SINGLE-VEHICLE ACCIDENTS INVOLVING UTILITY POLES

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From the limited data available, utility poles appear to constitute one of the major roadside hazards on U.S. highways. The data indicate that utility poles are one of the most frequently struck fixed objects along the roadside. Utility-pole accidents are estimated to account for more than 5 percent of the national traffic fatalities and more than 15 percent of the fixed-object traffic fatalities. Assessing and resolving the utility-pole accident problem is a formidable task. Contributing factors that make the problem difficult include sketchy accident statistics, lack of uniform standards and enforcement for locating utility poles, insufficient legal authority for states to undertake corrective action, inadequate right-of-way in many areas, and the high cost of current solutions to the problem. The purpose of this paper is to highlight the severity and complexity of the utility-pole accident problem and recommend further specific actions.

•THE MAGNITUDE of the utility-pole accident problem is difficult to determine because relatively few accident statistics are currently available that have the necessary degree of detail to make such a determination accurately. In addition, attempts to resolve the problem must consider the fact, that, unlike other fixed objects occupying highway rights-of-way, utility facilities are not owned by and do not come under the absolute control of either the state or local highway agency. Thus technical, legal, and political issues must be addressed in any program to reduce the magnitude and severity of the utility-pole accident problem.

PROBLEM

Utility poles generally are metal or timber structures used primarily by electric power companies and the telephone industry for supporting overhead wires and cables. These poles frequently are used jointly by the electric power and telephone industries, and, in urban and suburban areas, also may provide space for police and fire signal systems, street lighting, cable television, and other community utility services. Because of their varied use, accident reports may be inconsistent when they refer to utility poles; sometimes reports identify them as light poles, telephone poles, or simply poles. The majority of utility poles in use are timber and come in a variety of strengths, wood species, preservative treatments, and lengths.

An attempt was made to estimate the total number of utility poles that currently are located on the right-of-way of public roads and streets. The best information available on the total number of timber poles in service nationwide is from a 1958 report in which it was estimated that there would be 140 million utility poles in service in 1975 (1, p. 450). This figure may be somewhat high because of the increase in the number of underground power and telephone installations in the past few years. A conservative estimate of the number of poles now located on public roads and streets would be 60 percent or more of those in service. That would mean that approximately 80 million utility poles occupy highway rights-of-way. This is a rough estimate, but it serves to demonstrate that, even if there were no new installations, the magnitude of exposure to existing utility poles by the highway user is great.

To develop an effective program to relocate, rearrange, or convert existing overhead utilities that currently occupy hazardous locations along roadsides, one must overcome certain legal obstacles. The primary obstacle concerns who is to pay the cost of such work. When a utility occupies highway right-of-way by permit, the cost of relocation is usually the responsibility of the utility owner. Thus the states may be reluctant to force utilities to modify, remove, or relocate their facilities when the state cannot participate in the cost.

Federal law sets forth the provisions for federal reimbursement for the relocation of utility facilities under the federal-aid highway program (23 U.S.C. §123). This legislation is extremely important to consider in any federally funded program to correct roadside utility-pole hazards. It provides that, when a state pays for the cost of relocation of utility facilities necessitated by the construction of a federal-aid project, federal funds may be used to reimburse the state for such costs in the same proportion as federal funds are expended on the project. However, federal funds cannot be used to reimburse the state when the payment to the utility violates the law of the state or violates a legal contract between the utility and the state.

Currently, 38 states have laws permitting the state to pay for the cost of utility relocation, but such laws contain various types of limitations. For example, several of these states limit the payment of such cost to Interstate projects. Other states authorize payment only for relocating municipally owned facilities. Consequently, there are many instances under current legislation where federal funds may not be used in utility relocations or adjustments.

The accident problem involving a single vehicle and a utility pole is not well defined at the national level. Accident statistics identifying the object struck in fatal and nonfatal injury accidents involving fixed objects have been reported by only a few states in their state summaries of traffic accidents for 1972. Only Kansas, Oklahoma, Pennsylvania, Massachusetts, and Michigan identified the object struck in fatal and nonfatal injury accidents involving fixed objects in their published state summaries of traffic accidents for 1972. Also the data reported do not include some of the more important factors such as whether the pole was set back from the edge of the roadway; type of roadside environment (business, residential, or rural); or average traffic volume and operating speeds. Adequate data are also lacking on the causes of accidents in which a single vehicle strikes a utility pole. An accident of this nature may result from (a) an inability of the motorist to respond properly to specific road and environmental conditions, (b) avoidance of other vehicles or inadequate control or perceptual responses to other traffic, (c) particular motor-vehicle or motorist anomalies, or (d) a combination of highway, environmental, traffic, or driver conditions.

Available information, however, does indicate that utility poles constitute one of the major roadside hazards on U.S. highways (Tables 1 and 2). In some areas, they are the most frequently struck objects in run-off-the-road accidents. Data on utility-pole accidents have been obtained both from state summaries of traffic accidents and from an unpublished survey conducted in North Carolina. These sources show that the frequency of utility-pole fatalities varies from approximately 1 percent of the annual traffic fatalities in Oklahoma to more than 8 percent in Massachusetts. Based on the limited data reported, utility-pole accidents are estimated to account for more than 5 percent of the national traffic fatalities reported annually and more than 15 percent of the fixed-object traffic fatalities (Table 2). That is, utility-pole accidents account for an estimated 2,750 fatalities and 110,000 injuries annually. In addition, an estimated 250,000 utility-pole accidents each year involve property damage only. We believe, based on preliminary contacts with a limited number of states, that many states have collected data that are much more detailed than reported in the state summaries of traffic accidents. Further, each of the states contacted has indicated a willingness to share these data to help define and solve the utility-pole problem.

For example, North Carolina did not identify the object struck in fixed-object accidents in its 1972 and 1973 state summaries of traffic accidents. However, on investigation, they were found to have had this information readily available for the past 6 years. All reported traffic accidents are categorized and entered in a data processing system. By the use of this system, one can quickly and efficiently recall data on any accident category in the system.

Using the North Carolina data processing system in conjunction with police reports,

Table 1. Accident data from state summaries.

Year	State	All Accidents Total	All Accidents Fatal	All Accidents Injury	Fixed-Object Accidents Total	Fixed-Object Accidents Fatal	Fixed-Object Accidents Injury	Utility-Pole Accidents Total	Utility-Pole Accidents Fatal	Utility-Pole Accidents Injury
1971	Kansas	54,114	549	16,246	7,772	148	3,082	1,846	20	754
	Massachusetts	154,714	827	60,187	20,126	277	8,397	5,298	67	2,535
	Oklahoma	64,948	699	14,000	8,117	240	3,164	791	9	297
	Pennsylvania	301,374	2,019	82,033	44,915	669	17,323	10,054	126	4,483
	Total	575,150	4,094	172,466	80,930	1,334	31,966	17,989	222	8,069
1972	Kansas	61,830	552	19,877	12,164	212	4,815	2,590	27	1,155
	Massachusetts	162,911	905	56,478	25,805	306	10,129	7,285	80	3,342
	Michigan	359,745	1,997	113,673	63,164	647	23,867	10,159	86	4,731
	Oklahoma	68,617	722	14,253	8,705	248	3,271	848	7	303
	Pennsylvania	277,556	2,085	89,080	77,948	682	23,516	10,493	156	4,945
	Total	930,659	6,261	293,361	187,786	2,095	65,598	31,375	356	14,476

Table 2. Fatalities from 1972 state summaries.

State	Total Fatalities	Fixed-Object Fatalities	Utility-Pole Fatalities: Number	Utility-Pole Fatalities: Percentage of Total Fatalities	Utility-Pole Fatalities: Percentage of Fixed-Object Fatalities
Kansas	552	212	27	4.89	12.7
Massachusetts	905	306	80	8.84	26.1
Michigan	1,997	647	86	4.31	13.3
Oklahoma	722	248	7	0.97	2.82
Pennsylvania	2,085	682	156	7.48	22.9
Total	6,261	2,095	356	5.69	17.0

Table 3. 1971 utility-pole accident composition for Alamance, Buncombe, and Cumberland Counties, North Carolina.

Location	Accidents	Property Damage	Injuries Total	Injuries A	Injuries B	Injuries C	Fatalities	Percentage of Fatality and Injury Accidents	Percentage of Fatality and Injury Accidents at 90 Percent Confidence Limits
Central business district	46	21	25	13	8	4	0	54	42 to 68
Residential district	39	21	17	11	5	1	1	46	32 to 62
Rural area	37	22	13	9	3	1	2	41	26 to 56
Total	122	64	55	33	16	6	3	48	35 to 56

Note: A = visible sign of injury, such as bleeding wound, distorted member, or being carried from scene. B = other visible injury or bruises, abrasions, swelling, limping, and the like. C = no visible sign of injury but complaint of pain or momentary unconsciousness.

we examined in detail the 1971 accident data from 3 North Carolina counties (Alamance, Buncombe, and Cumberland) (Table 3).

Based on data made available from the aforementioned state summaries and additional information from North Carolina, 4 assumptions regarding utility-pole accidents can be drawn.

1. Utility poles are one of the most frequently struck roadside fixed objects.
2. Sufficient data exist to identify the utility-pole accident problem and to establish relationships among accident severity, accident frequency, and roadside environment.
3. A detailed analysis of utility-pole location and spacing, traffic density, and average speed versus frequency and severity of collisions is beyond the scope of the

data currently available.

4. The magnitude of the utility-pole problem dictates that serious attention must be given to this area in a balanced attack on the rigid obstacle problem.

EXISTING PRACTICES AND PROGRAMS

Historically, it has been in the public interest for public utility facilities to use and occupy the right-of-way of public roads and streets. This is particularly true for roads and streets that primarily provide a land service function to abutting residents as well as for those conventional highways that serve a combination of local, state, and regional traffic needs. This practice generally has been followed nationwide since the early formation of utility and highway transportation networks.

State and local highway agencies regulate the use of highway rights-of-way by utility facilities in accordance with state and local law. In some cases, this regulation is minimal; in others, standards for locating utility facilities are well established. These standards vary depending on the functional class of highway involved and the degree of control exercised by the responsible highway authority. Utilities have various degrees of authority to install their lines and facilities on the rights-of-way of public roads and streets. Their authority also depends on state laws and regulations that differ from state to state. Over the years, state and local highway agencies, in cooperation with the utility industry, developed their own policies for regulating utility use of public roads and streets.

In 1956, at the onset of the Interstate Highway program, federal and state highway officials recognized that the access-control feature of these important highways could be materially affected by the extent and manner in which public utilities cross or otherwise occupy Interstate highways. For this reason, in 1959 the American Association of State Highway Officials (AASHO), which is now the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA) and the utility industry, issued the document, A Policy on the Accommodation of Utilities on the National System of Interstate and Defense Highways. This policy later was extended for application to all freeways. Essentially, the policy does not permit utility facilities to be installed longitudinally along and within freeway rights-of-way except where frontage roads are provided or in extreme cases under strictly controlled conditions. In addition, the policy contains specific criteria for horizontal clearances of aboveground utility supporting structures. Developing this policy was a landmark, for it was the first time a national policy had been developed for accommodating utilities on any highway right-of-way.

During the 1960s, utility and highway transportation networks continued to grow in complexity as modern society expanded and intensified its organization of facilities for service and communications. As these networks grew, the frequency of occasions for them to occupy a common right-of-way or to intersect one another as well as the problems stemming from common use continued to increase. It was evident that there should be some national policy to provide reasonable uniformity in the engineering requirements employed by highway agencies for regulating utility use of highway rights-of-way. On February 15, 1969, FHWA issued Policy and Procedure Memorandum (PPM) 30-4.1, Accommodation of Utilities, and on October 25, 1969, AASHO issued A Guide for Accommodating Utilities on Highway Right-of-Way. The only national standards available for installation and maintenance of electric supply and communication lines are those contained in the National Electric Safety Code. The code is voluntary but has been adopted by various governmental agencies and utility organizations. All of these documents have provided guidance for state and local highway agencies in developing new or in modernizing existing accommodation policies. They do not, however, adequately deal with the problem of existing utility-pole hazards for 4 reasons:

1. PPM 30-4.1 primarily concerns new utility installations that are to cross or otherwise occupy highway right-of-way and the relocation and accommodation of existing utility facilities that fall in the path of proposed highway projects. It does not,

except for paragraph 6(c), apply to existing utilities along existing highways. Also, its application is limited to active or completed federal-aid projects.

2. PPM 30-4.1 requires that each state develop its own utility accommodation policy, which is subject to approval by FHWA. It does not prescribe specific criteria to be used by the states in their policy, such as minimum offsets from the roadway for utility poles, but rather leaves this up to the individual states. These policies must necessarily be written in conformity with each state law regarding utility placement on the public right-of-way.

3. The AASHO guide provides only broad criteria relative to the placing of utility poles within highway rights-of-way, and does not establish the relative hazards for such installations.

4. The National Electric Safety Code has only limited reference to utility-pole clearances. The current edition specifies that supporting structures should not be less than 6 in. (150 mm) from the street side of the curb. No provision is made for pole clearances where there is no curb.

Paragraph 6(c) of PPM 30-4.1 provides that, where existing utility facilities are likely to be associated with injury or accident to the highway user, the responsible highway authority is to initiate appropriate corrective measures to provide a safe traffic environment. Federal fund participation in the cost of adjusting or relocating utility facilities in accordance with this paragraph is subject to the provisions of federal law. Federal funds can be used to correct these hazards, but only to a very limited degree, because many states are hampered by lack of appropriate legal authority to pay for such corrective action.

The Highway Safety Act of 1973 contains several new programs for highway safety improvements. Section 210 of the act (23 U.S.C. §153) is a program for the elimination or reduction of hazards caused by roadside obstacles on the federal-aid system other than the Interstate Highway System. Section 230 of the act (23 U.S.C. §405) is a program for the elimination or correction of safety hazards in several categories (including those under Section 210 of the act) on highways not on any federal-aid system. Relocation of utility poles identified as traffic hazards is an example of the type of project that is eligible under these programs.

A continuing engineering survey of all highways to develop a procedure to detect high accident locations through accident analysis has been a requirement of Highway Safety Standard 9 since 1967. The Federal-Aid Highway Program Manual (2) sets forth the details for carrying out this survey for federal-aid highways. A survey is required by Section 210 of the Highway Safety Act of 1973 to identify hazardous roadside obstacles. This survey is considered to be a 1-time survey that will result in specific projects.

Among the types of hazardous obstacles to be identified in this survey are utility poles within 30 ft (9.14 m) of the edge of traveled way except those installed in protected locations. A protected location is considered to be a location behind bridge rail or guardrail, or on a nontraversable slope. Where the posted speed is 40 mph (64.4 km/h) or less, utility poles would be counted only if located within 10 ft (3.05 m) of the edge of traveled way. Also, if the posted speed is 40 mph (64.4 km/h) or less, the area behind a curb designed to inhibit or discourage vehicles from leaving the pavement is considered to be a protected area. These criteria for protected location are applicable only for this survey. Their use is not intended to imply that a roadside obstacle occupying a protected location, as described, does not present some degree of hazard to traffic, but rather that those obstacles not in a protected location present a greater hazard and should receive higher priority for correction.

These safety programs can be effective in eliminating hazards on highways both on and off the federal-aid system. However, because only a few states and political subdivisions have broad authority to pay for utility-pole adjustments or relocations under these programs, the effective implementation of any such projects is seriously hindered.

There are several methods now being used for reducing utility-pole hazards. Joint-use single-pole construction offers an effective way of increasing safety by reducing the number of utility poles along the roadside. Joint use of poles should be encouraged where more than 1 utility or type of facility is involved. This is of particular significance at locations where right-of-way widths approach the minimum needed. Although joint use of poles is now a common practice by the electric-power and telephone industries, more extensive use of this practice can result in significant safety benefits.

The use of more attractive, self-supporting utility poles with vertical alignment of cables and wires also should be encouraged, perhaps as a compromise between underground installation and use of conventional wood poles with cross-arm clutter and guy wires. Self-supporting poles with vertical alignment of utility lines have advantages from both safety and aesthetic standpoints because exposure to hazards and unsightly clutter are reduced.

Another effective method of elimination of utility-pole hazards is the conversion of overhead lines to underground lines. Conversion up to this time primarily has stemmed from beautification programs rather than from safety reasons. Installing new facilities underground also has been done by individual utility companies where it is found to be an economical alternate to overhead construction. For example, the Bell System has done a significant amount of underground installations in recent years. It is reported that their inventory of owned poles is decreasing at a rate of 0.5 million poles/year and may be expected to decrease even faster in the future. Their current policy is to use below-ground construction as a first choice in new construction and to replace existing aerial lines with underground lines wherever it is practical to do so.

Underground installation of electric power lines is confined mainly to low-voltage distribution circuits in new residential subdivisions. Where direct burial of electric cable can be used, the cost of underground installation may be as low as 1.5 times the cost of conventional overhead lines. However, the cost of converting all existing overhead distribution lines has been estimated to be a staggering $150 billion.

Underground installation of high-voltage transmission lines can be accomplished only after a number of economic and technological problems have been overcome. Underground transmission lines are many times more costly than overhead lines and are feasible today only in special areas such as metropolitan centers having high demands for power. Underground transmission lines have the advantage of being free from aboveground weather problems; therefore, they would have fewer service interruptions than would overhead lines. However, there are a variety of failures that do affect cables, and interruptions underground may last from a few days to several weeks while the fault is found, the cable is exposed, and the necessary repairs are made. Continued research on underground materials and installation methods could result in a substantial reduction in the overall cost of underground installation of electric transmission lines.

Many utility-pole hazards exist today because rights-of-way acquired for public roads and streets were inadequate to meet future demands for additional use by public utility facilities. When a new highway facility is to be constructed, the responsible highway agency must contact any utility company that has facilities that might be affected by the roadway construction. It is important that consideration also be given to future planned utility facilities that eventually may occupy the highway right-of-way. If utility use of the right-of-way is authorized by law, the right-of-way so acquired must be adequate to safely accommodate those utility facilities.

In the design of local roads and streets, AASHO (3) suggests that right-of-way width should be sufficient to accommodate the ultimate planned roadway, including space for public utility facilities. In addition, it suggests that the use of the right-of-way by utilities should be planned to cause the least interference with traffic using the street. If utility facilities are crowded onto highway right-of-way, both the utility consumer and the highway user suffer the consequences from the standpoints of safety, inconvenience, and added costs.

The breakaway concept has been used for roadside sign structures (4) and lighting supports (5) since the mid 1960s with well-documented success. Research conducted by Wolfe, Bronstad, Michie, and Wong (6) suggests that breakaway concepts also can be applied to utility poles. Although their work must be considered preliminary, it encourages the idea that breakaway designs for utility poles are technically feasible. More comprehensive research is proposed in the near future.

RECOMMENDATIONS

Based on information currently available, recommendations for further action regarding the utility-pole problem can be made. In the interest of carrying out an effective safety program for the elimination of roadside obstacles under 23 U.S.C. §§153 and 405, each state should seek whatever legislation it may need to permit relocation or adjustment of existing utility poles from hazardous locations along roadsides.

Where appropriate, state utility accommodation policies and practices should be modified and strengthened as necessary to ensure that

1. New pole-line installations along roadsides will be permitted only at locations that are conducive to a safe traffic environment;
2. More extensive use of joint-use single-pole construction will be made at locations along roadsides where more than 1 utility or type of overhead facility is involved, particularly where the right-of-way widths approach the minimum needed for a safe traffic environment;
3. Self-supporting utility poles will be used where appropriate to eliminate the need for guy poles and guy wires to encroach on roadside areas; and
4. On highways with narrow rights-of-way or on urban streets with closely abutting improvements, self-supporting, armless, single-pole construction with vertical configuration of overhead wires and cables (as opposed to conventional crossarm construction) will be employed where needed to permit pole installations as close as possible to the right-of-way line.

Available accident data from the states should be collected, validated, and analyzed. From this, recommended utility-pole setbacks from the traveled way that take into account available right-of-way widths should be established for each type and class of highway (urban or rural, major or minor arterial, collectors, and so forth) and incorporated in utility accommodation policies.

The underground installation of wire and cable facilities should be encouraged and location standards established.

Studies should be undertaken to determine the feasibility of developing breakaway utility-pole designs giving due consideration to

1. Structural feasibility,
2. Devices to minimize electrical hazards, and
3. Legal constraints.

If the studies are encouraging, an in-depth program of concept development should be undertaken.

Measures should be taken to ensure that needed field performance information be reported in a timely manner through either future state summaries of traffic accidents or by other means.

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