needs based on established levels of service. Priorities are set considering a number of factors. Among the major factors that may be considered, either quantitatively or qualitatively, are

- Safety
 - Is the condition unsafe?
 - Will maintenance work improve safety?
- Serviceability
 - Is the level of service inadequate?
 - Will maintenance improve riding quality of the roadway?
- Structural adequacy
 - Is maintenance necessary to protect or correct the structural condition of the structure (pavement, bridge, etc.)?
 - Is failure imminent?
- Network integrity
 - Is this a critical link in the system?
 - Does it involve high volumes or limited access to portions of the community or emergency facilities?

- **Geographic/political balance**

Is the maintenance program balanced in its allocation of resources among various geographical and/or political subdivisions?

To aid in setting and evaluating priorities, streets are classified by their purpose and role in meeting the transportation needs of the community.

PERFORMANCE STANDARDS

Nearly all maintenance functions are performed as repetitive operations. These operations can be defined and examined to determine the best procedure and its associated requirements in resources (personnel, equipment, time). This adopted maintenance practice becomes a benchmark for determining maintenance needs and monitoring performance. These standards are a guideline for managing maintenance operations that may be augmented by particular field conditions, crew and equipment availability, and other program demands.

Performance standards define the methods (specifications, equipment, and procedures) for preventive maintenance or repair and indicate the time and quantities to complete a unit of work. These standards for performing maintenance are driven by an adopted quality standard that defines the physical conditions indicating a need for maintenance and the characteristics of the completed work. Quality standards are used to ensure that maintenance work conducted by a large, geographically dispersed organization and conducted in a consistent, timely, professional manner.

Levels of service may be established to which facilities are to be maintained. This could translate into how frequently pavements are patched, catch basins cleaned, or street gutters swept. Levels of service are usually established

for each classification of road or street to best reflect the level required for that class of street to serve its intended function.

PERFORMING MAINTENANCE WORK

Several options are used by public agencies to conduct maintenance work. It may be done entirely by agency employees hired and assigned to the maintenance division. In some circumstances this is called "force account" work. Activities may be contracted to one or more private firms. A third alternative is to use rental equipment with operators furnished to undertake special projects. Variations and combinations of these methods are widely used.

Organizations that have infrastructure spread over a large geographic area (such as an SHA or large utility company) typically organize their maintenance forces by geographic region or districts, and not by function, because of the travel distances to work sites. Maintenance crews thus have a versatile range of talents to deal with the breadth of functions they may perform. Activities requiring special skills or equipment may be done by special crews or under contract.

The demands of the maintenance manager's job are increasing with the number of new requirements and issues associated with today's infrastructure. More sophisticated equipment (traffic control devices, telecommunications, etc.), mechanized equipment with greater capabilities and cost, new materials and techniques, increased training and safety requirements, ecological and aesthetic concerns, budget restraints, and tort liability are among the issues that affect the conduct of maintenance operations.

A good practice is to have highway maintenance personnel participate in the development of new projects. They may provide insight that will ensure that the constructed

project is maintainable in a safe and efficient manner. Maintenance personnel may also help identify and minimize high maintenance cost items.

MAINTENANCE RECORDS

Records are usually kept of maintenance work. Records may serve a number of functions, including

- Historical account of operations.
- Account of regular and special expenditures as a basis for developing future budgets.
- Current record to establish cost/performance relationships.

- Inventory condition information.
- Source of management information (trends, costs, needs, etc.).
- Source of information for public relations, progress reports, accomplishments, etc.

A reporting method to account for labor spent, use of equipment, and expenditure of material is basic to a management system. Using these elements efficiently is the goal of the maintenance manager as he/she assesses needs, prepares budgets, assigns work, and monitors and records progress. The end result of all of these steps is to see that the crew, materials, and equipment are available and assigned to meet the most pressing maintenance problems.

UTILITY MAINTENANCE

The variety in utilities in the public ROW brings with it a variety of maintenance requirements and procedures. Maintenance activities by utilities may require access to underground facilities by excavation or other use of travel lanes or by use of ROW abutting travel lanes. Maintenance activities conducted by utilities may range from visual surveys of facility condition, to tree trimming, to major excavations.

A use-and-occupancy permit may authorize utilities to conduct minor maintenance work in the public ROW. This typically involves minimal risk or delay to traffic and no interference with the property and rights of other permittees. Major maintenance activities, or ones that require excavation in the ROW, may require a special permit and usually require advance notice to the permitting agency before doing any work.

Work on utility facilities may be performed by in-house crews or by a contractor. For utilities with large networks, maintenance programs may be organized within districts. Maintenance work requiring specialized skills or equipment may be conducted by a crew that travels to all districts.

ACCESS

An important consideration in utility maintenance is, obviously enough, access. Finding and getting to the utility facility in need of maintenance can be a project in itself. Whether the utility is placed overhead or buried, special equipment and sometimes elaborate procedures are needed to safely conduct necessary work. Agreements that allow the utility to be located in the ROW often specify requirements and procedures for gaining access

to those facilities for maintenance. Special consideration is given to access that requires excavation or work in the ROW of limited access highways.

Maintenance of underground utility facilities may require efforts to identify and locate other

utility facilities as described in Chapter 7 — *Notification*. Use of the one-call center to check for other facilities in the area is a good practice, and required in a number of States prior to any excavations.

MAINTENANCE REQUIREMENTS IN THE ROW

Agencies that regulate use of the public ROW often specify requirements or provisions to perform routine or emergency maintenance on facilities in the ROW. Many times these provisions are summarized on the permit form. See Chapter 5 — *Permits* for a further discussion on permit practices.

Typical requirements for work in the ROW include obtaining appropriate permits and keeping them on the worksite, giving notice in advance of work, and using approved specifications for materials and procedures in the ROW. Permit provisions may also address OSHA requirements for trenching and shoring, replacing trees and shrubbery, grassing and mulching operations, and trimming trees.

The Utility Manual for the Colorado Department of Highways identifies general requirements for operation and maintenance. These requirements are summarized below:

- All repair, maintenance, reconstruction, relocation, and removal of utility facilities are to be accomplished with the least interference with normal operations and maintenance of the highway.
- The utility maintains at its sole expense the installations in the ROW.
- Routine, periodic maintenance addressed in the original use and occupancy agreement may be performed without notification.

- Extensive revisions, relocation, additions, excavation, impedance of traffic, or other disturbance of the public ROW requires a new or revised permit.
- Access to utility facilities in freeway medians or interchange areas requires approval.
- Specific written approval is required for any spraying, cutting, or trimming of trees or other landscape elements.
- Emergency repairs to protect the safety of the public may be performed immediately, with formal written notification provided after the fact.
- Utilities and district SHA staff should maintain continual liaison on matters concerning emergency procedures, correctable hazards, altered conditions of occupancy, and plans for future adjustment of highway or utility facilities.

NOTIFICATION

As noted in Chapter 7 — *Notification*, requirements for utilities to provide notification of proposed work in the ROW vary. For work in the public ROW, the highway department or other regulating agency is typically notified before any movement or removal of earth or pavement. Notifications may be required for

other agencies concerning environmental sensitivities, blasting, or job injuries.

A good practice is for the highway agency to notify the utility before it undertakes significant maintenance work in the ROW. This coordination is discussed in Chapter 3 — *Planning and Coordination*. Communication of

this nature may eliminate unnecessary excavations or project delays. It may also provide an opportunity for the utility to inspect and service its facilities before or in conjunction with the highway project. And it can be accomplished with relatively modest efforts, such as sharing project schedules.

TRAFFIC CONTROL DURING MAINTENANCE

The importance of effective work zone traffic control has been discussed earlier in this Guide. Chapter 4 — *Design* discussed the development of traffic control plans during the design process, and Chapter 10 — *Construction* provided information on traffic control devices and some typical applications. This section reviews some of the considerations for traffic control during maintenance, specifically for short-term operations.

Traffic control for utility work is very similar to that for highway work. The main difference is that most utility work is of short duration and performed during daylight hours. The crew size for utility work is usually small, and only a few vehicles are normally involved. Consequently, the number and types of traffic control devices needed in the work zone may be minimal in some instances.

Utility work on or near a highway usually consists of emergency operations, routine maintenance, new utility construction, or adjustments to existing facilities. Traffic control should be appropriate for the nature, location, and duration of the work; the type of roadway; the traffic volume and speed; and the potential hazard. Emergency utility operations and routine maintenance are discussed in this chapter. New utility construction and

adjustments to existing facilities are discussed in Chapter 10 — *Construction*.

EMERGENCY UTILITY OPERATIONS

Emergency utility operations may be caused by storm damage or by a traffic accident. This may happen anytime and involve disruption of services to customers. The work operation usually involves a small crew, one work vehicle, and a short period of time.

The work vehicle responding to emergency utility situations usually is equipped with adequate traffic control devices, such as a yellow flashing light and/or other special high-visibility lighting units, a limited number of portable signs and channelizing devices in good condition, and equipment for flaggers in the event they are needed. Because of the urgent nature of the work, traffic control devices used during emergency operations may sometimes be less than would be needed for longer-term construction or maintenance operations. Even so, sufficient provisions must be made for the safety of pedestrians, motorists, and workers.

A good practice is to prepare standardized traffic control plans in advance for typical emergency situations. Provisions of these plans

can be implemented by the work crew upon reaching the site.

ROUTINE MAINTENANCE

Routine maintenance may involve long-term, short-term, or short duration utility operations. Long-term operations last several days or more and may be conducted during the day or night. Short-term operations typically take less than one period of daylight and are not performed at night. Short-duration utility operations typically involve short stops of about one hour or less, one work vehicle, and a one or two-worker crew.

OTHER CONSIDERATIONS

The number and types of traffic control devices used during short-term and short-duration maintenance operations may be less than would be needed for long-term operations. Any reduction in the number of traffic control devices is normally offset by the use of high-visibility devices, such as special lighting units on work vehicles. Work vehicles should be located as far from the travel way as possible. If needed on or near the roadway, the vehicle should be equipped with yellow flashing lights and/or other special high-visibility lighting units visible from all directions. Reflectorized signs and channelizing devices are required if work is performed at night.

At any and all open-cut crossings, having a minimum of one-way traffic maintained during the daylight hours and two-way traffic at night is desirable. Traffic detours should be restricted

to the limits of the public ROW with flagmen and marking devices as needed. Detour of traffic outside of the ROW may be an option, but it usually requires approval of the appropriate governmental agencies.

TYPICAL WORK ZONE LAYOUTS

Standard procedures and diagrams for work zone traffic control may be developed for generally occurring conditions. These procedures may be customized or augmented as needed to address varying conditions in the work site.

Some SHA's have prepared guidance materials for work zone traffic control that provide standardized diagrams. A survey of SHA's indicated that about half had such plans for highway utility work. The Oregon State Highway Division has prepared such a booklet, entitled *Signing and Flagging Standards for Short-Term Work Zones*. This publication provides diagrams for signing and flagging procedures most often used in utility activities. These diagrams cover short-term stationary, mobile, moving, and emergency conditions.

A pocket size booklet, *Work Area Protection: Guidelines for Public Utilities*, was prepared by the Ohio utility industry, the Ohio County Engineers Association, the Institute of Transportation Engineers, and the International Right of Way Association. This concise manual was developed to comply with the MUTCD and provides principles and guidelines on the design, application, installation, and maintenance of traffic control devices required for public utility work.

MAINTENANCE AND DAMAGE PREVENTION

As the amount of underground facilities has increased, so has the need for extra effort and care in conducting maintenance or construction work in the public ROW. One of the reasons for moving facilities such as telephone and electric from aerial locations to underground was to avoid failures caused by storm damage, fires, and vehicle pole accidents.

The greatest hazard to buried facilities is accidental dig-ups. A number of programs have evolved over the years to reduce this hazard and prevent damage to underground facilities. State damage prevention laws have been enacted, one-call centers established, utility location and coordination councils formed, and a uniform color code for temporary marking of underground facilities adopted. Owners/operators of underground facilities and excavators have basic responsibilities to promote damage prevention. Following is a summary of these responsibilities:

Excavators

- Notify one-call center in advance of work in accordance with local regulations.
- Meet with owner's field representative, if necessary.
- Look for, observe, and preserve markings.

- Excavate in a careful and prudent manner and in accordance with local regulations.
- Notify facility owner immediately of any damage to facility, coating, or special backfill do not cover up.

Facility Owners

- Actively participate in the local one-call center.
- Respond to notices in a timely manner in accordance with one-call center guidelines and local regulations.
- Properly mark facility location in accordance with local regulations.
- Honor all field meeting appointments with excavators.
- Respond promptly to calls for assistance or information.

Other actions by excavators include backfilling with care; reporting unknown facilities that are found during excavation; ensuring that equipment operators are knowledgeable of color codes for marking underground facilities, tolerance zones and other safety precautions; and maintaining liaison with contractors' associations, utility location and coordination committees, and government agencies.

SUMMARY

This chapter has briefly reviewed basic issues of highway and utility maintenance operations. As in previous chapters, a common theme is the need for communication and coordination between highway agencies and utilities.

Whether scheduling maintenance work or setting up work zone traffic control, planning and communication at the front end of a project can avoid serious problems later in the project.

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CHAPTER TWELVE

RELOCATION REIMBURSEMENT

INTRODUCTION

Relocation reimbursement may be the most controversial subject in this *Guide*. The subject is complicated by the fact that it involves significant amounts of money. The reimbursement question is further clouded because reimbursement policies vary from State to State and from locality to locality. In some States, large utility companies are rarely reimbursed for relocations. Payment may take a long time. Because different States have different policies, a single utility company may be treated differently in different States. Federal policies may provide for relocation reimbursements on Federal-aid projects when State policies prohibit reimbursement, in which case reimbursement will not be made.

This chapter provides an overview of highway/utility relocation reimbursement policies and offers references to other sources.

DEFINITIONS

Utility

In this *Guide*, "utility" holds the same definition as that given by Part 645, Subpart A of Title 23 of the Code of Federal Regulations (23 CFR 645A):

utility is a privately, publicly, or cooperatively owned line, facility, or system

for producing, transmitting or distributing communications, cable television, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, stormwater 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.

Such utilities may involve underground, surface, or overhead facilities, either singly or in combination.

Relocation

Under the practice of jointly using a common ROW, highway and utility officials have two broad areas of concern. The first is the relocation, replacement, or adjustment of utility facilities that fall into the path of a proposed highway improvement project. This is commonly referred to as a utility *relocation*. Relocation includes removing and reinstalling the facility, including necessary temporary facilities; acquiring necessary ROW on the new location; moving, rearranging, or changing the type of existing facilities; and taking any necessary safety and protective measures. A utility may be eligible for reimbursement for such a relocation. This chapter outlines relocation situations that are reimbursable and those that are not.

Accommodation

The second major area of concern is the initial installation of utility facilities along or across a highway ROW with the intent that they will occupy and jointly use this ROW. This area is commonly referred to as utility *accommodation*. The initial installation of utility facilities is not a reimbursable situation except at certain times when the initial installation coincides with a highway project. For example, when a new utility installation is planned for construction on the proposed ROW of a planned highway project, the utility facility may need to be installed in a manner that meets requirements of the planned highway project. In that case, additional costs to the utility to meet those requirements may be eligible for reimbursement.

SHA and HA

A *State highway agency* is defined as the highway agency of one of the 50 States, the District of Columbia, or Puerto Rico. A *highway agency* (HA) is defined as the department, commission, board, or official agency of any of the aforementioned governmental units or of any political subdivision thereof, charged by its law with the responsibility for highway administration.

FEDERAL POLICY OVERVIEW

Relocation reimbursement is largely driven by Federal policies, because much relocation reimbursement is associated with Federal-aid highway projects. State reimbursement policies are also important and are addressed in this Guide, but policies of smaller units of government are too diverse to be treated here.

Federal funds are channeled to all State and local Federal-aid highway projects through the

SHA. Federal relocation reimbursement policy is founded on several basic principles:

- (1) It provides reimbursement funds only for work performed after the date the FHWA has authorized the SHA to proceed with relocation of the utility's facilities.
- (2) It provides reimbursement funds for eligible costs directly related to utility relocation work required for a Federal-aid highway project. Additionally, it may participate in projects that implement safety measures to correct utility roadside hazards.
- (3) Its intent in relocation is to restore the utility to a functional capacity equivalent to that in place before the relocation. Reimbursement consists of the actual cost of relocation minus any increase in value of the new facility and any salvage derived from the old facility.
- (4) It provides reimbursement funds in the same proportion (*pro rata* share) that Federal funds participate in the projects.
- (5) For State highway agency projects, it will only reimburse costs when the State has the authority to pay for utility relocations. If State and Federal reimbursement policies conflict, the stricter of the two policies prevails. For example, if State policies allow reimbursement and Federal policies do not, reimbursement is not made for that particular case. If the project is purely a local one — not on the State's road system — it is eligible for Federal participation if either the SHA or the local highway agency has a

legal basis for making the reimbursement and basic eligibility criteria have been met.

- (6) It provides funds only after the State or applicable local governmental unit first pays the cost from its own funds.

HISTORICAL PERSPECTIVE

The historical Federal perspective of relocation reimbursement is presented in Chapter 2 — *Historical Perspective*, which describes the rapid rise in utility relocation reimbursement since the 1944 and 1956 Highway Acts made substantial amounts of Federal funds available for highway construction. For expanded information on this

subject and for a general treatment of States' responses to developing Federal policy, see the FHWA document, *Utility Relocation and Readjustment Accommodation: A History of Federal Policy Under the Federal-aid Program, Part I; Utility Relocation*.

CODES, REGULATIONS, AND POLICIES

Regulations relative to Federal-aid utility relocation reimbursement have been developed and are contained in 23 CFR 645A. Much of the remainder of this chapter will be devoted to listing and clarifying those regulations. An excellent source for further explanation of the regulations may be found in FHWA's *Program Guide, Utility Adjustments and Accommodations on Federal-aid Highway Projects*.

As stated previously, State or local regulations providing for reimbursement must be in place before Federal funds may be used for relocation reimbursement. Table 12-1, at the

end of this chapter, was formulated to provide a reference for locating information concerning State statutes. It lists statutes and the type of highway projects to which they pertain. For full information, interested parties are advised to obtain the actual statutes themselves. Table 12-1 is based on a national survey conducted in 1992 by the International Right-of-Way Association.

Local statutes are far too numerous to be addressed in a similar manner, so they are not covered here.

REIMBURSABLE VERSUS NON-REIMBURSABLE PROJECTS

The rules for determining which relocations are reimbursable are usually different at the Federal, State, and local levels. This portion of the chapter describes both Federal and State eligibility requirements. Local eligibility policies are not directly addressed because they are so

diverse; however, they may be as broad as those of the States.

An important point to remember is that if two or more reimbursement policies conflict, the stricter of the two policies is followed on Federal-aid projects. For example, Federal policy allows

reimbursement for preliminary engineering. If the State (or local) policy does not allow reimbursement for preliminary engineering, then Federal funds will not participate in that portion of the relocation. However, Federal funds will participate in items which Federal and State policies agree are eligible.

FEDERAL POLICIES

Federal eligibility requirements are set forth in 23 CFR 645A. If any of the three following basic criteria are met on a Federal-aid project, the relocation meets Federal guidelines for reimbursement:

- (1) The utility has a property interest (for example, ownership or an easement) in the land that it occupies before the relocation.
- (2) The utility occupies privately or publicly owned land, including public road or street ROW, and the HA has a legal basis for making the reimbursement.
- (3) The utility occupies publicly owned land, including public road and street ROW, and is owned by a public agency or political subdivision of the State, and is not required by law or agreement to move at its own expense, and the HA has a legal basis for making the reimbursement.

Federal funds are also available for use on Federal-aid system projects that implement safety corrective measures to reduce the roadside hazards of utility facilities to highway users.

STATE POLICIES

State (and local) policies can address relocation on both Federal-aid and non-Federal-aid projects. For Federal-aid projects, the stricter of the State and Federal policies determines if reimbursement is made. If the project is not a Federal-aid project, then the State policies prevail, and the Federal government is not involved.

Most States have statutory authority to pay for relocation costs. Table 12-1 lists States and their applicable statutes. The statutes are highly variable. To illustrate that point, excerpts from two State highway/utility manuals are used. The first is from the Alabama Highway Department *Utility Manual*, and describes several types of eligible projects:

Private Row. If a utility is located on its own existing private ROW, the utility is automatically eligible for reimbursement for utility facility relocation. The reimbursement includes both relocation costs and payment for new private ROW unless relocated to public ROW. If the utility moves to public ROW and is required to relocate again, the new private ROW, if required, would be at the Department's expense.

Interstate Projects. Any relocation of utility facilities required by the Department in relation to an interstate highway project is eligible for reimbursement.

Federal-Aid Projects. Utility relocation required by the Department on

highway projects receiving any Federal participation (with the exception of the interstate system) is eligible for reimbursement if the gross receipts of the utility involved are less than \$50 million annually.

State Projects. To be eligible for utility reimbursement on State-financed highway projects, the utility involved must be certified by the Department's External Audit Section to be a "pauper." The utility must file a variance request (§ 2.28 of Alabama Utility Manual), must undergo a financial audit, and must otherwise demonstrate that it is economically unable to provide relocation of its facilities before it can be certified as a pauper.

Land Owned by Utilities. On all projects, State or Federal, where the utility facilities are located on utility property or on land where the utility has property rights, the utility is eligible for reimbursement.

Further Information. For further information concerning reimbursements, see Section 23-1-5, Code of Alabama, 1975, as amended.

As indicated above, Alabama reimburses relocations for interstate construction, where the utility has a property interest, and on a significant portion of Federal-aid projects. However, Alabama reimburses relocations much less frequently on State projects. Several States have these types of reimbursement standards to conserve their funds; they do not reimburse some relocation projects for which they will not be significantly reimbursed in turn by the FHWA. In contrast, New Jersey participates in relocations for far more projects as indicated by the following excerpt from a NJDOT document:

Since 1983, with the passage of NJSA 27:7-44.9, the utility reimbursement statute, the State of New Jersey has been required to pay utility companies for any facility relocation required as a result of a Department construction project. The relocation costs account for approximately 10% of the Department's construction program or nearly \$50 million annually.

It is important for all parties concerned in reimbursement issues to be aware of the particular statutes that apply in the State (or locality, if the project is purely a local one).

REIMBURSABLE AMOUNT

State, Federal, and local policies may not only differ on the general eligibility of a relocation project, they may also disagree on the methods by which the reimbursable amount is calculated.

This portion of the chapter will focus on Federal requirements in this area. State and local requirements may be different from Federal requirements, but the issues are similar.

CALCULATION PROCEDURES

The work-order accounting procedure is the cost accounting method preferred by the FHWA. In general, Federal reimbursement will be limited to eligible costs recorded by the utility in such a format.

A lump-sum payment method may alternatively be used if approved by the HA and the FHWA. This cost development procedure will be discussed further under the "Payment Procedures" section of this chapter. Other cost accounting procedures may be used if jointly approved by the HA and the FHWA.

CREDITS TO AGENCIES

The objective of Federal reimbursement policies is to restore the utility facility to a functional capacity equivalent to that in place before the relocation. If the facility is improved (bettered) during the relocation or if the utility salvages material during the relocation, the relocation project is credited with those costs. The following sections describe several of these credits.

Betterment

Federal policy will not reimburse for betterment of a facility. Betterment is any upgrading of the facility being relocated that is not attributable to the highway construction and is made solely for the benefit of and at the election of the utility. An example of betterment is the increase in cost between replacing a 150 mm (6 inch) pipeline with a 200 mm (8 inch) pipeline.

Temporary Utility Relocation

Sometimes a temporary utility facility may be constructed while the relocation effort is in progress. Under Federal policy, materials recovered from temporary use during the relocation and accepted for re-use by the utility are credited to the project. The credit is calculated by subtracting 10 percent from the prices charged to the job, which accounts for the material value lost during its temporary use. Materials used temporarily and then not accepted for reuse by the utility are sold to the highest bidder, and the funds generated are credited to the project.

Salvage Value

Equipment and material may be salvaged from the existing utility facility and not incorporated in the relocated facility. The salvage value of that equipment and material is credited to the relocation project. Materials recovered from the existing facility that are accepted for return to the utility's stock are to be credited to the project at the current stock prices for such used materials. Materials and equipment recovered and not accepted for re-use by the utility are sold to the highest bidder, and the amount is credited to the project.

Abandoned in Place

If material and equipment from the existing utility facility are abandoned in place, no credit is given to the relocation project. When the

utility facilities can be abandoned in place, but the utility or highway constructor elects to remove and recover the materials, Federal funds do not participate in removal costs that exceed the value of the materials recovered. The value of the salvaged material is credited to the project.

Accrued Depreciation

Accrued depreciation (also called expired service life credit) is a credit to the relocation project that takes into account the fact that existing old utility facilities are being replaced with new ones. The project is credited for the relocation of such major operational facilities as buildings, pumping stations, filtration plants, power plants,

substations, or any other similar operational unit. An accrued depreciation credit is not taken for any segment of a utility's service, distribution, or transmission lines, regardless of the length of line involved. The *Program Guide* supplies the following example for the calculation of such credits:

The original cost of a pumping substation in 1975 was \$80,000, and the original facility was expected to have a service life of 40 years. The facility is replaced in 1990 as part of a utility adjustment on a Federal-aid project. The original facility has served only 15 of the expected 40 years. The accrued depreciation credit amounts to $15/40 \times \$80,000 = \$30,000$.

PARTIES ELIGIBLE FOR REIMBURSEMENT

The FHWA and the SHA's generally distribute relocation reimbursement funds in the same fashion: they deal with only one group, and they avoid the added trouble and paperwork associated with dealing with subcontractors. For example, by law the FHWA reimburses only the SHA; it does not reimburse the utility, the utility's contractor, or any local HA that is included in a utility relocation project.

In a similar way, the SHA generally reimburses only one group, and that group is responsible for paying engineers, material suppliers, subcontractors, etc., who take part in the relocation. If the relocation is purely a local one (off the State's road system), the SHA passes along Federal reimbursement funds to the local HA.

Chapter 10 described the methods most used to perform the relocation reconstruction work. They are repeated here:

- (1) The relocation may be performed by a utility using its own forces and equipment (force account work).
- (2) A contract may be awarded by the utility or the HA to the lowest qualified bidder based on appropriate solicitation.
- (3) The HA may include the utility relocation work in the contract it lets for highway construction.
- (4) The relocation may be performed under an existing continuing contract which the utility has with a contractor.

PAYMENT PROCEDURES

The utility is reimbursed for eligible relocation costs by the HA. For Federal-aid projects, the Federal share of the relocation costs is later reimbursed to the HA through the SHA.

AGREEMENT AND ACCOUNTING PROCEDURES

For Federal-aid relocation projects, a written agreement between the utility and the HA is required that sets forth the responsibilities for financing and accomplishing the relocation work. The agreement must incorporate 23 CFR 645A by reference, must specify the type of contract or force account method used to perform the work, and must give the method to be used for developing relocation costs. The preferred cost development methods are the work-order method described earlier and the lump-sum method (to be described later in this chapter). The *Program Guide* describes the agreement:

The agreement between a utility and a State describing separate responsibilities for financing and accomplishing relocation work may be in the form of either a master agreement for relocation work to be encountered on an areawide or Statewide basis, or in the form of individual agreements for relocation work to be encountered on a case-by-case or project basis. No special form of written agreement is prescribed. Such an agreement usually consists of a formal document signed by officers who are authorized to bind the parties involved.

Pages 14 and 15 of the *Program Guide* contain a list of the terms and conditions generally incorporated in the written agreement. One

important part of the agreement is a cost estimate for the proposed work. This cost estimate is generally broken into the following subject areas:

- direct labor
- labor surcharges
- overhead and indirect construction charges
- materials and supplies
- handling charges
- transportation
- equipment
- right-of-way
- preliminary engineering
- construction engineering
- salvage credits
- betterment credits
- accrued depreciation credits

For consistency, many SHA's require the same type of agreement in the same format for their non-Federal-aid projects.

INVOICING AND PAYMENT SCHEDULES

A review of the billing policies of several of the States indicates that invoices are accepted from utilities approximately once every 30 days after the relocation agreement has been signed. In general, the cost items on the invoice are listed in the same form and order as in the agreement so that comparisons can readily be made. Several State utility manuals specify minimum amounts that can be invoiced. For example, the minimum invoice amount in Arkansas is \$5,000 and the minimum amount in Georgia is \$100. Generally, the invoices may include relocation work that has been completed and costs for materials on hand. A final invoice is generally

required within six months of relocation project completion. State utility manuals frequently indicate that the final billing will be a complete and detailed summary of all the expenses incurred in relocation, and that it will contain a summary of all credits accrued to the project. These State standards for the final invoice are similar to the FHWA's standards for final invoices for Federal-aid projects found on pages 24 and 25 of the *Program Guide*.

The same survey of State utility manuals indicates that both monthly and final invoices are often not paid for at least 90 days after they are submitted. In some States, a retainer may be kept on payments for monthly invoices until all work is completed and the final invoice is received. For Federal-aid projects, cost records and accounts relating to the project may be subject to audit by the Federal government for three years after the date final payment is received by the utility.

VERIFYING WORK QUANTITIES

The HA wishes to verify that the material, equipment, and labor costs itemized in the utility work orders are correct. In many State highway/utility manuals, the SHA requires that its inspectors confirm work quantities listed by the utility. Inspection by the HA is important to the utility as well as to the HA because this verification may be required before the utility can be reimbursed. For Federal-aid utility relocation projects, inspection by the HA is a requirement. This is because the SHA must report to the FHWA that work has been done in accordance with the terms of the relocation

agreement before the SHA can be reimbursed. The *Program Guide* indicates that a satisfactory inspection process is outlined in the "Utility Relocation and Adjustment" section of the AASHTO publication "Construction Manual for Highway Construction." Chapter 10 — *Construction* contains additional information on inspection.

COST OVERRUNS

Minor cost underruns and overruns are considered a normal part of typical highway utility relocations. Almost all State highway/utility manuals describe procedures for dealing with cost overruns. These are generally simple for minor overruns, but they may be complex for major overruns. The individual State manuals should be referred to as necessary.

LUMP-SUM AGREEMENTS

Where utility relocation projects can be clearly and concisely defined, the FHWA allows lump-sum agreements for eligible utility relocations. These agreements provide for one invoice after job completion, and actual costs of the relocation are not closely audited. A principal benefit of these agreements is that they reduce administrative record keeping and inspection costs. Lump-sum agreements may be used when the relocation work is performed by utility forces. The relocation cost is usually less than or equal to \$25,000. Many States also allow this type of agreement on their non-Federal-aid projects.

SUMMARY

This chapter offered an overview of highway/utility relocation reimbursement policies. The reader is urged to consult State codes and regulations (see Table 12-1) and State highway/utility manuals for further information con

cerning the topics introduced here. For more information concerning relocation reimbursement requirements on Federal-aid projects, the FHWA references are recommended.

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Table 12-1. Statutory Authority Relating to Reimbursement of Public Utility Relocation Expense.¹

	Interstate All	Interstate Urban Only	All Federal- Aid Highways	Controlled- Access Highways	State Highways	No Statutory Authority Located
ALABAMA Code of Ala. § 23-1-5	X		X			
ALASKA Alaska Stat. § 19.25.020			X			
ARIZONA						X
ARKANSAS						X
CALIFORNIA Deering's Calif. Code Street & Hwys § 700, § 600					X	
COLORADO Colo. Rev. Stat. § 43-1-225			X			
CONNECTICUT Conn. Gen. Stat. § 13a-126					X	
DELAWARE Del. Code Ann. Title 17 § 32; § 143		X				
FLORIDA Fla. Stat. Ann. § 337.401-403	X					
GEORGIA Geo. Code Ann. § 32-6-170					X	
HAWAII Ha. Rev. Stat. § 264-33					X	
IDAHO						X
ILLINOIS Ill. Rev. Stat. CH 121 Par. 9-113	X				X	
INDIANA Ind. Stat. Ann. 8-1-9-3	X					

Table 12-1. Statutory Authority Relating to Reimbursement of Public Utility Relocation Expense.
(Continued)

	Interstate All	Interstate Urban Only	All Federal- Aid Highways	Controlled- Access Highways	State Highways	No Statutory Authority Located
IOWA Iowa Code Ann. § 306A.10	X					
KANSAS						X
KENTUCKY Ky. Rev. Stat. 179.265, 175A.080, 177.035	X		X	X	X	
LOUISIANA La. Rev. Stat. § 48-381(c)	X		X	X	X	
MAINE Ma. Rev. Stat. Ann. 23 § 255	X					
MARYLAND Md. Ann. Code Art. 890 § 76	X					
MASSA- CHUSETTS Mass. Ann. L. Ch. 81, § 7G Ch. 33, § 6	X		X	X	X	
MICHIGAN						X
MINNESOTA Minn. Stat. § 161.46, § 161.20(2)	X					
MISSISSIPPI						X
MISSOURI § 227.240, RSMo 1986					X	
MONTANA 32-2414 et seq			X			
NEBRASKA Rev. Stat. Neb. § 39-1304.02	X					X
NEVADA Nev. Rev. Stat. 408.407			X			

Table 12-1. Statutory Authority Relating to Reimbursement of Public Utility Relocation Expense.
(Continued)

	Interstate All	Interstate Urban Only	All Federal- Aid Highways	Controlled- Access Highways	State Highways	No Statutory Authority Located
NEW HAMPSHIRE N.H. Rev. Stat. Ann. §§ 229.6					X	
NEW JERSEY N.J. Stat. Ann. 27:7-44.9	X		X	X	X	
NEW MEXICO N.M. Stat. Ann. 67-8-18	X		X	X	X	
NEW YORK Con. L. N.Y. Ann. § 10-24[6]	X		X	X	X	
NORTH CAROLINA						X
NORTH DAKOTA N.D. Century Code 24-01-41	X					
OHIO ORC 5501.51	X		X	X	X	
OKLAHOMA Okla. Stat. 69 § 12.06, § 14	X		X	X	X	
OREGON Oregon Rev. Stat. Ch. 366.321	X		X	X	X	
PENNSYLVANIA Purdon's Penn. Stat. Ann. § 36-670-412.1	X		X	X	X	
RHODE ISLAND R.I. Gen. L. 24-8.1(1-4)			X			
SOUTH CAROLINA						X
SOUTH DAKOTA S.D. Cod. L. 31-26-23	X		X	X	X	
TENNESSEE Tenn. Code Ann. 54-563	X					

Table 12-1. Statutory Authority Relating to Reimbursement of Public Utility Relocation Expense.
(Continued)

	Interstate All	Interstate Urban Only	All Federal- Aid Highways	Controlled- Access Highways	State Highways	No Statutory Authority Located
TEXAS Tex. Code Ann. Art. 6674 W-4	X					
UTAH Utah Code 27-12-11	X		X	X		
VERMONT Vt. Stat. Ann. Title 19-1512 1703 (c,d)	X		X	X		
VIRGINIA Code of Va. § 33.1-44; 55; 56		X			X	
WASHINGTON Rev. C. Wash. 47.44.030	X					
WEST VIRGINIA West Va. Code Ch. 17-4-17b	X					
WISCONSIN Wis. Stat. Ann. 84.09					X	
WYOMING Wy. Stat. 24-13-101 et. sq.			X		X	

¹This table of statutory references is included for the reader's convenience in locating the desired State statute. The table is illustrative only, and reference must be made to the statute for important exceptions, limitations, or requirements. For example, although the table indicates that some authority exists for reimbursement for utilities located on State highways, the provision may apply only to facilities owned by municipalities or public service companies, or may include privately owned utilities. The provision may be limited to State freeways or parkways or may include all limited access highways or all State highways. In some instances, a reimbursement provision clearly includes all Federal-aid highways and State highways. In sum, the reader is cautioned to consult the statute and any amendments.

APPENDIXES

A: GLOSSARY

B: RELATED ORGANIZATIONS

C: SAMPLE PERMIT FORMS

APPENDIX A

GLOSSARY

AASHTO: American Association of State Highway and Transportation Officials

Abandonment: Relinquishment of interest in right-of-way or activity thereon with no intention to reclaim or use again.

Accident Rate: The number of accidents, fatalities, or injuries divided by a measure of vehicle activity to provide a means of comparing accident trends through time.

Accommodation: The installation of utility facilities along or across highway right-of-way with the intent that they will occupy and jointly use the right-of-way.

Adjustment: The required modification to an existing utility facility to eliminate a conflict with a proposed highway construction project.

ADT: Average Daily Traffic

Advertisement: The direct or indirect contact between an agency and the general public by way of printed publications or broadcast announcements.

Advertisement for Bids: Published public notice soliciting bids for a construction project or designated portion of a project, included as part of the bidding documents.

Affirmative Action Plan: A plan for recruiting, hiring, training, and promoting minorities and women.

Agreement: A mutual understanding between two or more parties creating obligation between competent parties who enter engagement with each other by a promise on either side.

Alternatives: Potential solutions to meet a project's requirements.

Alternatives Analysis: Analysis of the various alternatives to determine validity and impact on project cost, project appearance, project schedule, and socioeconomic and environmental conditions.

AM/FM: Automated Mapping/Facilities Management.

ANSI: American National Standards Institute.

APWA: American Public Works Association.

ASCE: American Society of Civil Engineers.

As-Built Drawings: Also known as record drawings, these plans depict the facility as constructed, incorporating all field changes.

Authorization: Approval to proceed with a phase of a project. The date of authorization for a Federal-aid project establishes the date of eligibility for Federal funds to participate in the cost incurred in that phase of work.

Average Daily Traffic: The average number of vehicles that pass a particular point on a roadway during a period of 24 consecutive hours, and unless otherwise described, it usually denotes the average of that value pertinent to a duration of observation of 365 consecutive days.

Backfill: Replacement of suitable material compacted (as specified) around and over a pipe, conduit, casing, or gallery, or the material used to backfill an excavation.

Bedding: The structural system of soil or other suitable material upon which a pipe, conduit, casing, or gallery is supported.

Betterment: Any upgrading of the facility being relocated that is not attributable to the highway construction and is made solely for the benefit of and at the election of the utility.

Bid: A complete and properly signed proposal to perform the construction required by the contract documents, or designated portion of the documents, for an amount or amounts stipulated in the documents. A bid is submitted in accordance with the bidding documents.

BLM: Bureau of Land Management.

Breakaway Utility Pole: A utility pole designed to break on impact and swing out of the path of the vehicle and reduce the severity of the accident.

Bury: The depth of burial below the surface grade to the top of the casing of a cased carrier pipe, or to the top of an uncased carrier pipe, or the top of the duct for a telephone or electric power line.

CAD: Computer Aided Drafting.

CADD: Computer Aided Design and Drafting.

CADD/CAM: Computer Aided Design and Drafting/Computer Aided Mapping.

Cap: A rigid structural element that surmounts a pipe, conduit, casing, or gallery.

Carrier: A pipe that directly encloses a transmitted liquid or gas.

Casing: A larger pipe that encloses a carrier.

CATV: Cable television.

CFR: Code of Federal Regulations.

Change Order: A written order to the constructor signed by the owner and/or agent or representative, issued after execution of a contract, authorizing a change in the work or an adjustment in the contract sum or the contract time.

CIP: Capital Improvement Program.

Clear Recovery Area: That portion of the roadside within the highway right-of-way, established by the Department, that is free of non-traversable hazards and fixed objects. Its purpose is to provide drivers of errant vehicles that leave the traveled portion of the roadway a reasonable opportunity to stop safely or otherwise to regain control of the vehicles. Its nature and extent may vary with the type of highway, terrain traversed, and road geometric operating conditions. Its establishment for various types of highways and operating conditions should be guided by the AASHTO Roadside Design Guide.

Clear Zone, or Clear Roadside Policy: The policy employed by the Department to provide a clear

recovery area to increase safety, improve traffic operations, and enhance the aesthetic quality of highways. This is accomplished by designing, constructing, and maintaining highway roadsides as wide, flat, and rounded as practical and as free as practical from natural or manufactured hazards such as trees, drainage structures, nonyielding sign supports, highway lighting supports, utility poles, and other ground-mounted structures. (The policy addresses removal of roadside obstacles that are likely to be associated with accident or injury to the highway user. When such obstacles are essential, the policy provides for appropriate countermeasures to reduce hazards.) Full consideration should be given to sound engineering principles and economic factors in all cases.

Codes: Regulations, ordinances, or statutory requirements of, or meant for adoption by, governmental units relating to building construction and occupancy, adopted and administered for the protection of the public health, safety, and welfare.

Communication: The process by which all types of information are exchanged among individuals.

Comprehensive Plan: A plan for the future development of a community. It usually consists of a statement of goals, background data on past development trends, and a plan for future development, with details on land uses, housing, community facilities, streets, and other elements of the community.

Computer: A sophisticated electric machine for data storage, processing, and manipulation.

Conduit, or Duct: An enclosed tubular way for protecting wires or cables.

Consultant: The person or entity who provides specialized advice or services to an owner, design professional, or constructor.

Contract: A legally enforceable promise or agreement between two or among several persons.

Corridor: A strip of land between two termini within which traffic, topography, environment, and other characteristics are evaluated for transportation purposes.

Cross Section: A vertical section of the ground and facilities thereon at right angles to the center line.

Data Base: A collection of information stored in a computer system. The information is divided into records, each of which is described by a constant set of characteristics.

Design: The process in which drawings and specifications and the other parts of the contract documents are prepared under the direction of a design professional.

Directive: Any document used to guide or affect the performance or conduct of agency employees. The term includes policies, procedures, rules and regulations, general orders, special orders, memorandums, and instructional material.

Distribution line: That part of a utility system connecting its transmission lines with its individual customers or with the service lines of the individual customers.

DOT: Department of Transportation.

Easement: A right to use or control the property of another for designated purposes, such as for drainage or placement of utilities.

Encroachment: Unauthorized use of right-of-way or easements.

Environmental Assessment: A document that identifies and assesses the influence of a proposed project on significant economic, social, and physical elements of the environment.

Environmental Impact Statement: A report on the anticipated impact of a proposed project on surrounding conditions. Environmental, engineering, aesthetic, and economic aspects are included. Also, a detailed document meeting the goals of the National Environmental Policy Act, discussing alternatives to avoid or minimize adverse impacts or enhance the quality of human environment.

Equal Employment Opportunity: The provisions of equitable opportunities for employment and conditions of employment to all employees regardless of race, creed, color, age, sex, religion, national origin, or physical impairment.

FAPG: Federal-Aid Policy Guide.

FHPM: Federal-Aid Highway Program Manual.

FHWA: Federal Highway Administration.

FONSI: Finding of No Significant Impact.

Force Account Work: Work paid for by reimbursing a utility for the actual costs for labor, materials, and equipment used in the performance of the work, as directed, including a percentage for overhead and profit.

Functional Classification: Division of a transportation network into classes, or systems, according to the nature of the service they are to provide.

Gallery: An underpass for two or more utility lines.

GIS: Geographic Information Systems.

Goal: A relatively broad statement of the end or result that one intends ultimately to achieve. A goal usually requires a relatively long time span to achieve and, whenever possible, should be stated in a way that permits measurement of its achievement.

GPS: Global Positioning System.

Grade: The rate of ascent or descent of a roadway, expressed as a percent; the change of roadway elevation per unit of horizontal length.

Green Book: AASHTO publication; *A Policy on Geometric Design of Highways and Streets*.

GRI: Gas Research Institute.

Highway Agency: A department, commission, board, or official agency of a governmental unit charged by law with the responsibility for highway administration.

HPMS: Highway Performance Monitoring System (FHWA).

INDOT: Indiana Department of Transportation.

Inspection: Examination of work completed or in progress to determine if it generally conforms to the requirements of the contract documents.

Instructional Material: Training guides, bulletins, and checklists.

IRWA: International Right-of-Way Association.

ISTEA: Intermodal Surface Transportation Efficiency Act of 1991.

ITE: Institute of Transportation Engineers.

Invoice: The claim or billing by the utility for reimbursable cost.

Life-Cycle Costing: A systematic evaluation of life-cycle cost and comparison of alternative systems.

Maintenance: The work required to keep an existing facility in a good state of repair without adding to its physical makeup or changing its physical capacity.

Maintenance Hole, or Manhole: A structure that provides access to a sewer system for inspection, cleaning, maintenance, sampling, or flow measurement.

Maintenance Management System: A formal procedure used to plan, organize, direct, control, and evaluate maintenance programs and maintenance management units.

Maintenance Standard: A formally established criterion for a specific operation that encompasses elements usually found in Quality, Quantity and Performance Standards (a Maintenance Standard will usually provide general indications about why, where, when, and how an activity will be carried out, as well as expected results).

Management: The art of developing a mix of personnel, material, machines, and methods to achieve a specified goal.

Manual: A collection of policies, procedures, rules and regulations, or other directives.

Memorandum: An informal document that may or may not convey a directive; it is generally used to clarify, inform, or inquire.

Mobilization: The effort of the contractor to bring materials, labor, and equipment to the work site in preparation to begin construction activities. Mobilization is generally specified in the construction documents, and a payment allowance is provided.

MPO: Metropolitan Planning Organization.

MUTCD: Manual on Uniform Traffic Control Devices.

NCHRP: National Cooperative Highway Research Program.

NEPA: National Environmental Policy Act.

NESC: National Electric Safety Code.

NPDES: National Pollutant Discharge Elimination System administered by the U.S. Environmental Protection Agency.

NYSDOT: New York State Department of Transportation.

OCSI: One-Call Systems International, an entity of the American Public Works Association.

One-Call Systems: A communication system involving excavators and owners and operators of underground utility facilities, designed to avoid damage to buried facilities and injury to personnel and property.

OSHA: Occupational Safety and Health Administration.

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

Performance Budgeting System: A formal procedure used to establish workloads, allocate resources (labor, equipment, materials, funds), schedule work, and evaluate results.

Performance Standard: A formally established criterion for a specific activity that (1) outlines the work involved; (2) describes work methods and composition of efficient crews; and (3) lists the expected accomplishment or productivity rate.

Permit: A written agreement by which the highway authority approves the use and occupancy of highway right-of-way by utility facilities or private lines.

Planner: One who prepares or administers a plan for orderly growth and development of a social/physical/economic unit or program.

Plans: The contract drawings that show the location, character, and dimensions of the prescribed work, including layouts, profiles, cross sections, and other details.

Policy: A directive that is a broad statement of agency principles. Policy statements may be characterized by words such as "may" or "should" and usually do not establish fixed rules or set procedures for conduct of a particular activity, but rather provide a framework for development of procedures and rules and regulations.

Policies: Policies of an agency are the officially adopted and approved guidelines that an agency has adopted to set the responsibilities and expectations of its management and staff. They can and should be amended periodically and should be consistent with the legal and authorized requirements of the agency's jurisdiction.

PPM: Policy and Procedure Memorandum.

Preliminary Engineering: The work necessary to produce construction plans, specifications, and estimates to the degree of completeness required for undertaking construction.

Procedures: A directive that is a guideline for carrying out agency activities. They can and should be amended periodically and should be consistent with the legal and authorized requirements of the agency's jurisdiction.

Program Guide: Publication developed by FHWA on Utility Adjustments and Accommodations on Federal-aid Highway Projects.

Qualifications: The attributes of an individual or entity that are judged or reviewed to determine conformance to predetermined standards and requirements.

Quality: Conformance to predetermined requirements.

Quality Standard: A formally established criterion for a specific activity that (1) describes a deficiency, condition, or schedule that established the need for work; (2) outlines the work involved; (3) tells how to achieve good workmanship; and (4) lists expected end results.

Quantity Standard: A formally established criterion for a specific activity that (1) outlines the work involved and (2) lists the number of work units which are usually required to meet the quality standards for various categories of roads.

Records: A written account documenting data, activities, transactions, and memorandum of verbal communications, and usually including the contract documents.

Relocation: The replacement in another location of an existing utility facility to eliminate a conflict with a proposed highway construction project.

Reporting System: A formal procedure used to collect, process, analyze, and distribute data and information needed by the managers of a maintenance organization and its management units.

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

Roadway: The portion of a highway, including shoulders, for vehicular use.

ROW: Right-of-Way.

Rules and Regulations: A set of specific guidelines to which all employees must adhere.

Service Line: A water line connecting one individual customer with a distribution line, or a gas line connecting one or more customers with a distribution line.

Service Tap: The actual connection of a service line to a distribution line.

SHA: State Highway Agency.

Shop Drawings: Drawings, diagrams, schedules, and other data serving as extensions of the design required for manufacture, fabrication, and erection of the components of construction, prepared by the constructor or subcontractor.

Shoulder: The portion of the roadway contiguous with the traveled way primarily to accommodate stopped vehicles for emergency use, and for lateral support of base and surface courses.

Specifications: A part of the contract documents, contained in the project manual, consisting of written requirements for materials, equipment, construction systems, standards and workmanship, and usually including the Conditions of the Contract.

Standard: A prescribed set of rules, conditions, or requirements concerned with the definition of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, design, or operation; description of fit and measurement of size; or measurement of quality and quantity in describing materials, products, systems, services, or practices.

State Highway Agency: The highway agency of one of the 50 States, the District of Columbia, or Puerto Rico.

Subdivisions: The division or redivision of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels, or other divisions of land. Land partitioned by the court for distribution to heirs or devisees also constitutes as a subdivision.

SUE: Subsurface Utility Engineering.

TCP: Traffic Control Plan.

TIGER: Topologically Integrated Geographic Encoding and Reference Files.

TIP: Transportation Improvement Program.

Tolerance Zone: For excavations in the area of underground utilities, the space (typically specified in State damage prevention laws) within which hand tools must be used to excavate to avoid damage to underground facilities.

Traffic Control Device: A sign, signal, marking, or other device placed on or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn, or guide traffic.

Transmission Line: The part of a utility system connecting its main energy or material sources with its distribution system, to which individual customers usually are not connected.

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

TRB: Transportation Research Board.

ULCC: Utility Location and Coordination Council, an entity of the American Public Works Association.

Uniform Color Code: Guidelines adopted by the American Public Works Association for temporary marking of underground facilities before excavating. Specific colors are used to mark each facility type.

U.S.C.: United States Code.

Utility: A privately, publicly, or cooperatively owned line, facility, or system for producing, transmitting, or distributing communications, cable television, power, electricity, light, 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.

Utility Relocation: The relocation, replacement, or adjustment of utility facilities that fall into the path of a proposed highway improvement project.

Vent: An appurtenance to discharge gaseous contaminants from a casing.

WSDOT: Washington State Department of Transportation.

Zoning Ordinance: An official legal document that divides a municipality into districts and establishes requirements to govern the use, placement, and size of land and buildings and the intensity of development within each district.

APPENDIX B

RELATED ORGANIZATIONS

**AMERICAN ASSOCIATION OF STATE
HIGHWAY & TRANSPORTATION
OFFICIALS**
444 N. Capitol Street, NW
Washington, DC 20001

**AMERICAN CONGRESS ON SURVEYING &
MAPPING**
5410 Grosvenor Lane, Suite 100
Bethesda, MD 20814-2122

**AMERICAN NATIONAL STANDARDS
INSTITUTE**
11 West 42 Street
New York, NY 10036

AMERICAN PUBLIC GAS ASSOCIATION
11094-D Lee Highway, Suite 102
Fairfax, VA 22030

AMERICAN GAS ASSOCIATION
1515 Wilson Blvd
Arlington, VA 22209

AMERICAN PETROLEUM INSTITUTE
1220 L Street, NW
Washington, DC 20005

AMERICAN PUBLIC POWER ASSOCIATION
2301 M Street, NW
Washington, DC 20037

AMERICAN PUBLIC WORKS ASSOCIATION
106 W. 11th Street
Kansas City, MO 64105-1806

**AMERICAN ROAD & TRANSPORTATION
BUILDERS ASSOCIATION**
ARTBA Bldg - 525 School Street, SW
Washington, DC 20024

**AMERICAN SOCIETY OF CIVIL
ENGINEERS**
1015 15th Street, NW, Suite 600
Washington, DC 20005

**AMERICAN SOCIETY OF
PHOTOGRAMMETRY**
5410 Grosvenor Lane, Suite 210
Bethesda, MD 20814-2122

**AMERICAN SOCIETY OF SAFETY
ENGINEERS**
15083 Greenmont Drive
Woodbridge, VA 22193

AMERICAN WATER WORKS ASSOCIATION
6666 W. Quincy Avenue
Denver, CO 80235

AM/FM INTERNATIONAL
14456 East Evans Avenue
Aurora, CO 80014

**ASSOCIATED GENERAL CONTRACTORS OF
AMERICA**
1957 East Street, NW
Washington, DC 20006

EDISON ELECTRIC INSTITUTE
1111 19th Street, NW
Washington, DC 20036

ELECTRIC POWER RESEARCH INSTITUTE
3412 Hillview Avenue
Palo Alto, CA 94304

FEDERAL HIGHWAY ADMINISTRATION
Office of Engineering- HNG-12
400 Seventh Street, SW
Washington, DC 20590

FEDERAL HIGHWAY ADMINISTRATION
Office of Highway Safety-HHS-1
400 Seventh Street, SW
Washington, DC 20590

GAS RESEARCH INSTITUTE
8600 W. Bryn Mawr Avenue
Chicago, IL 60631

INSTITUTE OF TRANSPORTATION
ENGINEERS
525 School Street, SW, Suite 410
Washington, DC 20024

INTERSTATE NATURAL GAS ASSOCIATION
555 13th Street, NW - Suite 300 W
Washington, DC 20004

INTERNATIONAL FENCE INDUSTRY
ASSOCIATION
5300 Memorial Drive - Suite 116
Stone Mountain, GA 30083

INTERNATIONAL RIGHT-OF-WAY
ASSOCIATION
13650 Gramercy Place
Gardena, CA 90249

INTERNATIONAL UNION OF OPERATING
ENGINEERS
1125 17th Street, NW
Washington, DC 20036

NATIONAL ASSOCIATION OF HOME
BUILDERS
15th & M Streets, NW
Washington, DC 20005

NATIONAL CABLE TELEVISION
ASSOCIATION
1724 Massachusetts Avenue, NW
Washington, DC 20036-1905

NATIONAL TRANSPORTATION SAFETY
BOARD
800 Independence Avenue, SW
Washington, DC 20594

NATIONAL UTILITY CONTRACTOR
ASSOCIATION
1235 Jefferson Davis Hwy.
Arlington, VA 22202

OFFICE OF PIPELINE SAFETY
U.S. Department of Transportation
400 7th Street, SW - DPS-12
Washington, DC 20590

OCCUPATIONAL SAFETY AND HEALTH
ADMINISTRATION
200 Constitution Avenue, NW
Washington DC 20210

PIPELINE CONTRACTORS ASSOCIATION
4100 First City Center - 1700 Pacific Ave.
Dallas, TX 75201

POWER & COMMUNICATION
CONTRACTORS ASSOCIATION
6301 Stevenson Avenue - Suite 1
Alexandria, VA 22304

TRANSPORTATION RESEARCH BOARD
National Research Council
2101 Constitution Avenue, NW
Washington, DC 20418

URBAN & REGIONAL INFORMATION
SYSTEMS ASSOCIATION (URISA)
900 Second Street, NE
Washington, DC 20002

WATER ENVIRONMENT FEDERATION
601 Wythe Street
Alexandria, VA 22314-1994

APPENDIX C

SAMPLE PERMIT FORMS

Indiana Department of Transportation
Washington State Department of Transportation
Springfield, Oregon, Department of Public Works
Kentucky Department of Highways
Minnesota Department of Highways
Wellesley, Massachusetts
Billings, Montana
Pasadena, California
Sample Utility Permit, APWA

State of Indiana
Department of Highways
Right-of-Way Permit

Type of Permit:

☐ Cut Road ☐ Pole Line ☐ Bridge Attach. ☐ Miscellaneous

District _____ Sub-District _____ Telephone () _____

Project Location _____

Project Description _____

Project Purpose _____

Bond Required: ☐ Yes, Penal Sum \$ _____, Bond Number _____ ☐ No

PERMIT FEE: \$ _____ Check or Bank Draft Payable to "Indiana Department of Highways".

Special Provisions:

THE APPLICANT AGREES TO INDEMNIFY, DEFEND, EXCULPATE, AND HOLD HARMLESS THE STATE OF INDIANA, ITS OFFICIALS AND EMPLOYEES FROM ANY LIABILITY DUE TO LOSS, DAMAGE, INJURIES, OR OTHER CASUALTIES OF WHATSOEVER KIND, OR BY WHOMSOEVER CAUSED, TO THE PERSON OR PROPERTY OF ANYONE ON OR OFF THE RIGHT-OF-WAY ARISING OUT OF, OR RESULTING FROM THE ISSUANCE OF THIS PERMIT OR THE WORK CONNECTED THEREWITH, OR FROM THE INSTALLATION, EXISTENCE, USE, MAINTENANCE, CONDITION, REPAIRS, ALTERATION, OR REMOVAL OF ANY EQUIPMENT OR MATERIAL, WHETHER DUE IN WHOLE OR IN PART TO THE NEGLIGENT ACTS OR OMISSIONS (1) OF THE STATE, ITS OFFICIALS, AGENTS, OR EMPLOYEES; OR (2) OF THE APPLICANT, HIS AGENTS OR EMPLOYEES, OR OTHER PERSONS ENGAGED IN THE PERFORMANCE OF THE WORK, OR (3) THE JOINT NEGLIGENCE OF ANY OF THEM; INCLUDING ANY CLAIMS ARISING OUT OF THE WORKMEN'S COMPENSATION ACT OR ANY OTHER LAW, ORDINANCE, ORDER, OR DECREE. THE APPLICANT ALSO AGREES TO PAY ALL REASONABLE EXPENSES AND ATTORNEYS FEES INCURRED BY OR IMPOSED ON THE STATE IN CONNECTION HERewith IN THE EVENT THAT THE APPLICANT SHALL DEFAULT UNDER THE PROVISIONS OF THIS PARAGRAPH.

INSPECTOR

PERMIT APPLICANT SIGNATURE

DISTRICT PERMIT ENGINEER

NAME OF COMPANY OR ORGANIZATION

DISTRICT ENGINEER

POST OFFICE ADDRESS

()
TELEPHONE

5 Copies — Submit all copies

White — Division of Maintenance

Green — Surety

Canary — Sub-District

Pink — Applicant

Gold — District

APPLICATION NUMBER

ROAD NUMBER

COUNTY NO.

EXPIRATION DATE

ISSUE DATE

PERMIT NUMBER

**State of Indiana
Department of Highways
GENERAL PROVISIONS**

1. All work described in the permit shall be subject to the inspection of the Department of Highways and the permittee shall adjust or stop operations upon direction of any police officer or Department of Highways employee.
2. The permit may be rescinded at any time by the Department of Highways at its discretion or for non-compliance with any and/or all provisions of said permit.
3. The permittee shall notify the Department of Highways Sub-District five (5) working days preceding the beginning of any work activity.
4. The permittee shall notify the Department of Highways Sub-District that the work is complete and this notice is to be provided within seven (7) days from completion of all work on this permit.
5. The permittee shall have the permit complete with drawings and special provisions in their possession during work operations and will show said permit, on demand, to any police officer or authorized Department of Highways employee.
6. The permittee shall pay the Department of Highways for any inspection costs where it is necessary to assign a Department of Highways employee to inspect the work. The permittee shall immediately reimburse the State upon receipt of an itemized statement.
7. The permit is valid through the stated expiration date. If work is not completed within the allotted time, the permit is automatically cancelled unless an extension is requested prior to the expiration date and said request is approved by the Department of Highways. If a permit is cancelled, a new application must be submitted and approved before the proposed work can be accomplished.
8. The permittee shall erect and maintain all necessary signs, barricades, detour signs, and warning devices required to safely direct traffic over or around the part of the highway where permitted operations are to be done so long as the work does not interfere with traffic, in accordance with Section "VI" of the Indiana Manual of Uniform Traffic Control Devices.
9. All construction and materials used within the highway right-of-way must conform to the current Department of Highways "Standard Specifications" with the permittee being considered in the same status as the contractor.
10. The permitted operations shall not interfere with any existing structure on the Department of Highways right-of-way without specific permission in writing from the Department of Highways. In the event that any buildings, railings, traffic control devices, or other structures are damaged, said cost of the removal and/or damage shall be borne by the permittee.
11. This permit does not apply to any State roads or bridges that are closed for construction purposes, or to any county roads or city streets.
12. Approval of the permit application shall be subject to the permittee obtaining all necessary authorizations from local authorities and complying with all applicable laws. The issuance of the permit shall in no way imply Department of Highways approval of, or be intended to influence any action pending before a local board, commission, or agency.
13. The permitted operations shall be allowed on state highway right-of-way only between sunrise and sunset and shall not be performed on Saturdays, Sundays, or during the period beginning at 12:00 Noon on the last weekday (Monday through Friday) preceding and continuing until Sunrise on the day following: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas.
14. In accordance with the notice requirements of Indiana Code 4-22-1-25, any objection to the conditions and provisions of an approved permit must be submitted in writing to the Department of Highways within fifteen (15) days from the issue date.

**STATE OF INDIANA
DEPARTMENT OF HIGHWAYS**

**POLE LINE PERMIT
SPECIAL PROVISIONS**

1. The poles, including brace poles and guy poles, should be placed within 1'-6" of the right-of-way line. Exceptions to this placement policy will be granted only for special conditions and must be explained on the application.
2. The permittee agrees, as a condition of approval of this permit to move or remove any structures installed under this permit, at permittee's own expense, should future traffic conditions or road improvement necessitate and when requested to do so by the Indiana Department of Highways, except for the National System of Interstate and Defense Highways as outlined in I.C. 8-1-9.
3. The pole line will comply with all regulations outlined in the National Electrical Safety Code, and any other handbook issued by the Department of Commerce Bureau of Standards, which refers to the installation and maintenance of communications lines.
4. No trees or plants on the right-of-way of any State Highway will be trimmed or removed without written special permission from the Department of Highways (complete application for tree trimming or tree removal permit).
5. Work will not interfere in any way with any pole line or other existing structure along or across the State Highway.
6. Work within the sodded areas of the right-of-way is not to be performed during wet periods. Any damage to the sodded areas of the right-of-way by pole line equipment must be repaired and properly seeded.
7. Work shall be performed in accordance with the attached plans.

APPLICATION NUMBER

ROAD NUMBER

SECTION

EXPIRATION DATE

ISSUE DATE

PERMIT NUMBER

**STATE OF INDIANA
DEPARTMENT OF HIGHWAYS**

**CUT ROAD PERMIT
SPECIAL PROVISIONS**

APPLICATION NUMBER

ROAD NUMBER

SECTION

EXPIRATION DATE

ISSUE DATE

PERMIT NUMBER

1. (A) All cuts and trenches in and across the asphalt pavement or asphalt covered pavement and right-of-way of the State Highway shall be made by the permittee. After the work of installation of the project, the permittee shall restore all pavement surfaces and right-of-way according to requirements, specifications, and under the inspection of Department of Highways. Pavement replacement shall not be less than 12 inches of bituminous base mixture, thoroughly compacted in lifts of not more than 3 inches and the top lift of 1 inch shall be bituminous surface mixture properly compacted. A "Wacker-Rammer" compactor or equivalent shall be used for compacting the bituminous mixtures. The surface course shall meet Department of Highway Specifications for smoothness.

(a) If the permittee so elects and he states so in his application, the pavement replacement may consist of 9 inches of high early strength concrete placed so the top elevation of the new concrete is the same as the top elevation of the original concrete pavement or original brick pavement. The portion of the pavement replacement, from the top of the new concrete pavement to the present pavement elevation shall consist of a bituminous base mixture placed in thoroughly compacted lifts of no more than 3 inches depth, and the top lift of 1 inch shall be a bituminous surface mixture properly compacted. A "Wacker-Rammer" compactor or equivalent shall be used for compacting the bituminous mixtures. The surface course shall meet Department of Highway Specifications for smoothness. See sub-section 401.15 of the current Standard Specification.

(b) The sub-grade on which the concrete is to be placed shall be compacted thoroughly prior to placing the concrete.

(c) The Permit Inspector in the local sub-district shall be notified 24 hours in advance of the pouring of concrete or the placing of bituminous mixture.

(d) The concrete used shall be high early strength as set out in sub-section 501.03 (c) of the Standard Specifications, except test beams will not be required.

(B) Cutting in cement concrete pavement shall be done as follows: The trench or area to be removed shall be outlined with drilled holes spaced no more than 6 inches apart or sawed to the bottom of the steel mesh with a minimum depth of 2 inches. Breakage shall be confined to required lines. The edge of the area after removal shall be such that the maximum variation from the vertical will not exceed 1 1/2 inches. In trimming and straightening these edges, it may be necessary to use hand methods. Methods and equipment used in cutting, breaking, and removal shall not cause undue breakage, excessive shattering or spalling of the concrete to be left in place and shall be such that will prevent excessive vibration and shock from being transmitted along reinforcing steel to the adjacent pavement.

(a) The depth of the concrete pavement shall be the same as the removed pavement except it shall be a minimum of 9 inches. Anchor bolts shall be placed along all sides of the removed area. The spacing shall be 3 feet center to center on transverse side and 5 feet center to center on the longitudinal side with a minimum of 2 anchor bolts on a side. The anchor bolts shall be the same type and shall be placed as specified on sheet 20 (M1-1) of the Department of Highways standard sheets.

(b) The sub-grade on which the concrete is to be placed shall be compacted thoroughly prior to placing the concrete.

(c) The Permit Inspector in the local sub-district shall be notified 24 hours in advance of the pouring of concrete or the placing of bituminous mixture.

(d) The concrete used shall be high early strength as set out in sub-section 501.03 (c) of the Standard Specifications, except test beams will not be required.

(C) All cuts in the pavement area shall be open to traffic at all times except when the permittee is working at the site. If the cut in the pavement cannot be completed in the working day, it shall be temporarily backfilled, with the top 3 inches consisting of a temporary bituminous mixture, or the cut can be covered with a steel plate of sufficient size and thickness to satisfactorily carry the traffic. The steel plate shall be properly fastened down so as not to create a hazard. A steel plate shall also be used to cover any concrete area during curing period.

2. (A) All excavation from cuts in the pavement area shall be removed from the Right-of-Way. The backfilling of this area shall be Compacted Aggregate Base or "B" Borrow. This backfill shall meet Department of Highways Standard Specifications.

(B) Backfilling of all trenches outside of the shoulder lines on State Highway Right-of-Way shall be made with pit run sand and gravel mixture or with material acceptable to the Department of Highways, except for the top 12 inches which must be filled with top soil and compacted. Grass seed and fertilizer shall then be placed on the top soil which has been prepared in accordance with Department of Highways Specifications on seed bed preparation.

 - (a) When the trench is excavated or plowed in a lawn area that is mowed, the applicant shall replace all disturbed areas with sod. The sod to be placed and maintained according to the Department of Highways Specifications.
 - (b) Sod may be required at other areas where erosion may be a problem.
3. The permittee shall at all times protect the pavement surface and right-of-way from damage due to the use of heavy equipment, and shall provide and use approved pads, planks or dirt cushion to protect against other damage. Immediately before any section of the Highway is to be placed back in use for traffic, the permittee shall remove all excess dirt and sweep the pavement surface to eliminate unnecessary dust hazards.
4. Tunneling under State Highway pavements will be allowed when approved by the Department of Highways. Pipe for such tunnels shall be approved pipe as specified on the plans, inserted in the tunnel lining and the excess space filled with concrete as specified on the plans. Tunneling methods, supports and operations shall be subject to the approval of the representative of the Department of Highways assigned to inspect the work. Proper backfilling must be done around the tunnel lining in order to prevent any settling of the pavement and right-of-way.
5. Where a tunnel is used, permission will not be given for the jacking of pipe directly into position except into and through a tunnel properly lined with steel or timber supporting and retaining the top, sides and bottom of the excavated tunnel.
6. The top elevation of all manholes shall be held to ground or road surface level.
7. The permittee shall be responsible for the proper replacement of any driveways, driveway pipes or sidewalks that are disturbed during this work. Drainage on shoulders, ditches or otherwise on the right-of-way shall not be obstructed.
8. All permits on Interstate Highways and Freeways for utility crossings shall conform to the "AASHTO Policy on the Accommodation of Utilities on Freeway Rights-of-Way — 1969". In addition, all utility installations should be placed in accordance with the provisions of the AASHTO publication, "A Guide for Accommodating Utilities on Highway Rights-of-Way".
9. Within seven (7) days after a new installation or repair to an existing installation is performed, all excess dirt or obstructions caused by the installation or repair must be removed and the area must be restored to good condition by the Utility so as not to interfere with mowing the Highway.
10. All applicable provisions of the current "State of Indiana, Department of Highways Policies covering the use and occupancy of Public Highway Rights-of-Way by Utilities" shall apply to this permit.
11. Upon completion of all pavement cuts and before the work crew leaves the work area, the permittee shall furnish and place the appropriate color spot on the existing road surface next to the side of cut nearest the curb.

(A) If the cut is parallel to curb, the color spot must be placed at the end of cut or at the side and in the approaching traffic lane.

- (B) If the cut is from curb to curb or curb to centerline, the color spot must be placed at the edge of the patch in each approaching traffic lane and on the existing road surface.
 - (C) If a parallel cut is 15 feet or longer, the color spot will be placed at 15 foot spacings, or as directed by the Permit Inspector.
 - (D) The appropriate utility color spot shall be either a special paint or a special plastic disc tape with a minimum size of three (3) inch circle or two (2) inch by four (4) inch rectangle.
 - (E) Color and material must match the standard specified colors, and type assigned to each utility by the Department of Highways Maintenance Division.
 - (F) A Compliance Report will not be accepted, and the performance bond will not be released unless the appropriate color has been applied.
12. The permittee agrees, as a condition of approval of this permit, to move or remove any structures installed under this permit, at the permittee's own expense, should future traffic conditions or road improvement necessitate and when requested to do so by the Indiana Department of Highways, except for the National System of Interstate and Defense Highways as outlined in I.C. 8-1-9.
 13. Work shall be performed in accordance with the attached plans.
 14. If at any time in the future, this installation should become damaged due to normal maintenance or road work by the Indiana Department of Highways, the permittee shall be responsible for all repairs, and cost of repairs that may arise from such damage.

PERMIT INSPECTION REPORT AND COST SUMMARY

Type of Permit:

☐ Oversize
☐ Overweight ☐ Driveway ☐ Cut Road ☐ Pole Line ☐ Bridge Attachment ☐ Misc.

District _____ Sub-District _____

To: Chief, Division of Maintenance
and Engineer of Permits

This is to inform you the work in the referenced permit has been thoroughly inspected and found to be as checked in the box below.

Date of Inspection: _____

☐ **COMPLIES** — (The work has been completed according to all provisions outlined in the permit and final approval is granted.)

Explain: _____

Release Surety on Bond Number: _____

☐ **DOES NOT COMPLY** — (The applicant has been informed to make the following corrections to comply with the permit provisions.)

Explain: _____

Notify Surety on Bond Number: _____

☐ **CANCEL** — Explain: _____

Release Surety on Bond Number: _____

INSPECTOR _____

Name of Applicant _____

DISTRICT ENGINEER _____

Address _____

5 Copies

White — Division of Maintenance
Green — Surety
Canary — Sub-District
Pink — Applicant
Gold — District

☐ No inspection costs are to be charged.

☐ Inspection costs are shown on reverse side of this report.

APPLICATION NUMBER

ROAD NUMBER

COUNTY NUMBER

COMPLIANCE DATE

ISSUE DATE

PERMIT NUMBER

The following is an Itemized cost summary for services performed on the referenced permit.

STATE EMPLOYEE

Date	Hours	X	Hourly Rate	=	Labor	+	Overhead	=	Amount
------	-------	---	-------------	---	-------	---	----------	---	--------

Sub-Total: _____

VEHICLE

Date	Miles	X	Rate	=	Amount
------	-------	---	------	---	--------

Sub-Total: _____

OTHER

Date	Unit Name	Number of Units	X	Rate	=	Amount
------	-----------	-----------------	---	------	---	--------

Sub-Total: _____

Total: _____



Permit No. _____

CS _____

SR _____

District No. _____

Name and Address of Applicant: _____

The Applicant, hereinafter referred to as the "Utility," having applied for a permit to construct, operate, and maintain

on a portion of State Route No. _____ in _____ County, Washington, the Washington State Department of Transportation or its designee, hereinafter referred to as the "Department," hereby orders that this permit be granted, subject to the terms and provisions stated upon the reverse hereof and Exhibits attached hereto and by this reference made a part hereof.

Exhibit "A" — Special Provisions for Permits and Franchises, Pages _____

This permit shall be void unless the work herein contemplated shall have been completed before _____

This permit is accepted and approved by the Utility subject to the terms and provisions as herein set forth.

UTILITY

By: _____

Title: _____

Date: _____

DEPARTMENT OF TRANSPORTATION

By: _____

Title: _____

Date: _____

General Provisions

1. This franchise is subject to Chapter 47.44 RCW and Chapter 468-34 WAC and amendments thereto.
2. Whenever necessary for the construction, repair, improvement, alteration, or relocation of all or any portion of said highway as determined by the Department, or in the event that the lands upon which said highway is presently located shall become a new highway or part of a limited access highway, or if the Department shall determine that the removal of any or all facilities from the said lands is necessary, incidental, or convenient to the construction, repair, improvement, alteration, or relocation of any public road or street, this franchise may be cancelled (in whole or in part) upon notice by the Department, and any or all of such facilities shall be relocated or removed from said highway as may be required by the Department.
3. Upon failure, neglect, or refusal of the Utility to immediately do and perform any change, removal, relaying, or relocating of any facilities, or any repairs or reconstruction of said highway herein required of the Utility, the Department may undertake and perform such requirement, and the cost and expense thereof shall be immediately repaid to the Department by the Utility.
4. The Utility, its successors and assigns, agrees to protect the State of Washington, its officers and employees and save them harmless from all claims, actions or damages of every kind and description which may accrue to or be suffered by any person, persons, or property by reason of the acts or omissions of the Utility, its assigns, agents, contractors, licensees, employees or any person whomsoever, in connection with Utility's, its assigns', agents', contractors', licensees' or employees' construction, installation, maintenance, operation, use or occupancy of the right of way or in the exercise of this franchise. In case any suit or action is brought against the State of Washington, its officers and employees, arising out of or by reason of any of the above causes, the Utility, its successors or assigns will, upon notice of such action, defend the same at its sole cost and expense and satisfy any judgement against the State of Washington, its officers, or employees: PROVIDED, that if the claims or damages are caused by or result from the concurrent negligence of (a) the State of Washington's agents or employees and (b) the Utility or Utility's agents or employees, this indemnity provision shall be valid and enforceable only to the extent of the negligence of the Utility or the Utility's agents or employees.

The Utility, and on behalf of its assigns, agents, licensees, contractors and employees agrees to waive any claims for losses, expenses, damages or lost revenues incurred by it or its agents, contractors, licensees, employees or customers in connection with Utility's, its assigns', agents', contractors', licensees' or employees' construction, installation, maintenance, operation, use or occupancy of the right of way or in the exercise of this franchise against the State of Washington, its agents or employees except the reasonable costs of repair to property resulting from the negligent injury or damage to Utility's property by the State of Washington, its agents, contractors or employees.
5. Any breach of any of the conditions and requirements herein made, or failure on the part of the Utility of this franchise to proceed with due diligence and in good faith after its acceptance with construction work hereunder shall subject this franchise to cancellation after a hearing before the Department, of which said hearing the Utility shall be given at least 10 days written notice, if at that time the Utility is a resident or is doing business in the State of Washington; otherwise, by publishing a notice of said hearing once a week for two consecutive weeks in a newspaper of general circulation in Thurston County, Washington, the last publication to be at least 10 days before the date fixed for said hearing.
6. Whenever it is deemed necessary for the benefit and safety of the traveling public, the Department hereby reserves the right to attach and maintain upon any facility by the Utility under this franchise any required traffic control devices, such as traffic signals, luminaires, and overhead suspended signs, when the use of such devices or attachments does not interfere with the use for which the facility was constructed. The Department shall bear the cost of attachment and maintenance of such traffic control devices, including the reasonable cost of any extra construction beyond normal; such extra cost to be determined jointly by the Department and the Utility of this franchise. It is not to be construed that the Department is to share in the normal cost of installation, operation, or maintenance of any of the facilities installed under this franchise.
7. No assignment or transfer of this franchise in any manner whatsoever shall be valid nor vest any rights hereby granted until the Department consents thereto and the assignee accepts all terms of this franchise. Attempting to assign this franchise without Department consent shall be cause for cancellation as herein provided.
8. The Utility shall, within 20 days from receipt of a copy of this order, file with the Department its written acceptance of the terms and conditions of this franchise.
9. All of the work herein contemplated shall be done under the supervision and to the satisfaction of the Department, and the entire expense of said supervision shall be borne by the party or parties to whom this franchise is issued.
10. The Utility pledges that performance of routine cutting and trimming work will be accomplished in such a manner that the roadside appearance will not be disfigured. When major work is involved or damage to roadside appearance may become significant, the holder shall secure the approval of the Department in advance of the work.
11. The Utility hereby certifies that the facilities described in this franchise are in compliance with the Control Zone Guidelines.



Permit/Franchise No.

Applicable provisions are denoted by (X)

- ☒ 1. No work provided for herein shall be performed until the Utility is authorized by the following Department representative:
- ☒ 2. A copy of the permit or franchise must be on the job site, and protected from the elements, at all times during any of the construction authorized by said permit/franchise.
- ☒ 3. In the event any milepost, right of way marker, fence or guard rail is located within the limits of this project and will be disturbed during construction, these items will be carefully removed prior to construction and reset or replaced at the conclusion of construction to the satisfaction of the Department. All signs and traffic control devices must be maintained in operation during construction.
- ☒ 4. Prior to construction, the Utility shall contact the Department's representative (listed under Special Provision Number 1) to ascertain the location of survey control monuments within the project limits. In the event any monuments will be altered, damaged or destroyed by the project, appropriate action will be taken by the Department, prior to construction, to reference or reset the monuments. Any monuments altered, damaged or destroyed by the Utility's operation will be reset or replaced by the Department at the sole expense of the Utility.
- ☒ 5. During the construction and/or maintenance of this facility, the Utility shall comply with the Manual on Uniform Traffic Control Devices for Streets and Highways. If determined necessary by the Department, the Utility shall submit a signing and traffic control plan to the Department's representative for approval prior to construction or maintenance operations.
- ☒ 6. The Utility shall notify the Department's representative upon completion of the work under this permit/franchise so that a final inspection can be made and shall immediately furnish to the District Utilities Engineer a revised franchise or permit plan of the final location or relocation of its facilities if the original permit/franchise plans have been revised during the course of construction.
- ☐ 7. Prior to the beginning of construction, a preconstruction conference shall be held at which the Department and the Utility and utility's engineer, contractor, and inspector shall be present.
- ☐ 8. Should the Utility choose to perform the work outlined herein with other than its own forces, a representative of the Utility shall be present at all times unless otherwise agreed to by the District representative. All contact between the Department and the Utility's contractor shall be through the representative of the Utility. Where the Utility chooses to perform the work with its own forces, it may elect to appoint one of its own employees engaged in the construction as its representative. Failure to comply with this provision shall be grounds for restricting any further work by the Utility within the State right of way until said requirement is met. The Utility, at its own expense, shall adequately police and supervise all work on the above described project by itself, its contractor, subcontractor, agent, and others, so as not to endanger or injure any person or property.
- ☐ 9. The Utility agrees to schedule the work herein referred to and perform said work in such a manner as not to delay the Department's contractor in the performance of his contract.
- ☐ 10. Work within the right of way shall be restricted to between the hours of _____ and _____, and no work shall be allowed on the right of way Saturday, Sunday, or holidays, unless authorized by the Department. Any lane closures must be submitted for approval in advance of use. The hours of permitted closure may differ from the above noted hours.
- ☐ 11. If determined necessary by the Department, any or all of the excavated material shall be removed and replaced with suitable material as specified by the Department.
- ☐ 12. Wherever deemed necessary by the Washington State Department of Labor and Industries and/or the Department for the safety of the workers and the protection of the highway pavement, the sides of the trench (or excavation) shall be adequately supported to reduce the hazard to workers and prevent any damage by cracks, settlement, etc., to the pavement. No other work in the trench or excavation area will be allowed until this requirement is met.
- ☐ 13. Trenches shall be backfilled as soon as possible behind the laying of pipe or cable. No open trenches shall be left overnight. This includes boring or jacking pits which shall be covered with material of sufficient strength to withstand the load of highway traffic if the pit is not to be backfilled with material each night.

- ☐ 14. All slopes, slope treatment, top soil, ditches, pipes, etc., disturbed by this operation shall be restored to their original cross section and condition. All open trenches shall be marked by warning signs, barricades, lights and if necessary, flagmen shall be employed for the purpose of protecting the traveling public. Roadside operations may be specified by the Department's representative.
- ☐ 15. Where applicable, markers shall be placed at each right of way line for all crossings and placed every 500 feet for longitudinal lines to include: company name, pipeline or cable identification, telephone number for contact, and the distance from the marker to the line in feet. Markers shall be placed so as to minimize interference with maintenance operations. Markers shall also be placed at all changes in offset distance from right of way line or centerline of highway.
- ☐ 16. The utility shall install detector tape or cable approximately 12 inches above the underground facility. The tape shall conform to the standards of the American Public Works Association Uniform Color Code.
- ☐ 17. In the event that construction and maintenance of the highway facility within the proximity of the utility installation becomes necessary during the period which the Utility will occupy a portion of the right of way, it is expressly understood that, upon request from the Department's representative, the Utility will promptly identify and locate by suitable field markings any and all of their underground facilities so that the Department or its contractor can be fully apprised at all times of its precise location.
- ☐ 18. The shoulders, where disturbed shall be surfaced with crushed surfacing top course _____ inches minimum compacted depth, or as directed by the Department's representative. The surface of the finished shoulder shall slope down from the edge of pavement at the rate of 0.02 foot per foot unless otherwise directed. The restored shoulder must not have any strips or sections less than 2 feet wide. The restored shoulder shall be surfaced with _____
- ☐ 19. All crossings of roadways surfaced with oil, asphalt concrete pavement or cement concrete pavement shall be accomplished by jacking, boring, or augering the cable or pipe under the roadway, unless specifically provided for otherwise under special provision No. 21.
- ☐ 20. The cable or pipe shall be placed within a suitable encasement as specified on the attached exhibits. Said encasement pipe shall be jacked, bored, or augered through the highway grade with a minimum depth of 5 feet from top of casing to finished road grade and a minimum of 3½ feet of depth from bottom of ditch to top of casing.
- ☐ 21. Open trench construction will be allowed only at those locations identified on the plan exhibits and/or listed on Exhibit(s) with restoration to be performed as noted on the attached "Open Cut Detail," Exhibit _____
- ☐ 22. No routine maintenance of this facility will be allowed within the limited access area.
- ☐ 23. Routine maintenance of this facility will not be permitted from the through traffic roadways or ramps of SR _____ and all service to this facility will be by access from _____
- ☐ 24. Bond coverage required to ensure proper compliance with all terms and conditions of said permit or franchise will be furnished by a Blanket Surety Bond held at Headquarters in Olympia.
- ☐ 25. The Utility shall provide to the Department in the amount of \$ _____, a surety bond written by a surety company authorized to do business in the State of Washington or an escrow account with a bank approved by the Department, prior to start of construction, to insure compliance with any and all of the terms and conditions of this permit or franchise. Said bond/account to remain in force for a period ending one year after date of completion of construction.
- ☐ 26. The utility agrees to bury the aerial lines covered by this franchise in Scenic Classes "A" and "B", as defined on attached Exhibit _____ either at the time of major reconstruction of the line, for that portion of line to be reconstructed, or prior to expiration of this franchise.
- ☐ 27. The Utility agrees to bury the aerial lines covered by this franchise in Scenic Classes "A", "AX", "B", and/or "BX", as defined on attached Exhibit _____, at the time the pole owner buries its facility.
- ☐ 28. The Utility agrees to bury or relocate aerially the existing overhead lines in Scenic Classes "AX" and "BX", as defined on attached Exhibit _____, to a location acceptable to the Department either at the time of major reconstruction of the line, for the portion of line to be reconstructed, or prior to the expiration of this franchise. The existing aerial lines may remain in their present location if acceptable to the Department.
- ☐ 29. The Utility agrees to be responsible for any construction deficiencies as a result of the roadway installation.
- ☐ 30. No lane closures shall be allowed except as approved by the Department representative. Approvals may cause revision of special provisions, including hours of operation.
- ☐ 31. The responsibility of the Utility for proper performance, safe conduct, and adequate policing and supervision of the project shall not be lessened or otherwise affected by Department approval of plans, specifications, or work or by the presence at the work site of Department representatives, or by compliance by the Utility with any requests or recommendations made by such representatives.
- ☐ 32. All material and workmanship shall conform to the Washington State Department of Transportation *Standard Specifications for Road, Bridge and Municipal Construction*, current edition, and shall be subject to inspection by the Department.
- ☐ 33. Any changes or modifications to the approved franchise/permit shall be subject to prior review and approval by the Department.



Utility Franchise

Franchise No.

CS

SR

District No.

Name and Address of Applicant:

The Applicant, hereinafter referred to as the "Utility," having applied for a franchise to construct, operate, and maintain

on a portion of State Route No. _____ in _____ County, Washington, the Washington State Department of Transportation or its designee, hereinafter referred to as the "Department," hereby orders that this franchise be granted for a period to expire _____, subject to the terms and provisions stated upon the reverse hereof and Exhibits attached hereto and by this reference made a part hereof:

Exhibit "A" — Special Provisions for Permits and Franchises, Pages _____

Construction of facilities proposed under this franchise shall begin not later than two years and completed within three years from date of issuance; otherwise, this franchise shall become considered null and void.

DEPARTMENT OF TRANSPORTATION

By: _____

Title: _____

Date: _____

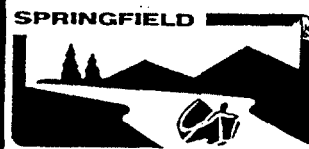
General Provisions

1. This permit is subject to Chapter 47.32 RCW and/or Chapter 47.44 RCW and Chapter 468-34 WAC and amendments thereto.
2. During the progress of the work such barriers shall be erected and maintained as may be necessary or as may be directed for the protection of the traveling public; the barriers shall be properly lighted at night.
3. The Utility, its successors and assigns, agrees to protect the State of Washington, its officers and employees and save them harmless from all claims, actions or damages of every kind and description which may accrue to or be suffered by any person, persons, or property by reason of the acts or omissions of the Utility, its assigns, agents, contractors, licensees, employees or any person whomsoever, in connection with Utility's, its assigns', agents', contractors', licensees' or employees' construction, installation, maintenance, operation, use or occupancy of the right of way or in the exercise of this permit. In case any suit or action is brought against the State of Washington, its officers and employees, arising out of or by reason of any of the above causes, the Utility, its successors or assigns will, upon notice of such action, defend the same at its sole cost and expense and satisfy any judgement against the State of Washington, its officers, or employees: PROVIDED, that if the claims or damages are caused by or result from the concurrent negligence of (a) the State of Washington's agents or employees and (b) the Utility or Utility's agents or employees, this indemnity provision shall be valid and enforceable only to the extent of the negligence of the Utility or the Utility's agents or employees.

The Utility, and on behalf of its assigns, agents, licensees, contractors and employees agrees to waive any claims for losses, expenses, damages or lost revenues incurred by it or its agents, contractors, licensees, employees or customers in connection with Utility's, its assigns', agents', contractors', licensees' or employees' construction, installation, maintenance, operation, use or occupancy of the right of way or in the exercise of this permit against the State of Washington, its agents or employees except the reasonable costs of repair to property resulting from the negligent injury or damage to Utility's property by the State of Washington, its agents, contractors or employees.
4. Except as herein authorized, no excavation shall be made or obstacle placed within the limits of the State highway in such a manner as to interfere with the travel over said road.
5. If the work done under this permit interferes in any way with the drainage of the State highway, the Utility shall wholly and at its own expense make such provision as the Department may direct to take care of said drainage.
6. On completion of said work herein contemplated, all rubbish and debris shall be immediately removed and the roadway and roadside shall be left neat and presentable and satisfactory to the Department.
7. All of the work herein contemplated shall be done under the supervision and to the satisfaction of the Department, and the entire expense of said supervision shall be borne by the party or parties to whom this permit is issued.
8. The Department hereby reserves the right to order the change of location or the removal of any structure or structures authorized by this permit at any time, said change or removal to be made at the sole expense of the party or parties to whom this permit is issued or their successors and assigns.
9. All such changes, reconstruction, or relocation by the Utility shall be done in such manner as will cause the least interference with any of the Department's work, and the Department shall in no wise be held liable for any damage to the Utility by reason of any such work by the Department, its agents or representatives, or by the exercise of any rights by the Department upon roads, streets, public places, or structures in question.
10. This permit or privilege shall not be deemed or held to be an exclusive one and shall not prohibit the Department from granting other permits or franchise rights of like or other nature to other public or private utilities, nor shall it prevent the Department from using any of its roads, streets, or public places, or affect its right to full supervision and control over all or any part of them, none of which is hereby surrendered.
11. The Department may revoke, amend, or cancel this permit or any of the provisions thereof at any time by giving written notice to the Utility. The Utility shall immediately remove all facilities from the right of way. Any facilities remaining upon the right of way 30 days after written notice of cancellation shall be removed by the State at the expense of the Utility.
12. The party or parties to whom this permit is issued shall maintain at its or their sole expense the structure or object for which this permit is granted in a condition satisfactory to the Department.
13. Any breach of any of the conditions and requirements herein made or failure on the part of the Utility of the permit to proceed with due diligence and in good faith after its acceptance with construction work hereunder shall subject this permit to cancellation as herein provided.
14. The Utility pledges that performance of routine cutting and trimming work will be accomplished in such a manner that the roadside appearance will not be disfigured. When major work is involved or damage to roadside appearance may become significant, the holder shall secure the approval of the Department in advance of the work.
15. The Utility hereby certifies that the facilities described in this permit are in compliance with the Control Zone Guidelines.

DEPARTMENT OF PUBLIC WORKS
225 NORTH 5TH STREET
SPRINGFIELD, OREGON 97477
(503) 726-3753

PUBLIC RIGHT OF WAY
ENCROACHMENT
APPLICATION



The applicant shall submit the following:

1. Two copies of the work plan.
2. If applicable, a copy of or certificate of insurance in a sum not less than \$500,000. per occurrence for property damage, personal injury or wrongful death, endorsed to the City of Springfield (storage of articles during construction only).

APPLICANT: _____ PHONE: _____

ADDRESS: _____ ZIP: _____

Project Supervisor: _____ Phone: _____

Name of Contractor (if work will be done by someone other than the applicant): _____

Contractor License # _____ Phone: _____

Expiration Date: _____

Name of other utility if this is a joint project: _____

Work Site Location: _____

Purpose of the Work (Water, Gas, Power, TV Line, Street Oiling, Etc.): _____

Type of Work: (a) Cut _____ (b) Bore _____ (c) Jack _____ (d) Other _____

Dimensions of the Work Area: Length _____ Width _____ Depth _____

Amount of time Articles are to be stored: _____ Dimension of Area: _____

Description of Warning Devices to be Utilized: _____

Type of Security Deposit: Blanket Surety Bond _____ Surety Bond _____ Cash/Check _____

Existing Surface Material: _____

Backfill Material to be Utilized: _____

Surface Replacement Material to be Utilized: _____

Type of Oil Utilized (Street Oiling Only): _____

Project Beginning Date: _____ Project Completion Date: _____

The undersigned hereby agrees to comply with the requirements of City Code 2-5-6 through 2-5-16 inclusive, applicable City Standard Specifications and drawings and to contact the Lane Utilities Coordinating Council "one call number" 48 hours before digging/beginning work.

Authorized Signature: _____ Date: _____

THIS PERMIT EXPIRES 6 MONTHS FROM THE DATE OF ISSUANCE

FOR OFFICE USE ONLY

PUBLIC RIGHT OF WAY
ENCROACHMENT
PERMIT

Amount of Security Deposit

Fee: Storage of Articles During Construction

Fee: Maintenance Surcharge

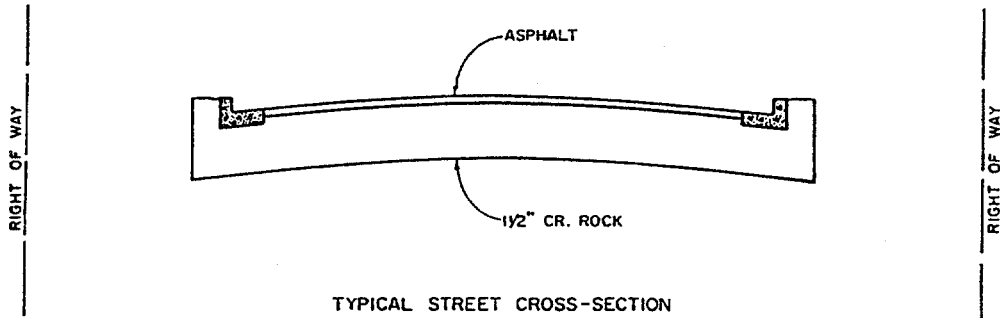
Fee: Permit

Total Amount to be Paid at Time of Permit Issuance

PLAN REVIEW COMMENTS/ SPECIAL INSTRUCTIONS

ALL RESTORATION WORK SHALL BE IN CONFORMANCE WITH EXISTING CITY CODES AND IN COMPLIANCE WITH CURRENT STANDARD SPECIFICATIONS, EXCEPT AS NOTED BELOW.

COPY



YOU ARE REQUIRED TO CALL
THE LANE UTILITIES COORDINATING COUNCIL'S
"ONE CALL NUMBER," 1-800-332-2344
48 HOURS BEFORE DIGGING

Plan Reviewed By:	_____	Date:	_____
Permit Issued By:	_____	Date:	_____
Inspections			
Work in Progress:	_____	Date:	_____
At The Time of Completion:	_____	Date:	_____
Eleven Month:	_____	Date:	_____
Deposit Returned:	_____	Date:	_____

COMMONWEALTH OF KENTUCKY
Transportation Cabinet
Department of Highways
Division of Traffic

TC 99-1
Rev. 5/90

Released Date _____

ENCROACHMENT PERMIT

PERMIT NO. _____

APPLICANT IDENTIFICATION

NAME: _____
CONTACT PERSON: _____
ADDRESS: _____
CITY: _____
STATE: _____ ZIP CODE: _____
PHONE: A.C. () _____

PROJECT IDENTIFICATION

Access Control ☐ By Permit ☐ Partial ☐ Full
COUNTY: _____ PRIORITY ROUTE NO: _____
MILEPOINT: _____ ☐ LEFT ☐ RIGHT ☐ X-ing
PROJECT STATUS: ☐ MAINTENANCE ☐ CONST. ☐ DESIGN
PROJECT NO. STATE: _____
PROJECT NO. FEDERAL: _____
ROAD/STREET NAME: _____

TYPE OF ENCROACHMENT:

☐ COMMERCIAL ENTRANCE - BUSINESS
☐ PRIVATE ENTRANCE: ☐ SINGLE FAMILY ☐ FARM
☐ UTILITY: ☐ OVERHEAD ☐ UNDERGROUND
☐ GRADE: ☐ FILL ☐ LANDSCAPE ON R/W
☐ AIRSPACE: ☐ AGREEMENT ☐ LEASE
☐ OTHER (SPECIFY) _____

ATTACHMENTS:

☐ STANDARD DRAWINGS (LIST ON TC 99-21 UNDER MISC.)
☐ APPLICANT'S PLANS
☐ HIGHWAY PLAN AND PROFILE SHEETS
☐ TC 99-3 (PONDING ENCROACHMENT SPECS. & CONDITIONS)
☐ TC 99-4 (REST AREA USAGE SPECS. & CONDITIONS)
☐ TC 99-5 (TREE CUTTING/TRIMMING SPECS. & CONDITIONS)
☐ TC 99-6 (CHEMICAL USE OF SPECS. & CONDITIONS)
☐ TC 99-10 (TYPICAL HIGHWAY BORING CROSSING DETAIL)
☐ TC 99-12 (OVERHEAD UTILITY ENCROACHMENT DIAGRAM)
☐ TC 99-13 (SURFACE RESTORATION METHODS)
☐ TC 99-21 (ENCROACHMENT PERMIT GENERAL NOTES & SPECS.)
☐ TC 99-22 (AGREEMENT FOR SERVICES TO BE PERFORMED)
☐ TC 99-23 (MASS TRANSIT SHELTER SPECS. & CONDITIONS)
☐ OTHER ATTACHMENTS: (Specify) _____

TYPE OF INDEMNITY: ☐ BOND ☐ CASH
☐ SELF-INSURED AMOUNT ENCUMBERED \$ _____
☐ OTHER _____

NAME AND ADDRESS OF LOCAL INSURANCE AGENCY OR SELF-INSURED
REPRESENTATIVE: _____

INDEMNITY: The applicant, in order to secure this obligation, has deposited with the Transportation Cabinet as a guarantee of conformance with the Department's Encroachment Permit requirements an indemnity in the amount of \$ _____ as determined by the Department. It shall be the responsibility of the applicant or permittee, his heirs and assignees to keep all indemnities in full force until construction or reconstruction has been completed and duly accepted by an authorized agent of the Transportation Cabinet, Department of Highways.

BRIEF DESCRIPTION OF WORK TO BE DONE: (If private entrance, show sketch with pipe location. Separate attached drawings required for encroachments other than private entrances.)

IMPORTANT: (PLEASE READ) (Applicant does ☐ does not ☐ intend to apply for excess R/W)

WHEN THE WORK IS COMPLETED IN ACCORDANCE WITH THE TERMS OF THIS ENCROACHMENT PERMIT YOUR INDEMNITY WILL BE RELEASED. HOWEVER, THE PERMIT IS EFFECTIVE UNTIL REVOKED BY THE TRANSPORTATION CABINET AND THE TERMS ON THE PERMIT AND ACCOMPANYING PERMIT DOCUMENTS AND DRAWINGS REMAIN IN EFFECT AS LONG AS THE ENCROACHMENT EXISTS. FUTURE MAINTENANCE OF THE ENCROACHMENT IS THE RESPONSIBILITY OF THE PERMITTEE. IT IS IMPORTANT THAT YOU UNDERSTAND THE REQUIREMENTS ON THIS ENCROACHMENT PERMIT APPLICATION AND ACCOMPANYING DOCUMENTS. IF YOU HAVE NOT DONE SO, IT IS SUGGESTED THAT YOU REVIEW THESE DOCUMENTS AND PLACE THE PERMIT PACKAGE IN A SAFE PLACE FOR FUTURE REFERENCE.

A COPY OF THIS PERMIT AND ALL DOCUMENTS SHALL BE GIVEN TO YOUR CONTRACTOR AND SHALL BE READILY AVAILABLE AT THE WORK SITE FOR THE ENCROACHMENT PERMIT INSPECTOR TO REVIEW AT ALL TIMES. FAILURE TO MEET THIS REQUIREMENT MAY RESULT IN CANCELLATION OF THIS PERMIT.

IN THE EVENT THIS APPLICATION IS APPROVED, THIS DOCUMENT SHALL CONSTITUTE A PERMIT FOR THE APPLICANT TO USE THE RIGHT-OF-WAY, BUT ONLY IN THE MANNER AUTHORIZED BY THIS DOCUMENT AND REGULATIONS OF THE DEPARTMENT AND THE DRAWINGS, PLANS, ATTACHMENTS AND OTHER PERTINENT DATA ATTACHED HERETO AND MADE A PART HEREOF.

The permittee agrees to the following terms and conditions:

1. The permittee shall comply with and is bound by the requirements of the Department's Permits Manual as revised to and in effect on the date of the issuance of this permit which is made a part hereof by reference.
2. Permittee agrees that if the Department determines that vehicular capacity deficiencies or over capacity conditions develop as a result of the installation and use of this facility, the permittee shall adjust, relocate or reconstruct the facilities and/or provide and bear the expense for signs, storage lanes or other corrective measures reasonably deemed necessary by the Department and as set forth in the Department's Permit Manual within a reasonable length of time after receipt of written notice regarding such adjustments, relocation, additions, modifications and/or corrective measures, such time to be specified in the notice. In cases where traffic signals are permitted or required, as determined by the Department, the costs for signal equipment and installation(s) shall be borne by the permittee and/or the Department in accordance with Department policy then in force as set forth in the Traffic Manual. Any modifications to the permittee's entrance necessary to accommodate signalization (including necessary easement(s) on private property) shall be the responsibility of the permittee, at no expense to the Department. (This applies only to Entrance Permits.)
3. The said encroachment will not infringe on the frontage rights of an abutting owner without written consent of the said owner as hereto: "I (we) consent to the granting of attached permit." _____ Date _____ (This does not apply to utilities which serve the general public.)
4. Any permit granted hereunder shall be with the full understanding that it shall not interfere with any similar rights or permits heretofore granted to any other party except as otherwise provided by law.
5. A plan prepared by _____ and dated _____ is attached hereto and made a part hereof, which describes the facilities to be constructed by the permittee for which facilities this permit is granted. The permittee agrees as a condition to the issuance of the permit to construct and maintain such facilities in accordance with said plan, and the permittee shall not use the facilities authorized herein in any manner contrary to that prescribed by this permit and plan. Normal usage and routine maintenance only are authorized under this permit.
6. Permittee shall comply with the Manual on Uniform Traffic Control Devices as revised to and in effect on the date of the issuance of this permit which is made a part hereof by reference.
7. Permittee shall at all times from date when work is first commenced and until such time as all facilities are removed from the right-of-way premise, defend, protect and save harmless the Department from all liability, claims, and demands arising out of work undertaken by the permittee pursuant to this permit, due to any negligent act or omission by the permittee, its servants, agents, employees or contractors. This provision shall not inure to the benefit of any third party or operate to enlarge any liability of the Department beyond that existing at common law if this right to indemnity did not exist.
8. Upon a violation of any of the provisions of this permit, the Department may revoke the permit by giving notice to the permittee in writing to remove from the right-of-way any facilities placed thereon within a reasonable time as set forth in the notice, and in the event said facilities are not so removed, and the right-of-way restored the Department may cause same to be removed, and the costs thereof shall be charged to the permittee.
9. The permittee, his successors and assigns shall use the encroachment premises in compliance with all Federal requirements imposed pursuant to the provisions of the Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000-1) and regulations of the U.S. Department of Transportation as set forth in Title 49 C.F.R., Part 21, and as said regulations may be amended.
10. Permittee agrees that in the event it should become necessary, as may be reasonably determined by the Department, for the facilities covered by this permit to be removed or relocated in connection with the reconstruction, relocation or improvement of the abutting highway, the Department may revoke this permit and require removal or relocation by the permittee at his own expense according and pursuant to the procedures provided in Paragraph 8 above except in those cases where the Department is required by law to pay any or all the same.
11. The permittee understands and agrees that this permit is personal to the permittee and shall not inure to his successors and assigns without the written approval of the Department and that he is bound by the provisions of this permit as long as the encroachment exists unless a written release has been obtained from the Department. (Does not apply to utilities serving the general public.)
12. If the work authorized by this permit is on a project in the construction phase, it shall be the responsibility of the permittee to make personal contact with _____ Resident Engineer on the project to coordinate the permitted work with the State's prime contractor on the project.
13. This permit does not alleviate any requirements of any other government agency.

THE UNDERSIGNED APPLICANT (BEING DULY AUTHORIZED REPRESENTATIVE/OWNER) DOES AGREE TO ALL TERMS AND CONDITIONS SET FORTH HEREIN.

JANUARY 1st ☐ JULY 1st ☐ 19 _____
Completion Date

_____ 19 _____
Date

Signature

RECOMMENDED FOR APPROVAL

APPROVED

Title

Signature

Chief District Engineer

Date

19 _____

PRIVATE ENTRANCE: TO BE COMPLETED BY PERSONNEL INSTALLING FACILITY.

INSTALLED BY: _____

Title

Signature

DATE

19 _____

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS

TC 99-18
Rev. 6/87

**REQUIRED DOCUMENTATION AND INFORMATION
BY APPLICANT FOR ENCROACHMENT PERMIT**

(This form must be signed and returned by the applicant with the items checked)

- I. ☐ Encroachment Permit Application (Form TC 99-1)
(Applicant shall complete the following:)
- ☐ All blanks under "Applicant Identification"
 - ☐ County and milepoint or location under "Project Identification"
 - ☐ Name and address of applicants local insurance agency (if applicable)
 - ☐ Items 3 and 5 on back of application (if applicable)
 - ☐ Date and signature of applicant or his official representative
- II. ☐ Indemnity
- ☐ Encroachment Permit Bond (form TC 99-7) With Power of Attorney.
 - ☐ Cashier or certified check
 - ☐ Other _____
- III. ☐ Department of Highway Roadway Plan Sheet(s) with the encroachment shown in red.
- IV. ☐ Applicants plans showing:
- | | |
|---|---|
| <input type="checkbox"/> Title block with date, scale (1"=20' when possible) county, applicants name, and spaces for permit number and approval signature | <input type="checkbox"/> Cross Sections |
| <input type="checkbox"/> Total area of development | <input type="checkbox"/> Paving Specifications |
| <input type="checkbox"/> Total work area within R/W | <input type="checkbox"/> Proposed Building Location |
| <input type="checkbox"/> Actual R/W line, property lines, existing entrance, etc. | <input type="checkbox"/> North Arrow |
| <input type="checkbox"/> Curbing and/or sidewalk | <input type="checkbox"/> Drainage Calculations |
| | <input type="checkbox"/> Traffic Generation Study |
| | <input type="checkbox"/> Size, length and location of pipe |
| | <input type="checkbox"/> Roadway or median modification |
| | <input type="checkbox"/> Details of all drainage facilities |
- V. ☐ Other Required Documentation ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- VI. ☐ I have reviewed and understand the requirements on the encroachment permit application and I am aware that I must;
- ☐ Comply with the Manual on Uniform Traffic Control Devices.
 - ☐ Complete the work by the date specified on the permit.
 - ☐ Obtain approval of all other applicable local, state or federal agencies.
 - ☐ Advise the District Permit Engineer before beginning work.
 - ☐ Meet the requirements of all additional documents attached to and made a part of the permit by the Department of Highways.

19

Date

Signature

Title

COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS
ENCROACHMENT PERMIT GENERAL NOTES AND SPECIFICATIONS

TC 99-21
Rev. 6/87
Page 1 of 4

PERMIT NO. _____

I SAFETY

A. General Requirements

- ☐ All signs and control of traffic shall be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition, Part VI and safety requirements shall comply with the Permits Manual.
- ☐ All Work necessary in shoulder or ditchline areas of a state highway is to be scheduled to be promptly completed so that hazards adjacent to the traveled-way are kept to an absolute minimum.
- ☐ No more than one(1) traveled-lane is to be blocked or obstructed during normal working hours. All signs and flagmen during lane closure shall conform to the Manual on Uniform Traffic Control Devices.
- ☐ When it is necessary to block one (1) traveled-lane of a state highway the normal working hours shall be as directed by the Department. No lanes are to be blocked or obstructed during adverse weather conditions (i.e. rain, snow, fog, etc.) without specific permission from the Department. Working hours shall be between _____ and _____.
- ☐ The traveled-way and shoulders shall be kept clear of mud and other construction debris at all times during construction of the permitted facility.
- ☐ No nonconstruction equipment or vehicles or office trailers will be allowed on the right-of-way during working hours.
- ☐ The right-of-way shall be left free and clear of equipment, material and vehicles during nonworking hours.

B. Explosives

- ☐ No explosive devices or explosive material shall be used within State right-of-way without proper license and approval of Kentucky Department of Mines and Minerals, Explosive Division.

C. Other Safety Requirements

- ☐ _____

II UTILITIES

- ☐ * All work necessary within the right-of-way shall be behind a temporary fence erected prior to a boring operation.
- ☐ *The temporary woven wire fence shall be removed immediately upon completion of work on the right-of-way and control of access immediately restored to original condition, in accordance with applicable Kentucky Department of Highways Standard Drawings.
- ☐ * All vents, valves, manholes, etc. are to be located outside the right-of-way.
- ☐ * Encasement pipe shall extend from right-of-way line to right-of-way line and shall be one continuous run of pipe. The encasement pipe shall be welded at all joints.
- ☐ The boring pit and tail ditch shall not extend past the existing toe of slope or bottom of ditch line (from the right-of-way) and shall be a minimum of 30" deep.
- ☐ Encasement pipe shall conform to current standards for highway crossings in accordance with the Permits Manual.
- ☐ Parallel lines shall be constructed between back slope of ditch line and right-of-way line and shall have a minimum of _____" cover above top of pipe or conduit. (30" preferred)
- ☐ All pavement cuts shall be restored per Kentucky Transportation Cabinet Form No. TC 99-13.
- ☐ Aerial crossing of this utility line shall have a minimum vertical clearance of _____ feet from the high point of the roadway to the low point of the line (calculated at the coefficient for expansion of 120 degrees Fahrenheit).
- ☐ The 30' clear zone requirement will be met to the extent possible in accordance with Chapter 99-01.0521 of the Permits Manual.
- ☐ Special Requirements
- _____

- Applies to Fully Controlled Access Highways only.

A. OSHA

- III ☐ Kentucky Occupational Safety and Health Standards for the construction industry which has the effect of law states in part: (Page 52, 1926.651 Specific Excavation Requirements) "Prior to opening an excavation, effort shall be made to determine whether underground installations: i.e., sewer, telephone, water, fuel, electric lines, etc., will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

B. Archaeological

- ☐ Whenever materials of an archaeological nature are discovered during the course of construction work or maintenance operations, contact shall be made immediately with The Division of Environmental Analysis which maintains an archaeologist on its staff, or with the Office of the State Archaeologist located at the University of Kentucky. Following this consultation further action shall be decided on a case-by-case basis by the State Highway Engineer or the Transportation Planning Engineer or their designated representative.

C. Utilities in the Work Areas

- ☐ The permittee is to be responsible for any damage to existing utilities and any utility modifications or relocations within State right-of-way which necessary, as determined by the Department or by the owner of the utility, are to be at the expense of the permittee and subject to the approval to the Department.
- ☐ All existing manholes and valve boxes are to be adjusted to be flush with finished grade.

IV RIGHT-OF-WAY RESTORATION

- ☐ All disturbed portions of the right-of-way are to be restored to grass as per Kentucky Department of Highways Standard Specifications for Road and Bridge Construction (latest edition). A satisfactory turf, as determined by the Department, is to be established by the permittee prior to release of indemnity. Sodding or seeding as follows:

Lawn or High Maintenance Situation	- 70 % Lawn Fescue (eg. variety-Falcon) - 30 % Bluegrass or 70 % Lawn Rye (eg. variety-Derby) 30 % Bluegrass
Right-of-Way Lawn Maintenance Situation	- 70% KY 31 Fescue - 30 % Perennial Rye Grass or 100% KY 31 Fescue

- ☐ 2 Tons Clean Straw mulch per acre of seeding.
- ☐ Prior to seeding, the ground must be prepared in accordance with Kentucky Department of Highways Standard Specifications for Road and Bridge Construction (latest edition).
- ☐ Substitutes for sod such as artificial turf or rocked mulched, or paved areas may be acceptable if they are esthetically pleasing.
- ☐ All ditch flow lines and all ditch side slopes are to be sodded.
- ☐ Existing concrete right-of-way markers are not to be disturbed, but if damaged in any way, they are to be entirely replaced by the permittee with new concrete markers to match the original markers, in accordance with Kentucky Department of Highways Standard Drawings. Markers which are entirely removed are to be re-established in the proper locations by the permittee and to the satisfaction of the Department.
- ☐ Other right-of-way restoration requirements are as follows:

V DRAINAGE

- ☐ All pipe is to be laid in a straight alignment, to proper grades, and with all materials and methods of installation including bedding and joint seating in accordance with Department Standard Specifications for Road and Bridge Construction, latest edition. Pipe is not to be covered until inspected by Department and express permission obtained to make backfill.

- ☐ All gutter lines at the base of new curbs are to be on continuous grades, and pockets of water along curbs, or in entrance areas, or other paved areas within the right-of-way are not to be acceptable.
- ☐ All drainage structures and appurtenances (manholes, catch basins, curbing, inlet basins, etc.) shall conform to department specifications and shall be constructed in accordance with Department standard drawings. Type required _____

VI PAVING

- ☐ No bituminous pavement is to be installed within the right-of-way between November 15 and April 1, nor when the temperature is below 49°F., without the express consent of the Department. No bituminous pavement is to be installed when the underlying course is wet.
- ☐ Paving within the right-of-way shall be as follows:
- ☐ Base (Type) _____ (Thickness) _____
- ☐ Surface Base (Type) _____ (Thickness) _____
- ☐ Finished Surface (Type) _____ (Thickness) _____
- ☐ Existing pavement and shoulder material shall be removed to accommodate the above paving specifications.
- ☐ The finished surface of all new pavement within the right-of-way shall be true to the required slope and grade, uniform in density and texture, free of irregularities and equivalent in riding qualities to the adjacent highway pavement or as determined by the Department of Highways.
- ☐ All materials and methods of construction, including base and subgrade preparation shall be in accordance with Kentucky Department of Highways Specifications for Road and Bridge Construction, latest edition.
- ☐ 24 hours notice to the Department is required prior to beginning paving operations.
Phone _____ Name _____
- ☐ To insure proper surface drainage the new pavement is to be flush with the edge of existing highway pavement and is to slope away from the existing edge of pavement as specified on drawings.

VII SIDEWALKS SPECIFICATIONS

A. New Sidewalks

- ☐ Sidewalks are to be constructed of Class A concrete (3,500 p.s.i. test), are to be _____ feet width, are to be 6" in thickness across the bituminous entrance and 4" in thickness across the remaining sections.
- ☐ Sidewalks are to have tooled joints, not less than 1" in depth at "four (4) foot intervals, and 1/2" premolded expansion joints extending entirely through the sidewalk at intervals not to exceed fifty (50) feet.
*This dimension should be equal to the width of the sidewalk.
- ☐ All materials and methods of construction, including curing, is to be in accordance with Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, latest edition.

B. Existing Sidewalks

- ☐ (Applicable if existing sidewalks are being relocated) Use of the sidewalk is not to be blocked or obstructed and a usable walkway is to be maintained across the construction area at all times.
- ☐ All damaged sections of the sidewalks are to be entirely replaced to match existing sections.

VIII DENSE GRADED SHOULDERS

- ☐ Any existing dense graded aggregate shoulders on the entire frontage within the construction area, which have been disturbed, damaged or on which dirt has been placed or mud is deposited or tracked, are to be restored to original condition by removal of all contaminated material and replaced to proper grade with new dense graded aggregate.
- ☐ All new graded aggregate shoulders as specified on the plan are to consist of 5" compacted dense graded aggregate/2 1/2 pounds per square yard calcium chloride.
- ☐ All dense graded aggregate shoulders are to slope away from the new edge of pavement at the rate of 1/4" per foot.

IX CURBING

A. Bituminous Curbs

- ☐ Bituminous Concrete curbs shall be given a paint coat of asphalt emulsion.
- ☐ The surface under the bituminous concrete curb shall be tacked with asphalt emulsion.
- ☐ All bituminous concrete curbs shall be constructed of a Class I Bituminous concrete mixture as specified by official Department of Highways specifications.

- ☐ All bituminous curbs shall be of the rolled curb type with a minimum base width of 8" and a minimum vertical height of _____ inches. The top of the curb shall be constructed in such a manner as to guarantee a uniform rolled effect throughout the entire run.

B. Concrete Curbs

- ☐ All curbs or curb and gutter are to be constructed of Class A concrete, 3,500 p.s.i. test, and are to be uniform in height, width and alignment, true to grade and satisfactory in finish and appearance as determined to the Department. All materials and methods of construction, including curing, is to be in accordance with Department of Highways Standard Specifications for Road and Bridge Construction, latest edition.
- ☐ All concrete curbs are to be 6" in width, extend _____ " above finished grade and 12" below finished grade, with all visible edges rounded to 1/2 " radii.
- ☐ All concrete curbs shall have expansion joints constructed at intervals of not more than 30 feet and 1/2" premolded expansion joint material (cut to conform to the curb or to the curb and gutter section) shall be used in each expansion joint.
- ☐ The last _____ feet of all concrete curbs are to be tapered down to finish grade.

X. Right-of-Way Fence Replacement

- ☐ • The replacement fence shall be a height of at least (48") and shall be of sufficient density to contain all animals. (If applicable)
- ☐ • The replacement fence shall be a minimum of one foot (1') and a maximum of two feet (2') outside the right-of-way line.
- ☐ • The fence materials and design shall meet accepted industry standards and be treated or paintable.
- ☐ • The permittee shall be required to maintain the fence in a high state of repair.
- ☐ • The existing fence shall be removed by permittee and stored at Department's maintenance storage yard for future reuse by the Department.
- ☐ • The control of access shall not be diminished as a result of replacement of the fence.
- ☐ • Miscellaneous: _____
- _____
- _____
- _____
- _____

NOTICE TO PERMITTEE

THE PERMITTEE AGREES THAT ALL WORK WITHIN THE EXISTING RIGHT-OF-WAY SHALL BE DONE IN ACCORDANCE WITH THE PLANS AS APPROVED AND PERMITTED BY AN ENCROACHMENT PERMIT, ANY CHANGES OR VARIANCES MADE AT THE TIME OF CONSTRUCTION WITHOUT WRITTEN APPROVAL FROM THE DEPARTMENT OF HIGHWAYS SHALL BE REMOVED BY THE PERMITTEE AT NO EXPENSE TO THE DEPARTMENT OF HIGHWAYS AND SHALL BE REDONE TO CONFORM WITH THE APPROVED PLANS.

SUBMIT 5 (FIVE) COMPLETED FORMS WITH SKETCHES TO: Commissioner of Transportation Transportation Building St. Paul, MN 55155 Attn: Utilities Engineer	STATE OF MINNESOTA DEPARTMENT OF TRANSPORTATION APPLICATION FOR UTILITY PERMIT ON TRUNK HIGHWAY RIGHT OF WAY
INSTRUCTIONS TO APPLICANT	1. No photo copies of application 2. Only page one of form is to be completed 3. Sign all five forms
Reference: County _____ T.H. _____	Company Project No. _____
<input type="checkbox"/> New Facility <input type="checkbox"/> Replacement Facility	Agreement No. _____
Application is hereby made for permission to place, construct and thereafter maintain a _____ along or across Trunk Highway No. _____ from _____ to _____ _____ feet from center line on the _____ (east, west, north or south) side of the trunk highway as shown on the attached sketch.	
I. AERIAL CONSTRUCTION (Check appropriate box) <input type="checkbox"/> Single pole <input type="checkbox"/> Open wire <input type="checkbox"/> H-Frame <input type="checkbox"/> Cable <input type="checkbox"/> Single pole & H-Frame <input type="checkbox"/> Vertical <input type="checkbox"/> Steel tower <input type="checkbox"/> Cross-arm <input type="checkbox"/> Other _____ <input type="checkbox"/> Vertical & cross-arm	LIGHTING Mounting Height _____ Mast Arm Length _____ Type of Lamp _____ Watts _____ Poles-Breakaway _____ Non-Breakaway _____
Voltage _____	Number of Conductors _____
Minimum height of conductor: _____ ft. along highway _____ ft. at crossings over highway	
II. UNDERGROUND CONSTRUCTION <input type="checkbox"/> Direct buried	Will Facility be attached to a bridge? <input type="checkbox"/> Yes <input type="checkbox"/> No
Voltage _____	Number of Conductors _____
Size of Conductors _____	Depth _____
CONDUIT <input type="checkbox"/> Multiple tile <input type="checkbox"/> Transite <input type="checkbox"/> Clay tile <input type="checkbox"/> Sectional concrete <input type="checkbox"/> Steel pipe <input type="checkbox"/> Other _____	CASING <input type="checkbox"/> Steel pipe <input type="checkbox"/> Sectional concrete <input type="checkbox"/> Other Wall thickness _____ Grade _____ Class _____ Size _____
Max. Operating Pressure _____ Wall thickness _____ Grade _____ Class _____ Size _____ Depth _____	
METHOD OF INSTALLING UNDER ROADBEDS (if open trench, explain why necessary) <input type="checkbox"/> Jacking <input type="checkbox"/> Boring <input type="checkbox"/> Pneuma Gopher <input type="checkbox"/> Open trench	
III. EXTENT & LOCATION OF TREE TRIMMING AND/OR CLEARING:	
IV. Work to start on or after _____ and to be completed on or before _____ V. The applicant, in carrying on all of the work mentioned above or referred to in its application and in the Permit for construction issued therefore, shall strictly conform to the terms of the Permit, and the Rules of the State of Minnesota as set forth in Minnesota Rules 1983 as of July 31, 1983 together with the Special Provisions, all of which are made a part hereof. The applicant specifically agrees to be bound hereby. The applicant shall also comply with the regulations of all other governmental agencies for the protection of the public. The work shall be accomplished in a manner that will not be detrimental to the highway and that will safeguard the public. Dated this _____ day of _____, 19____.	Applicant _____ <small>Name of Utility making application</small> Address _____ City _____ State _____ Zip _____ Telephone (____) _____ By _____ <small>Name Print or Type Title</small> Signature _____

Pursuant to Minnesota Statutes, Section 161.45, the following Rules have been promulgated by the Commissioner of Transportation (see reverse side).

MINNESOTA RULES

1983

Adopted as of July 31, 1983

UTILITIES EQUIPMENT

8810.3100 DEFINITIONS.

Subpart 1. **Interstate highways.** Under this order "interstate highways" shall mean all trunk highways which are a part of the interstate system.

Subp. 2. **Noninterstate highway.** Under this order "noninterstate highways" shall mean all trunk highways which are not a part of the interstate system.

Subp. 3. **Trunk highways.** Under this order "trunk highways" shall mean all trunk highways including those which are a part of the interstate system.

Subp. 4. **Utility.** Under this order "utility" shall mean and include all privately, publicly, or cooperatively owned communication lines and facilities, any systems, lines, and facilities for the distribution and transmission of electrical energy, oil, gas, water, sewer, steam, and other pipe lines, railways, ditches, flumes, or other structures which under the laws of this state or the ordinance of any village or city may be constructed, placed, or maintained across, along or on trunk highway right-of-way. Dependent upon the meaning intended in the context, "utility" shall also mean the utility company, inclusive of any wholly owned subsidiary.

Statutory Authority: MS s 161.45

8810.3200 PURPOSE AND SCOPE.

Subpart 1. **Purpose.** The purpose of parts 8810.3100 to 8810.3600 is to carry out the mandate of the legislature and to effectuate that mandate as set forth in the Laws of Minnesota 1959, chapter 500, article II, section 45 (Minnesota Statutes, section 161.45) with reference to the placing, constructing, reconstructing, and maintaining of utilities across, along, upon or under the right-of-way of trunk highways.

Subp. 2. **Scope.** The scope of parts 8810.3100 to 8810.3600 is confined within the framework of and consistent with the Laws of Minnesota 1959, chapter 500, article II, section 45.

Statutory Authority: MS s 161.45

8810.3300 PERMITS.

Subpart 1. **Construction.** Except as otherwise permitted, utility construction and relocation on trunk highway right-of-way shall not be commenced until an application for a permit for construction has been made and such permit granted. The permit for construction sketch shall show the location of the proposed utility with reference to pertinent features such as the right-of-way lines, curb lines, trunk highway center line, etc. A copy of the sketch shall be provided for each copy of such permit. Prints of trunk highway right-of-way maps available upon request from the Road Plans Information Office, Department of Transportation Building, Saint Paul, Minnesota 55155.

Subp. 2. **Maintenance.** The utility shall obtain a work permit from the office of the assistant district engineer, maintenance, prior to performing service and maintenance operations on the interstate highways and shall also obtain a work permit prior to performing service and maintenance operations on the noninterstate highways when such operations require opening and disturbing the surface of the right-of-way thereof. In all other instances the utility shall notify the office of the assistant district engineer, maintenance, prior to performing service and maintenance operations on the noninterstate highways which interfere with the normal flow of traffic thereon. However, the company may perform service and maintenance operations on the trunk highways including opening and disturbing the surface of the right-of-way without a work permit in those instances where an emergency exists that is dangerous to the life or safety of the public and which requires immediate repair. The utility upon knowledge of such an emergency shall immediately notify the State Patrol Division. The utility shall take all necessary and reasonable safety measures to protect the

all claims for damages, actions, or causes of action arising out of the work to be done herein and the continuing uses by the utility, including but not limited to the placing, constructing, reconstructing, maintaining, and using of said utility under this application and permit for construction.

Subp. 7. **No easement.** The work permit or permit for construction as issued does not in any way imply an easement on private property.

Statutory authority: MS s 161.45

8810.3400 STANDARDS FOR WORK CONDUCTED UNDER PERMIT.

Subpart 1. **Trees, brush, and vegetation.** At the time of construction of the utility and at the times of subsequent maintenance, prior approval shall be obtained from the district engineer or his authorized representative for the cutting and trimming of trees within the trunk highway right-of-way. Where ever trees are cut the resulting stumps shall be removed unless otherwise provided in the special provisions of the permit for construction. Any holes caused by stump removal shall be backfilled, the area leveled, and all materials associated therewith disposed of outside the trunk highway right-of-way. The utility shall advise the district engineer or his authorized representative at least 48 hours in advance of its intent to start clearing and grubbing operations so that the proper supervision can be provided.

Burning or disk operations and/or the use of chemicals to control or kill trees, brush, and other vegetation is prohibited without prior approval from the assistant district engineer, maintenance.

Subp. 2. **Waterways.** All waterways and lines of drainage shall remain operative.

Subp. 3. **Topsoil and sod.** Wherever topsoil and sod are disturbed they shall be replaced and maintained satisfactorily until the turf is established.

Subp. 4. **Existing utility facilities.** The utility facility and installation shall not interfere with any existing utility facilities on the trunk highway right-of-way.

Subp. 5. **Warning devices.** When necessary, barricades, warning devices and flagmen shall be provided by the utility during all phases of their construction and maintenance operations on the trunk highway right-of-way.

Subp. 6. **Restoration to original condition.** Upon completion of an installation, the utility shall restore the trunk highway right-of-way to its original condition. The utility shall then notify the office of the assistant district engineer, maintenance, or project engineer of the completion of the work so that inspection can be made to determine its acceptability.

Subp. 7. **Conformity.** The installations shall be made in conformity with all applicable laws, rules, and codes covering said installations. All installations shall be made in conformity with rules of governmental agencies for the protection of the public.

Statutory Authority: MS s 161.45

8810.3500 AERIAL LINES.

There shall be only a single pole line on the trunk highway right-of-way on either side of the center line thereof, unless otherwise authorized in the special provisions of the permit for construction.

Longitudinal installations on noninterstate trunk highways shall normally be located in the outer five feet of the right-of-way. At crossings of the noninterstate trunk highway, poles shall be placed at a minimum of 30 feet from the shoulder lines of the through roadbeds unless right-of-way widths are prohibitive to such location.

Unless clearly indicated on the permit for construction sketch, the location of all brace poles, anchors, and anchor poles within the limits of the trunk highway right-of-way shall be approved by the

traveling public and shall cooperate fully with the State Patrol Division to that end. The utility in such an event will request a work permit from the office of the assistant district engineer, maintenance, not later than the second working day thereafter when a work permit would ordinarily have been required but for the emergency.

Subp. 3. **Orders to make improvements.** If at any time the state of Minnesota, acting through its commissioner of transportation, shall deem it necessary to make any improvements or changes on all or any part of the right-of-way of the trunk highway which affect a utility located on trunk highway right-of-way, then and in such event, the owner of the utility shall within 15 days after written notice from the commissioner of transportation or his authorized agent, proceed to alter, change, vacate, or remove said utility from the trunk highway right-of-way so as to conform to said trunk highway changes and as directed by the commissioner of transportation. Such work shall be done without any cost whatsoever to the state of Minnesota except as otherwise provided by law or agreement and shall be completed within the date specified in said written notice, which date shall be reasonable under the circumstances. The utility shall assume all liability and save the state of Minnesota harmless from any and all claims of damage of any nature whatsoever occasioned by reason of not having removed said utility within the time specified in said notice. Notwithstanding the provisions of parts 8810.3100 to 8810.3600, the state may reimburse a municipality for the cost of the first relocation of a municipally owned utility located within the limits of a municipal street at the time that the street was taken over by the State as a trunk highway, when such relocation is required by construction or reconstruction of the trunk highway.

Subp. 4. **Along interstate highways.** Utilities along interstate highways shall be located outside the control-of-access lines except as outlined below. Where the control-of-access lines coincide with the right-of-way lines, the utilities shall generally be located on private property. Where the control-of-access lines and right-of-way lines do not coincide, utilities may in general be located in the area between them. All utilities shall be serviced and maintained without access from the ramps, loops, and through traffic roadbeds. Utilities may be serviced from frontage roads and roads other than another interstate highway which cross either over or under the interstate highway. At aerial crossings of an interstate highway, supporting poles may be located on interstate highway right-of-way if they are a minimum of 30 feet beyond the shoulders of all through traffic roadbeds; however, in no event shall they be located in a median unless its width is 80 feet or more. Manholes and other points of access to underground crossings may be permitted on the interstate highway right-of-way only when located outside the shoulders of the through traffic roadbeds, loops, or ramps. The restrictions of this subpart shall not apply to utility lines which service facilities required for operating the interstate highway.

There may be extreme cases where, under strictly controlled conditions, a utility may be permitted inside the control-of-access lines along an interstate highway. In each case there must be a showing that any other utility location is extremely difficult and unreasonably costly to the utility consumer, that the installation on the right-of-way of the interstate highway will not adversely affect the design, construction, stability, traffic safety, or operation of the interstate highway and that the utility can be serviced without access from through traffic roadbeds, loops, or ramps.

Subp. 5. **Deposit, bond, or undertaking.** The commissioner of transportation may require the utility, or its contractor, to furnish a deposit in the form of a certified check, a surety bond or corporate undertaking in favor of the state of Minnesota, commissioner of transportation, for any expense incurred by the state in the repairing of damage to any portion of the trunk highway right-of-way caused by work performed under a work permit or a permit for construction, including any out of the ordinary engineering supervision and inspection expense provided by the state. In those instances wherein a deposit is required, the amount of the deposit shall be specified in the special provisions of the permit. If a check is furnished, any moneys remaining over and above such expense shall be returned to the applicant.

Subp. 6. **Liability.** Except for the negligent acts of the state, its agents, and employees, the utility shall assume all liability for, and save the state, its agents and employees, harmless from, any and

district engineer or his authorized representative prior to actual installation.

In those instances in which a utility is issued a permit or permits for construction on both sides of the trunk highway right-of-way in a given area such permit is conditioned upon the utility subsequently providing joint use to other utilities upon reasonable terms mutually agreeable to the utilities.

Statutory Authority: MS s 161.45

8810.3600 UNDERGROUND LINES.

All crossings of the roadbeds of the trunk highways shall be made by boring inside a casing or carrier pipe, or by jacking, unless this procedure is modified in the special provisions of the permit for construction. The auger shall not lead the casing or carrier pipe by more than one inch. Open trenching shall be restricted to the area from five feet beyond shoulder to the right-of-way line except as modified in the special provisions of the permit for construction.

When pipes with bells and flanges are installed, the crossings of the roadbeds of trunk highway shall be made by boring inside a conduit, as provided in the preceding paragraph, of jacking a conduit of sufficient diameter to permit threading the carrier pipe through it.

All voids caused by jacking or boring shall be filled by pressure grouting. The grout material shall consist of a sand-cement slurry of at least two sacks of cement per cubic yard and a minimum of water to assure satisfactory placement.

The underground utilities shall be so installed as virtually to preclude any necessity for disturbing the roadbeds to perform maintenance operations.

Underground installations shall be accomplished without damaging or destroying the principal root structure of specimen trees.

Statutory Authority: MS s 161.45

NOTE:

As used in Minnesota Rules, Utilities Equipment, part 8810.3100 Definitions, Subpart 1, interstate highways shall include all Interstate Highways and Federal Aid Freeways.

ENCLOSE SKETCH

STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION

Page 4

Attn:

Utility Permit

Reference: Control Section _____ T.H. _____

In accordance with Minnesota Statutes Section 161.45,
Minnesota Rules Section 8810, and this application,
a Utility Permit for construction is granted to:

to place, construct and thereafter maintain a:

on or across, the right of way of Trunk Highway No. _____ in the location shown on
the sketch which is a part of the application, or in a location specified by the Department of Transportation in
the attached Special Provisions.

COPY

Recommended for approval:

Dated this _____ day of _____ 19 ____

District

(Date)

Approved by:

Division Engineer
Federal Highway Administration

(Date)

Commissioner of Transportation
Transportation Building
St. Paul, Minnesota 55155

By _____
Utilities Engineer

COPIES:

Applicant _____
Utilities Engineer _____
District Engineer _____
Assistant District Engineer _____
Maintenance _____
Project Engineer _____

Permit No. _____

Amount of Surety Bond Required

TOWN OF WELLESLEY

WELLESLEY, MASSACHUSETTS 02181

Stephen S. Fader, P.E.
TOWN ENGINEER



DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
STREET OCCUPANCY PERMIT

- ☒ APPLICATION
☒ EXCAVATION
☐ NON-EXCAVATION
☐ RESIDENTIAL DRIVEWAY
☐ COMMERCIAL DRIVEWAY
☐ RESURFACE EXISTING DR.
☐ CORING OR SHUTOFF HOLES
☐ SAWCUTS

NO. _____

PERMIT FEE _____

DATE _____

LETTER OF CREDIT _____

CERTIFIED BANK CHECK _____

BOND _____

Having filed the required indemnity and subject to certain conditions, restrictions and limitations which are set forth on the reverse side hereof,
PERMISSION IS HEREBY GIVEN TO: _____ **ADDRESS OF WORK:** _____

For the purpose of _____

Pedestrian and vehicular traffic must be protected at all times. The Department of Public Works and all utilities must be notified 72 hours before work commences exclusive of Saturdays, Sundays and legal holidays. Copy of permit is to be kept on the job site when work is being done.

DIG SAFE NO. _____

STARTING DATE _____

The authority to do any act under this permission shall expire at
six p.m. on _____.

APPROVAL UTILITY DIVISIONS:

Electric _____ Engineers _____ Sewer _____ Water _____

Permanent restoration will be done by (X) the Permit Applicant () Town of Wellesley

Signature of Applicant _____

Date _____

Approved for the Board of Public Works

By _____
Director

Date _____

For Ast. Director & Town Engineer

Date _____

Permittee shall give written notice to Highway Division when temporary surfacing is completed and when permanent surfacing is finished, giving date of completion.

CONDITIONS, RESTRICTIONS, AND LIMITATIONS

1. That the licensee, named on the reverse side hereof, shall indemnify and save the Town of Wellesley harmless from any damage, loss, cost or expense of any kind or nature, sustained or incurred by the Town of Wellesley and due to the presence of the wires, pipes or structures of said licensee in, upon or under the highways of said town or to the prosecution of any work covered by this permit or undertaker by virtue of this permit.
2. That if said licensee shall open, occupy or obstruct any street said licensee shall at all times keep said street properly lighted and protected by day and properly lighted by night and shall in respect of said street perform all the duties which the Town of Wellesley would be required to perform to keep the street safe and passable and in such condition as to fully comply with the requirements of law in respect to the condition of said street.
3. That the said licensee shall acquire no vested interest in said street, and no vested right to maintain any wires, pipes or structures, attachments, appliances and fixtures or apparatus in or under said street, but shall upon request of the Board of Public Works of said Town of Wellesley make any removal of its wires, pipes, or structures, attachments, appliances, fixtures and apparatus erected under this permission whenever necessary in the judgment of said Board for any public purpose, and if it shall fail to do so upon said request said Board of Public Works of the Town of Wellesley for the time being may remove or cause to be removed said wires, pipes or structures, appliances, attachments, fixtures and apparatus, at the expense of said licensee without liability upon said town for any damage or loss sustained by said licensee therefrom; and said licensee shall after notice and a hearing reestablish its wires, pipes, or structures if desired in any substitute location granted it by said Board of Public Works in accordance with the provisions of the Statutes of the Commonwealth.
4. That no work shall be done hereunder unless and until the said licensee shall obtain the approval in writing hereto of the Director of Public Works of the said Town of Wellesley, and all work done under this permission shall be done in a manner satisfactory to the Board of Public Works of the Town of Wellesley, or its duly authorized agent or appointee.
5. In case any wires, pipes, or structures erected under this permission or in connection therewith, shall be upon poles which do not belong to the Town of Wellesley, or upon land which is not a public highway duly established according to law then in such case the location of any such pole, shall, if the same thereafter be comprised within the limits of a public highway, cease and determine and be and become the property of the Town of Wellesley, and the pole shall, if requested by the Board of Public Works of the Town of Wellesley, be sold to the Town of Wellesley by said licensee for its then fair cash market value, unless said pole shall be relocated in the name of said licensee by duly authorized officials. In case the parties cannot agree upon the value of said pole, the same shall be determined by three arbitrators to be selected, one by each of the parties and the third by two so chosen, who shall give the parties a hearing. A decision of a majority of whom shall be final and binding upon the parties.
6. If permanent restoration is to be done by the permit applicant: The permit applicant agrees to guarantee his permanent restoration work for a period of two (2) years from the date of permanent restoration. This date shall correspond to the date on which the permit applicant receives initial acceptance of his work after returning the Permanent Restoration Record Card to the Permit Office. The applicant must provide an exact description and location of restored work on the permanent Restoration Record Card. The permit applicant could be required to completely re-excavate, refill, and repave any permanent restoration that may fail within the two year guarantee period.
7. The permit applicant hereby authorizes the Town to make emergency temporary repairs to any street right-of-way excavation as may be necessary to insure the safety of pedestrians and vehicles and to charge the costs of said repairs to the applicant.
8. If the within named licensee shall fail to comply with, or observe any of the provisions of this permit, the said Town of Wellesley shall have the right to revoke all authority arising hereunder and upon giving notice to said licensee of said revocation all authority to act hereunder shall cease.
9. This permission is subject to such rules and regulations in regard to the subject matter hereof as may from time to time be made by the Board of Public Works of the Town of Wellesley in respect thereto.
10. In case the licensee within named shall do any act under or by virtue of this license said licensee shall be deemed to have accepted and assented to, and shall be bound by all the terms, provisions and conditions thereof.

№ 17227

**Office of the City Engineer
657-8277**

PUBLIC RIGHT OF WAY PERMIT APPLICATION

City of Billings, Montana P.O. Box 1178 Billings, Montana 59103

Fees \$ _____ Charge _____ Cash _____ Receipt _____ Date of Application _____
 Issued to: _____ Phone # _____
 Builder: _____ Phone # _____
 Property Owner: _____ Phone # _____
 Job Address: _____
 Legal Description: _____

YOUR WORK MUST BE INSPECTED—CALL 24 HOURS IN ADVANCE

This permit must be kept on the work site and shown when requested. All work in the right of way will be signed pertaining to traffic control in accordance with "Manual of Uniform Traffic Control Devices."

All attached special provisions and sketches are considered part of this permit and are therefore governed in accordance with the aforementioned. Contractor shall call all utilities before excavating.

Approved by _____ DATE ISSUED _____
(For City Engineer)

Comments: _____

DRIVE APPROACH	ACCESS	FEES	FEES
<input type="checkbox"/> Standard	No. _____ Width _____	<input type="checkbox"/> Paved Street <input type="checkbox"/> Gravel Street <input type="checkbox"/> Concrete Street <input type="checkbox"/> Exc. - R/W Only <input type="checkbox"/> Paved Alley <input type="checkbox"/> Concrete Alley <input type="checkbox"/> Gravel Alley <input type="checkbox"/> Boring	Length _____
<input type="checkbox"/> Rollover	No. _____ Width _____		Length _____
<input type="checkbox"/> Alley Approach	No. _____ Width _____		Length _____
<input type="checkbox"/> Other	No. _____ Width _____		Length _____
			Length _____
SIDEWALK	CONCRETE		
<input type="checkbox"/> Boulevard	Length _____	<input type="checkbox"/> Storm Drain <input type="checkbox"/> Water <input type="checkbox"/> Sanitary Sewer	
	Width _____		
<input type="checkbox"/> Curbwalk	Length _____		
	Width _____		
CURB & GUTTER		SERVICE CONNECTIONS	
<input type="checkbox"/> Standard	Length _____	No. _____ Size (In.) _____	
<input type="checkbox"/> Rollover	Length _____	No. _____ Size (In.) _____	
		No. _____ Size (In.) _____	
		OTHER	
<input type="checkbox"/> Sidewalk	Length _____	<input type="checkbox"/> Private Project: Contract Amount _____	
<input type="checkbox"/> Curb & Gutter	Length _____	Engineering Firm _____	
		<input type="checkbox"/> Misc. (Describe) _____	
	SUB TOTAL \$ _____		SUB TOTAL \$ _____
			TOTAL FEE \$ _____

Nature of Work:

Estimated Date of Work Start:

This Permit Expires in one hundred eighty (180) days from

DATE ISSUED and becomes null and void if work is not completed in that time.

Application is hereby made for this permit as indicated above and shown on the accompanying plan or sketch and/or described on the reverse side of this sheet. Said Work will be done under and in accordance with all rules, regulations, and ordinances of the City of Billings, Montana, so far as said rules are applicable thereto. Applicant agrees to maintain work in a manner approved by the City. Applicant also hereby agrees and is bonded and held responsible to the owner for any and all damages to any other installation already in place as a result of work covered by this permit. Applicants to whom permits are issued shall at all times indemnify and save harmless the City of Billings, members of the City Council, the State of Montana, and all City and State employees, agents, and officers from responsibility, damage, or liability arising from the exercise of the privileges granted in such permits.

Dated

Name of Company

By

Title[illegible]

Orig. - Customer
Dupl. - Finance
Trip. - Public Works File
Quad. - Inspector
Quint. - Hard Copy

PUBLIC WORKS & TRANSPORTATION DEPARTMENT

CITY OF PASADENA

Street Improvement or Occupation Certificate

No 25265

CITY HALL
100 N. GARFIELD AVE., RM. 212
(818) 405-4191

Date _____ 19____

THIS CERTIFIES, that _____

Address _____ Phone _____

City _____ State _____ Zip _____

is hereby granted permission to _____

at _____
per Chapter 12.24 of the Pasadena Municipal Code, as amended, and in accordance with the "Standard Specifications For Public Works Construction", latest edition, and any special provisions of the Public Works Department.

Permit Expires on: _____

Inspection MUST BE requested ONE DAY in advance.

Cynthia J. Kurtz, Director of
Public Works and Transportation

By: _____

VOID UNLESS VALIDATED BY CASHIER

FEES

Processing\$ _____
Inspection\$ _____
Rent\$ _____
Penalty\$ _____
Total Fees\$ _____

DEPOSITS

Paving\$ _____
Street tree\$ _____
Other\$ _____
Total Deposits\$ _____
PAY CASHIER\$ _____

5/91

A VALIDATED COPY OF THIS PERMIT MUST BE KEPT AT THE JOB SITE AT ALL TIMES.

Sample Utility Permit

City of _____ Permit No. _____
Receipt No. _____ One-Call Ticket No. _____

FOR APPLICANT TO FILL IN (PRINT)

Permittee _____
Mail Address _____
City _____ Zip _____
Telephone No. _____
Emergency No. _____
Job Location _____

FEES

Issuance Fee \$ _____
Plan Check Fee \$ _____
Inspection Fee \$ _____
Special Deposit Fee \$ _____
One-Call Service Fee \$ _____

Estimated Start Date _____
Estimated Completion Date _____

Type of Surface _____
Length _____ Width _____ Depth _____
City License No. _____
State License No. _____
Workman's Compensation No. _____

APPLICANT'S DECLARATION

I hereby make application for permit to encroach into the public right-of-way at the described location(s). It is agreed by the applicant that the City of _____ and any of its officers or employees thereof shall be saved harmless by the applicant from any liability or responsibility for any accident, loss or damage to persons or property occurring as the proximate results of any of the work undertaken under the terms of this application and that all of said liability is hereby assumed by the applicant.

Permit void if work is not started and inspection not requested within 60 days of date of permit issuance. I am/we are aware of, and will comply with Section 3800 of the Labor Code regarding liability insurance for Workman's Compensation or to undertake self-insurance before commencing any of the work.

Call _____ 24 hours prior to all required inspections.

Signature of Permittee: _____ Date: _____

PERMIT APPROVAL AND ACCEPTANCE OF WORK

Street pavement section B _____ P _____ latest date and type of resurfacing _____. In compliance with the above application and subject to all the terms, conditions and restrictions written or printed as general or special provisions on any part of this form and attached hereto, permission is granted to encroach or perform work within public rights-of-way.

Approved by: _____ Date: _____

Work was hereby inspected and accepted by the City.

Inspector's signature: _____ Date: _____

All work in public right-of-way shall be per City standards, policies, codes and these Special Provisions as well as these General Conditions, and shall be done under the supervision of and to the satisfaction of the City Engineer or their representatives.

All inspection costs incurred to this work shall be borne by the Permittee unless otherwise specified on the face of the permit.

Utilities damaged or broken by Permittee shall be repaired or replaced to the satisfaction of their owners at Permittee's expense. Any trees, shrubbery, or landscaping damaged shall be replaced as directed by the City Engineer.

Any concrete to be removed shall be sawcut and replaced as directed to match existing color, finish and scoring. Pavement to be removed shall be saw or spade cut. Permanent sidewalk, parkway and pavement repairs shall be completed within 30 days of installation of facilities covered under permit.

All traffic interference, control, detours, and lane closures shall be made in accordance with latest State "Manual of Warning Signs, Lights and Devices" and are subject to the City Engineer's prior review and approval. Cost of these warning devices shall be borne by the Permittee.

Compaction test may be required at the discretion of the City Engineer and shall be performed at Permittee's expense by an approved soil testing agency.

Non-compliance with these or other permit conditions may be cause for permit revocation.

SPECIAL PROVISIONS

(items checked shall be made part of permit)

- All trenches and/or open holes shall be filled, covered, or plated and adequately barricaded at the end of each day and whenever work is not in progress.
 - _____ lane(s) of traffic in _____ direction(s) is (are) to be kept open and clear at all times on _____.
 - _____ work on _____ shall be done between the hours of _____ and _____.
 - Permittee shall obtain a State Division of Industrial Safety Excavation permit and file copy of the same with City Engineer prior to start of permitted work.
 - Compaction in pavement and traffic areas shall be 85% minimum, with 90% in the upper three feet from the pavement surface or finished grade.
 - Compaction in parkway and sidewalk areas shall be 85% minimum relative compaction and shall be mechanically compacted.
 - Jack/bore facilities are as shown on plan.
 - Concrete sidewalks or curbs shall be sawcut to the nearest score marks and replaced equal in dimensions to that removed with score marks matching existing score marks. Sidewalk shall be Class 520 - C-2500 concrete 4" thick.
- Pipe bedding and backfill of excavations shall be with attached standards.

Additional conditions.

Source: *Guidelines for Regulation of Excavations in/or Adjacent to Streets*, APWA

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