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Special Report 75

Benefits to Utilities from Highway Locations

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JAMES H. LEMLY, Chairman, Department of Transportation and Public Utilities, Georgia State College of Business Administration

•IN KEEPING with sound economic objectives, National policy in recent years has tended to support the philosophy that costs of Federal-aid highways should be paid for by those who receive benefits from these highways, whether this applies to vehicular users or other categories that might emerge. But measurement of these benefits has proved to be difficult. When the Congress passed legislation to provide for the new National system of Interstate highways, it was believed that neither the public nor the Congress was able to judge as to the degree of benefits which highways provided to the various groups within the Nation. To obtain the necessary data to act intelligently on this matter, the Congress directed the Bureau of Public Roads to initiate studies to develop background information on highway benefits and to provide this information to the Congress and the Nation. Thus, the immediate cause for this study was the request of the Congress that the Bureau of Public Roads undertake a series of studies of benefits to vehicular and non-vehicular users of the Nation's highways. The specific request was made of the Bureau in Section 210 of the Highway Revenue Act of 1956.

It is well known that utilities provide a multitude of services in the extensive networks of the street and road system of the country. Obviously, many of these streets and roads are parts of the Federal highway system. For this reason, it was deemed desirable to investigate the benefits that utilities received through use of streets and highways as locations for these service facilities, and to provide as much information as possible about the social, economic, and legal framework of these activities.

Along with the industrialization and urban development which have encouraged the expansion of the highway network, the United States has experienced tremendous growth in its "utility" plant. As this utility plant has grown, it has generally used streets and roadways within municipalities as locations for service lines. Also, when utility services have extended beyond urban areas, the same pattern of roadway use has been followed in many instances. With the development of major transmission-type activity over long distances, both for electric and other types of services, a pattern of cross-country installation has arisen so that a large amount of these transmission lines has ceased to follow roadways. Individual customer service, however, which is commonly called distribution service, must of necessity reach the customer's house, building, or other location, and in a majority of cases these individual service installations ultimately make use of streets or roads.

Throughout the history of this country, it has been almost universally accepted without question that utility companies may use streets and roads as rights-of-way for their installations, and in a large number of instances, no specific charge or fee is paid as a result of such street use. It is true that in a number of cases, utilities have developed patterns of payments to local government units, which to some extent can be considered payment for use of streets and roads, but there is no common or universal pattern of payment which is considered normal or standard.

Method

It is difficult to establish a money cost or price for a service or benefit not customarily priced in the market place. In economic analysis, the approach generally

deemed most appropriate for investigations of this type is a study of alternative possibilities. As Stigler (1, p. 102) has stated:

> The generally accepted explanation of costs is contained in the alternative (or opportunity) cost theory. The cost of any productive service X in the production of any commodity A is the maximum amount that X would produce of any other product (B, C, ...). If capital funds can earn 4 percent elsewhere, that is their cost to the automobile industry. If an acre of land can earn $6 a year in oats, that is its cost in producing wheat.

Thus, if it is possible to measure the value of the best alternative solution, product, or other item, such a value can be attached to the basic service, or area, as a workable estimate of its value. In this study, then, it was decided to seek the value of benefits to utility operations from the use of street and highway rights-of-way by discovering the alternative cost of other rights-of-way. Such an approach obviously demands the accumulation of specific data, but it was quite impossible to collect data on all utility activity throughout the entire Nation. Neither did it seem feasible to use a simple random sample for the Nation. A different approach was chosen, in that specific sectors in four different States (Fig. 1) were used in an effort to secure representative data which would produce meaningful information.

In addition to the specific cost data that was sought, other information was to be collected to shed light on the social, economic, and legal patterns that were found to be in existence in the areas under examination. As the study has developed, these aspects to the problem have taken on added significance to the extent that they sometimes tend to overshadow the statistical measurements found within the study areas.

To provide as much diversity as possible, utility activity in urban and rural areas was examined, and the study disclosed that there were a variety of forms, or methods,

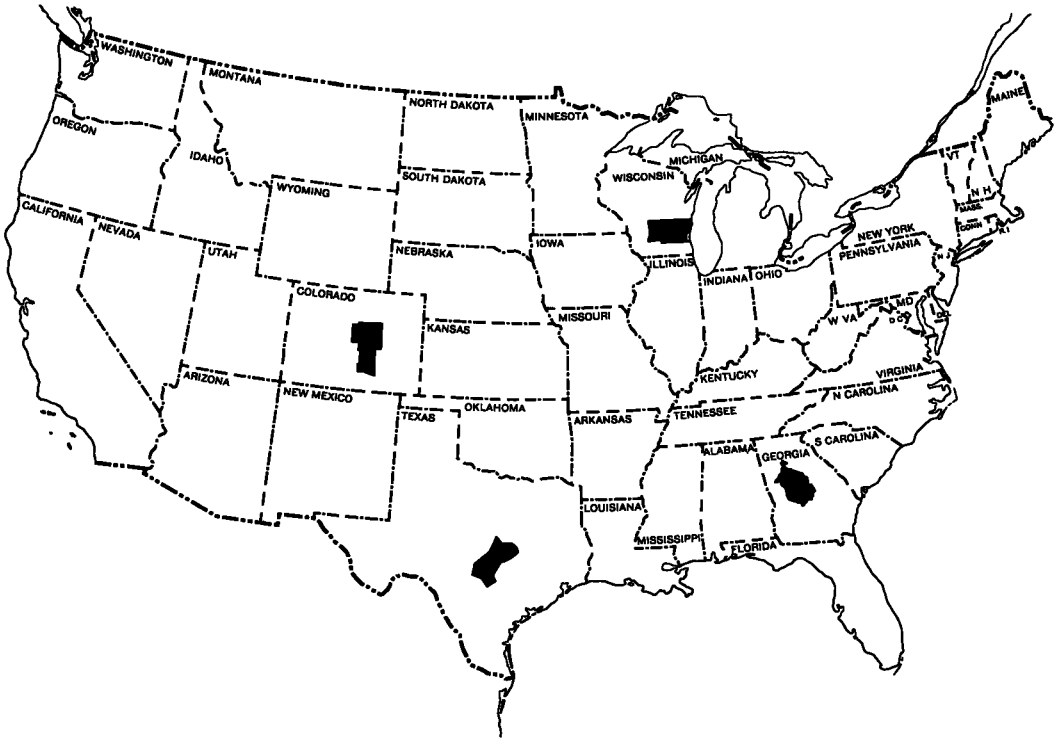

Figure 1. Map of United States showing the four study sectors.

of organization in existence. Typical corporate structures were found alongside municipal ownership activity, as well as government-sponsored cooperatives oriented to rural areas and some State-owned activities. In some other instances, manufacturing corporations were found to own or control mill villages, and in some of these, utility services were provided as an auxiliary feature of the primary corporate activity.

In addition, it was discovered that a diversity of ownership patterns for streets and highways existed. Streets in some mill villages belong to the corporation, whereas some subdivision developers still own the streets serving their units. In other cases, municipalities owned their streets and other governmental units owned their roads and highways, but in a number of instances there was no way of knowing what width of street or highway might be owned by the various governmental units. There existed also the problem of "assumed" easements, in which rights-of-way might be provided by subdividers for utility services, and over time, the rights-of-way cease to be thought of as owned by anyone, but available for utility service locations.

The Areas Studied

The Georgia Area.—To secure a diversity of urban and rural situations, the Georgia area included Atlanta, the State's largest city, and Macon, its neighbor some 90 miles south along the future path of Interstate 75. All the territory between these cities was included as well as the rural sectors of the counties in which Atlanta and Macon lie (Fig. 2). The sectors were made up of counties in order to provide opportunity for use of census and other data which are developed by governmental units. Within the Georgia area, the counties included in the study were Bibb, Butts, Clayton, Crawford, De Kalb, Fayette, Fulton, Henry, Jasper, Jones, Lamar, Monroe, Newton, Pike, Rockdale, Spalding, and Upson.

The Texas Area.—The area selected within Texas consists of the eight counties located in the vicinity of, and including, Austin and San Antonio (Fig. 3). The counties in the area are Bastrop, Bexar, Caldwell, Comal, Guadalupe, Hays, Travis, and Wilson.

The Colorado Area.—In Colorado, the area chosen was the central region running north and south which includes Denver and Pueblo, and the eight counties needed to fill out the sector (Fig. 4). The counties were Adams, Arapahoe, Denver, Douglas, Elbert, El Paso, Jefferson, and Pueblo.

The Wisconsin Area.—To use relatively comparable areas, the Wisconsin sector included Milwaukee and extended to Madison at the western limit. Again, county units were selected and eight counties were included (Fig. 5). They were Columbia, Dane, Dodge, Jefferson, Milwaukee, Ozaukee, Washington, and Waukesha.

In addition to the provision of widely dispersed areas, the four study sectors produced other advantages. There is a regional diversification, and there are important regional differences which are apparent. Wisconsin and Colorado have more extensive winter problems than do the Georgia and Texas sectors. Wisconsin has a multitude of farm operations within the study area, where Colorado and Texas have a much smaller number. In addition, there are problems of terrain, although the Colorado sector chosen is not exceedingly mountainous. The Texas sector happens to include a rather large State-owned public power-generating authority which is a dominant force in the electric utility pattern in that region. No other sector has this major public power generation feature, although all sectors have extensive REA operations. The Texas sector also provides a region relatively free of timber obstructions, which is definitely not true of Georgia and Wisconsin. On the whole, it was felt that the four study sectors were large enough to be significant and that they were sufficiently diverse, as well as separated widely enough to provide worthwhile evidences of utility patterns across the Nation.

To determine the value of land used by utilities for rights-of-way, the intent was to secure, as nearly as possible, a total inventory of utility service lines that exist within each study sector. Although some small utility units did not provide data, it is felt that approximately 90 percent of the service lines in each area were reported and used in the tabulations that follow.

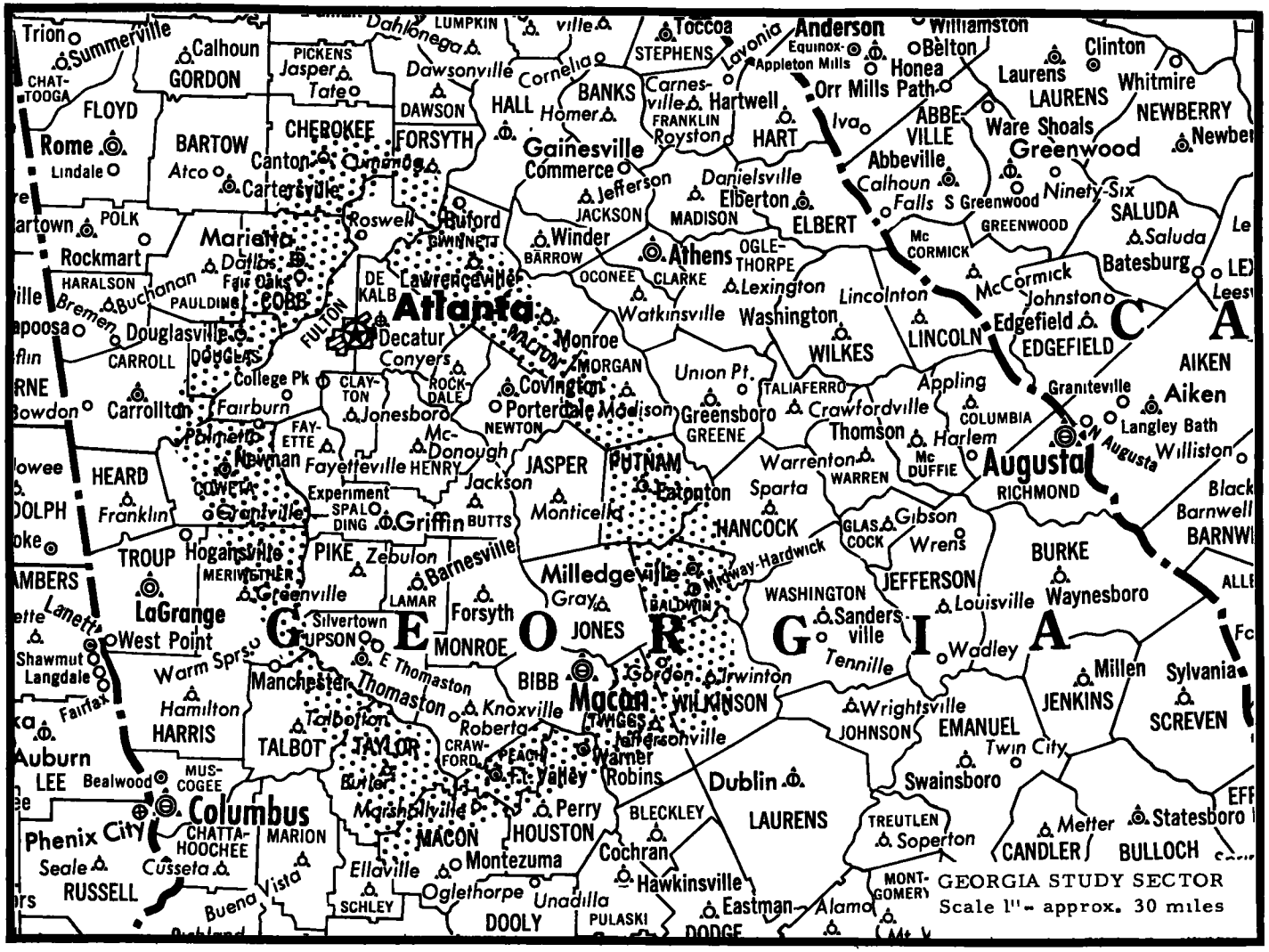

Figure 2. Map of Georgia with study area marked.

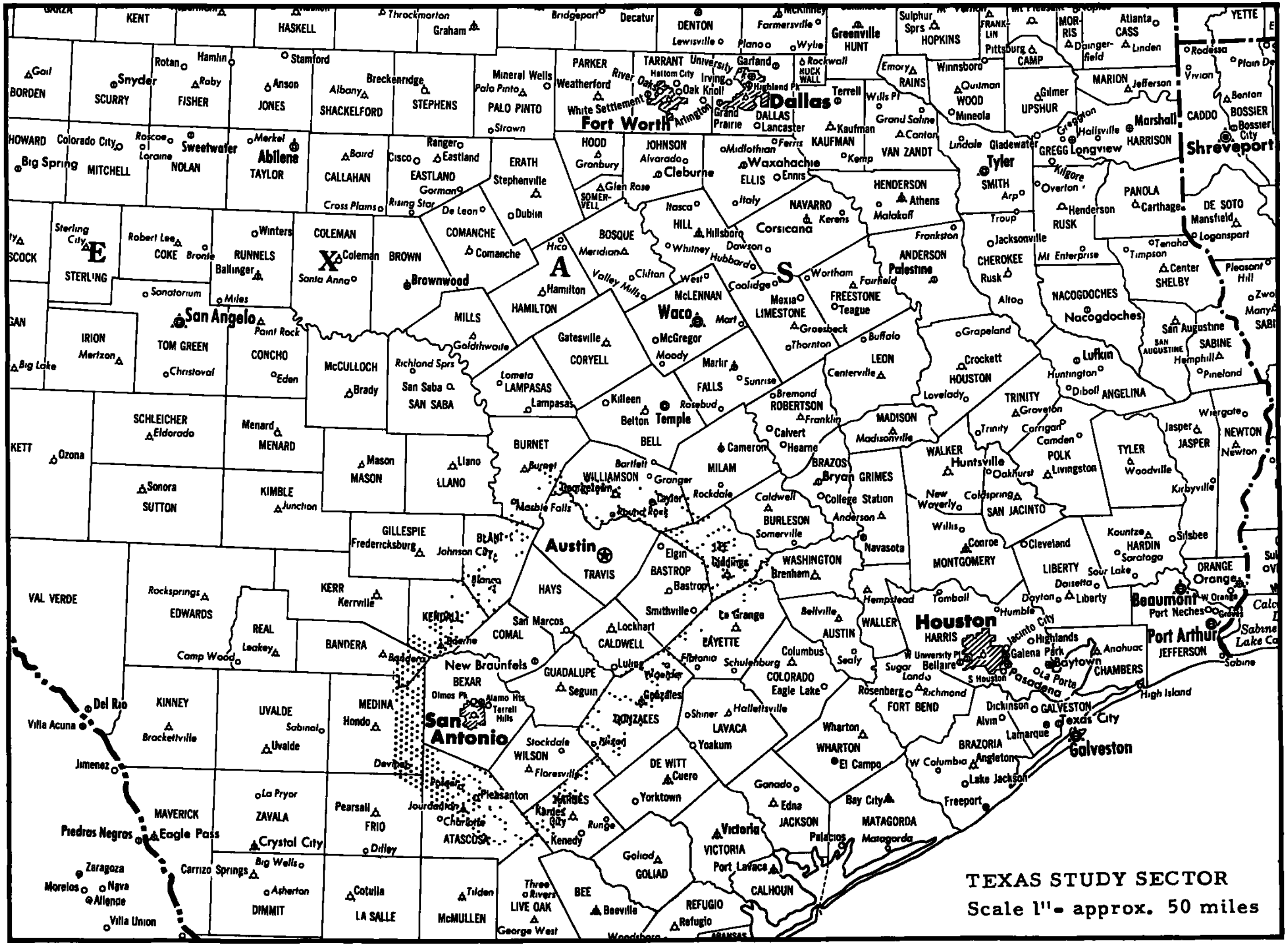

Figure 3. Map of Texas with study area marked.

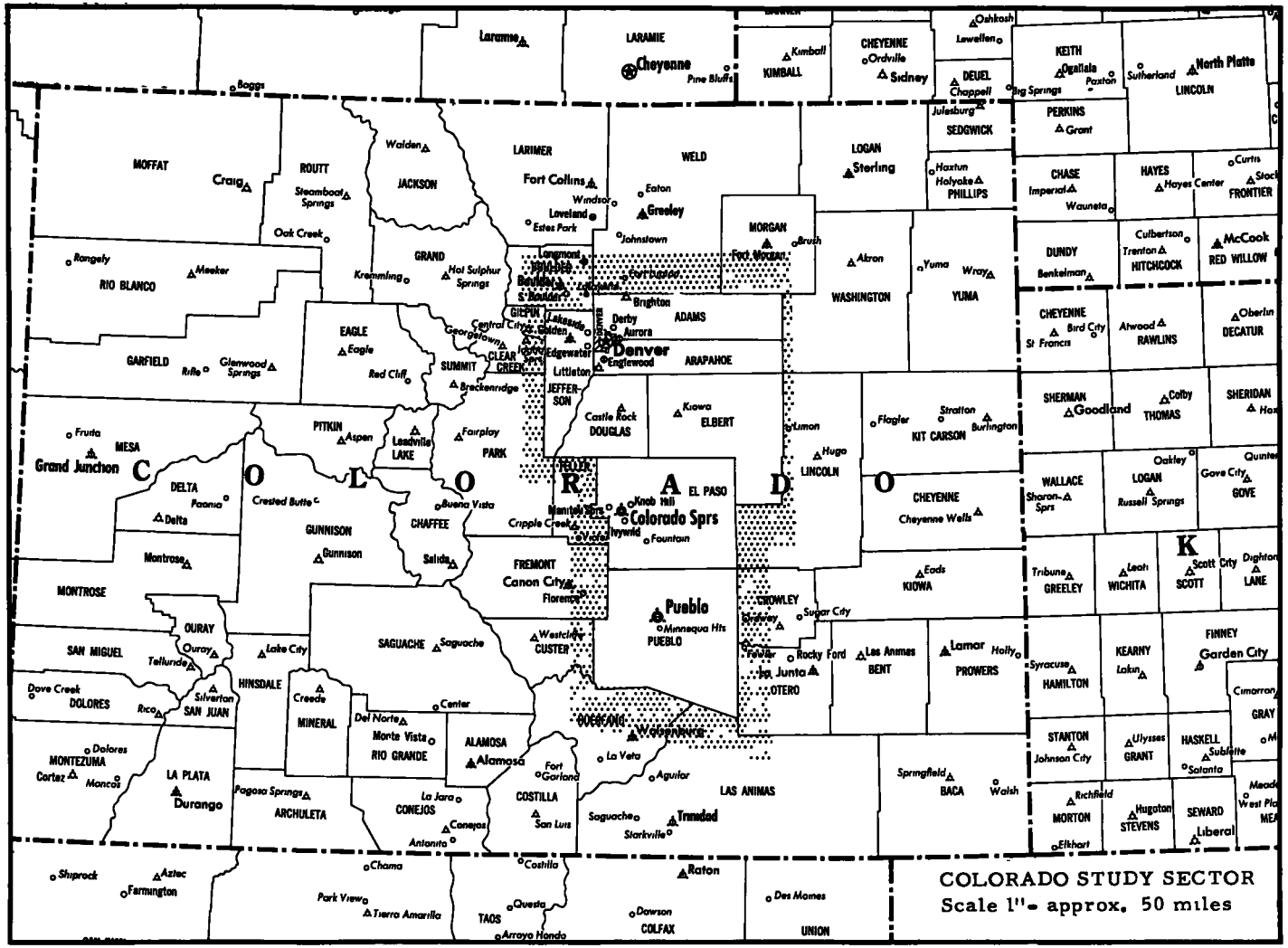

Figure 4. Map of Colorado with study area marked.

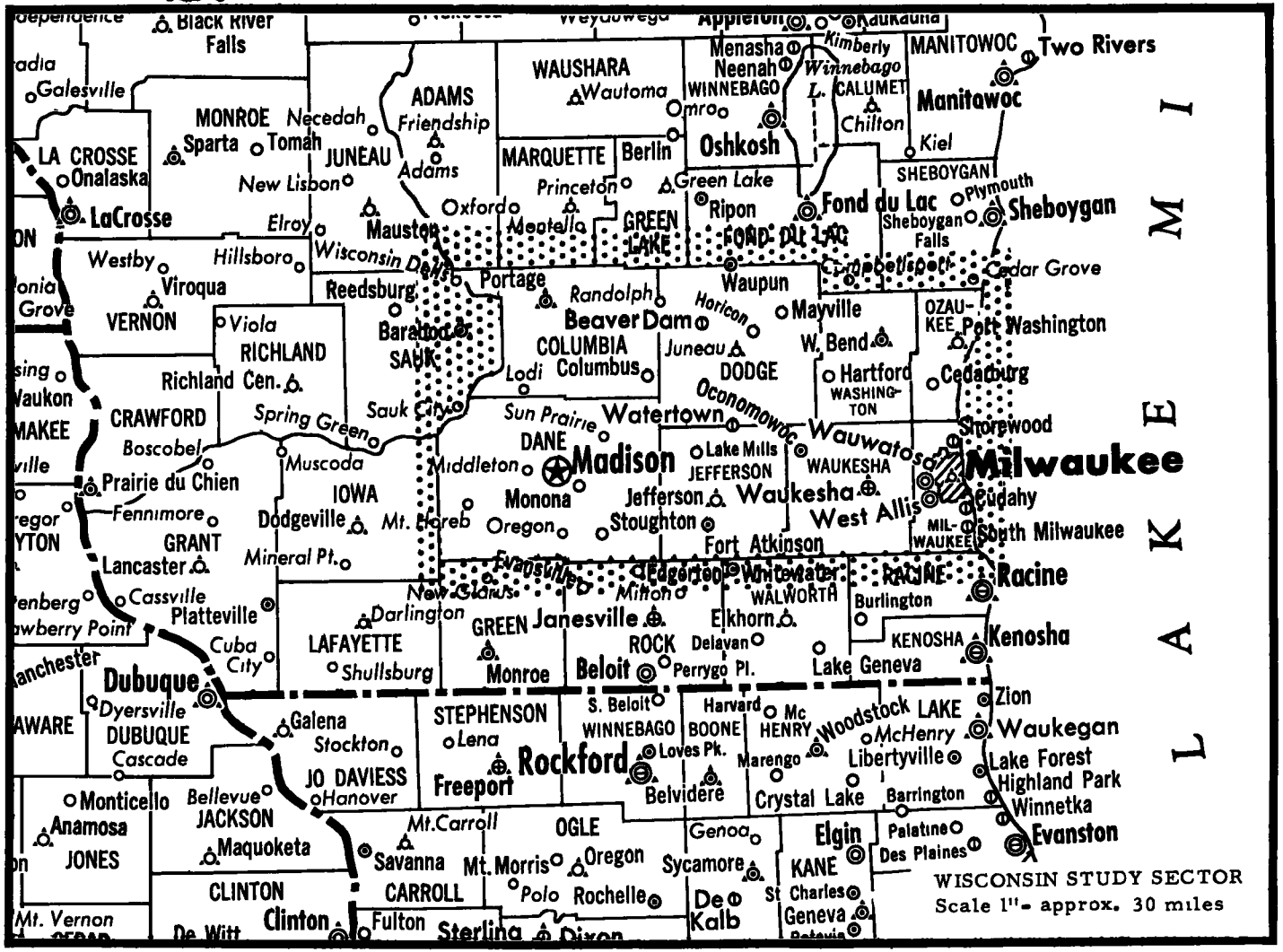

Figure 5. Map of Wisconsin with study area marked.

It has been said that these areas are not statistically perfect samples, and it is obvious that they are not exactly equal in size, importance, etc. There were, however, some important reasons for these selections. Atlanta is the major city of Georgia, as well as being the capital of the State. It was felt that substantial assistance could be secured within Atlanta from the various State offices which would thus expedite the study activity. When the Georgia area was chosen, it was decided to choose the remaining areas on a somewhat similar basis. Thus, a major city not too far from one million population was to be sought. It was desirable to have a State capital included within the study area, and it was deemed necessary to have a college or university within the study area which would agree to secure information within each sector. Milwaukee, Madison, and the University of Wisconsin fitted these specifications admirably. Austin, and the University of Texas did likewise, and the same is true for Denver and the University of Denver.

SOME INTERRELATIONSHIPS BETWEEN HIGHWAYS AND STREETS, AND UTILITIES

Vehicular Purposes of Streets and Highways

Highways and streets, spoken of as a common consolidated grouping, constitute one important element in an assemblage of factors that provide an important benefit or service to the citizens of the Nation. These highways and streets together provide the path over which many types of vehicles move in giving people and goods a high degree of mobility.

Historically, the streets of towns and cities have been of more importance than the highways, because the streets have been there "always," whereas the highways, at least of the present type, have been a development of the 20th Century. At present, however, an important part of the highway mileage is quite similar to the street system. This is true because much of the highway network, after construction as rural mileage, has, in reality, become urban mileage, as structures fronting these roadways have multiplied to city-like proportions. For these and other reasons, many of the highways have "inherited" the advantages and disadvantages of the street network.

This similarity of streets and highways in the public mind has been carried over to theoretical studies as well. D. P. Locklin (2, p. 659), and citing C. L. Dearing as a supporting authority (3, pp. 158-163, 209-212), has said,

> ...it is necessary to recognize that highways serve three more or less distinct purposes. One of these purposes is to provide a means of access to land, without which land would be practically unusable and worthless. Thousands of miles of country and township roads principally serve to provide access to farm lands. City streets perform the same function for city property.
>
> A second function of roads is commonly described as a "community-service function." This function cannot be entirely separated from the first, but, in this capacity, roads provide for the local movement of persons and property in the performance of the processes of production, marketing, buying supplies, going to school, and carrying on numerous social and other activities.
>
> The third function of the highway under modern conditions is to provide a means of intercommunity mobility and long-distance transportation. This is the function, as we have noted that came into prominence with the development of the automobile.

Actually, the first and second purposes are functions of streets, and of course, in the past, the third purpose, that of intercommunity mobility and long-distance transportation has been grafted onto the already overburdened street system.

Before the development of motor vehicles and highways, the rail net was the most important factor in providing intercommunity mobility and long-distance transportation, but this has continued to change as the newer system of motor vehicular traffic has become more versatile and ubiquitous.

As railroads learned many years ago, there is a sharp conflict of interest between local traffic and long-distance movement. Local service desires freedom of maneuver for stopping, starting, parking, turning, and the like; whereas long-distance movement seeks speed, freedom from obstacles, etc. As the need for long-distance movement has grown, special-purpose roads have begun to be provided to serve these demands, and it has come to be realized that these ways must be designed in such a manner that they become inimical to street usage. The freeway design of today is approaching the ultimate in evolution away from the city "street." In essence, these freeways are single-purpose facilities which, in reality, are quite similar to a tunnel or bridge over local areas connecting points relatively widely separated.

Non-Vehicular Purposes of Streets and Highways

The urban street system as it has evolved has served other purposes in addition to vehicular or pedestrian traffic. From the very inception of utility services such as water supply and sewage disposal, the city streets have provided a path for these facilities. With the coming of other services such as gas, telephone, and electricity, the city street has become invaluable as a path for these installations. Urban communities would be vastly different if other provisions for rights-of-way for utility services had been necessary. In addition, the real cost of providing these utility services would have been appreciably increased if special rights-of-way had been required.

In relatively recent years, these utility-type services have been extended throughout widespread rural areas to large numbers of structures, which usually front on State-provided highways, with the result that the former rural highways have taken on more of the characteristics of city streets. This has been desired by those who use the structures so served, but at the same time, the highway which generally was provided at State or Federal expense has been less able to discharge its function of providing long-distance movement.

Utility services, like highways and streets, provide important benefits or services to the citizens who have them available. Where highways and streets provide mobility for people, often making it possible for people to move toward "goods" or locations, the utility service company provides mobility of goods toward specific locations. Thus, the utilities take their services to their customers rather than requiring their customers to come to them for service. This type of organization, of necessity, calls for special-purpose paths so these goods can be distributed. If the existing ways to homes and businesses were not available, a separate provision of such ways would be essential, thus increasing the cost of providing these services. For this reason, as urban-type civilization has evolved, it generally has been deemed desirable to combine the two necessary paths by allowing the utilities to install their lines and services within the street system of the community so served. In some instances, it would be almost impossible to provide separate ways for streets and utilities.

It must be said that aesthetically some utility service installations leave much to be desired and in some communities where advance planning has allowed it, alleys or rear serviceways have been provided. This pattern has been successful in some communities but in others it has been so lightly regarded that services have been moved to front areas to avoid the costs of duplicate land provision and the costs of inaccessibility.

Highway Development and Utility Installations

There are three basic observations which seem pertinent here. First, it can be said that generally in the American governmental system, there is no long-standing

pattern of moral obligation of a State government to provide purely local road or street service, either inside municipalities or outside them. Theoretically this is a function of the local city or county governmental unit. Custom and the necessities of political organization have caused States (often supported by Federal funds) to engage in such activity extensively in rural areas, but this is not quite equal treatment to the urban dweller who pays city taxes to provide his purely local street needs. In recent years, as the political power of urban population has increased, a somewhat corresponding increase in highway department activity in urban areas has appeared.

The second observation about highway activity pertains to utility services in rural areas, and not highway construction as such. Logically, governmental units should provide similar treatment to utility lines, whether they are located within municipalities or outside them, unless there are significant differences in operating conditions. This implies, of course, that if cities provide free rights-of-way for utility services, that the same treatment should be expected in rural areas. In situations of this type, however, the American practice of separation of governmental units causes confusion, because, in general, municipal governments own and control streets, whereas in the ordinary county pattern there is a mixture of county and state ownership of roads and rights-of-way.

Also, as a general rule, State governments do not establish local control policies for city and county governments. As a result, there is no method of guaranteeing equal treatment to different utilities within separate geographical units, nor is it possible to guarantee equal treatment to the same utility within separate geographical units. Many States have tried to provide similar treatment, at least in taxation patterns, but it is still possible to find widespread differences in a number of areas.

The third point also pertains to differences between urban and rural areas. It is quite apparent that on a strictly economic basis, sparse development makes for greater cost of utility service as customers obviously will be located at greater distances apart, thus tending to cause higher costs for construction and delivery of the service to each structure. For this reason, any precipitate decline in the provision of new and improved rural roads or any imposition of special charges for utility installations along rural rights-of-way would drastically curtail rural development as contrasted with urban expansion. State highway departments whether intentionally or not, have been vital factors in the decentralization of cities and it would be difficult for many of them to reverse their activities at this time.

In spite of the problems outlined, any theoretical consideration of the separation of duties between local and State governmental units will indicate that provision of local streets is not logically a function of a State government as long as local units are in existence. Certainly there is no theoretical or moral obligation for the State or Federal governments to provide rights-of-way either in cities or in rural areas which are of sufficient width to provide paths for utility services, if the the objective of the State and Federal governments is to provide paths for intercommunity mobility and long-distance transportation. The problem is an entirely different one if the objective of the larger governmental units is to provide street-type services. If this latter sentiment ever does become of paramount importance, then drastic revisions in philosophy and in taxing power should precede such actions.

UTILITY SERVICES WITHIN THE STUDY SECTORS

Georgia Area

As explained earlier the Georgia area (Fig. 2; Table 1) is composed of 17 counties located largely within the northwestern quarter of the State. Macon is very near to the geographic center of the State, while Atlanta is considered the center of the northwestern quarter. Terrain within the study area may be described as rolling or hilly, with extensive woodlands, and some abandoned farmland which is slowly reforesting itself. Farming activity is carried on throughout much of the area, with most of the more valuable agricultural land lying within the lower half of the study sector. There are no massive terrain problems, such as mountains or swamps. These features exist in other parts of the State, but do not pose a problem for this study.

Approximately 30 percent of all the residents of Georgia live within the study sector. Of the 1,168,716 people within the study area, approximately 1,000,000 of them live within the urban centers of Atlanta and Macon. The metropolitan Atlanta area is itself

TABLE 1

GEORGIA STUDY SECTOR, SUMMARY OF MILES OF SERVICE FACILITIES ON PUBLIC AND PRIVATE RIGHTS-OF-WAY

Service Facility	Right-of-Way (mi)				Number of Customers
	Public	Private	Public	Private	
Electric:	Transmission Lines		Distribution Lines		
Urban	21.44	5.84	1,854.90	224.13	193,276
Suburban	22.17	254.73	1,548.47	556.21	104,991
Rural	3.56	656.12	517.14	4,794.80	39,043
Total	47.17	916.69	3,920.51	5,575.14	337,310
Gas:	Supply Mains		Distribution Lines		
Urban	109.84	19.50	2,115.12	1.50	186,997
Suburban	67.36	11.81	996.25	--	89,445
Rural	97.77	25.25	28.02	--	1,485
Total	274.97	56.56	3,139.39	1.50	277,927
Telephone.	Toll Lines		Exchange Lines		
Urban	13.20	--	1,197.00	225.90	204,565
Suburban	42.65	--	725.85	532.95	89,333
Rural	120.75	542.95	895.15	2,387.35	19,592
Total	176.60	542.95	2,818.00	3,146.20	313,490
Water:	Supply Mains		Distribution Lines		
Urban	35.25	3.75	2,921.70	35.10	182,419
Suburban	28.25	--	1,016.00	--	60,380
Rural	30.63	12.57	111.63	3.75	2,829
Total	94.13	16.32	4,049.33	38.85	245,628
Sewage:			Disposal Lines		
Urban	--	--	2,438.45	307.90	--
Suburban	--	--	73.00	12.00	--
Rural	--	--	6.00	31.00	--
Total	--	--	2,517.45	350.90	--

slightly over the one million mark according to preliminary census figures, but two of the counties which are included in the metropolitan area are excluded from this study sector.

Telephone Service.—Southern Bell Telephone and Telegraph Company provides the vast majority of telephone service in the study area. Practically without exception, all toll lines are owned by Southern Bell and American Telephone and Telegraph Company. There are three small independent rural telephone companies, and one small city company at Thomaston. The rural lines of these companies are financed through the Rural Electrification Authority and they adhere to right-of-way policies developed for REA activity.

Power Service.—Georgia Power Company is the dominant supplier of electric power in the study sector, supplying Atlanta, Macon, and most of the other towns in this area. Within the study area there are 10 REA cooperatives which serve some or all of the 17 counties. (These 10 cooperatives also serve in 24 counties outside the study area.) Power for these cooperatives is secured through the transmission lines of Georgia Power Company and is purchased from Georgia Power or Southeastern Power Administration. There are 14 municipalities within the 17-county area which operate electric power distribution systems. These municipalities also secure power through the transmission lines of Georgia Power Company and from the generation facilities of the same company.

Georgia Power Company is a large, integrated company which has many hydroelectric plants along the rivers of the State. It also, by itself, and with its sister company, Alabama Power Company, operates a number of large steam generation plants.

Southeastern Power Administration markets power from a number of hydroelectric plants in Georgia. These are flood control and river flow stabilization installations primarily, although there is navigation on the lower reaches of both the Chattahoochee-Apalachicola and the Savannah waterways. There is no freight navigation within the study area.

The power company sought, unsuccessfully, to operate the generation facilities within these Federal projects. Georgia Power Company has been successful, however, in serving as the power transmission agency for all current generated at these installations. Apparently its functions as wholesaler and retailer are not causing serious public relations problems at the present time.

Gas Service.—Georgia does not have a pattern of rural gas service comparable to its REA or telephone service pattern. It is true, however, that natural gas pipeline companies often provide service in rural areas relatively close to their transmission facilities. There are eight municipalities within the study area which operate their own natural gas service or use a small local supply company.

The majority of natural gas service in the study area is supplied by Atlanta Gas Light Company, which is a distribution company exclusively. It buys its gas from the major pipeline firms located within the State. Atlanta Gas Light Company operates a great majority of its lines within streets and alleys of the municipalities it serves.

There are two small companies which operate transmission lines and local service within the study area. Both of these companies buy their gas from the major transmission lines serving the State.

Two major gas transmission companies extend through the study area. Southern Natural Gas Company is the principal supplier of Atlanta Gas Light Company in this area and has approximately 284 mi of transmission lines extending through the study area. These lines are almost wholly on private rights-of-way which are secured through easement, as a regular policy. Transcontinental Gas Pipeline Corporation pipes gas through the State and is not a principal supplier in the State.

There are two petroleum products, pipelines that cross this study area. Both of these are located on private rights-of-way exclusively. Plantation Pipeline Company has approximately 68 mi of line through the study area and Southeastern Pipeline Company has approximately 122 mi of line through the study area. These lines are not normally thought of as public utilities in the conventional sense of the word and do not serve local customers as this term is commonly used.

Water Service.—Within the study sector 22 municipalities provide water service. In almost all cases, the lines of these systems are located in public streets and alleys although there are mains bringing water from nearby sources which utilize private rights-of-way in some instances.

Two water companies provide service within the study area. The operating pattern of these units is similar to that of municipal water operations except that in some instances private rights-of-way have been secured to protect the corporate interests sponsoring the water service.

Sewerage Service.—Sewage disposal services are maintained by 20 municipalities within the study area. Because of the characteristic that sewerage systems operate on the gravity principle primarily, these systems are greatly influenced by new street or highway activity. Insofar as is known, there are no commercial sewage disposal facilities within the study area in Georgia.

Texas Area

The Texas study area (Fig. 3; Table 2) is composed of eight counties located in south central Texas. These counties generally lie about 150 or more miles west of Houston; and Travis, the northernmost county of the study area, is about 180 miles south of Fort Worth. Austin, the capital of Texas, is situated in Travis County and metropolitan San Antonio occupies most of the area of Bexar County, which is at the southern end of the study sector. These eight counties, in the main, lie just east of the Balcone's Escarpment which extends roughly north to south through central Texas and which marks the limit of the gulf coastal plain. Much of the western areas of the study sector consist of hilly regions bordering the well-known sheep-grazing section known as the Edwards Plateau. These areas fall away to the east into rolling hills and level land. It is estimated that about two-thirds of the land area consists of mildly rolling hills. Rainfall in the study sector is relatively light, but extensive farming, as well as grazing, is carried on throughout most of the area.

Austin is well known as the site of the capital of Texas and of the State University. In addition to these major achievements, the city is a center for local distribution and light industry tied to farming activity of the region.

San Antonio, one of Texas' oldest cities, is a major transportation and marketing center for agricultural produce from the nearby areas, as well as the major marketing center for livestock products coming from the Edwards Plateau. It has major oil refineries, although it is not the dominant oil city of the State.

Because of the massive size of Texas, the study sector is a very small part of the total land area, but it constitutes a larger percentage of the population group. Slightly more than 2 percent of the land area of Texas is in the study sector, whereas about 11 percent of the residents of Texas live within the study sector. Again, as in the case of Georgia, a large majority of the people within the study sector live within the two metropolitan areas of San Antonio and Austin. Approximately 900,000 of the 1,000,000 people within the study sector reside in the two largest metropolitan centers.

Telephone Service.—Southwestern Bell Telephone Company provides the major proportion of telephone service within the study sector, but General Telephone Company is active in the area north and west of San Antonio. Toll lines, in the main, are owned by Southwestern Bell and American Telephone and Telegraph. There are at least three small telephone companies operating within the Texas study sector, but it was not possible to obtain significant information from these units.

Power Service.—Three REA Cooperatives are active in the Texas study sector. Power for these cooperatives is secured through the transmission lines of the Lower

TABLE 2

TEXAS STUDY SECTOR, SUMMARY OF MILES OF SERVICE FACILITIES ON PUBLIC AND PRIVATE RIGHTS-OF-WAY

Service Facility	Right-of-Way (mi)				Number of Customers
	Public	Private	Public	Private	
Electric:	Transmission Lines		Distribution Lines		
Urban	42.00	106.60	1,800.00	46.00	213,009
Suburban	22.50	28.33	1,500.00	200.00	95,696
Rural	3.00	563.67	702.00	4,067.40	19,917
Total	67.50	698.60	4,002.00	4,313.40	328,622
Gas:	Supply Mains		Distribution Lines		
Urban	--	--	2,018.10	3.50	162,358
Suburban	--	--	1,716.00	--	72,275
Rural	--	--	13.51	--	785
Total	--	--	3,747.61	3.50	235,418
Telephone:	Toll Lines		Exchange Lines		
Urban	5.04	10.27	1,814.00	--	156,845
Suburban	10.77	12.87	1,444.50	--	65,551
Rural	135.55	357.78	2,024.10	363.10	9,287
Total	151.36	380.92	5,258.60	363.10	231,683
Water:	Supply Mains		Distribution Lines		
Urban	2.68	7.19	2,068.85	21.85	154,872
Suburban	--	--	765.00	1.00	45,187
Rural	--	--	2.50	0.50	288
Total	2.68	7.19	2,836.35	23.35	200,347
Sewage:			Disposal Lines		
Urban	--	--	1,199.70	143.50	--
Suburban	--	--	875.00	115.00	--
Rural	--	--	--	--	--
Total	--	--	2,074.70	258.50	--

Colorado River Authority. There are eight municipalities within the eight-county area which operate electric power distribution systems. These municipalities secure most of their power through the transmission lines of LCRA, except that San Antonio, which has a municipal distribution system, also generates a major portion of its power locally. There is no dominant privately-owned power activity within the Texas study sector.

LCRA is a State-owned hydroelectric generation system. Its dams are located along the Colorado River of Texas. This Authority was created as an independent operating unit many years ago by the Texas legislature. Its objective was to take over unfinished dams which were abandoned in the collapse of the Insull utility empire many years ago. From a small beginning, this Authority has grown to be a principal producer of electric power and a dominant force in the economic life of south central Texas. It is publicly owned, but is managed along independent lines, and it has been financed through the sale of bonds, as well as re-investment of revenues. It acts much as a private utility in its management decision pattern.

Gas Service.—The larger of the major cities, San Antonio, provides natural gas distribution service through municipal activities. The Southern Union Gas Company supplies metropolitan Austin. In the other counties, the distribution division of United Gas Corporation is the principal supplier. United Gas serves Bastrop, Comal, Guadalupe, and Hays Counties, and not other gas activity has been reported in these areas. Southwest Natural Gas Company handles distribution in the two principal municipalities in Caldwell County. The pipeline division of United Gas Company is the principal supplier, both for the distribution division of United Gas and for the municipal operation in San Antonio and the separate distributing company in Austin.

Water Service.—Water service within the Texas study sector apparently is provided by a large number of small units. It has been estimated that as many as 200 separate suppliers exist within Bexar County. (Public Health authorities do not require the reporting of water activities in Texas.) Most of these, of course, are very small and provide water service to a subdivision or other minute geographic sector. Seventeen communities provided information about their water supply activities, and it is felt that these 17 units constitute the bulk of the water supply activity. The two major communities of Austin and San Antonio have reported the number of customers which they supply, and it is logical to assume that most of the population of these two major areas are represented in the data available.

Sewerage Service.—Thirteen communities provided information pertaining to sewage disposal service within the study area. Again the two large communities of Austin and San Antonio constitute a large majority for this service.

Colorado Area

The Colorado area (Fig. 4; Table 3) is composed of eight counties and includes Denver, the capital of the State, which dominates the northern part of the study sector, and Pueblo at the southern part. It will be recognized that, in general, this tier of counties lies on the plateau running immediately east of the Rocky Mountain ranges which extend through the center of the State and westward. Terrain within most of the study area may be described as high plains, although in some minor areas, foothills and rough terrain exist.

Denver is the dominant city in the Rocky Mountain region and is a major center for meatpacking and agricultural processing in general. It is also a major transportation center for the entire Rocky Mountain region. Colorado Springs, south of Denver, is predominantly a health and tourist resort center, as well as the commerical center for many of these activities. Pueblo is Colorado's second largest city and is an active manufacturing center. It is the site of one of the West's largest iron and steel manufacturing complexes because of its good transportation and its nearness to both coal and iron ore deposits of the region. In the rural areas, farming, including grazing and cattle-raising, are the dominant activities, with irrigated land in the area being especially productive and highly valuable.

Approximately 1,115,000 people live within the eight counties of the study sector. It is estimated that approximately 1,000,000 people live within the three metropolitan

TABLE 3

COLORADO STUDY SECTOR, SUMMARY OF MILES OF SERVICE FACILITIES ON PUBLIC AND PRIVATE RIGHTS-OF-WAY

Service Facility	Right-of-Way (mi)				Number of Customers
	Public	Private	Public	Private	
Electric:	Transmission Lines		Distribution Lines		
Urban	1.91	24.48	1,677.42	381.98	245,825
Suburban	52.15	287.33	573.00	1,066.00	81,400
Rural	42.75	567.76	1,013.92	6,113.92	18,868
Total	96.81	879.57	3,264.34	7,561.90	346,093
Gas:	Supply Mains		Distribution Lines		
Urban	1.00	20.40	1,701.90	7.30	195,276
Suburban	2.10	6.30	1,381.20	25.60	86,637
Rural	--	--	--	--	--
Total	3.10	26.70	3,083.10	32.90	281,913
Telephone:	Toll Lines		Exchange Lines		
Urban	38.10	2.00	1,001.60	296.70	278,738
Suburban	40.00	40.00	63.80	--	--
Rural	332.40	446.00	844.20	984.10	12,196
Total	410.50	488.00	1,909.60	1,280.80	290,934
Water:	Supply Mains		Distribution Lines		
Urban	2.50	109.30	2,064.69	42.20	195,485
Suburban	66.89	1.00	429.21	24.90	37,250
Rural	--	105.49	54.00	2.00	2,971
Total	69.39	215.79	2,547.90	69.10	235,706
Sewage:			Disposal Lines		
Urban	--	--	1,607.00	243.50	--
Suburban	--	--	270.95	51.55	--
Rural	--	--	--	--	--
Total	--	--	1,877.95	295.05	--

areas of Denver, Colorado Springs, and Pueblo. More significantly, well over 60 percent of the entire population of the State is located in these eight counties, out of the State's 64.

Telephone Service.—Mountain States Telephone and Telegraph Company provides the vast majority of the telephone service within the study area. As is true for the Southern Bell Company in Georgia, practically all toll lines are owned by Mountain States and American Telephone and Telegraph Company. There are five independent telephone companies in the study sector. Four of them provided information for this study, and of the four, only one reported that it is financed through the Rural Electrification Authority.

Power Service.—Within the study area, there are three REA Cooperatives, each of which serves various areas within one or more of the seven counties outside of Denver County. Power for these cooperatives is secured from (a) the major generating companies within Colorado, (b) from the Bureau of Reclamation, or (c) from the Colorado-Wyoming Power Pool. Apparently, only two municipalities within the eight-county area operate electric power distribution systems. These municipalities also secure power in the same manner as do the rural cooperatives.

Gas Service.—Gas service within the Colorado study sector is provided by the two major utilities, Public Service Company and Pueblo Gas and Fuel Company. (Pueblo Gas and Electric Company, while a subsidiary of Public Service, is a large operating unit and as such deserves separate consideration in a report such as this.) Natural gas in part of the Colorado Springs area is provided by Pueblo Natural Gas Company, with the city of Colorado Springs providing some of its citizens with gas service as it

does electric service. According to information gathered, there are no small localized gas operations within the Colorado study sector. The major pipeline transmission companies are Colorado Interstate Gas Company and Colorado-Wyoming Gas Company.

Water Service.—Within the Colorado study sector, 20 communities or smaller units provide water service in the area. Denver apparently obtains much of its water from catchment basins in the mountains, but the other localities use surface streams or deep wells as sources of supply. Apparently there has been a tendency to provide water service in a few, newly developed subdivisions or other urban areas. These activities are minor in relation to the total water supply service.

Sewerage Service.—Sewage disposal agencies are maintained by the three municipalities or communities within the study area. The dominant water and sewage disposal activity in the whole region is carried on by Denver, which provides service not only to Denver City and County, but to the metropolitan area surrounding the central city.

Louviers is apparently a wholly-owned community provided by the DuPont Company for employees living in El Paso County. Because it is wholly owned by the corporation, it does not fit the normal description of a municipal activity.

Wisconsin Area

The Wisconsin study sector (Fig. 5; Table 4) is composed of eight counties situated in the southeast quarter of the State. The area is roughly a rectangle made up of two tiers of four counties each. Milwaukee County, on the east, is on the shore of Lake Michigan about 80 mi north of Chicago. Dane County is some 60 mi west of Milwaukee

TABLE 4

WISCONSIN STUDY SECTOR, SUMMARY OF MILES OF SERVICE FACILITIES[a] ON PUBLIC AND PRIVATE RIGHTS-OF-WAY

Service Facility	Right-of-Way (mi)				Number of Customers
	Public	Private	Public	Private	
Electric:	Transmission Lines		Distribution Lines		
Urban	4.98	26.66	2,517.78	1,508.55	403,089
Suburban	0.40	4.50	735.00	640.00	71,529
Rural	549.48	723.66	5,873.15	1,605.34	47,678
Total	554.86	754.82	9,125.93	3,753.89	522,296
Gas:	Supply Mains		Distribution Lines		
Urban	4.40	--	2,492.96	20.67	252,611
Suburban	--	--	888.32	3.48	75,364
Rural	37.62	73.27	181.25	55.54	4,454
Total	42.02	73.27	3,562.53	79.69	332,429
Telephone:	Toll Lines		Exchange Lines		
Urban	39.90	0.10	1,324.47	989.45	368,537
Suburban	24.90	0.10	143.20	195.55	28,000
Rural	626.34	256.00	4,350.30	630.20	29,796
Total	691.14	256.20	5,817.97	1,815.20	426,333
Water:	Supply Mains		Distribution Lines		
Urban	30.92	1.68	2,305.67	26.62	247,361
Suburban	0.25	--	954.18	--	47,200
Rural	--	--	59.81	1.73	3,966
Total	31.17	1.68	3,319.66	28.35	298,527

[a]Data not available on sewage service facilities.

and about 30 mi north of the Illinois border. Terrain within much of the study sector is composed of rolling hills and level fields, but in some areas, large hills formed in the Glacial Age are found. Rainfall in the region is adequate for general farming, and dairying is the dominant activity in the rural areas.

Milwaukee is the largest city in Wisconsin and is the largest city in any of the four study sectors. Because of its location on Lake Michigan, it is an important harbor site. The city is a major industrial center which is noted for its metal workers and other skilled employees. The manufacture of heavy machinery and other tools for numerous aspects of the National economy is an important part of Milwaukee's business activity.

Madison is the State capital, the site of the University of Wisconsin, and a chief city of the important Wisconsin dairying industry which dominates rural activity in Dane County. The rural areas, particularly around Madison, are heavily populated, as is attested by the large number of village-type utility installations in Dane County. (In addition to Wisconsin Telephone Company and General Telephone Company, there are 15 smaller telephone operations; there are 3 larger electric utilities in the County and 15 smaller ones; and there are 24 water service units in Dane County.) This, of course, is contrary to the situation that exists in much of the land area of the other study sectors.

From the standpoint of land area, the study sector is slightly more than 8 percent of the total area of the State; but about 40 percent of the State's population lives within these eight counties. As is true of the other areas, a large majority of the people in the study sector live within the urban areas. Approximately 1,400,000 people live in Milwaukee, Waukesha, and Dane Counties, and Waukesha is considered almost an extension of the urban activity in Milwaukee County.

Telephone Service.—Wisconsin Telephone Company provides the major proportion of telephone service within the study sector and General Telephone provides some service in seven of the eight counties studied. In addition to these larger units, there are 29 small companies or cooperatives in the Wisconsin study sector. As is true in the other regions, the Bell System's units, Wisconsin Telephone and American Telephone and Telegraph, own almost all of the toll lines in the area.

Power Service.—There are four REA Cooperatives which are active in the Wisconsin study sector, and 18 units listed as municipal electric companies, with four units listed as municipal electric departments, and six units listed as private corporations. The larger of these are (a) the Wisconsin Electric Power Company with headquarters in Milwaukee, (b) the Wisconsin Power and Light Company, and (c) Madison Gas and Electric Company. Both of these last two have their headquarters at Madison.

Gas Service.—In contrast to the large number of suppliers of telephone, electric, and water service, there are only five distributors of natural gas and all of these are listed as private corporations. Two of them, Madison Gas and Electric and Wisconsin Power and Light, provide both gas and electric service in some areas, whereas Milwaukee Gas Light Company and Wisconsin Natural Gas Company supply gas service only. The other supplier is a local community unit, Stoughton Light and Fuel Company. All natural gas for the area is supplied by Michigan-Wisconsin Pipe Line Company.

Water Service.—Water service within the Wisconsin study sector is provided by 87 different supply units. Three of these seem to be private corporations, while the other 84 are publicly owned. Communities in the vicinity of Lake Michigan generally secure their supply from the lake, whereas others use surface streams or wells.

Sewerage Service.—No data pertaining to sewage disposal service were collected in Wisconsin. It was felt that collection and tabulation would prove difficult because of the large number of municipal units, and there was no State agency available to render the type of assistance that came from the Public Service Commission of Wisconsin.

LEGAL AND MONETARY PROVISIONS FOR STREET AND ROAD USE

General Legal Provisions

Each of the four States in the study has State laws that control or allow the use of State and county roads for utility operations. Within municipalities, State law gen-

erally is permissive, and a further action by the municipal governing body normally is required. There are exceptions to this situation because some State laws provide statewide franchise coverage. The major utility companies have been quick to point out the existence of all of these laws in any discussion of the legal basis for their operation. These laws, in most instances, spell out the fact that utilities may, under specified circumstances, use streets and roads as locations for lines, poles, etc. (No attempt has been made to collect the provisions of State laws which pertain in general to use of streets and roads by utilities. It is felt that such a tabulation probably should be a separate operation handled by someone more familiar with legal terminology and sources.)

Monetary Provisions

It is also true that each of the four States has some form of legal provision for the assessment of charges on utility activities within the State. Most of these provisions refer to the use of streets and roads along with other aspects of utility operation. Some are more specific than others. For example, one Texas statute is called a Street Rental Tax Law. Some of the statutes are merely permissive, allowing cities or other political subdivisions to work out their own arrangements for financial compensation in this area of activity.

Georgia Study Sector.—Within the Georgia study sector, Georgia Power Company pays a 3 percent gross revenue franchise tax to each municipality in which it provides retail electric service. This tax is collected on all services except industrial accounts. The company makes no payment of this type to counties or to towns that receive wholesale service from the company.

The power company has franchises granted by practically all municipalities in which it serves, and the standard franchise agreement lists street use as one of the benefits that the company is to receive as a result of these payments.

The Atlanta Gas Light Company has franchises in all but two of the 67 communities in Georgia which it served on September 30, 1959. Some, but not all, of the franchises recently granted include a franchise tax provision, usually effective after a five-year development period, at a 3 percent rate, whereas others start at 1 percent and increase ½ percent annually to a maximum of 3 percent.

The Southern Bell Telephone and Telegraph Company also has agreements covering its service in practically all of the municipalities in Georgia. The consideration the company gives to the city for such permission varies among the various communities. In practically every instance, the ordinance calls for the furnishing by the company to the city of space on each pole for wires to police- and fire alarm-signaling systems of the city, and in some instances, ducts in underground conduits are provided for fire- and police-signaling devices. In addition, in some instances, the company furnishes telephone service free of charge or at reduced rates for municipal activity. The only city in which a monetary payment is required by ordinance is the City of Atlanta, which receives 1 percent on all gross exchange and miscellaneous receipts from business done wholly within the county of Fulton and the City of Atlanta. In addition, Atlanta receives rate reductions on municipal service amounting to approximately $85,000 per year.

Beginning in the year 1960, the rural electrification units in Georgia will start making payments comparable to those made by Georgia Power Company where the rural cooperative serves customers within a municipality. This was an important part of a compromise agreement reached between the cooperatives and the municipalities of Georgia. The municipalities wanted to exclude the cooperatives from the urban areas and remove the cooperatives from areas to be annexed in the future. Under this agreement, the cooperatives can keep their existing customers and territory.

The municipalities, in large measure, operate their systems in approximately the same pattern as do the private companies. Obviously, the municipality does not make any tax payment to itself for the use of its streets and alleys. The rate structure within these municipalities varies, and in some instances, "profits" from some electric services find their way into municipal budgets. There is no established pattern through which these municipalities secure general funds from utility operations.

Texas Study Sector.—There is no major electric utility company operating within the Texas study sector. Electric generation facilities are controlled principally by the Lower Colorado River Authority, or by the City of San Antonio. These units, insofar as can be discovered, make no payments which could be construed as franchise tax payments.

Southwestern Bell Telephone Company evidently operates in approximately the same manner as Southern Bell in Georgia, but specific data in this regard are not available.

United Gas Company, as well as Southwest Natural Gas Company, follows the rather universal Texas pattern of paying 2 percent on all gross revenues to the municipalities involved. This payment is made possible through an action of the Texas Legislature, which permits municipalities to collect up to 2 percent in gross revenues from all utilities providing service within the State. Apparently, some old franchise agreements, which provide for larger payments, have not been disturbed under these provisions.

No information is available about any payments from either rural electrification cooperatives or municipal utility activities within the Texas sector.

Colorado Study Sector.—The Colorado Municipal League has provided information pertaining to franchise financial agreements with utilities within the Colorado study sector. It is apparent from this information that the electric companies pay approximately 2 or 3 percent in gross revenues per year to municipalities which they serve, and gas companies apparently range from 1 to 3 percent in payments.

The Mountain States Telephone and Telegraph Company operates in the Colorado study sector under a variety of franchise, occupational, license taxes, and other special agreements. The provisions and terms of these vary widely. In general, the company pays to municipalities in which it operates, an amount equivalent to just about 2 percent of gross exchange revenues.

No information is available about any payments from either rural electrification cooperatives or municipal utility activities within the Colorado study sector.

Wisconsin Study Sector.—Within Wisconsin, no municipality as such collects any franchise tax payments from utilities. Wisconsin, however, does collect taxes from all utility activities within the State except municipally owned operations which do not extend beyond the city proper. Apparently, municipalities do pay taxes on utility installations that they own outside of their own corporate limits.

In the year 1958, the telephone companies of Wisconsin paid gross earnings taxes of $8,150,886 to the State. This tax is in lieu of all other forms of tax for the telephone companies of the State. Hence, it is not specifically comparable to franchise or gross receipt taxes in other States where ad valorem taxes are assessed on real property.

Specific figures for electric utilities are not available, but it is realistic to assume that the tax pattern will be roughly comparable, at least, to that of telephone companies. Also, cooperatives in Wisconsin pay what is, in effect, a 3 percent operating revenue tax to the State, and, as has been implied, municipalities owning electric, water, gas, or other utility services outside their corporate units are taxed in the same manner as the private companies within the State.

Wisconsin has developed a rather complicated formula by which it shares its revenue from utility services with the various municipal and other political subdivisions of the State.

BENEFITS TO UTILITIES AS A RESULT OF USE OF STREETS AND ROADS

It has been said that "the benefits to a public utility of free use of highways can be measured, conceptually at least, by the net added costs they would be required to incur if they could not use highways and were forced to use the next best alternative" (4). Of course this statement can be expanded to cover the use of city streets and secondary rural roads, as well as highways, for there is no difference in the basic concept of any type of vehicular right-of-way being used as a right-of-way for other services at the same time. In fact, a vast majority of utility customers, and therefore utility services, are located in urban areas, so the street is a much more common right-of-way for utility services than the rural road.

Theoretical Framework for Measurement of Benefits

If, for some reason, utility lines were not located in streets and roads, the preferred alternative, in most instances, would be a location just alongside the street or road but outside the public right-of-way. If the utility managers were given a choice, they would logically select this type of location, for it would provide almost all of the freedom of the roadway without many of its problems. For example, the pavements of streets are expensive to cut and patch, and utility managers would be most appreciative of a situation that might avoid this problem. Such a location alongside roads or streets would also provide convenient access, as well as the ability to make visual inspections from moving vehicles on the road alongside. For these and other reasons, utility managers who can do so locate their lines in this manner. The most notable examples are the rural cooperatives which provide a large share of electric service in many rural areas. In most instances a vast majority of the REA lines within the four study sectors are located on private property and most often they are found just behind the farmer's fence line along the road that serves the farmer's home.

Another location which has been used by a number of utilities is a rear line location. This is used most often in subdivisions with uniform lot size for pole-type services that are installed at the time of development of an area rather than after development has taken place.

If utilities in any given area were told at a specific time that their lines or services would have to be removed from roadways, their only alternative would be to seek a new right-of-way nearby. Hence, an agreement of some type would be sought to allow the placement of the utility service on private land. (Actually the term should be customer's land, which in many cases might be "public" land, owned by any of a vast number of governmental agencies which must have utility services just as much as individuals or corporate enterprises.) In every instance, the customer needing to retain the service would try to provide some form of right-of-way for his own service. The difficulty would arise from the fact that no one customer would be happy about providing a right-of-way for "through" service for his neighbor, or for other customers located at some distance away. Because of the complexities that would arise, the development of new rights-of-way for utility service in congested areas would be just as difficult as the provision of new rights-of-way for highway and street development, and the problems of acquisition would be identical except that a utility right-of-way, in most instances, would need less width.

Currently there is no feasible alternative to utility use of street rights-of-way in congested, previously developed areas. For this reason, it would not prove worthwhile to investigate the hypothetical costs of securing such a right-of-way through congested, heavily built-up communities. Urban communities could not exist without utility service, as has been said before. The absolute needs of health and welfare, to say nothing of convenience, would force a decision to reconsider any attempted plan to remove utility services from the public streets.

It is possible, however, to analyze the situation that might have developed if, for some reason, utilities had never been allowed to use street rights-of-way but, from the beginning of utility service, had provided their own separate rights-of-way. (Provision of such separate rights-of-way would have been highly uneconomic, especially in early periods when streets were unpaved and movement along them was slow and light.) For the purpose of measuring theoretical benefits, such an exercise appears to be both valid and workable, and this is the approach that has been used in this study.

To develop such an analysis, it was necessary to determine the existence of utility lines in the areas studied, and the results of this examination are summarized in Tables 1 through 4. Once the extent of lines was known by territories, and by types and variations of service patterns, the next step was to determine what kind of an alternative right-of-way would be required. For the purposes of this study the simplest and least costly substitute seemed to be called for, because this would be the choice of a prudent manager who was forced to secure such a right-of-way.

Once the question of the size of rights-of-way was settled, the only remaining problem was to compute the area needed per mile of line and then to determine what values

should be assessed for these alternative rights-of-way in the various communities under investigation. Because these hypothetical rights-of-way would have to develop along with the community they were to serve, the land needed would be unoccupied, in the most part, because it would not be built on generally until utility service was provided. For this reason, prices of vacant land have been used throughout this study.

On the basis then of a value, an acreage, and a location, it was possible to construct tables that provide hypothetical values and annual charges for substituted rights-of-way for utility service both in urban and rural areas. If one is able to accept the reports of the length of line, the area specifications, and the value figures assigned, a workable estimate of the value of substituted or alternative right-of-way thus becomes available.

Gross Monetary Benefits

For Individual Utility Service Classification. —Table 5 gives the estimated current value of land necessary for providing alternative rights-of-way within the Georgia study sector as $68,332,695. If, as in Table 6, an interest rate of 7 percent is applied to this value, then an annual expenditure of $4,783,290 would be necessary to meet the charges for owning these rights-of-way. (The figure of 7 percent has been used in the computation of annual charges that would be necessary if alternative rights-of-way were provided by the utilities. This figure perhaps is slightly higher than the rate of return that most utility regulatory commissions sanction, but it is not as high as the return that urban property owners in general seek from their ownership of land. In order not to be too controversial, a substitute figure of 6 percent has been used in the text itself. Thus, the choice of figures is left to the reader.)

An interest rate of 6 percent would produce a figure of $4,099,962. In the conceptual point of view taken in this study, this amount then might be considered the value of the gross benefits in money terms which would accrue to the utilities as a result of the "free" use of street and road rights-of-way within the Georgia study sector.

As shown earlier, the Georgia study sector has a population of 1,168,716 and a land area of 4,740 sq mi. There are 14,853 farms in the sector and a number of small towns which provide a tendency to dispersion. Throughout the rural areas especially, private rights-of-way for pole-type utility service are used extensively. Within the total sector, about 59 percent of the 9,495 mi reported as electric line mileage is on private rights-of-way, and slightly more than 90 percent of the rural electric mileage is on private rights-of-way. The total percentage of telephone mileage is somewhat less, but about 53 percent of the 5,964 mi of telephone line is reported on private rights-of-way. The rural mileage is 3,282 and of this, 2,387 mi or about 73 percent is on private rights-of-way. The other services reported (gas, water, and sewage) are located predominantly on public rights-of-way and in urban areas. This is the expected pattern, because operating requirements for below ground services are substantially different from pole-type installations.

In the same manner, Table 7 shows $74,548,557 as the value of alternative rights-of-way in the Texas study sector. Interest at 7 percent provides a sum of $5,218,403 as the annual charge, whereas the 6 percent figure is $4,472,912 (Table 8).

The Texas study sector has a population estimated in 1960 as 1,000,000 and a land area of 6,445 sq mi. There are 13,050 farms in the sector and this area also includes a number of small towns which are dispersed throughout the sector. The Texas reports show a smaller number of rural customers in that sector than in Georgia, but not far from equal rural mileage. There is less private right-of-way in electric service in Texas than in Georgia and in the case of telephone mileage, the ratio of public right-of-way is a phenomenal 93 percent. The reports for gas, water, and sewage service show again that these lines are almost exclusively located on public rights-of-way.

Table 9 gives similar evidence of values for the Colorado study sector. The estimated value of substituted rights-of-way is $53,401,911 and the interest charges at 7 percent amount to $3,738,130, whereas the figure at 6 percent is $3,204,115 (Table 10).

As shown earlier, the Colorado study sector has a population estimated at 1,115,600 and a land area of 10,210 sq mi. This sector is substantially larger even than the Texas sector and is more than twice as large as the Georgia and Wisconsin sectors. There are 6,255 farms, and the number of towns is smaller than in any other area

TABLE 6

GEORGIA STUDY SECTOR, SUMMARY OF TOTAL CHARGES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Charges (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	19,693	19,217	37	38,947
Distribution	1,056,303	583,480	4,154	1,643,937
Subtotal	1,075,996	602,697	4,191	1,682,884
Gas:				
Main	19,505	7,630	250	27,385
Distribution	375,502	109,243	57	484,802
Subtotal	395,007	116,873	307	512,187
Telephone:				
Toll	2,880	16,398	1,374	20,652
Exchange	815,170	266,610	14,139	1,095,919
Subtotal	818,050	283,008	15,513	1,116,571
Water:				
Main	3,102	3,048	170	6,320
Distribution	572,015	101,919	539	674,473
Subtotal	603,017	104,967	709	680,793
Sewage disposal	782,769	7,895	191	790,855
Total	3,674,839	1,114,840	20,911	4,783,290

TABLE 5

GEORGIA STUDY SECTOR, SUMMARY OF TOTAL VALUES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Value (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	281,330	274,540	524	556,394
Distribution	15,090,046	8,335,425	59,350	23,484,821
Subtotal	15,371,376	8,609,965	59,874	24,041,215
Gas:				
Main	278,647	109,008	3,560	391,215
Distribution	5,364,320	1,560,615	816	6,925,751
Subtotal	5,642,967	1,669,623	4,376	7,316,966
Telephone:				
Toll	41,135	234,263	19,625	295,023
Exchange	11,645,275	3,808,712	201,966	15,655,953
Subtotal	11,686,410	4,042,975	221,591	15,950,976
Water:				
Supply	44,325	43,542	2,429	90,296
Distribution	8,171,622	1,455,979	7,704	9,635,305
Subtotal	8,215,947	1,499,521	10,133	9,725,601
Sewage disposal	11,182,420	112,787	2,730	11,297,937
Total	52,099,120	15,934,871	298,704	68,332,695

TABLE 7

TEXAS STUDY SECTOR, SUMMARY OF TOTAL VALUES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Value (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	1,272,600	204,510	45,450	1,522,560
Distribution	15,788,724	7,393,200	253,848	23,435,772
Subtotal	17,061,324	7,597,710	299,298	24,958,332
Gas:				
Main	--	--	--	--
Distribution	5,958,890	2,830,490	812	8,790,192
Subtotal	5,958,890	2,830,490	812	8,790,192
Telephone:				
Toll	17,453	60,200	20,422	98,075
Exchange	17,188,132	8,026,450	300,876	25,515,458
Subtotal	17,205,585	8,086,650	321,298	25,613,533
Water:				
Supply	2,209	--	--	2,209
Distribution	5,541,517	1,319,500	82	6,861,099
Subtotal	5,543,726	1,319,500	82	6,863,308
Sewage disposal	5,884,042	2,439,150	--	8,323,192
Total	51,653,567	22,273,500	621,490	74,548,557

TABLE 8

TEXAS STUDY SECTOR, SUMMARY OF TOTAL CHARGES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Charge (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	89,082	14,316	3,181	106,579
Distribution	1,105,210	517,524	17,769	1,640,503
Subtotal	1,194,292	531,840	20,950	1,747,082
Gas:				
Main	--	--	--	--
Distribution	417,124	198,134	57	615,315
Subtotal	417,124	198,134	57	615,315
Telephone:				
Toll	1,222	4,215	1,430	6,867
Exchange	1,203,169	561,852	39,820	1,786,082
Subtotal	1,204,391	566,067	41,250	1,792,949
Water:				
Main	155	--	--	155
Distribution	387,906	92,365	6	480,277
Subtotal	388,061	92,365	6	480,432
Sewage disposal	411,884	170,741	--	582,625
Total	3,615,752	1,559,147	62,263	5,218,403

TABLE 9

COLORADO STUDY SECTOR, SUMMARY OF TOTAL VALUES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Value (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	57,900	338,600	4,567	401,067
Distribution	16,490,877	2,672,166	69,724	19,232,767
Subtotal	16,548,777	3,010,766	74,291	19,633,834
Gas:				
Main	2,880	3,861	--	6,741
Distribution	5,395,060	2,441,933	--	7,836,993
Subtotal	5,397,940	2,445,794	--	7,843,734
Telephone:				
Toll	461,800	146,046	17,719	625,565
Exchange	9,665,045	392,836	49,209	10,107,090
Subtotal	10,126,845	538,882	66,928	10,732,655
Water:				
Supply	6,470	122,090	--	128,560
Distribution	6,074,350	755,947	1,467	6,831,764
Subtotal	6,080,820	878,037	1,467	6,960,324
Sewage disposal	7,827,405	403,959	--	8,231,364
Total	45,981,787	7,277,438	142,686	53,401,911

TABLE 10

COLORADO STUDY SECTOR, SUMMARY OF TOTAL CHARGES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Charge (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	4,053	23,698	320	28,071
Distribution	1,154,361	187,052	4,882	1,346,295
Subtotal	1,158,414	210,750	5,202	1,374,366
Gas:				
Mains	202	270	--	472
Distribution	377,654	170,936	--	548,590
Subtotal	377,856	171,206	--	549,062
Telephone:				
Toll	32,326	10,224	1,240	43,790
Exchange	676,552	27,499	3,444	707,495
Subtotal	708,878	37,723	4,684	751,285
Water:				
Mains	453	8,546	--	8,999
Distribution	425,204	52,916	102	478,222
Subtotal	425,657	61,462	102	487,221
Sewage disposal	547,919	28,277	--	576,196
Total	3,218,724	509,418	9,988	3,738,130

TABLE 11

WISCONSIN STUDY SECTOR, SUMMARY OF TOTAL VALUES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Value (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	41,935	3,715	332,009	377,659
Distribution	19,994,737	4,324,932	923,880	25,243,549
Subtotal	20,036,672	4,328,647	1,255,889	25,621,208
Gas:				
Main	26,675	--	17,236	43,911
Distribution	6,620,965	1,625,409	13,056	8,259,430
Subtotal	6,647,640	1,625,409	30,292	8,303,341
Telephone:				
Toll	329,070	159,200	147,311	635,581
Exchange	10,454,346	735,138	666,194	11,855,678
Subtotal	10,783,416	894,338	813,505	12,491,259
Water:				
Supply	28,116	480	--	28,596
Distribution	5,805,247	1,684,854	10,033	7,500,134
Subtotal	5,833,363	1,685,334	10,033	7,528,730
Sewage disposal	--	--	--	--
Total	43,301,091	8,533,728	2,109,719	53,944,538

studied. As one might expect, the mileage of electric lines in Colorado is greater than either Georgia or Texas. Of the 10,825 mi of electric line reported in the Colorado sector, about 66 percent is in rural areas and about 70 percent of all the electric mileage is reported as being on private rights-of-way. Telephone service in Colorado seems to be much less ubiquitous than electric service and of the mileage reported, less than 50 percent is on private rights-of-way. The gas, water, and sewage service activities seem definitely to be confined to urban areas and are seldom found on private rights-of-way.

Estimates for the Wisconsin study sector are shown in Table 11. The value assigned to that sector is $53,944,538, whereas the interest charges at 7 percent are $3,776,126 and at 6 percent are $3,236,672 (Table 12).

The Wisconsin study sector is substantially larger in population than the other units studied. It is estimated that 1,640,672 people live in the Wisconsin sector within a land area of 4,887 sq mi; 21,658 farms are reported in the area; and there is substantially more rual mileage of electric and telephone lines than in any of the other sectors. Wisconsin reported 12,878 mi of electric lines, of which 7,478, or 58 percent, was rural mileage. In contrast to Georgia, Texas, and Colorado, most of this rural mileage (79 percent) was on public rights-of-way rather than private. The same general pattern was found in telephone service, with 87 percent of the rural mileage being on public rights-of-way. In the case of gas and water service, these activities were not generally available to the rural areas and almost all of these lines were found on the public rights-of-way, as has been true in the other three study sectors.

For Grouped Utility Service.—If, over time, no utility service could have used streets or roads for service installations, it is extremely likely that the whole group of utility suppliers would have arranged some joint plan for combined rights-of-way. They would, by their common needs, be forced to get together and provide a new "pathway for utilities" separate from, but close to, the existing street system.

TABLE 12

WISCONSIN STUDY SECTOR, SUMMARY OF TOTAL CHARGES DEVELOPED FROM COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHTS-OF-WAY

Service Facility	Total Value (dollars)			
	Urban	Suburban	Rural	Total
Electric:				
Transmission	2,935	260	23,242	26,437
Distribution	1,399,636	302,744	64,670	1,767,050
Subtotal	1,402,571	303,004	87,912	1,793,487
Gas:				
Main	1,867	--	1,208	3,075
Distribution	463,467	113,779	915	578,161
Subtotal	465,334	113,779	2,123	581,236
Telephone:				
Toll	23,035	11,144	10,312	44,491
Exchange	731,805	51,460	46,633	829,898
Subtotal	754,840	62,604	56,945	874,389
Water:				
Supply	1,970	34	--	2,004
Distribution	403,367	117,940	703	525,010
Subtotal	405,337	117,974	703	527,014
Sewage disposal[a]	--	--	--	--
Total	3,028,082	597,361	147,683	3,776,126

[a]Data not available.

From this, it may be assumed that a more realistic substitution than the one developed in the previous section would be the creation of a new right-of-way in which would be located all utility lines in a given vicinity. To develop an adequate substitution figure for such a right-of-way, a width must be assumed, and for this purpose 25 ft has been adopted. This figure is excessive for some needs, but is almost totally inadequate for others, such as electric transmission purposes. Nevertheless, it has been used as a workable compromise figure.

A composite right-of-way of the type envisioned here would not be suitable for all situations in all areas. Certainly these composite rights-of-way would not be used in sparsely settled or rural areas where none of the below ground type of service lines are found at the present time. The cost of facilities such as water, gas, and sewage lines is prohibitive unless a relatively large number of customers is available in a small area. This contention is supported by clear evidence that the pole-type services (i.e., telephone and most often electricity) are offered more widely throughout more of the Nation than other types. For these reasons, then, a composite 25-ft right-of-way usually would be suitable only in urban or suburban areas.

It is not possible to test these conclusions in each of the four study sectors, but to have one example of this procedure—the Georgia sector was tested in this manner. All streets within the Georgia sector that were classed as ubran were assumed to require utility services of all types; therefore, the composite substitute right-of-way procedure would be applicable in the case of all urban streets.

In Table 13, urban streets in Georgia have been subdivided into city streets and Federal-aid roads. To secure total composite alternative right-of-way figures for all urban roads in the Georgia sector, it has been necessary to combine the value and annual charge figures from Tables 14 and 15.

TABLE 13

GEORGIA STUDY SECTOR, ROADS AND STREETS IN URBAN AND RURAL AREAS

County	Mileage							
	State Highway System	Estimate State System Urban	City Streets	Total Urban Mileage (2) + (3)	State System - Urban (1) - (2)	County Roads	Total Rural Roads	Total State Roads
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bibb	100.31	20.35	186.29	206.64	79.96	396.91	476.87	683.51
Butts	55.32	3.66[a]	21.80	25.46	51.66	304.03	355.69	381.15
Clayton	82.49	14.13[a]	76.78	90.91	68.36	341.63	409.99	500.90
Crawford	70.01	2.71[a]	5.09	7.80	67.30	337.10	404.40	412.20
De Kalb	139.29	46.74	270.00[a]	316.74	92.55	760.56	853.11	1,169.85
Fayette	87.57	5.82[a]	13.54	19.36	81.75	362.15	443.90	463.26
Fulton	244.96	118.31[a]	2,399.04[b]	2,517.35	126.65	1,345.27	1,471.92	3,989.27
Henry	101.91	6.39[a]	20.52	26.91	95.52	623.72	719.24	746.15
Jasper	129.88	5.30[a]	9.68[c]	14.98	124.58	388.51	513.09	528.07
Jones	87.14	4.04[a]	8.40	12.44	83.10	406.59	489.69	502.13
Lamar	52.28	5.98[a]	25.91	31.89	46.30	321.23	367.53	399.42
Monroe	137.69	5.38[a]	27.41	32.79	132.31	452.99	585.30	618.09
Newton	115.42	14.10[a]	42.24	56.34	101.32	423.00	524.32	580.66
Pike	54.14	2.05[a]	12.80	14.85	52.09	371.61	423.70	438.55
Rockdale	53.21	4.10[a]	18.49	22.59	49.11	238.94	288.05	310.64
Spalding	60.67	8.98	65.56	74.54	51.69	441.48	493.17	567.71
Upson	73.02	7.28[a]	33.14	40.42	65.74	433.89	499.63	540.05
Total	1,645.31	275.32	3,236.69	3,512.01	1,369 99	7,949.61	9,319.60	12,831.61

[a]Highway statistics for urban highways not tabulated for cities under 5,000 population. These items have been developed from other highway tabulations (DHP 215 3-1-58).
[b]Subject to revision based on newer estimates being developed by highway department.
[c]Town of Shady Dale omitted.

TABLE 14

GEORGIA STUDY SECTOR, COMPUTATION OF CHARGES FOR SUBSTITUTED RIGHT-OF-WAY 25 FT WIDE, COMPOSITE RIGHT-OF-WAY FOR ALL UTILITIES ALONGSIDE ALL URBAN STREETS OTHER THAN FAP ROADS

County	Length (mi)	Percent Acre per Mi	No. of Acres in R/W	Value per Acre ($)	Total Value R/W ($)	Annual Charge[a] ($)
Bibb	186.29	3.03	564.46	5,000	2,822,300	197,561
Butts	21.80		66.05	2,000	132,100	9,247
Clayton	76.78		232.64	4,000	930,560	65,139
Crawford	5.09		15.42	1,000	15,420	1,079
De Kalb[b]	700.00		2,121.00	6,000	12,726,000	890,820
Fayette	13.54		41.03	1,500	61,545	4,308
Fulton[b]	1,500.00		4,545.00	10,000	45,450,000	3,181,500
Henry	20.52		62.18	1,500	93,270	6,529
Jasper	9.68		29.33	1,500	43,995	3,080
Jones	8.40		25.45	1,200	30,540	2,138
Lamar	25.91		78.51	2,000	157,020	10,991
Monroe	27.41		83.05	1,500	124,575	8,720
Newton	42.24		127.99	2,000	255,980	17,919
Pike	12.80		38.78	1,000	38,780	2,715
Rockdale	18.49		56.02	1,500	84,030	5,882
Spalding	65.56		198.65	3,000	595,950	41,717
Upson	33.14		100.41	2,000	200,820	14,057
Total	2,767.65		8,385.97		63,762,885	4,463,402

[a]At 7 percent.
[b]Estimates of urban street mileage seemed so unrealistic that adjustments to figures were made. Following figures are earlier estimates for these counties:

De Kalb	270.00	3.03	818.00	6,000	4,908,600	343,602
Fulton	2,399.04		7,269.09	10,000	72,690,900	5,088,363
With these figures, the totals would be						
	3,236.69		9,807.16		83,186,385	5,823,047

TABLE 15

GEORGIA STUDY SECTOR, COMPURATION OF CHARGES FOR SUBSTITUTED RIGHT-OF-WAY 25 FT WIDE, COMPOSITE RIGHT-OF-WAY FOR ALL UTILITIES ALONGSIDE ALL FAP ROADS IN URBAN AREAS OF COUNTIES UNDER STUDY

County	Length (mi)	Percent Acre per Mi	No. of Acres in R/W	Value per Acre ($)	Total Value R/W ($)	Annual Charge[a] ($)
Bibb	20.35	3.03	61.66	5,000	308,300	21,581
Butts	3.66		11.09	2,000	22,180	1,553
Clayton	14.13		42.81	4,000	171,280	11,990
Crawford	2.71		8.21	1,000	8,210	575
De Kalb	46.74		141.62	6,000	849,720	59,480
Fayette	5.82		17.63	1,500	26,445	1,851
Fulton	118.31		358.48	10,000	3,584,800	250,936
Henry	6.39		19.36	1,500	29,040	2,033
Jasper	5.30		16.06	1,500	24,090	1,686
Jones	4.04		12.24	1,200	14,688	1,028
Lamar	5.98		18.12	2,000	36,240	2,537
Monroe	5.38		16.30	1,500	24,450	1,712
Newton	14.10		42.72	2,000	85,440	5,981
Pike	2.05		6.21	1,000	6,210	435
Rockdale	4.10		12.42	1,500	18,630	1,304
Spalding	8.98		27.21	3,000	81,630	5,714
Upson	7.28		22.06	2,000	44,120	3,088
Total	275.32		834.20		5,335,473	373,484

[a]At 7 percent.

Tables 14 and 15 provide the results of this composite alternative right-of-way procedure. According to these tables, the composite rights-of-way in Georgia would be valued at $69,098,358 and, at a 7 percent annual charge, $4,836,886 would be necessary to pay for the use of these rights-of-way. At 6 percent, the figure would be $4,145,901.

These figures are slightly larger than those presented for the Georgia sector under the individual right-of-way pattern. It seems that the procedure under the individual right-of-way pattern should produce a larger figure than the one that uses urban streets and omits rural roads. If the figures were developed in a precise manner and on exactly equal terms the results seemingly should be reversed. It must be remembered, however, that these methods, as well as the data reports, are estimates and it should also be kept in mind that some few units did not report utility mileage, whereas it can be assumed that the street mileage used would be as accurate as engineering tests can be.

For Rights-of-Way Along Federal-Aid Highways.—The use of the composite 25-ft rights-of-way along urban roads allows a further development of special interest in this study. State highway departments maintain accurate records of the extent of Federal-aid highways in urban areas. It is apparent that the land abutting any conventional Federal-aid highway in an urban area is going to be so built up that utility service will be necessary. From the facts thus available, a value for composite rights-of-way alongside all primary Federal-aid highways can be developed and such a figure was found for the Georgia sector used in this study. (Federal-aid secondary roads can be treated in a similar manner, except that some secondary mileage in some urban areas might not justify the use of a composite alternative right-of-way; therefore, these roads were left out of this tabulation.) According to these calculations (Table 15), such composite substitute rights-of-way in the Georgia sector would have a value of $5,335,473, and annual charges at 7 percent would be $373,484. The charges at 6 percent would be $320,128.

This computation appears to have real significance, especially at the Federal level. It seems to be a reasonable method and one easily understood; at the same time, it presents in clear fashion an estimate of the general benefits that utilities of all types receive as a result of being able to locate on the rights-of-way occupied by primary Federal-aid highways.

In pursuing the idea of the 25-ft composite alternative right-of-way along Federal-aid highways, nothing has been said about utility service along rural Federal-aid high-

ways. The reason for the omission is that a different set of circumstances exists in rural as contrasted with urban areas. It is reasonable to assume that more utility service in total is required along Federal-aid highways located in rural areas than along isolated rural roads, but no authentic measurement of this situation is available at this time. Because of this void in the basic information, the only applicable measure of utility service in rural areas would be a percentage comparison of rural utility services existing along public roads compared with the total mileage of rural roads. Such a measure would be patently inaccurate or inconsequential; therefore, no effort has been made to develop it in this report.

The State Highway Department of Georgia reports that, in the past year, it has collected data as to the units of property alongside State highways, but these data have not been consolidated into usable statistical reports. If these figures could be made available, it is likely that results could be devised by relating known rural population to dwelling units along highways. By this device a more realistic estimate of utility service along rural highways might be developed.

DISADVANTAGES TO UTILITIES FROM USE OF HIGHWAYS

This discussion of disadvantages to utilities from use of highways is designed to explore some of the problems utilities face in using public rights-of-way. Many of the problems mentioned as difficulties that utilities face are problems that highway and street officials and motorists face also, but generally from the opposite side of the question. One of the most time-consuming and unpleasant tasks of road and street improvement projects is waiting for the removal of utility lines. Also, all motorists seemingly are almost constantly harassed by the everlasting problem of cut, blocked, or patched streets and roads. Unfortunately, almost all building or expanding of facilities for home or business, whether it be road improvement or utility installation, causes discomfort and dislocation during the construction period. Up to now, at least, no one seems to have found an answer to these problems. Perhaps this is a permanent price to be paid for growth and progress.

Utility services of all categories encounter a number of disadvantages which result from placing their service facilities on highway or street rights-of-way. Perhaps the most important of these disadvantages is the cost of relocating lines when highway and street improvement projects require this. In urban areas, of course, the cost of cutting and replacing pavements can become extremely heavy. In some instances, also, it is difficult to find room to perform maintenance or installation work within street and highway rights-of-way. One other problem that often arises is the desire on the part of the general public to develop trees alongside streets for the sake of appearance and shade. Under other situations, tree trimming need not be a matter of art, but rather of efficiency.

Relocation Costs

No specific investigation of relocation costs was made in this study, but in every contact with utility personnel, the problem of relocation costs was uppermost in their minds. All utility officials contacted, whether of public or private units, and whether in urban or rural areas, were unhappy about relocation problems and relocation costs. One might think that officials of publicly owned utilities would not worry about relocation costs because, in most instances, road improvement projects pay what are thought of as total costs of relocation of publicly owned lines when highway improvement is being carried out. However, in this instance, at least, money costs or money outlay is by no means the only item that burdens the mind of the utility executive. It seems to be true that the degree of administrative effort which goes into relocation is great, and that little or no compensation is provided to cover this area of activity. If this were not true, there would seem to be no real reason for municipal water and sewage officials to be as vehement as they are about the problems connected with highway improvement.

The problem of relocation costs is discussed more fully by Koplin and Watson (4). Because of the seriousness of this problem, various utility groups and governmental agencies have developed much information about relocation problems and expenses. One major study that presents extensive material on this subject is (5).

Relocation costs, along with operating preferences, have helped to create a standard operating technique for rural electric and telephone development in Georgia, and to a

lesser degree in Texas and in Colorado. (Apparently this pattern in Wisconsin is by no means as strong as in these other States, because much of Wisconsin's rural electric development preceded the creation of the Rural Electrification Administration.) Rural cooperatives, which receive financial assistance and administrative counseling from the Rural Electrification Administration, have established a pattern of location on private rights-of-way whenever possible. This is feasible for rural cooperatives for a number of reasons. In the first place, land values are relatively low and the type of installation is inexpensive and usually inconspicuous. Because these cooperatives generally provide only electric distribution service or telephone exchange service on a local level, and because the cooperatives do not produce profits as such, it has been possible in almost every instance for them to secure private rights-of-way without payments to the land owners. In fact, the agreement to serve a rural customer normally includes a right to install lines anywhere within the property of the person accepting the service. Such right also is assumed to provide the right to trim or cut trees at the discretion of the operating managers involved. This feature, more than any other, has tended to create dissatisfaction within the ranks of REA customers because, in some instances, tree trimming has become tree slashing and in some cases, at least, valuable timber has been sacrificed to provide a utility right-of-way which might have been located elsewhere with little expense.

In the Georgia study sector, at least, Southern Bell Telephone and Telegraph Company has extended rural lines in many parts of the State and it has been able to establish a pattern very similar to that of the electric cooperatives. Apparently, this has not proved feasible in Texas because a large majority of all telephone mileage is on public rights-of-way in that area.

Tree Trimming Costs

Measurement, for comparative purposes, of tree trimming costs along public and private rights-of-way does not seem to offer much empirical evidence to support either position. In some areas where highway development has removed trees, then trimming costs along the highway rights-of-way would be nonexistent, but as has been implied, trimming in urban areas could be much more expensive along a street of attractive residences that it would need to be at the rear of properties of this type. It is felt that the question of trimming offers little or no basis for comparison or contrast in a discussion of advantages or disadvantages of the use of public or private rights-of-way.

Costs of Cutting and Replacing Pavements

In urban areas, of course, streets and sidewalks, normally parts of public rights-of-way, are almost always paved. If a utility service line could be installed on unpaved, private rights-of-way, the expense of installing lines beneath the ground would be appreciably reduced. It is probable, however, that installations of piping below ground would present serious problems in many instances if they were not located on public streets or roads. In any event, there is little evidence that might be obtained in this situation which could be presented as authoritative and thus worthy of specific analysis and comparison.

Payment of Street Use Taxes or Franchise Taxes by Utilities

Evidence has been presented that utilities in a majority of urban communities make payments to the governments of those urban communities in the form of franchise taxes, street rental taxes, or special utility taxes under some other name. In attempting to measure net benefits for utility use of streets and roads, it would be necessary to reduce the gross monetary benefits by some amount that is part of the annual franchise tax payment.

Certainly most municipalities would object to the idea that the entire payment made to a municipality by a privately owned utility was a payment for use of streets or roads alone. As stated earlier, different municipalities use many and diverse patterns in collecting revenue from utilities that operate in their midst. It is not possible to ex-

amine these patterns in detail in this study because the legal bases for these payments are varied and, apparently, not at all constant.

On the other hand, the utility company involved certainly would feel that the major benefit obtained as a result of franchise tax payments is the use of public streets and roads. No way has been found to decide how to reconcile this conflict of interest. A very real conflict exists, however, because of the size of some of the payments that are made to some of the municipalities. In the Georgia sector, for example, payments in the form of franchise taxes to the City of Atlanta for the year 1959 ran as follows: Atlanta Gas Light Company, $189,966.02; Southern Bell Telephone and Telegraph Company, $208,372.87; and Georgia Power Company, $875,502.83; for a total of $1,273,841.72. In addition to its monetary payment to the City of Atlanta, Southern Bell provides, on many of its poles, space for the installation of fire and police signaling systems.

Because of the way in which the figures for this study have been developed, it is not possible to extract from the total for Fulton County the amount of the benefits which should be available to the City of Atlanta proper. (Obviously, a major part of this total would accrue to the City if an equitable division were made because, as has been said many times, utility service is a function of urban development, in the main.) The fact that stands out, however, is that Georgia Power Compnay paid over $875,000 to the City of Atlanta during the year 1959. From any viewpoint this sum appears to be an appreciable contribution in lieu of the hypothetical benefits computed for all electrical operations in Fulton County, which is figured at $1,183,803. The computation for electrical operation benefits in Fulton County shows, at 7 percent, an annual charge of $15,793 for rights-of-way for transmission lines and $1,168,010 as the annual charge for rights-of-way for distribution lines.

That there are advantages to utility use of street or road rights-of-way is apparent. If this were not true, the REA units, for example, would not seek to locate on private rights-of-way. Specific measurement of these advantages, however, would be difficult because of the complexities of the task, and because no two utilities would face exactly the same problems or difficulties.

For all of these reasons, this study has pointed out the areas where major disadvantages are likely to exist, but has made no attempt to provide quantitative measurements in money terms of the extent of disadvantages that utilities suffer as a result of occupying highway and street rights-of-way.

NET BENEFITS RESULTING FROM USE OF STREETS AND ROADS

It has been shown earlier that both publicly and privately owned utilities receive benefits in the form of lower costs as a result of using streets and roads as locations for service facilities. Estimates have been presented that indicate the magnitude of these benefits within certain areas. Also, from the utilities standpoint, there are disadvantages in using certain public roads as rights-of-way, and this use often demands specific expenditures as a result. No attempt has been made to attach definite value figures to these disadvantages because (a) it is very difficult to estimate costs of this type, and (b) the estimate of benefits was a hypothetical one rather than an attempt at an actual current cash measurement.

Although it is not possible to measure the exact extent of net benefits to utilities, the belief strongly remains that there are benefits to utilities as a group as a result of their use of public streets and roads. The next question that must come to mind is the extent of specific individual monetary benefits that accrue as a result of this situation. It must be said that if a privately owned utility were known to be making excess profits, and if these profits were allowed either to be distributed as dividends or were retained to improve the value of the business, thereby increasing stock values, specific benefits would be accruing to stockholders from such a situation. If, however, the privately owned utility is making only reasonable profits and if the regulatory body controlling the utility is requiring a high level of performance and efficiency, it is hard to see how anyone could feel that a specific benefit would be accruing under this condition to the stockholder of the utility. Actually, any specific benefit that might be apparent in this

instance would be chargeable to the utility rate payer rather than to the company rendering the service.

It is possible to make a similar analysis of publicly operated utilities if evidence is available that excess profits are received by such units. The only difference here is that the general taxpayer presumably is benefiting in this instance rather than stockholders, as is the case for the private utilities. One other possibility remains, of course. If the governmental unit is being mismanaged, and if funds are being drained off from public services to private uses, then it is clear that through this devious route some specific benefit from utility service is being passed on to the recipient of municipal favors. To assess this benefit, however, would be most difficult indeed.

CONCLUSION

In the final analysis then, it appears that net benefits accrue from utility use of streets and roads, but under conditions of efficient management and effective regulation, these benefits would appear to pass on to the general utility rate-paying public as general benefits, rather than specific benefits to utility managements or utility stockholders

Under these circumstances, any action to assess "user charges" for road use would result in shifting the impact of payments from payers or road taxes or general taxes to the general utility service user. Such an action would make some reduction in highway tax requirements but certainly would result in higher utility service charges. The question then becomes one of equity and National policy and thus outside the scope of this study.

ACKNOWLEDGMENT

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Economic Implications of Utility Use of Highway Locations in Utah

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Use of highway right-of-way by public utilities presents a multifacet cost vs benefit vs equity question. Reliable information as to the costs and benefits is essential to the delineation of valid lines of consideration and the interpretation of the economic consequences of possible courses of action. Sampling surveys of operating procedures and records of Utah public utilities have thrown light on several aspects of these costs and benefits.

The alternatives available to the regulatory commissions or legislatures are limited to three "pure strategies"—(1) complete prohibition of use of highway right-of-way by utilities, (2) permission to utilities to use right-of-way upon payment of some specified tax or fee, (3) free use of right-of-way by utilities—or a mixture of these "pure strategies" for application to different types of roads and/or in different areas. A weighted combination of the economic implications of the "pure strategies" indicates the aggregative economic effect for an area.

• ECONOMIC EVALUATION of the question of use of the highway right-of-way by public utilities presents a multifacet cost vs benefit vs equity problem. It is not the purpose of this report to present over-all conclusions, but rather to delineate the valid lines of consideration and to interpret the economic consequences of the possible courses of action that may be selected by the regulatory commissions. Generally, the course of action for which the net benefit or value exceeds cost by the greatest amount is the one that is economically most desirable, provided that the sociological effects are also evaluated in the determination of benefits and costs. Therefore, any policy evaluation must weight the quantitative and the qualitative aspects of all applicable direct benefits and/or costs to the highway users, to the utilities and their customers and stockholders, and the desirability of the action from the standpoint of society as a whole in the allocation of resources. Certainly, in the interest of equity, the incidence and terminal effects of the costs and benefits must be included as part of the evaluation. This report will in turn discuss the costs and benefits from use of the public right-of-way by utilities and then the economic considerations associated with the policy alternatives available to the regulatory commissions or legislatures.

Before the discussion, it should be recalled that utilities are subject to public regulation as to operating procedures, service requirements, and profits. Some of the objectives and problems of utility regulation by the public service commissions are important to the investigation. For any industry supplying electricity, natural gas, telephone service, water, or sewage disposal, the technological requirement of a distribution network or wire or pipe place them in the category of "natural monopoly." A single firm, in each instance, can more cheaply satisfy the demand in an area than could two or more firms with duplicate distribution facilities. The telephone industry is a natural monopoly for the additional reason of the nature of its product, that each phone may be most conveniently connected with every other phone.

Ordinarily, a natural monopolist operates under conditions of steadily decreasing average cost; that is, as the utility increases output to satisfy a greater demand for the service, the average cost of producing each unit of output becomes less. Faced

with this industry situation, regulatory commissions are usually authorized to set such prices as will yield the regulated firm a "fair return on a reasonable investment." It is not enough for the regulatory agency to enforce some rate of return on the invested capital in the regulated firm, but the criterion of "prudent investment" must be established and operating efficiency investigated. If the owners of the firm were eager to make that rate of return on still more invested capital, they would have an incentive to invest more capital in the business than would be necessary for efficient operation of the firm at the actual production output. Similarly, if the private operators were permitted to make a specified return irrespective of their operating costs, they would have a greatly weakened incentive to keep these costs to a minimum. Therefore, in the interests of efficient regulation, the public utilities commissions must compel a smaller percentage return whenever the production appears to be less than "reasonably" efficient. Also, contrary to the popular belief that the central purpose of regulation of the industries is to prevent abnormal monopoly profits, the commissions should consider the objective of improving the efficiency of resource allocation.

Diagramatically, the typical situation for a natural monopoly is similar to Figure 1. AC is average cost in the economic sense, including the rate of return on investment. The shape of the AR, average revenue or demand curve, does not influence the relationships for this situation. Without regulation the firm would produce at the profit maximizing output, q_m, and sell at the price, p_m. (The decreasing trend in average cost as depicted by the AC cost curve has nothing to do, of course, with the changes in the costs of the factors of production over time and the resulting effect on the relative cost of one period as compared with another.)

A price less than average cost (AC) may sometimes be preferable from the standpoint of improving the efficiency of resource allocation. Although there is understandably quite a general reluctance on the part of the public to provide the public subsidies required by the lower price, usually everyone can be persuaded that a public subsidy is desirable when some "necessary" public utility cannot be operated except at a loss, no matter what the price or fare. There is considerable precedent, particularly in some of the larger cities or in rural areas for this type of action. The amount of the subsidy is represented by the rectangle abcd in Figure 1, with a price p_s and output q_s.

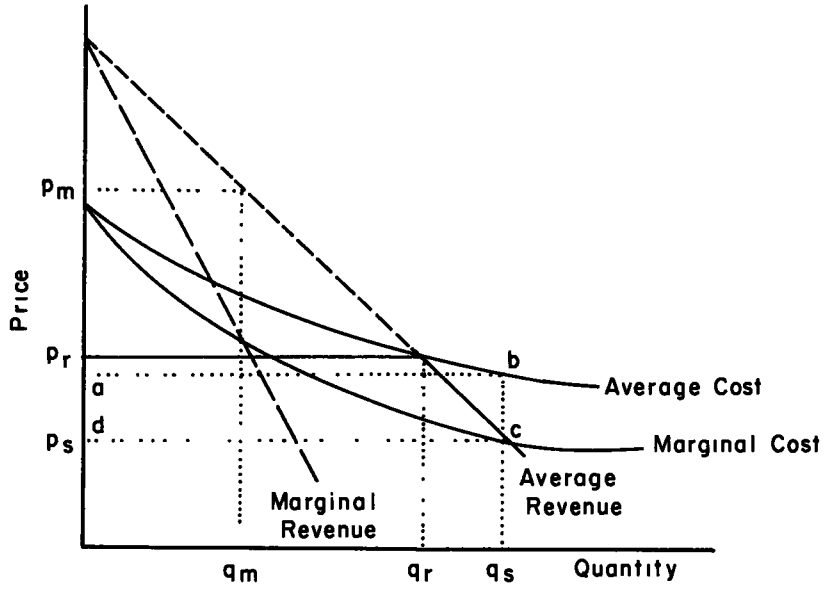

Figure 1. Cost and revenue curves showing typical situation for natural monopoly.

COSTS AND BENEFITS

There are a number of costs and benefits associated with utility use of roads, streets, and highways. Some are essentially qualitative and no dollar figure may be attached. Technical problems associated with utility operational procedures have generally all but precluded the quantification of most of the others. However, rational policy decisions can be made only on the basis of adequate, reliable information. Therefore, an attempt has been made to obtain data that will throw light on these actual costs and benefits. All of the following applicable costs and benefits must be considered.

Costs

There are three general categories of costs associated with utility use of highway right-of-way: effects on actual vehicle operation, effects on construction and maintenance costs of the highway system, and aesthetic effect of utility poles.

Road Construction and Maintenance. —The costs of construction and maintenance of of the road network may be affected in two ways. First, provision for reimbursement of the utilities for the costs of relocation of their facilities when the right-of-way is moved will, in some instances, have a significant effect by increasing the total cost of construction. The arguments pertaining to this question are discussed later.

Second, from the standpoint of the best allocation of resources the utilities generally argue that highway planning should take into consideration the "multiple use aspects of public rights-of-way." Economically, the reasoning for this point is valid provided proper weighting is given to the various classes of users, their relative importance, and the costs of modification of highway construction to satisfy the particular requirements of the utility users. An example of extreme and economically unsound modification of road design to meet utility requirements might be provision for interurban electric lines on the public right-of-way in rural areas. On the other hand, it may be desirable to make these provisions and modifications within an urban area.

Traffic Flow. —The effect of the presence of public utilities on highways on flow of traffic and the accompanying inconvenience and cost to the highway users is partially dependent on the type of roadway involved. Whenever something impedes the movement of traffic, there is a direct economic loss to the users. Sometimes it will be as obvious as the additional cost of out-of-pocket wage payments to truck drivers who were slowed or halted, and the associated cost of the capital equipment (e.g., the truck) doing less than the optimum amount of work during the period. In other instances the loss takes the form of time lost by the individual driving his automobile to work, on the job, or even on his vacation. In any event, anything that slows the flow of traffic is negating some of the original cost of construction of the highway, which was designed to maximize the safe flow of traffic for the money expended.

This problem appears to be of primary importance, with respect to utilities as a causal factor, in the urban areas where the right-of-way is relatively narrow so that the distribution networks are located either immediately adjacent to or under the traveled roadway. In rural areas, where the utilities locate along fence lines of a wide right-of-way or where the traffic is very light, this problem is not significant. Whether the utility facilities are located on public or private right-of-way it will still be necessary for the distribution networks to be constructed across the roadways and therefore there are delays which cannot be eliminated. The possible exception to the last statement would occur when the length of "drop" from the electric power or telephone lines, located on private right-of-way, is so great across a wide right-of-way that dual distribution networks have to be installed on either side of the highway, eliminating most of the crossovers.

Vehicular Maintenance. —The effect on vehicular maintenance expense, resulting from streets that have been torn up because of utility operations, is closely associated with the preceding question. Again, this is primarily an urban problem. It is impossible to draw any conclusions regarding the net effect when one considers the other operations that also tear up the streets.

Safety Considerations. —Safety aspects must also be considered. Utility poles and vehicles owned by utility companies that are stopped to service facilities constitute an

accident hazard. For example, entrance or exit of slowly moving vehicles into or from moving lines of traffic particularly on high-speed, high-volume routes have been recognized by all turnpike and throughway authorities and designers as a serious potential safety hazard. Therefore, long runways at all authorized entrances and exits permit a vehicle to attain speed or to slow down sufficiently out of the major traffic flow. Utility company vehicles servicing lines would, of course, be unable to accelerate or decelerate except on the shoulder of the main roadway.

The Massachusetts investigation (2) of the economic costs of motor vehicle accidents points up the significant loss to society accruing from motor vehicle accidents. However, none of the published data may be directly applied in the evaluation of the significance of fixed objects or of starting or stopping vehicles on the periphery of the roadway as causes of accidents. The similar Utah investigation being conducted by the Research Department, State Road Commission of Utah has some preliminary data on the economic cost of passenger car accidents. The investigation of accidents involving trucks was initiated during 1959.

Landscape Preservation.—The marring of the landscape by electric power and telephone poles represents another definite, although nonquantifiable, economic cost to the users of the highway. On the other hand, it makes little difference to the passing traveler, from the aesthetic standpoint, whether poles are located along the edge of the right-of-way or if they are located on private property a short distance from the roadway.

The U. S. Forest Service has recognized the economic value of natural scenery in the forest areas and has therefore severely restricted the use of the highway right-of-way through the primitive areas. This can be done effectively, however, only because the agency maintains control of the adjacent areas as well as the roadway.

Transmission lines, the type ordinarily found in the primitive areas, usually do not follow highways because of the relatively high cost per mile. Because these transmission facilities follow a straight line as nearly as possible, this restriction by the Forest Service has a relatively minor effect on the utility's operations.

Accrued Benefits

The economic arguments for permitting the utilities to use the rights-of-way that were primarily acquired for highway purposes lean heavily on the economic desirability of multiple use of scarce land resources and on the savings in resources of labor, materials, etc., that are supposed to accrue in the construction and maintenance of the distribution facilities.

Lower Rates.—Insofar as lower rates accrue from real benefits that come about as the result of multiple use of the public right-of-way, there is economic justification for utility distribution lines along the highways. This is not true when the benefits accrue to one group at the expense of another.

Faced with a declining cost curve (Fig. 1), utilities would be able to expand production to satisfy the increased demand for products and services for consumption at the lower rates that should arise as a result of the lower costs and proper supervision by the State regulatory agency. Utility use of the highway right-of-way eliminates the out-of-pocket costs paid to the private land owner and the engineering and acquisition costs of running the line on private property. Because these costs are included in the rate base, the payment of a return on the investment that would be required for these facilities if an off-highway location were used does not have to be paid by the utility customers when the lines are on the public right-of-way.

Tables 1 and 2 summarize the easement costs for the Utah Power and Light Company and the Mountain States Telephone and Telegraph Company, the two major utilities in the State that have overhead lines. The most striking thing about the data is the wide variation in the amount paid per unit. In the case of the power company most of the easements required no payment, yet for the years checked it was necessary to pay as high as $150 for the right to place one distribution pole or one guy wire on private land. The mean cost per unit including payment to the land owner and acquisition costs was $23.68 for easements where there was a payment for land. Where no pay-

ment to the land owner was required, the average cost to the power company was still $13.75 per hole for engineering, recording, expenses of the land, men, etc.

Figure 2 shows that for that for each of the four years the median cost was zero and also shows the number of payments under $10 and the payments of $10 or more. Salt Lake County zoning ordinances now require that a 5- to 10-ft easement for facilities be provided at the rear of the lots in new subdivisions. Most municipalities and counties are now adopting a similar ordinance. This would account for the high percentage of no-cost easement recorded by the utilities.

The easement costs of the telephone company followed a somewhat similar pattern although the average payments were lower. This lower average is the result of two factors. First, telephone poles are relatively easy to move; therefore, the telephone companies pay the minimum amount for an easement. Second, phone operations are predominantly urban where many utility corridors are provided. In the case of conduit, the costs are about the same as the gas company for an "iron clad" recorded right-of-way. Comparable to the $23.68 power company average, the telephone unit costs varied from $12.65 to $17.52 for the three years checked.

TABLE 1

NUMBER AND PAYMENTS FOR EASEMENTS ACROSS PRIVATE LAND, UTAH POWER AND LIGHT COMPANY, 1955-1958

Division	1955	1956	1957	1958	Total
All:					
No. of units	1,149	792	1,051	1,391	4,384
Mean payment/unit ($)	3.30	3.89	3.59	2.25	3.14
Median payment/unit ($)	0.00	0.00	0.00	0.00	0.00
Standard deviation ($)	20.40	22.75	23.61	20.21	21.59
Salt Lake:					
No. of units	223	172	292	637	1,324
Mean payment/unit ($)	1.73	6.95	1.27	1.41	2.15
Median payment/unit ($)	0.00	0.00	0.00	0.00	0.00
Standard deviation ($)	15.96	41.92	8.10	9.58	5.77
Ogden:					
No. of units	211	99	191	160	661
Mean payment/unit ($)	6.75	1.87	11.49	5.97	7.20
Median payment/unit ($)	0.00	0.00	0.00	0.00	0.00
Standard deviation ($)	40.10	11.75	51.69	50.01	43.84
Preston:					
No. of units	387	357	349	270	1,363
Mean payment/unit ($)	3.68	4.12	2.59	1.85	3.15
Median payment/unit ($)	0.00	0.00	0.00	0.00	0.00
Standard deviation ($)	35.84	14.57	9.12	29.24	11.45
Southern:					
No. of units	328	164	219	324	1,036
Mean payment/unit ($)	1.71	1.41	1.38	2.40	1.81
Median payment/unit ($)	0.00	0.00	0.00	0.00	0.00
Standard deviation ($)	9.27	9.67	7.46	16.09	11.61
All (summary of easements[a]):					
No. of units	405	306	333	344	1,388
Mean payment/unit ($)	9.37	10.07	11.33	9.10	9.93
Mean cost/unit[b] ($)	23.12	23.82	25.08	22.85	23.68
High payment/unit ($)	150.00	100.00	100.00	50.00	150.00
Division	Ogden	Salt Lake & Preston	Ogden	Salt Lake	Ogden

[a] For which payment was required.

[b] Including estimated acquisition costs. Special study by accounting department of company showed for 1958 cost of acquiring easements was 438 percent of payments made for easements. However, due to costs for engineering, recording, etc., associated with acquisition of "free" easements, a more reasonable figure would be mean cost of $13.75 per easement plus payment to landowner.

TABLE 2

PRIVATE RIGHT-OF-WAY COSTS, THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY, 1955-1957

Item	1955	1956	1957
Number of poles in sample	755	460	209
Mean cost per pole[a] ($)	12.65	15.56	17.52
Standard deviation of payments per pole[b] ($)	14.04	18.41	21.67

[a]Including engineering and acquisition costs.
[b]For private right-of-way including acquisition and engineering.

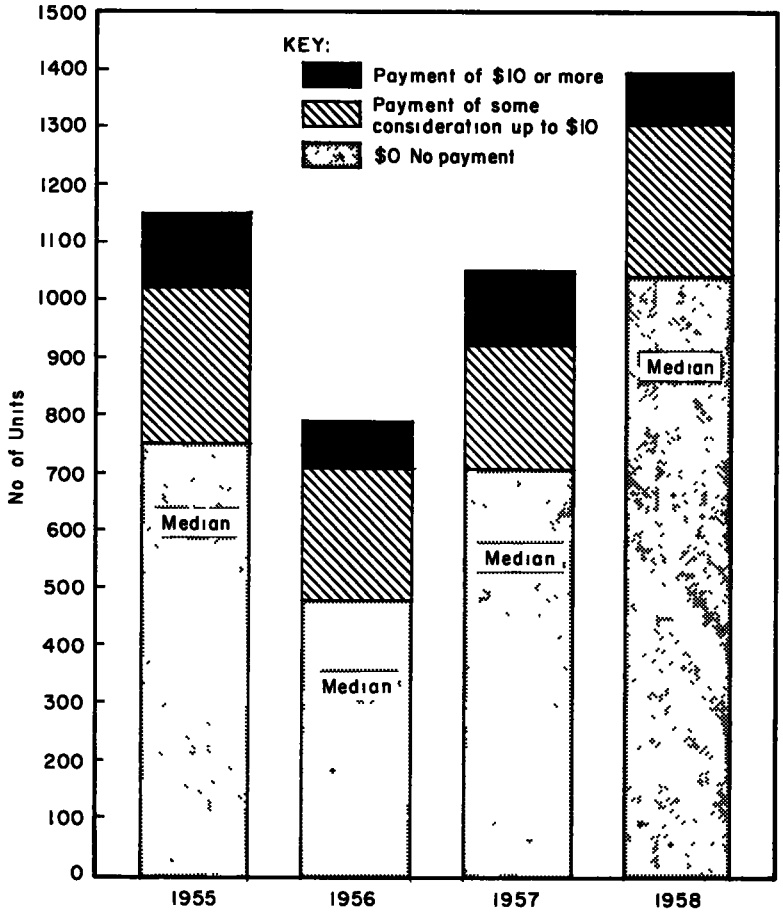

Figure 2. Number of distribution line easements, classified by unit cost, Utah Power & Light Company, 1955-1958.

TABLE 3

ESTIMATED MINIMUM INCREASED COSTS TO UTILITY CUSTOMERS RESULTING FROM PAYMENTS FOR EASEMENTS AND ENGINEERING COSTS IF ALL ELECTRIC POWER DISTRIBUTION LINES AND PRIVATE TELEPHONE LINES WERE MOVED FROM PUBLIC ROADS AND STREETS IN UTAH

Sample Basis	Utah Power and Light Co. Paid Easements 1955-58	Mountain States Tel & Tel Co Private Easement Costs 1955-57	Total
Number of units[a]	1,388	1,424	
Avg cost per unit ($)	9.93	--[b]	
Acquisition expense	13 75	--[b]	
Total cost	23 68	14.30	
Increased customer cost per per unit [c]	3.36	2 03	
Number of units to be moved [d]	--	--	119,800
Electric distribution	57,900	--	--
Telephone	--	61,900	--
Annual increased cost to customers ($)			320,200
Electric distribution	194,500	--	
Telephone	--	125,700	--

[a]Easements on private land are usually paid for at rate of some specified amount per hole to provide for guy wires as well as poles.
[b]Breakdown not available
[c]Return at 6 25 percent after taxes Cost based on an accounting estimate of tax obligations of Utah utilities for recent years
[d]Adjusted for estimated duplication where new right-of-way need not be acquired

An attempt was made in Table 3 to estimate the minimum expected increase in rates that would have to be borne by the utility customers to compensate for the easement and engineering costs that would accrue if these utilities were denied the use of the streets and highways. The estimates are very rough because of the differences in spacing and in the number of guy wires required from area to area, and because of the limitations of a crude estimate of the amount of duplication where the utility has feeder lines on the street and also service poles located in the back yards. These estimates represent a minimum because they are based on payments for easements when the landowner often desired the service. If the landowner already had service, there is little question that he would require a higher fee for the right-of-way. Based on these historical costs and at the current 6.25 percent rate of return, the consumers would have to pay an additional $320,000 per year to compensate these two types of facilities for their increased investment in "plant" accruing from acquisition and payments for easements.

Natural gas distribution lines are almost 100 percent on public rights-of-way in the urban areas. Mountain Fuel Supply Company reports that the only feeder lines on private built-up residential land are those that were in before the housing was developed in the area. On the other hand, their major transmission lines are usually on private property, where generally they have been able to pay a uniform set fee per rod because the buried lines do not interfere with agricultural activities. Mountain Fuel, the only distributor of natural fuel gas in the State, indicates that many of the small towns where it is now in the process of inaugurating service "may not be piped" if the opportunity to use the streets were eliminated (3). The Company is close to marginal so that any increase in costs would possibly extend the investment payout period enough to preclude the installation of natural gas service and distribution facilities for the town.

Table 4 summarizes the costs associated with the last significant acquisition of private right-of-way by Mountain Fuel Supply Company. This occurred during 1957. Unfortunately these data are not strictly comparable to those for the power and telephone companies; however, as noted, they represent the only information available. The data actually represent high-pressure feeder mains which are more like the power company transmission line. In practically all other instances where private land was crossed, the owner of the land was interested in obtaining service; only a few rods of right-of-way were involved, and the easement was obtained for the payment of $1. On the basis of the 1957 experience a capital expenditure of over $3 million would be required to obtain easements for all natural gas lines on roads. At the current rate of return allowed by the Utah Public Service Commission this would necessitate increased rates for the customers, which would in turn provide about $426,000 per year to the natural gas distributor.

Only a minimum mileage (dictated by engineering considerations and location of water source) of the water and sewer lines in Utah is located off the highway and street rights-of-way. For both types of utilities there is less than 8 percent on private right-of-way. Again, the cost of obtaining easements, if the use of the public rights-of-way were

TABLE 4

PRIVATE RIGHT-OF-WAY COSTS, MOUNTAIN FUEL SUPPLY COMPANY, 1957[a]

Feeder Main Type	Cost ($)			Length on Pvt. Land (rods)	Cost per Unit ($)		
	Purchase	Ac. and Eng.[b]	Total		Rod	Wtd. Avg. Per Rod	Wtd. Avg. Per Mile
12-in. high-press.	13,005	17,687	30,692	7,335	4.18	4.33	1,385.60
20-in. high-press.	31,169	21,454	52,623	11,920	4.41		

[a] Most recent significant acquisition of private right-of-way by company.
[b] Including payroll overhead.

withdrawn, would result in increased rates for the consumer. At the present time available data are not adequate to permit even an educated guess as the the magnitude of these increases because of the negligible amount of experience of these usually public-owned utilities in acquiring private rights-of-way for their distribution systems.

Lower rates mean reduced out-of-pocket expense for various classes of customers of the utilities. If the individual home customer is paying less for the same utility, he has more money to spend on consumption goods or services. The additional goods purchased may be locally produced or they may be shipped in from some other area, benefiting manufacturers, transportation companies, and marketing organizations. Also, local commercial and industrial operators paying less for utilities are in a position to pass on savings to their local and national customers.

Further, economics have shown that whenever income increases for any reason, consumption will also increase by some amount. This creates an additional increment of income, which in turn leads to more income and more spending and hence to another increment of income, and so on. The ratio of the total increase in income, from this succession of effects, to the original increase is called the "multiplier." Economists generally estimate this multiplier at between 2.0 and 3.0. Thus an increased expenditure of $1 million would have an over-all effect on the local and national economy of increasing consumption by $2 and $3 million.

Payment of fees to land owners and investors in the utilities would naturally increase their income. However, the propensity of these usually higher income individuals to increase their consumption expenditures is less than the propensity to consume of individual householders, for example, who must spend most of their income on food, clothing, and shelter. Therefore, the social gain balance is economically tipped in favor of the utility users as opposed to the landowners and investors provided the benefits are not gained at the expense of the highway user.

Resource Utilization. —Multiple use also implies better utilization of scarce resources, which in turn implies a social gain. First, less land is used. There is no loss trying to cultivate around telephone or power transmission poles. There is no loss or damage to crops because of the necessity of performing maintenance during the growing season before the harvest time. In addition to the economic loss of land in the rural areas to obtain a right-of-way within urban areas, the utilities are sometimes forced to purchase a "corridor" before they can construct the transmission facilities. This relatively high-cost and valuable land is lost to other uses, and also becomes part of the investment base used in rate making.

Second, less labor is required in construction and maintenance. As noted in Table 3, use of private right-of-way entails additional engineering costs and acquisition costs plus the out-of-pocket costs of the right-of-way. For Utah Power and Light Company these costs averaged approximately 140 percent of the amount expended for the paid easement. The telephone company engineering and acquisition costs are about three times the payment to the property owner. However, because of their minimum

payment policy for easements, as noted previously, the total cost is only slightly larger than the power company's acquisition expense. Based on these costs of the Mountain States Telephone and Telegraph Company (Tables 2 and 3), if all private telephone company lines were removed from the public rights-of-way the cost of telephone service in Utah would increase a minimum of $0.41 per telephone per year or a minimum of $0.58 per main line per year. These estimates were computed on the basis of the Utah Public Service Commission allowing 6.25 percent return on investment after taxes. Similar figures for electric power customers, based on easement costs paid by Utah Power and Light Company for the four years investigated indicated that the minimum increase per customer per year would average $0.98 for all classes of customers. As noted previously, these figures are based on costs during a period when there was no compulsion for the companies to obtain private right-of-way and when most of the individual land owners involved had an interest in the lines because they personally desired service.

Construction Costs. —Utah utilities do not have construction information available which differentiates between type of location. Therefore, a sample of 229 job authorization (JA) reports showing the labor costs for particular construction projects was selected from the accounting records for the Salt Lake Division, Utah Power and Light Company. These individual records were then checked against the sketches detailing the location of the specific job, and the project covered by the particular JA was classified as to location with respect to public vs private right-of-way and as to rural or urban location. The work covered by the JA was recorded in detail. Because each major job was somewhat different, and because costs for specific types of operations within the major jobs were not recorded, it was necessary to reconcile and classify the data. By discarding almost one-half the original sample it was possible to reconcile approximately the totals for the work performed for the rural and the urban so that a comparison of aggregate costs could be made. These results are summarized in Table 5.

On the basis of the limited sample and considering the fairly rough reconciliation procedure that had to be used, there is no indication that there is a statistically significant difference between the costs of construction on private as opposed to public rights-of-way in either rural or urban areas.

The sample results tend to substantiate the intuitive expectations concerning the construction cost relationships when two factors are considered. First, the timing for construction is flexible so that highway locations can usually be taken care of during inclement weather and the plowed fields, etc., when access is easy. Of course, if all lines on the highway right-of-way were prohibited, then the flexibility would be

TABLE 5

SUMMARY OF SAMPLING SURVEY OF CONSTRUCTION COSTS CLASSIFIED BY LOCATION, SALT LAKE DIVISION, UTAH POWER AND LIGHT COMPANY 1956-1958

Area	Location	No. of Jobs in Samples[a]	Total Labor Cost ($)	Public as % of Private
Rural	On or adjac. to hwy	48	2,428	96.9
	On pvt. r/w	35	2,505	
Urban	On or adjac. to hwy	23	1,875	90.0
	On pvt. r/w	26	2,084	

[a]Though number of jobs in sample is different for each classification, aggregate work performed in the 4 groups of job samples was the same for each classification. Therefore, total labor cost information is for performing specified equal "amount of work" at each type of location.

diminished and over-all costs for construction on private rights-of-way would probably rise. Second, in new subdivisions and urban areas generally the power facilities are installed before fences and landscaping, hence even heavy equipment may usually have direct access to the construction site.

Maintenance Costs.—From a maintenance or replacement standpoint, when landscaping is completed and the area is built up, one would expect the labor costs associated with private rights-of-way to be generally higher than for lines located on the edges of the public roads and streets. Permission must be obtained from the property owner to move equipment across his lawns, etc., and the equipment must often be hand carried instead of backing a truck into position next to the pole. Patrolling and inspection of lines can be accomplished from vehicles if the lines are located along the highway or street. The urban obstacles of fences, buildings relatively close together, etc., necessitate men walking to perform the same function if the lines are in the back yards.

Utah Power and Light Company has many miles of feeder lines located on the city streets with "duplicate" service poles located in the rear of the residences primarily because of the problem of patrolling and the associated objective of minimizing the breaks in service. Lines located in plowed fields or other rural areas may be relatively inaccessible during inclement weather. During the growing season it may be impossible to reach the poles with equipment without considerable damage to the crops, so maintenance must either be deferred until after harvest or the landowner must be reimbursed for the damage incurred. The substantial annual labor cost of topping trees to protect the lines is certainly minimized when the task can be performed from trucks with elevated platforms.

The pipeline transporters are faced with more serious maintenance problems when the lines are not located on the public right-of-way. A periodic leakage survey must be made of the lines. The gas company lines are checked at varying time intervals depending on the resistance of the pipelines installed, the electrolysis, the soil conditions, and the location of the lines. The time interval may be as short as one year (in downtown Salt Lake City) and will average about every five years for the survey. When the problems of working in back yards, where there are garages, patios, landscaping, etc., and where it would be impossible to use all types of mechanized equipment are considered, the estimate that it would entail an expenditure of "ten times the cost of repairing lines in the streets" (3) does not appear unreasonable. The natural gas distributor has had a negligible amount of experience with respect to this type of operation because feeder lines are not located in the back yards. The same situation exists with respect to the water and sewer lines in the State.

One additional consideration, which applies to both overhead and pipeline or conduit distributors, pertains to the disadvantages associated with the use of traveled roadways. There are the out-of-pocket costs required for flagging, for barricading the work area, and for insurance on the employees. There is also the psychological effect on the workmen in close proximity to moving traffic and the resulting reduction of efficiency.

Any attempt to prove the intuitive "conclusions" by analyzing the utility company records is seriously hindered by their accounting methods, which are different from those usually encountered in nonregulated business enterprises. The cost of property in service less accumulated depreciation (rate base) forms an essential part of the pricing formula with generally greater emphasis on property records than is the case with other types of business operations. Classification of costs between construction, operation, and maintenance must conform to the system of accounts prescribed by the regulatory authorities. At the same time, considering the regulated operating basis with an allowable return on investment, utilities in general classify everything possible as construction as opposed to maintenance so that the costs may be included in the investment base.

Investigation of the record-keeping systems of the power and telephone companies indicated that the most practical and fruitful approach for determining relative on- and off-highway maintenance costs would be to select some fairly common job, which is recorded under a special account number and is performed on all lines regardless of location. Thus by determing the labor required to complete the same useful task in the different types of location there would be determined a valid basis for comparison

of the maintenance costs on and off the highways and streets. It was also necessary to find some activity that occurred often enough to permit the selection of a sample of sufficient size which would provide conclusive statistical results.

Transformer installation time was selected as the best operation if not the only operation that fitted the previous requirements. All jobs involving transformer installation in the Salt Lake and Ogden Divisions of Utah Power and Light Company during 1957, 1958, and through part of September 1959 were checked. The various records pertaining to the job were collated and if sufficient information were available to permit classification as to location on the highway, private built-up area, private not built-up area, and rural or urban area, the data pertaining to the job were included in the sample. All jobs were analyzed for the period investigated so that any systematic bias an individual foreman may have had in the way he reported the time for his crew would not invalidate the results of the survey. An initial sample indicated that crew size was having a very significant effect on the time reported for installation of transformers of the same capacity in the same type of location. Therefore, the information was also classified by size of work crew to improve the homogeneity of the sample data.

Altogether it was possible to include 800 transformer jobs in the sample. This represented all the jobs of the specified type that were completed, which could be classified, in the Salt Lake and Ogden Divisions of Utah Power and Light Company during the 33-month period checked. The results are summarized in Table 6. To maintain an adequate sample in all of the subgroups, it was only possible to stratify or break down the data for two different crew sizes. Also, it was necessary to report the information separately for the two divisions because of differences in the character and operating procedures of the divisions.

In every instance where these maintenance costs on private built-up areas were compared with the corresponding costs on either the public rights-of-way or in the non-built-up sections, the results supported the intuitive conclusions that working in back yards, etc., would significantly increase the costs. The sample results

TABLE 6

COMPARISON OF TRANSFORMER INSTALLATION TIME, CLASSIFIED BY TYPE OF LOCATION AND CREW SIZE, SALT LAKE AND OGDEN DIVISIONS, UTAH POWER AND LIGHT COMPANY, 1957-1959

Crew Size	Type of Location	Sample Size (no.)	Mean Time (hr)	Std. Dev.	Comparison of Time Required				
					Location Type	Obs. Diff. (hr)	Sig. Level	Relative Type	Relative Percent
6 or more	Pvt. built-up (A)	96	7.42	3.06	A vs B	1.24	0.004	A to B	120.1
	Pvt. not built-up (B)	117	6.18	3.12	A vs C	1.16	0.005	A to C	118.5
	Pub. r/w (C)	78	6.26	2.32	B vs C	0.06	---[a]	---	---
Less than 6	Pvt. built-up (A)	22	7.05	3.31	A vs B	1.66	0.097	A to B	130.8
	Pvt. not built-up (B)	36	5.39	2.40	A vs C	2.23	0.006	A to C	146.3
	Pub. r/w (C)	51	4.82	1.79	B vs C	0.57	---[a]	---	---

[a]Not significant.

TABLE 7

COMPARISON OF AVERAGE TRANSFORMER INSTALL .TION TIMES ARRANGED IN ORDER OF MAGNITUDE

Division	Mean $\bar{X}$	Location Type	Crew Size
Salt Lake	7.42	Pvt. built-up	Large
	7.05	Pvt. built-up	Small
	6.26	Pub. r/w	Large
	6.18	Pvt. not built-'	Large
	5.39	Pvt. not built-'	Small
	4.82	Pub. r/w	Small
Ogden	9.97	Pvt. built-up	Large
	8.14	Pub. r/w	Large
	7.50	Pvt. built-up	Small
	7.30	Pvt. not built-u	Large
	6.12	Pvt. not built-u	Small
	5.73	Pub. built-up	Small

TABLE 8

COMPARISON OF RELATIVE TIME REQUIRED FOR TRANSFORMER INSTALLATION ARRANGED IN ORDER OF MAGNITUDE, CLASSIFIED BY LOCATION AND CREW SIZE

Location Types Compared	Comparison of Rel. Time (%)	Division	Crew Size
Pvt. built-up vs not built-up	136.6	Ogden	Large
	130.8	Salt Lake	Small
	122.5	Ogden	Small
	120.1	Salt Lake	Large
Pvt. built-up vs pub. r/w	146.6	Salt Lake	Small
	130.9	Ogden	Small
	122.5	Ogden	Large
	118.5	Salt Lake	Large

were very consistent as shown by the array in Table 7. The level of statistical significance leaves no doubt that a saving does accrue to the utilities when they use the highways and streets in an urban area. On the other hand, there does not appear to be a statistically significant difference between at least the installation of transformers on the roads as opposed to the same operation in areas on private property which are not built-up.

Table 8 clearly indicates the influence of operating territory and crew size on the differences observed between the costs in the various types of locations. However, with the percentage comparison of private property, built-up area installations running from about 18 to 46 percent higher than when the same type of job is performed on the highway, one is probably safe in assuming the maintenance costs will run at least one-fifth more when the public right-of-way is not available in urban areas. As noted before, the nature of the utility maintenance accounting records does not permit an overall estimate of the annual cost increase that would accrue because of increased maintenance if the utilities were not permitted to operate on the public rights-of-way.

As with right-of-way acquisition costs, the maintenance and replacement costs again tip the economic balance in favor of the multiple use concept of the public right-of-way. The social cost for the same service is higher if multiple use is denied. Also, the rates charged the customers would be increased not only by the higher out-of-pocket costs but also because much of the costs become part of the rate base and hence the utility is permitted a reasonable return on this "investment" which means the customer's payments must provide for this return after payment of taxes.

Service Quality.—Another social cost is in the form of poorer service to the utility customers when private right-of-way is used. Although it is impossible to quantify, in times of inclement weather the repair of facilities is more difficult and time consuming if a plowed field, for example, must be crossed. In other instances, some maintenance must be delayed because of possible crop damage. Finally, if a field must be crossed before the crops have been harvested and damage occurs or if a lawn or shrubs are damaged, the utility must reimburse the property owner for the damage that was incurred.

Equity Question

The problem of determining an equitable basis with respect to the use of the public right-of-way and the financing of the construction of these facilities is not a clearly definable economic problem. It is in this area that most of the arguments opposing free use of the right-of-way by the utilities originate. Certainly there is much justification for specifying that those who receive the economic benefit should be required to pay a share of the cost that is proportionate to the relative benefit accrued from the use of the facility. However, there are the fundamental questions of exactly who receives the benefit from each of the multiple uses of the right-of-way, what are the absolute and relative economic values of this privilege, what does the specific group now contribute to the construction and maintenance costs, and finally, does the question of inequitable assessment assume significant enough proportions with respect to any individual, group, or firm to dictate changes in regulations and legislation to provide for their relief and shifting of the financial burden. The last question raised is particularly difficult in that every individual and firm is indirectly and directly involved in not one but many ways; for example, as a private motorist, as a taxpayer into the general funds, as a consumer of products produced or transported by firms using both the public right-of-way and utility services, and as a direct customer for the services provided by the utilities.

It is important that any action designed to relieve some undesirable situation, from any equity standpoint, consider all facets of the problem just suggested plus the overall social effects relative to economic waste as indicated earlier and also discussed in the following section.

ECONOMIC CONSIDERATIONS

The alternatives available to the regulatory commissions or legislatures are essentially one of three "pure strategies": (a) complete prohibition of use of the highway right-of-way by the utilities, (b) permission to utilities to use the right-of-way on payment of some specified tax or fee, (c) free use of the right-of-way by the utilities; or a mixture of these "pure strategies" for application to different types of roads or areas. There is also the question of payments for relocation costs of the utilities located on the public right-of-way when the roads are re-aligned. It is recognized that the course of action selected for a large area or State will very possibly mix the alternatives. However, to simplify and bring out the salient points, this section is restricted to the economic implication of the "pure strategies" taken one at a time. Obviously, the aggregative economic effect for an area would be indicated by a weighted combination of the specific course of action taken for the individual parts. This section also points out the areas for consideration without getting involved in the more specific details of effects covered previously.

Complete Prohibition of Use

The most complete reversal of policy that could be made in Utah would be to force the utilities completely off all public rights-of-way or from a practical standpoint at least, prevent them from constructing any new facilities on the rights-of-way. (An AASHO policy statement does prohibit the placing of utilities longitudinally on the rights-of-way of the Interstate System.) If such were the policy, what would be the economic effects?

Obviously, the utilities would immediately be placed in the position of having to purchase a right-of-way across private property. This can take the form of either an easement permitting the erection of poles or laying pipelines through an individual's property, or in some instances the purchase of a corridor. Utilities have reported that there are data to substantiate that the initial charges along a right-of-way easement, near the start of a distribution line, are reasonable; however, as the line becomes more definitely committed to a particular route the charges for right-of-way become progressively higher. This situation conforms well with economic theory, and is analogous to the classic case of the feudal barons who each exacted a fee on the traffi passing through their domains along the Rhine. At the start of a particular line, the utilities have alternative routes that they can easily select, so the seller of the right-of-way has only limited bargaining power. As the line progresses, the alternatives become fewer or the cost of constructing detours around particular pieces of property becomes more expensive. Thus the individual landowner along the route finds himself in a position approaching that of a monopoly. With many individuals to handle along the distribution network, a situation of sequential monopoly is then created. Each monopoly in the sequence along the road to the final consumer takes its toll of a still higher price, and a still lower quantity. In the case of the natural monopolies, including the utilities in question, the regulatory agencies seek to establish rates limiting them to a fair return on a reasonable investment. Expenditures on rights-of-way, although relatively small in comparison with the total distribution costs, will cause the cost curves to rise; therefore, rate increases will be be necessary.

Any attempt to evaluate the ultimate significance of this sequential monopoly possibility In Utah, if the use of highway rights-of-way is prohibited to utilities, is purely conjectural because to date utilities have paid comparatively little for rights-of-way within the State. Where private land has been used, the individuals involved have often been interested in obtaining service, so the easement has been free or the charges have been nominal. Thus, it is impossible at the present time to indicate the magnitude of the effects. There would be direct economic effects including the payments to the landowners, the increased cost of utilities to the private, commercial, and industrial consumers, and increased payments to the investors arising from the larger sums of mone required. In addition, there would likely be indirect effects on the cost of goods produced within the area and on the competitive position of the firms involved. The transfers of purchasing power would also result in some dislocations or modifications in the markets for many goods and services.

As previously discussed, these disadvantages of ruling the utilities off the highway rights-of-way are augmented by the often poorer utilization of resources in construction and maintenance, and poorer utilization of land when only private property must be relied on for construction of the distributive networks.

Finally, do the costs arising from selection of the policy alternative that denies the utilities use of the public rights-of-way exceed the costs of permitting use of the highway rights-of-way by the utilities? If the total economic costs of prohibiting use exceed those of permitting use, then it is in the general public interest to adopt a policy that permits utilities to use public rights-of-way. In the event that the social gain, including all direct and indirect benefits and costs, is in favor of prohibition the policy question is solved. There may be significant differences between the effects in rural and urban areas.

Finally, if at least some use is permitted, the problem of equity must be faced, and the question of the burden of the costs and the incidence of the benefits must be considered.

Use Predicated on Tax or Fee Payment

If it should appear economically and socially desirable to permit the utilities to use the highway right-of-way, the question of equity must be solved. The evident solution is to try to arrive at some quantification of the costs and benefits to the parties involved, and then impose some new tax or fee schedule on the use of the highway by the utilities. The receipts would then most likely be expended as part of the highway program to offset the costs to the highway users. In addition to the nebulous problem of incidence of the costs and benefits and the even more difficult problem of quantifying the effects, there is also the difficult problem of designing an economically sound tax structure.

It is necessary that one speak of the effects, not just of the incidence of a tax. Any tax is likely to imply a "burden" quite apart from payment of the tax revenues. Also, probably a tax on utilities would result in certain benefits to other persons in the economy, with most accruing to the highway users if receipts were placed in the highway funds. Therefore, any analysis must consider the price effects plus the other effects including particularly the effects on the quantity produced by the taxed utility and benefit to the highway users. A significant decrease in demand because of a higher price resulting from imposition of a tax will reduce the factor requirements (labor, capital, etc.) of the utility.

Basically there are three different types of taxes that could be imposed on the utilities or their customers to provide for the costs incurred as a result of the utility operations, or as a means of charging for benefit received when lines are constructed along roads, streets, and highways. These include (a) a "specific commodity" type of tax which would tax the customer and producer of the utility service a specific amount per kilowatt-hour of electricity, per cubic foot of natural gas, etc.; (b) an "ad valorem" tax which would be levied at a specific percentage of the value of the service rendered; and (c) a lump sum franchise tax based on the number of miles of line, the number of poles, etc., constructed on the public right-of-way.

For the special case of the natural monopolies, all cost increases resulting from the imposition of any of the suggested types of taxes would be passed on to the utilities' customers. Regulatory commissions would have to permit rate increases to compensate for the tax costs. The increased rate in turn may cause some customers to reduce their requirements or to look for a possible fuel substitute, for example. Regardless of the type of tax, there would be some reduction in the quantity of the service that would be saleable at the higher price. With these decreasing cost industries, the rise in price would therefore legitimately exceed the amount of the tax. The tax revenue could be considered a transfer of funds from one group to another for reasons of equity. The additional cost borne by the customers, after the tax is established, would represent a loss to society as a whole. Obviously, the reduced output by the utility firms would mean some reduction in the labor and other factors employed by these firms.

Economic static equilibrium analysis assists in showing the effects of the various types of taxes. Because of analytical preference and relative ease of illustration, the tax has been treated as shifting the average revenue (or demand) curve vertically downward. Without changing the results, the tax effect could have been shown by shifting firms cost curves upward by the vertical distance equal to the amount of the tax at every output.

Figure 3a shows that, before the tax, price would be p_1 and output would be at q_1. To raise tax revenue equal to the area of the shaded rectangle, price would rise to p_2 and the output would necessarily be reduced to q_2 to compensate for the lower demand at the higher price. The social loss is shown by the rise in price which exceeds the amount of the tax at the given output.

Figure 3b shows the price to the consumer and the output of the firm if the tax were not imposed. Under the assumptions of this section that the utilities should be taxed, the shaded area indicates the same total "tax revenue" as Figure 3a, which is absorbed by society or groups in society that are not necessarily receiving the direct benefits of lower rates for the services of the utilities using the public right-of-way. On the other hand, the social group as a whole, including the ones paying the costs, would accrue

the direct and indirect advantages associated with greater output, lower price, and over-all better use of the economic resources.

It is certainly possible that the price rise associated with the establishment of a tax on the utilities could exceed the amount of the tax and the social loss already mentioned The method of levying the tax or assessment and the action of the regulatory commissions would determine whether the tax ultimately ends up in an account which is included as part of the base used in computing the return to the investors. If it does, the price would be still higher to cover the return on "investment," and there would be a greater reduction in output than previously indicated. No mention has been made as to the magnitude of the tax and its relation to the benefits received by the utilities. This is purely a policy and not an economic question. The imposition of any tax will have the economic effects discussed and the policy decision will only determine the importance or magnitude of the resulting economic effects.

Free Use

A continuation of present policy permitting free use of the public right-of-way by the utilities is the third and final possible "pure strategy" that could be selected by the legislative and regulatory branches of the State. This course of action is the economi-

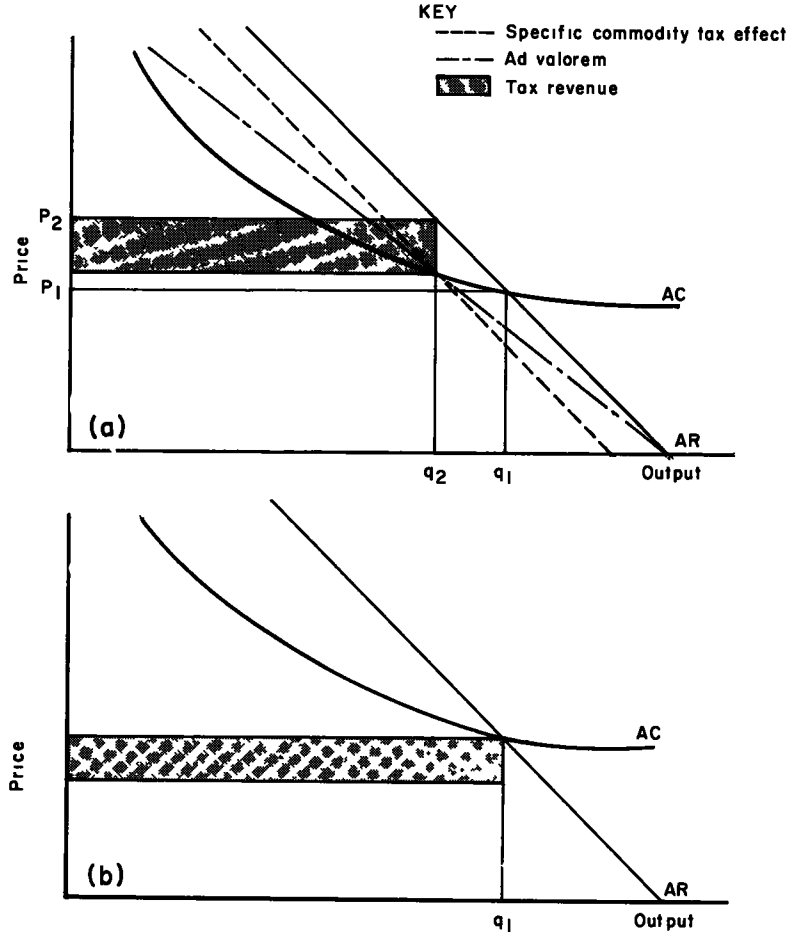

Figure 3. Effects of various types of taxes.

cally desirable one if a complete evaluation of the benefits vs costs vs equity considerations for highway users, utility stockholders and consumers, and society as a whole favor the multiple-use concept for the rights-of-way. Reference to the previous sections on the cost vs benefit vs equity question makes any further discussion relative to this decision redundant.

Use Predicated on Payment of Relocation Costs

The question of payment to the utilities for the costs of relocating their facilities when the highways are aligned is more of a judicial and political question than an economic problem. The hearings before members of the U.S. Senate Committee on Public Works relative to Federal-aid highway acts of the last few years, particularly 1954 and 1958, contain numerous arguments pertaining to this problem.

From an economic standpoint, a decision to pay the utilities for relocation costs goes one step beyond permitting free use of the rights-of-way by these natural monopolies. Society would gain in that the relocation costs would not become part of the capital structure or investment base; therefore, the price to the consumer would be lower and the output of the utilities would be greater. As noted previously, nearly everyone would benefit either directly or indirectly to some extent as a result of the lower-price greater-quantity situation and the conservation of scarce land and labor resources.

On the other hand, is it possible to justify the use of money from either highway or general funds for this purpose where, at least on the surface, the highway users who pay taxes for gasoline and vehicle registration appear to be subsidizing the utility customers? In this instance, every highway user and individual or firm using products or materials transported over the highway is assuming a burden proportionate to his dependence on the road network which may bear no relation to the benefits accrued as a utility customer. It may also result in certain allocational or competitive inequities. For example, the railroads may obtain some advantage over the truckers, and firms largely dependent on motor transport may be penalized relative to their competitors who rely primarily on rail freight.

As a final consideration, the effect on small utilities should be investigated on an individual basis. It may well be that society will, in some cases, have to decide between subsidy in the form of payment for relocation costs or the loss of the small utility and the services rendered because of inability of the utility to absorb the relocation expense within a reasonable rate structure.

CONSOLIDATION OF FACTORS

The different economic considerations are briefly summarized in Table 9 together with the estimated dollar amounts involved, in instances where it is possible to derive a reasonable estimate. The tables are included with some misgivings, as it is impossible to summarize the considerations adequately in the few lines available. However, it is felt that the advantages of at least listing all the factors in one place and providing a concise statement of status outweighs the danger inherent in this type of a summary.

There is little question that significantly large net monetary maintenance savings are made by Utah utilities because of their location on the public rights-of-way in the urban areas. Also, there are annual savings of over $1.5 million in right-of-way acquisition. Certainly one could say that there is much justification for utilities to share in street and highway costs. Whether this share should be greater than existing property tax contributions is not clear. At the same time, the customers of the utilities, many public owned, are also the vehicular users of the rights-of-way. These dual customers of both could be detrimentally affected both directly and indirectly by any significant change in utility rates, which would have to increase enough to pay the road share, the increased costs because of reduction in output, and the regulated return to the utility investors. In any event, the policy-making agency must carefully weigh these considerations together with the desirability of multiple land use efficiency, aesthetics, the influences on traffic flow, etc. There is obviously no panacea or universally "right" solution. Rational behavior would dictate the continuation of decision-making based on the specific problems of the particular type of road or the specific areas.

TABLE 9

COSTS ASSOCIATED WITH UTILITY USE OF PUBLIC RIGHT-OF-WAY

Nature of Cost	Status or Likelihood	Estimated Cost Borne by General Public and Highway Users in Utah			
		Basis for Estimation	Units (mi)	Cost/Unit[a]	Cost[b]
Marring of landscape	Certain	Social loss from aesthetic standpoint	---	---	Qualitative
Vehicular maintenance expense	Probable	Tearing up of highways probably increases overall vehicle maintenance expense	---	---	NE
Reduction in traffic flow[c]	Certain	Impossible to quantify	---	---	NE
Safety	Some effect	No basis available at present, State Commission study will throw some light on importance	---	--	NE
Relocation expense:	Dependent on legislative and regulatory action	(Number of units developed by this survey)			
Federal-aid-primary:					
Power and telephone lines			989.2	---	---
Pipelines			438.7	---	---
Federal-aid secondary:					
Power and telephone lines			1,746.6	---	---
Pipelines			545.1	---	---
State:					
Power and telephone lines			277.8	---	---
Pipelines			155.6	---	---
Other:					
Power and telephone lines			5,135.2	---	---
Pipelines			4,967.8	---	---

[a]Information on relocation costs not developed, not included in research assignment.
[b]NE = not estimable in quantitative terms with limited information presently available.
[c]Driver time lost and equipment time "wasted."

ACKNOWLEDGMENT

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Benefits to Utilities from Rural Highway Locations in Oregon

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The recent emphasis on economic impact studies and the need for determining non-user as well as user benefits from highway improvements has resulted in the Oregon State Highway Departments, having the University of Oregon, Bureau of Business Research, prepare a study on electric utility benefits resulting from free use of rural highway right-of-way. The economic study measured the extent of utility use of rural highway right-of-way, the approximate benefits received, and the cost incurred from such use. Use of rural highway right-of-way by utilities benefits the utility by eliminating the necessity to acquire easements from private property owners, providing easy access and inspection, and reducing maintenance costs. Disadvantages to the utility result from the necessity of paying for relocation resulting from highway changes and damages to utility equipment by vehicular accidents.

The study showed net monetary benefits to utilities, with the advantages generally outweighing the disadvantages. The existence of utility lines on the highways seriously affects the highway user when their presence (a) decreases safety, (b) increases cost of highway construction and maintenance, (c) reduces flow of traffic, and (d) interferes with the aesthetics of the landscape.

• THE MANDATE by Congress in Section 210 of the Highway Revenue Act of 1956 requiring the Secretary of Commerce to study and investigate "...any direct and indirect benefits accruing to any class which derives benefits from Federal-Aid Highways..." resulted in a request to all State highway departments to assist by conducting studies of the economic impact of improved highways. The importance of these studies, the diverse area of study, and the relatively short time for their completion required that existing highway department personnel be augmented by utilizing universities and research agencies to provide as much useful data as possible.

The Oregon State Highway Department, in cooperation with the Bureau of Public Roads, contracted with the University of Oregon, Bureau of Business Research, for a study of non-user benefits from Oregon highways (1). The many possible combinations of non-users and their benefits and the limited time and personnel available for the stud required a limitation of the study to electric power lines on Federal-aid highways in the rural areas of the State.

USE OF HIGHWAY RIGHT-OF-WAY BY UTILITIES

The rural Federal-aid highway system in Oregon is composed of 640 mi of interstate road, 2,971 mi of primary, and 5,230 mi of secondary, for a total of 8,841 mi. Information on the extant utility use of the Federal-aid highways was not readily available from records of the utility companies nor the Oregon State Highway Department; therefore, a sampling procedure was used to determine the extent of its use. The basic sample was 5 percent of the mileage obtained by selecting every twentieth 2.5-mi section of the interstate mileage and every twentieth 5.0-mi section of primary and secondary mileage.

Each of the selected sections was inspected in the field for utility use. Information on the type and miles of lines on and adjacent to the highway right-of-way was obtained

and the adjacent land was classified by general land use groups. All field information was verified with each utility company represented to fix the exact location of their facilities with respect to the highway right-of-way.

From the sample data, it was estimated that there were 3,212 mi of electric power lines located on Federal-aid highway right-of-way and 1,514 mi of electric power lines located immediately adjacent to the highway on private land.

The estimated mileage of electric power lines by type is given in Table 1. The table shows distribution lines that serve the customers directly account for the largest part of lines on or adjacent to the highway, and twice as many lines are on the highway as are adjacent to it. Three times as many miles of subtransmission line are on highways as are adjacent, whereas twice as many miles of transmission line are adjacent to highways as are on them. Statistical tests indicate that the data concerning the extent of use of the highway right-of-way by utilities are reasonably reliable; however, this applies to the total only and may not reflect the condition for subgroups. For instance, the probability of error in the expanded mileage of transmission lines could be appreciable because of the very small size of the sample.

The subtransmission line which was a blanket intermediate category between distribution and transmission has about 80 percent of its mileage serving a dual purpose; that is, it has both distribution and subtransmission lines. This predominate combination feature may reflect the location selected for the distribution lines and not the subtransmission line. The 20 percent of the mileage composed entirely of subtrans-

TABLE 1

ESTIMATE OF MILEAGE OF ELECTRIC POWER LINES

Type of Estimate	Mileage	
	On Highway	Adjacent to Highway
By line:		
Distribution	2,420	1,136
Sub-transmission	752	273
Transmission	40	105
Total	3,212	1,514
By land use:		
Industrial, commercial, residential	471	73
Intensive agriculture	1,244	421
Extensive agriculture	1,209	838
Timberland	288	182
Total	3,212	1,514
By company:		
Private	2,399	466
Public:		
Cooperatives	346	966
Public utility districts	206	32
Bonneville Power Admn.	---	50
Municipally owned	261	---
Total	3,212	1,514

mission line was derived from a sample that indicated more than three times as many miles adjacent to the highway as on the highway. Because of the sample size, extreme care should be exercised when using the subgroup data.

The distribution of electric power line mileage by broad land use types is also given in Table 1. The data show the preponderant agricultural nature of the rural highways in Oregon. The percentage of the lines that are on the highway right-of-way, as compared to those adjacent to it, is highest for roads through populous areas, and falls as the value of the land declines.

The location of electric power lines appears to be affected by its ownership. Table 1 gives the location distribution of mileage by private and public owners. Private utility lines are usually on the highway right-of-way, as are the public utilities operated by municipalities and utility districts, whereas public cooperative utilities consistently locate on private property adjacent to the highway. The differences in location practices are caused primarily by the differences in easement costs. The cooperatives typically make no payment for private easements for any line other than a transmission line, whereas any other public or private utility will normally have to pay for any easement.

BENEFITS TO UTILITIES FROM USE OF HIGHWAYS

Advantages

The principal advantages to public utilities from location on highways were determined and evaluated in general terms by considering the possible alternatives and their effect on utility operations and costs. Although the benefits to public utilities from free use of highways can be thought of in terms of the net added cost utilities would be required to incur if they could not use highways and were forced to use the next best alternative, considerable difficulty was encountered in attempting to estimate a monetary value of these benefits. Estimates were made for savings in easement costs, but other advantages, although important, were not quantifiable.

Public utilities must obtain easements from property owners to place power lines on private property. The cost of these easements is the most easily measurable of the expenses of locating lines off highway right-of-way. The study investigated these costs and obtained estimates from the utility companies for the use of acquiring private easements for all lines reported as being on highway right-of-way. The results of these investigations are given in Table 2, which shows that the estimated easement costs per mile are higher in areas of heavy development, and decrease as the use of the land and value of the land decreases. The total estimated cost of easements for utility lines found on rural Federal-aid highways in Oregon was approximately $2,800,000. This is a capital cost, and being a land cost it is not subject to amortization; however, it can be converted to an annual cost in terms of the return on the capital invested. Using 7 percent as the rate of return, this total cost converts to an annual cost of approximately $200,000 which represents the annual easement cost saved by free use of highway right-of-way as estimated by the study. To this should be added the costs of negotiating easements and the costs of condemnation proceedings, which would in turn be partially offset by the cost of negotiating for permits for use of highway rights-of-way.

Cost data with respect to easement cost, for the most part, are based on individual cost estimates made by company officials. These company officials were generally very reluctant to give any specific cost estimates; therefore, considerable caution is suggested in the use of these values. In addition, the use of historical costs to represent future costs may not give a true reflection on conditions as they currently exist.

As mentioned earlier, the data for public cooperatives (Table 2) would indicate that they have not been required to pay any easement cost, whereas all other public and private utilities have paid substantial amounts for easements. The cost of private easements represents a financial fact, and when it can be avoided by free use of highway right-of-way, a definite benefit results, one whose monetary value can be approximate

TABLE 2

ESTIMATED EASEMENT COSTS

Type of Easement	Miles on Highway	Cost ($)	
		Per Mile	Total
Total	3,212	866	2,799,860
By company:			
Private	2,399	929	2,229,600
Public:			
Cooperative	346	0	0
Other	467	1,178	550,260
By land use:			
Industrial, commercial, residential	471	2,366	1,114,200
Intensive agriculture	1,244	983	1,223,440
Extensive agriculture	1,209	196	236,560
Timberland	288	714	205,660
By line:			
Distribution	2,420	782	1,893,260
Sub-transmission, transmission	792	1,119	886,600

Other advantages to public utilities from free use of highway right-of-way which are not easily measured in monetary terms also exist.

The location on highway right-of-way normally places the utility in the most favorable position for serving its customers who typically locate immediately adjacent to the highway. The necessity of locating elsewhere than on the highway or immediately adjacent to it normally requires additional expenditure for the utility to provide service to its customers.

Many utility officials indicated that ease of inspecting lines for maintenance purposes and to locate outages was a definite advantage in favored locations on or immediately adjacent to highway right-of-way. The importance of the advantage in this case was not so much the man-hours of labor saved but the increased ability of the utility to provide continuous service and the quick elimination of outages.

The ease of access to utility lines when placed on or adjacent to the highway right-of-way is an advantage to the utility. The difficulty of access to construct and maintain lines on private property varies significantly with the distance from the highway or other road and the type of land use. A line on private property immediately adjacent to the highway shares most of the advantages of the highway location. Lines across cultivated areas present a distinct problem, and many times maintenance must be delayed until after crops are harvested, or heavy damage payments must be paid to offset resulting damages.

Another advantage to the highway use cited by most utilities is the savings on clearing land of timber and brush and trimming trees threatening to interfer with service. Though the importance of these factors varies from one locality to another, there are few places where trees or brush do not constitute a serious obstacle to utility service. This problem increases with an increase in the voltage and importance of power lines. In addition, where it is necessary to clear timberland, clearing expenses may exceed the cost of right-of-way easements.

Disadvantages

There are some disadvantages to utilities in placing lines on highway right-of-way. The most important is the cost of relocating lines as a result of highway improvement projects. The utilities considered the relocation costs the most important disadvantage of locating on highways, and some companies, particularly cooperatives, avoided highways because of the potential cost. The cost of relocating the utility lines on highway right-of-way was considered as a cost offsetting the benefits from the use of highway rights-of-way.

An estimate of utility relocation costs incidental to highway construction was made using data compiled by the House of Representatives (2). Because the figures needed for this study did not appear directly in the report, the estimate was derived. This estimate indicated that the net relocation costs to electric utilities on rural Federal-aid highways in Oregon was approximately $47,000 in 1953. Adjusting for price increases and changes in the mileage of utility lines on highway right-of-way subsequent to 1953, it was estimated that for the current year (1958) relocation costs would approach $100,000. Attempts to obtain the information from utilities with respect to recent relocation costs elicited varying responses indicative of the opinion of utility officials concerning the subject of relocation, but little in the way of concrete information. However, on this subject, it was not intended that the study should represent an exhaustive treatment.

The possibility of being forced to relocate the utility facilities has not been a strong deterrent to utility use of highway right-of-way, except where a relocation seemed likely in the foreseeable future. A direct question to utility representatives indicated that the possibility of relocation might cause the utility to build on private right-of-way The fact that utilities do use highway right-of-way as extensively as they do is witness to the strong presumption that relocation is not a really serious disadvantage.

Other disadvantages to location on highway right-of-way mentioned by utility compan representatives included the occasional higher cost for trimming trees when located on highway right-of way. In some instances, it becomes advantageous to use private easements where easement costs are low and concentrations of trees can be avoided. The required trimming and the need for permits for trimming on highway rights-of-way sometimes increased trimming costs on lines located on highway right-of-way as compared to lines located on private land.

Another disadvantage was the possibility of damage to poles and lines and power company vehicles by vehicles on the highway. This disadvantage, however, did not seem to be very significant

Net Benefits

To the annual savings from easement cost of $200,000 should be added an estimated monetary value for the other advantages. These were estimated to be approximately $100,000, giving a total benefit of $300,000. From this must be subtracted the relocation cost of $100,000 resulting in a net monetary value somewhere in the neighborhood of $200,000 per year.

These benefits are distributed very unevenly among utility lines. They are relatively low for lines subject to relocation expenses and for lines passing through land areas of low value, and relatively high in areas of high values, in timber territory where clearing and trimming are expensive, and on highways were relocation expenses are unimportant.

In addition to benefits to public utilities, the utility users benefit from the utility use of highway right-of-way to the extent that savings to utilities were passed on to their customers. They benefit by paying lower rates for electric service by expanding their consumption of electricity.

The highway user would be adversely affected by the existence of utility lines locatin on the highway right-of-way, if they in any way increased highway costs. However, the evidence indicates that such additional costs are virtually non-existent, and that the location of utilities on highways does not represent a serious disadvantage. The highway

user may also be harmed from the safety point of view to the extent that the utility poles and utility vehicles create a potential accident hazard. The placement of utility facilities and the parking of utility service equipment on highway rights-of-way and the provision of access rights from highway to utility facilities can result in restrictions to the normal flow to traffic which not only reduces practical capacity but causes an accident hazard as well. However, the frequency of accidents involving the utility equipment is quite minor.

Another disadvantage to the highway user is the loss of aesthetic value of the landscape marred by the existence of utility facilities. One has become used to utility lines, and the fact that lines not on the highway are located on private land near the highway suggests that few net aesthetic disadvantages derive from the placement of lines on the highway.

In summary, there is a balance of net monetary benefits to utilities, a significant combined utility and non-utility benefit from utility use of the highways. The advantages outweigh the disadvantages generally with exceptions where the existence of utility lines on the highways seriously affect (a) the safety of highway users, (b) the costs of highway construction or maintenance, (c) the flow of traffic, or (d) the aesthetics of the landscape.

ECONOMIC IMPLICATIONS

The finding of a significant non-user benefit to utilities from free use of highways has obvious economic implications which bear on policy alternatives of a financial nature. Some consideration of these implications was a desirable part of this study, particularly with reference to the mandate in the Highway Revenue Act of 1956 (3) to "make available to the Congress information on the basis of which it may determine what taxes should be imposed... in order to assure... an equitable distribution of the tax burden among the various classes of persons using the Federal-Aid Highways or otherwise deriving benefits from such highways." Within the context of this directive, the study explored the economic implications of the alternative policies which could be applied to utility use of highways.

Perhaps the most controversial aspect of financial policy pertaining to utility use of highways is that of reimbursement or nonreimbursement for relocation expenses. There can be little doubt that the benefits utilities receive as a whole from free use of highways exceeds the relocation cost. However, the reverse may be true on individual sections of highway, and it is these situations which are the real cause of the problem. In general, equity considerations would indicate a policy of nonreimbursement, because the utility would presumably have weighed the possible costs of relocation against the benefits of free use of the highway before making the decision of placing them on or off the highway right-of-way.

There is also the question as to which policy would be the more conducive to efficiency in highway and electric utility development. Considering the impact of potential relocation costs on both the utility companies and highway departments, the stronger case can clearly be made for nonreimbursement. A nonreimbursement policy would have more effect in causing utilities to avoid highways where relocation is imminent or highly probable in the near future than a reimbursement policy would have in causing highway departments to avoid highway improvements where relocation costs would arise. In other words, utilities are in the best position to weigh the relocation cost factor in their planning, and they will be much more inclined to do this under a policy of nonreimbursement.

As to the broader question of under what conditions utilities should be permitted to use highways, one possibility and perhaps the most obvious would be to impose a tax or fee on utility use of highways. That public utilities as a group would be willing to pay a significant amount to retain the privilege of using the highways is evident from the benefits demonstrated in this study. By the same token, the equity of such a tax could not be challenged. However, there is a considerable range of savings to utilities between one section of highway to another, depending on adjacent land use, type of company, and likelihood that relocation expenses would be incurred at some time due to highway improvements. Because of this, the study suggests "...that administratively it would be virtually impossible to devise a workable tax system." Unless the tax precisely

equaled the benefits for each section of power line, the tax would be inefficient because some lines would be driven off the highways, whereas others would retain benefits in excess of the tax. However, although this difficulty is a formidable one, it is no different from that experienced in any user tax application; for that reason alone, further consideration might be justified.

A second alternative would be drawing on general funds to finance highway improvements in an amount approximately equal to the demonstrated non-user benefits. It is generally conceded that if the benefits to non-users are so general and diffused as to make a direct tax unfeasible or impracticable, the use of general tax funds would be justified. It has in the past, however, been very difficult to come to grips with the policy implications inherent in this solution.

Finally, the question arises as to what extent and under what circumstances utilities should be flatly prohibited from placing lines on highway right-of-way. In concept, the answer is relatively simple; whenever the benefits to utilities from such use are less than the costs incurred in the use (the highway users and others are well), prohibition is proper. Where the costs are appreciable in terms of traffic safety or restrictions to traffic flow (such as on freeways and probably on most major highways) or in terms of impairment of scenic values, outright prohibition of utility use is clearly justified.

In summary, it can be demonstrated beyond question that benefits to utilities from free use of highways are substantial on the whole, but that considerable variation in the magnitude of the benefits exists between one highway location and another. Because of these variations, the problem of attempting to allocate a portion of the tax burden to the utilities would be formidable. Also, with regard to relocation costs, it can be concluded that in general a policy of nonreimbursement is preferable from the standpoint of efficiency as well as equity, although exceptions involving individual cases do occur.

POLICY IMPLICATIONS

Information on the extent of utility use of highways, the advantages and disadvantages to utilities resulting from such use, and the net benefits accruing from free use of highways as brought out in the Oregon study was supplemented by similar research in Utah (4) and Georgia (5). These studies also explored the problems and economic implications resulting from such use and by so doing brought into clearer perspective important aspects of utility use of highways which impinge on public policy. The far-reaching effects and increasing significance of these policy implications strongly suggests that they warrant additional study.

At the heart of the problem is the need for attaining greater efficiency in land use. There is a growing awareness that concerted efforts must be made to improve on present practices not only with respect to the economy of land use but the compatibility and harmony among various land uses. In this respect, the dimensions of the highway construction program in which the United States is now engaged and may anticipate during the next 15 years, at least, will have a far-reaching impact on all aspects of the economy especially through its effect on land use. With the large mileage of freeways and expressways projected and with wider rights-of-way required in other types of roads as well, the conflict with other land uses is much more evident, and is in some areas becoming critical.

The significance of this problem in terms of the use of highway rights-of-way is due largely to the fundamental difference in the function of a superior type of traffic facility such as a freeway or expressway, and the traditional concept and use of a public way. In the case of the former, the movement of large volumes of vehicular traffic efficiently and without interference is the primary, if not exclusive function, whereas in the latter, land access and service is the principal function and multiple use is implicit. As stated by Lemly (5), "The freeway design of today is approaching the ultimate in evolution away from the city 'street.' In essence, these freeways are single purpose facilities which, in reality, are quite similar to a tunnel or bridge over local areas which connect points relatively widely separated." And along with city streets, he might well have included rural roads.

Assuming that certain minimum rights-of-way are required for such facilities under single purpose use, would joint use be physically possible and economically justified? And if not, would wider rights-of-way be justified if joint use were feasible?

The element of cost in acquiring necessary rights-of-way for highway construction cannot be ignored in considering this problem. If joint use of rights-of-way can be justified in certain instances, considerations of equity would demand that right-of-way costs be fairly allocated between the various users. The problem then would be one of devising an equitable and efficient method of allocating costs.

The imposition of a tax or fee on utility use of highways was considered by the authors of two of the studies. Koplan and Watson (1) concluded that such a tax would be undesirable because it would be conducive of inefficiency and difficult to administer. The authors of the Utah study (2) concluded that a tax would have an undesirable effect on resource allocation through its effect on the price-cost relationship of the utility service. In fact, the authors of the Utah study concluded that a policy of free use of highways by utilities would be economically desirable, "if a complete evaluation of the benefits vs. costs vs. equity considerations for highway users, utility stockholders, and consumers, and society as a whole favor the multiple-use concept for the rights-of-way."

All the studies referred to have concluded that benefits to utilities from use of highway rights-of-way significantly exceed any additional costs incurred as a result of such use. In other words, concrete savings accrue from joint use because the total cost to all users combined is less when utilities make use of highway rights-of-way than when they use separate rights-of-way. Though this strongly supports the case in favor of utility use of highways, it does not necessarily imply that such use must be on a free basis.

The expense of providing rights-of-way for new highways is becoming a more and more significant element of cost even in rural areas and in urban areas it has in certain instances exceeded the construction cost. Because this cost is almost universally borne from road user tax funds, it is part of the price paid by road users for the availability and use of highway facilities. Thus, if right-of-way costs were allocated among multiple users not only would there be more funds available for highway construction, but such a policy would tend to encourage efficiency in the use of economic resources; in particular, land use. In effect, then, the pricing system would be used in the allocation of resources as between the highway user and the utility user. Of the alternatives, free use of highways by utilities implies a subsidy, varying with the circumstances, but clearly so when abutting land has no access rights to the highway right-of-way. And absolute prohibition of use, by forcing utilities to other locations, results in inefficient land use.

As for the problem of devising a method of cost allocation, a rental or franchise charge based on a simple proration of costs or some more sophisticated method such as the alternative justifiable expenditure method might be feasible. The studies referred to suggest that sufficient data on easement costs are available for this purpose.

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