Strategies To Avoid Utility Relocations

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ABSTRACT
Many utilities are unnecessarily relocated each year to accommodate highway construction. This is because far too many highway projects are designed without consideration of underground utilities information. Upon or near completion of the design, available utilities information is added. Any utilities that are in the way of the already designed roadway have to move. Often utilities are not even discovered until damaged during excavation activities. This no longer has to happen though. There is no longer a need to relocate many utilities. Strategies are available now to keep this from happening. Enhanced coordination, cooperation, and communication (CCC) between project owners and utility companies and utilization of accurate and comprehensive information provided using subsurface utility engineering (SUE) make it possible for designers to utilize a myriad of techniques to make relatively minor adjustments and "design around" utilities that traditionally would have been relocated.

INTRODUCTION
Many utilities are unnecessarily relocated each year to accommodate highway construction. This is because highway projects are often designed without consideration of underground utilities information. In such cases, upon or near completion of the design, available utilities information is added and any utilities that are in the way have to move. Utilities are often not even discovered until damaged during excavation activities. This no longer has to happen though. Enhanced coordination, cooperation, and communication (CCC) between governmental transportation departments and utility companies, and utilization of accurate and comprehensive information provided using subsurface utility engineering (SUE) make it possible for designers to utilize a myriad of techniques to make relatively minor adjustments and "design around" many utilities that traditionally would have been relocated.

COORDINATION, COOPERATION, COMMUNICATION (CCC)
Good CCC between governmental transportation departments and utility companies are essential throughout the development and construction of highway projects. Projects have typically been designed in the past without sufficient consideration of utilities, resulting in the need to unnecessarily relocate many conflicting utilities to accommodate highway construction. Consultation with utility companies early in the development of highway projects may facilitate minor plan changes to avoid utilities, thus eliminating the need to relocate them.

It has been common knowledge for many years that utility-related problems are a leading cause of delays to highway construction projects. Avoiding utility relocations would alleviate this problem. Early and frequent use of CCC can help.

Increased Federal and State funding for highway projects, combined with utility company mergers and downsizing, result in more potential utility relocations and construction delays, and more of a need to avoid them if possible. A video prepared for and available from the Federal Highway Administration (FHWA) entitled *CCC: Making the Effort Works!* (1) outlines ways in which transportation departments and utility companies can reduce utility-related disruptions, minimize costs, and accelerate construction (2).

A best practice developed by the American Association of State Highway and Transportation Officials (AASHTO) Highway Subcommittee on Right of Way and Utilities for the AASHTO Standing Committee on Highways (3) encourages transportation departments to coordinate and communicate frequently with utility companies to reduce delivery time, reduce costs, and improve quality in the utilities process.

The AASHTO best practice encourages transportation departments to:

- Provide utility companies with long-range highway construction schedules.
- Host meetings with utility companies to discuss future highway projects.
- Recognize the importance of long-range highway/utility coordination.
- Organize periodic (monthly, quarterly, annual) meetings with utility owners within a municipality, county, or geographic or highway planning region.
- Solicit similar information on utility owners' capital construction programs, particularly where a utility's planned expansion or reconstruction may encroach on and coincide with a planned highway project
- Consider using the long range-planning meeting as a convenient forum to discuss other highway/utility issues, such as accommodation policies, reimbursement, etc.

The State of Wisconsin has passed legislation mandating CCC and setting up a timeframe for interaction. Other States are starting to pay more attention to the benefits of CCC.

It just makes good sense. The more information that is available early in the development of projects; the more informed transportation departments and utility companies are of each others needs; the more stakeholders are talking to each other -- the more likely it is going to be that utility relocations can be avoided.

SUBSURFACE UTILITY ENGINEERING (SUE)

A new engineering process has evolved in the United States over the past few decades. Many governmental transportation agencies, utility companies, and design consultants use these services to identify the quality of subsurface utility information needed for highway plans, and to acquire and manage that level of information during the development of projects. This engineering process is known as Subsurface Utility Engineering (SUE). The efficient use of SUE allows highway designers to avoid utility relocations.

The SUE process combines civil engineering, surveying, geophysics, nondestructive excavation, and other technologies. It provides accurate mapping of existing underground utilities in three dimensions, which not only makes it possible to avoid unnecessary utility relocations and related downtime, but also eliminates unexpected conflicts with utilities, and enhances safety during construction. The use of SUE has become a routine requirement on many highway projects, and is strongly advocated by the FHWA and many governmental transportation departments.

Purdue University studied the cost savings of four State transportation departments that routinely used SUE. Seventy-one (71) projects were studied. The total construction costs of these projects were in excess of one billion dollars. The projects involved a mix of freeway, arterial, and collector roads in urban, suburban, and rural settings. As a result, a total of $4.62 in savings was quantified for every $1.00 spent on SUE (4).

A national standard guideline developed by the American Society of Civil Engineers (CI/ASCE 38-02, *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data*) (5) defines SUE as a branch of engineering practice that involves managing certain risks associated with: utility mapping at appropriate quality levels, utility coordination, utility relocation design and coordination, utility condition assessment, communication of utility data to concerned parties, utility relocation cost estimates, implementation of utility accommodation policies, and utility design. These activities, combined with traditional records research and site surveys, and utilizing new technologies such as surface geophysical methods and non-destructive vacuum excavation, provide quality levels of information.

The ASCE standard guideline recognizes four quality levels of subsurface utility information that should be depicted on highway plans. These quality levels range from Quality Level D (the lowest level) to Quality Level A (the highest level). The highest level of accuracy and comprehensiveness is generally not needed at every point along a utility's path, only where conflicts with design features are most likely to occur. Hence, lesser levels of information may be appropriate at points where fewer conflicts or no conflicts are expected.

The four quality levels are as follows:

- Quality Level D (QL-D) information comes solely from existing utility records.
- Quality Level C (QL-C) involves surveying visible above-ground utility facilities, such as manholes, valve boxes, posts, etc., and correlating this information with existing utility records.
- Quality Level B (QL-B) involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities.
- Quality Level A (QL-A) involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material, and other characteristics.

The ASCE standard closely follows concepts already in place in the subsurface utility engineering (SUE) profession. Nicholas Zembillas, a nationally recognized authority on SUE and a member of the ASCE committee that developed the standard, says, "SUE is a revolutionary engineering process that has evolved in the United States over the past two decades. Many state and local highway agencies and/or their design consultants use it routinely in the early development of highway projects. They do so by employing the services of SUE consultants to identify the quality of subsurface utility information needed for highway plans and to acquire and manage that level of information during the development of projects. The use of SUE enables designers to prepare plans with thorough and comprehensive knowledge of the exact locations of underground utilities, and enables excavators to avoid damaging underground assets, historical/archaeological sites, and other underground items"(6).

The bottom line is this – the use of SUE information enables designers to "design around" many utilities, and thus to avoid many costly and time consuming utility relocations.

DESIGN STRATEGIES

A manual prepared for and available from the FHWA entitled *Avoiding Utility Relocations* (7) encourages highway designers to avoid unnecessary utility relocations in the designs for which they are responsible. This was accomplished by identifying both the value of avoiding utility relocations on highway construction projects and the techniques and technologies that can be used to achieve this goal. A compilation by the authors of design strategies that have been used to avoid utility relocations is contained in the following sections.

Geometric/Alignment Changes

Geometric and alignment changes that have been made by highway designers to avoid utilities are as follows:

- Grade
- Alignment
- Widen one side of highway as opposed to other
- Offset location of centerline for short distances
- Move ramps

Drainage/Ditch/Culvert/Inlet/Curb Strategies

Drainage, ditch, culvert, inlet, and curb changes that have been made by highway designers to avoid utilities are as follows:

- Move storm drains
- Low head storm pipe
- Alternative type inlets
- Alternative storm drain (oval, etc.)
- Ditch culverts
- Narrow ditch widths
- Redesign ditches from flat bottom to “V” bottom
- Adjust flow lines
- Ditch grade changes
- Use paved ditches
- Change from ditch cross section to gutter
- Adjust manhole locations
- Extend storm pipe runs to avoid ditch cuts that impact utilities
- Concrete slabs over utilities in ditch bottom
- Revise or eliminate portions of the drainage design
- Install closed drainage and curbing
- Use rip-rap on ditches
- Add curb and gutter
- Alternative curb and gutter

Slope/Retaining Wall/Barrier Changes and Additions
Slope, retaining wall, and barrier changes/additions that have been made by highway designers to avoid utilities are as follows:

- Barriers
- Guard rails instead of moving poles
- Change backslope rate
- Add retaining walls to the design to reduce slope encroachment
- Remove slope rounding
- Change retaining wall types
- Impact attenuators on above ground appurtenances

Structure/Bridge/Footing Changes
Structure, bridge, and footing changes that have been made by highway designers to avoid utilities are as follows:

- Move bridge bents
- Move bridge end that would conflict with pipeline
- Alternative foundations
- Move bridge ends
- Structural box modifications
- Structure footing redesign
- Abutment modifications to allow bridge occupancy
- Customized foundation design
- Move bridge pilings
- Change bridge type
- Use protective casings
- Pre-bore and batter pile driving to miss utilities

CONCLUSIONS
Based upon the above, it is concluded that:

- Utilities are a major cause of delays to highway contractors. The lack of adequate coordination, cooperation, and communication between governmental transportation agencies and utility companies, and the inability to accurately and comprehensively identify the locations of underground utilities are measurable contributors to construction problems (cost overruns, delays, change orders, redesign costs, claims).

- Many utilities are unnecessarily relocated each year to accommodate highway construction. This is a costly, time consuming, wasteful activity, particularly in light of the fact that strategies are now available to alleviate the need to relocate many utilities.

- Good coordination, cooperation, and communication between transportation departments and utility companies are essential throughout the development and construction of highway projects. It has been typical in the past to design projects

without consideration of the utilities, and then to relocate conflicting utilities. Consultation with utilities early in the developmental stages may result in minor plan changes to avoid them, or even major plan changes that subsequently avoid costly, time-consuming, and unnecessary relocations.

- Subsurface Utility Engineering (SUE) is a proven, cost-effective engineering process for accurately identifying the quality of subsurface utility information needed for highway plans, and for acquiring and managing that level of information during the development of a highway project. The efficient use of SUE information allows designers to avoid utility relocations. The use of quality levels in the SUE process allows designers to certify on the plans that a certain level of accuracy and comprehensiveness has been provided.

- Every effort should be made to "design around" as many utilities as possible. It is imperative to identify potential utility conflicts early in the development of highway projects and to incorporate the most efficient and cost-effective accommodation possible into the highway design.

- Videos and manuals are available from the Federal Highway Administration encouraging governmental transportation agencies to CCC early and often, to obtain and use SUE information in the development of highway projects, and to make every effort to avoid the need to relocate utilities.

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