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122 S. Michigan Ave., Suite 1600
Chicago, IL 60603-6107

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UNDERGROUND WIRING IN NEW RESIDENTIAL AREAS

In the opinion of many people, billboards are the number one eyesore of our urban areas. But overhead wires and service poles have also been with us for a long time -- so long, in fact, that many of us seem to have become accustomed to them. The visual chaos of overhead wiring in the mass-produced subdivision, however, stirred one advocate of better community appearance to comment:¹

Somebody once said if you look at a monstrosity long enough you get so you don't notice it. Maybe some people have been looking at the monstrosity of poles so long they don't realize how perfectly awful they look. Some time, take a good look at what poles are doing to square miles of suburban countryside. When you have trees and live in a two-story house, you don't notice the telephone poles. But, sure as shooting, in most new tracts of one-story houses, the only thing you can see is the poles.

Happily, public utility companies and the home building industry in some areas of the United States and Canada are beginning to realize the value of underground power and telephone lines in new residential subdivisions. The Canadian Federation of Mayors and Municipalities, for example, actively promotes underground wiring, not only in new subdivisions, but also in downtown areas and older residential neighborhoods, where the Federation urges the gradual burying of existing overhead systems. Some utility companies have been quietly proceeding with substantial underground installations, but many others still resist the idea, despite many advances in equipment and installation techniques. In some cases, builders and developers underwrite part of the costs of underground installation, recognizing the sales potential of improved subdivision appearance thereby gained. And lenders are beginning to give added valuation credit for underground service installations.

This report will present some of the main features of underground wiring distribution systems. It will cover the reasons for the widespread and continuing use of overhead systems and include a review of significant developments in underground installation and of local government activities in this field.

¹This and subsequent references are listed at end of report.

OVERHEAD DISTRIBUTION

Electric power and telephone distribution systems in the U. S. and Canada have been developed primarily with overhead construction. Underground installation has been used in the past only where load density made it impossible to use overhead distribution. For example, many central business districts of larger communities and some telephone long-distance trunk lines are serviced by underground systems. In a few cities, underground systems are found in high-priced residential areas where the higher installation costs are paid by the developer -- and, of course, ultimately passed on to the home buyer.

Adoption of the overhead distribution system was based primarily on its advantages of minimum initial investment and less complicated construction. The system was flexible; additional wires meant additional capacity. Overhead distribution, then, was admirably suited to meet any expansion of residential, business, and industrial loads.

The original design of our national power systems was greatly influenced, especially as regards electrical distribution methods, by service load requirements that were quite small in comparison with today's demands. Residential electrical usage, only a short while ago, consisted principally of illuminating fixtures scattered through the house. Only recently has the remarkable increase in number and type of household appliances brought a commensurate growth in residential power demands.

Another design factor encouraging the use of overhead distribution was the adoption of the single-phase, 110-220 volt, three-wire power delivery system. In Europe, where underground distribution is commonplace, the majority of electrical distribution systems use a design voltage of double the North American standard -- an important element in determining costs, since European lines with double our voltage can run four times as far, given the same power loss, or, alternatively, can carry four times the load over the same distance. Consequently, larger and fewer transformers can be used. Lower labor wage rates (a significant proportion of total underground installation expense in this country is represented by labor cost) also play a role in promoting underground distribution in Europe.

Still another factor that encouraged the continued use of overhead distribution systems in North America was the explosive growth of post-World War II residential service demands. Nearly all utility planners failed to recognize that residential load growth, begun some years before, was latent throughout the war period. Relying on the precedent of post-World War I contraction in electricity utilization, they anticipated another cutback in power demands consequent to the halt of war production, instead of the continuation of residential demand growth that actually occurred. In the face of this unexpected surge, hard-pressed utility companies have done an admirable job in extending their services to new housing developments while at the same time expanding their capacity to accommodate increased demand from existing residential and commercial areas. Given these difficulties, the overhead distribution system was ugly but functional.

In spite of the exigencies of the situation, some efforts have been made to improve plant appearance. The use of twisted power cables for house service,

spun or twisted power cables for secondaries, and spun aerial cables that eliminate the need for cross-arms on primaries has helped considerably. Rear-lot pole easements and improvement of transformer appearance have also been effective. But these changes can do nothing more than make unattractive overhead lines and equipment slightly less objectionable.

UNDERGROUND DISTRIBUTION SYSTEMS

Telephone and power companies started more than 50 years ago to replace overhead distribution systems with underground service installations in the congested areas of our large cities. Conversion was made wholly to insure better service in high-load areas where utility companies faced extensive and costly service failures when pole service was interrupted. In these locations, therefore, underground installation could be economically justified. Similarly, main telephone feeders and long-distance trunk lines have been buried for many years. Today the material and methods for burying residential phone service lines have been fully developed. The power industry, however, is confronted with different problems involving more costly and complex distribution equipment that make underground installation in new subdivisions a difficult matter.

The American Telephone and Telegraph Company has instructed its 20 operating companies to install underground lines in new subdivisions wherever practical. In some areas where conditions are favorable, telephone cables can be buried at costs equal to or even less than those associated with aerial construction. The Illinois Bell Telephone Company, for example, which has provided buried plant to over 25,000 residential units since 1959, has adopted the following policy on underground distribution:²

1. Place buried distribution plant in all locations where it is considered practical to do so and where the estimated cost of buried plant does not exceed the estimated cost of aerial plant by more than ten per cent.
 - (a) Every effort should be made to make this a joint undertaking with the power company or other sub-surface utility.
 - (b) Lack of interest, however, on the part of the power company should not deter us from taking advantage of the benefits of buried distribution systems.
2. Where the estimated cost of buried plant in subdivisions exceeds the estimated cost of aerial plant by more than ten per cent, we should negotiate with the builder or developer on the following basis:
 - (a) No charge where the developer or builder digs and backfills trenches for the distribution cable and all service wires in the subdivision.
 - (b) Where our company digs and backfills all trenches, the developer or builder will pay that cost which exceeds the estimated cost of aerial plant by more than ten per cent.

Under the above statement of policy, buried plant is considered standard Illinois Bell construction. There may, of course, be individual cases where the placement of buried plant is not considered practical or economical. In these isolated cases we would be obli-

grated to place the type of plant dictated by sound engineering judgment.

Progress in residential underground electrical distribution in the past five years has been considerable. Largely because of vigorous promotion of buried cable systems by a few utility companies, 78 per cent of the major utilities in the United States and 73 per cent in Canada now have adopted residential underground distribution programs. A 1961 survey of electrical utility companies conducted by Electrical World³ magazine included data from 78 utilities in 42 states, serving over 60 per cent of U. S. meters, and 11 utilities in five Canadian provinces, serving about 40 per cent of Canada's meters. The figures summarize these data.

Figure 1 shows the per cent of electric utilities now offering some type of underground residential wiring. In all but two geographic regions, 70 per cent or more of the reporting utilities offer such service, the exceptions being New England with a 45 per cent average for six states, and the East South Central region with a 50 per cent average for four states.

Figure 2 shows the per cent of electric utilities which have adopted new residential underground wiring installation practices within the last five years, and the per cent which expect to be using new practices within the next five years.

Figure 1

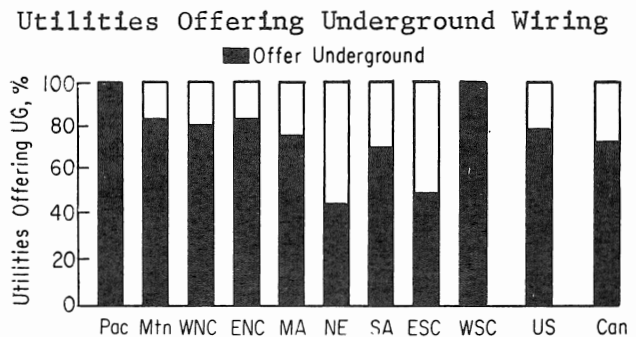
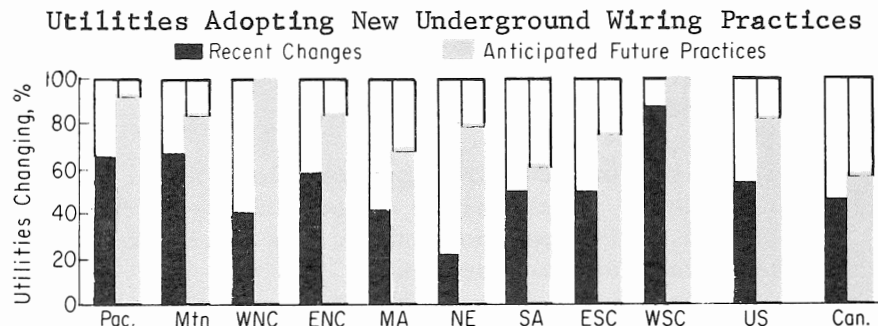


Figure 2



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Planning for Underground Systems

A Canadian utility officer has expressed some of the problems involved in planning for underground wiring distribution systems:⁴

Before any system, overhead or underground, is installed, a certain amount of planning is necessary, and more emphasis is required in this respect for the underground system. This is because the overhead system, being readily accessible, is much more flexible and can be added to or modified to suit changing loads or other requirements without too much difficulty.

It is probable that the different approaches utilities use to-

wards planning is partly responsible for the variation in the overall design of underground systems. In planning, a utility usually is looking for a system that, consistent with economy, will give a high degree of service continuity, is capable of maintenance, is safe both to public and to utility employees, and can supply present and future loads without expensive modification or additional construction. The methods used and the degree to which these objectives are met are reflected in the basic arrangement and ultimate design of the underground system.

The location of the system is important. Unless cables can be laid underneath a sidewalk, they are probably subject to more damage in the street location from the operation and maintenance of other utilities such as water, sewer, gas, than in a rear lot location. This must be balanced against more difficult accessibility of equipment, should maintenance be required when in the rear lot location.

Knowledge of present and future loads is important in the planning of any system and probably more so for underground /systems/. Many utilities today are called upon to supply electric heating loads in new subdivisions with little knowledge in advance of how many /units there will be, or where they will be. Because electric heating is such a large load and the electrical distribution facilities are usually required before home construction is completed, the utility is faced with a difficult problem. If 100% electric heating is provided for, considerably larger transformers and house or secondary conductors are required, and if this load does not develop, the system installed obviously becomes an uneconomic one which will not be supported by the revenue obtained. On the other hand, if not enough electric heating is provided for in the initial installation and heating /demand/ does develop, additional transformer capacity and conductors will be required. With an overhead system these additions usually are no problem but with underground they could be difficult and expensive unless carefully planned for in advance.

Continuity of service is of ever increasing importance. While we hope that interruptions to service on an underground system will be less frequent than on an overhead system, nevertheless they will occur and must be provided for. Interruptions on an underground system are usually considerably longer than those on overhead systems and therefore it is necessary in the planning of an underground system to build in adequate facilities to avoid lengthy interruptions should a fault occur.

Operations and maintenance on an underground system are usually carried out in a much more confined space than on overhead systems and, therefore, to ensure safety to linemen, special facilities and work methods are usually required. It should also be noted that operations on an underground system are generally not as adaptable to live line tool techniques as on an overhead system.

Another planning aspect is the very definite trend, because of increasing loads, towards higher distribution voltages. On an underground system over-insulating the primary cables for a future higher voltage is relatively expensive whereas on an overhead system providing larger insulators is inexpensive.

There are, of course, other considerations but suffice to say

that layout and planning is more important on underground systems than on overhead systems.

The anticipated life of underground wiring may be 50 to 100 per cent longer than that of an overhead system. Therefore, the design of the underground system should be on the basis of load growth for an additional 15 years or more over that of overhead systems.⁵

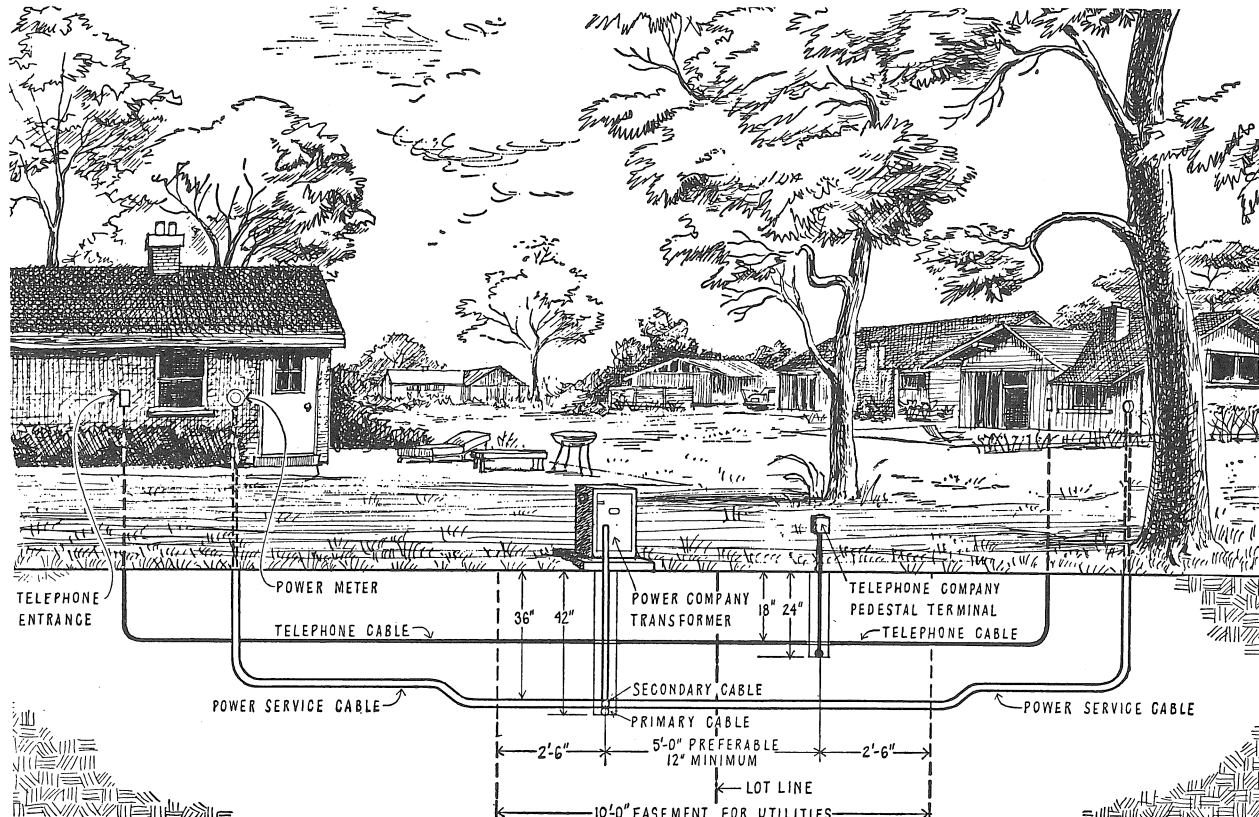
Characteristics of Residential Underground Systems

Methods of constructing underground distribution systems vary widely. Small systems involving a few homes may require a single underground tap or lateral from an overhead line leading into the subdivision. Large subdivisions may require main trunk feeders with alternate overhead supply points, or the main supply itself might be taken from underground feeder lines directly connected to the central station. Telephone and power lines in some areas may be buried in separate trenches; in other areas they may be placed in a common trench. Some utility companies require burial of lines in steel or fiber ducts; others use direct burial.

Figure 3 illustrates a typical underground distribution system for power and

Figure 3

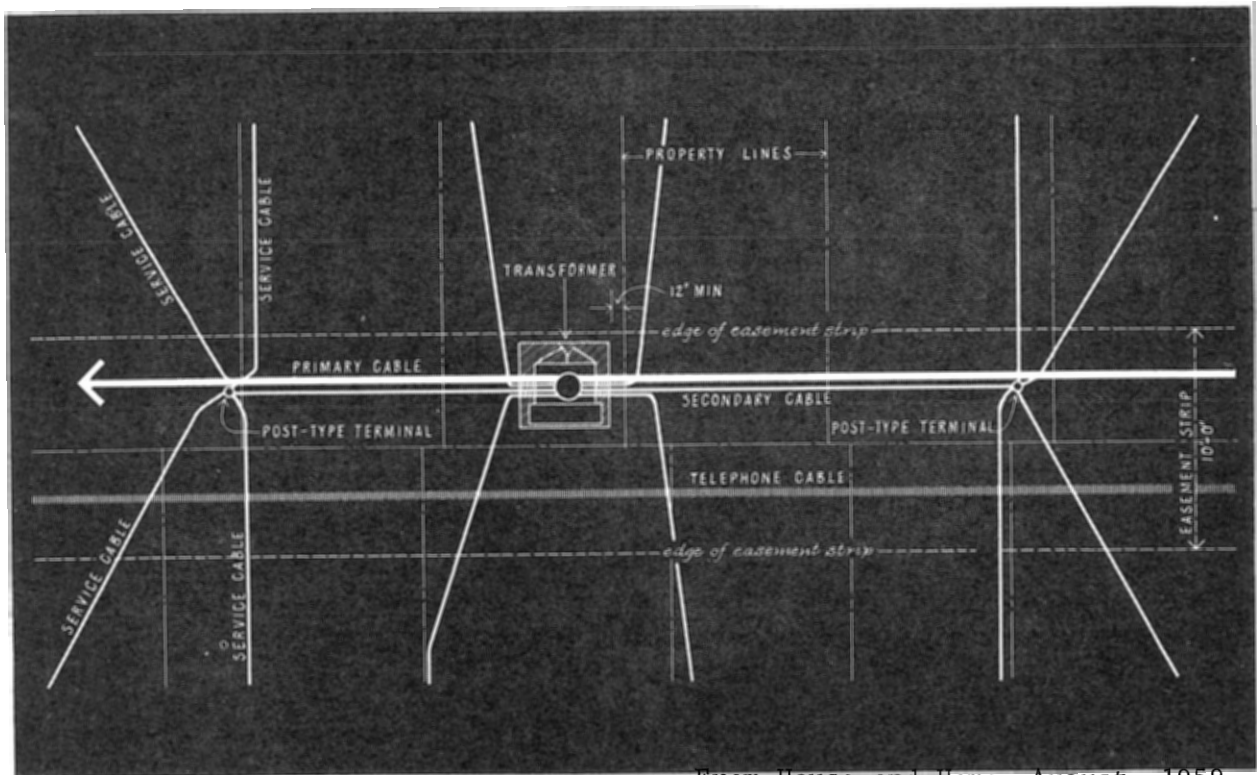
Typical Residential Underground Wiring Distribution System



From House and Home, August, 1959.

Figure 4

Typical Underground Power Distribution Diagram



From House and Home, August, 1959.

telephone lines in a residential subdivision. Figure 4 is a power distribution diagram showing 12 houses served by one transformer. The primary cable delivers high-voltage power to the transformer, which steps it down to house voltage for distribution by secondary cable. In both Figures, the telephone cable is laid in a separate trench.

Location. Underground installations in new subdivisions are usually located within easements along rear lot lines. The easement plan in Figure 5, prepared by the Detroit Edison Company and Michigan Bell Telephone Company, is typical. A utility easement guide prepared jointly by the two companies suggests the following design criteria for underground service lines:⁶

Location of Easements

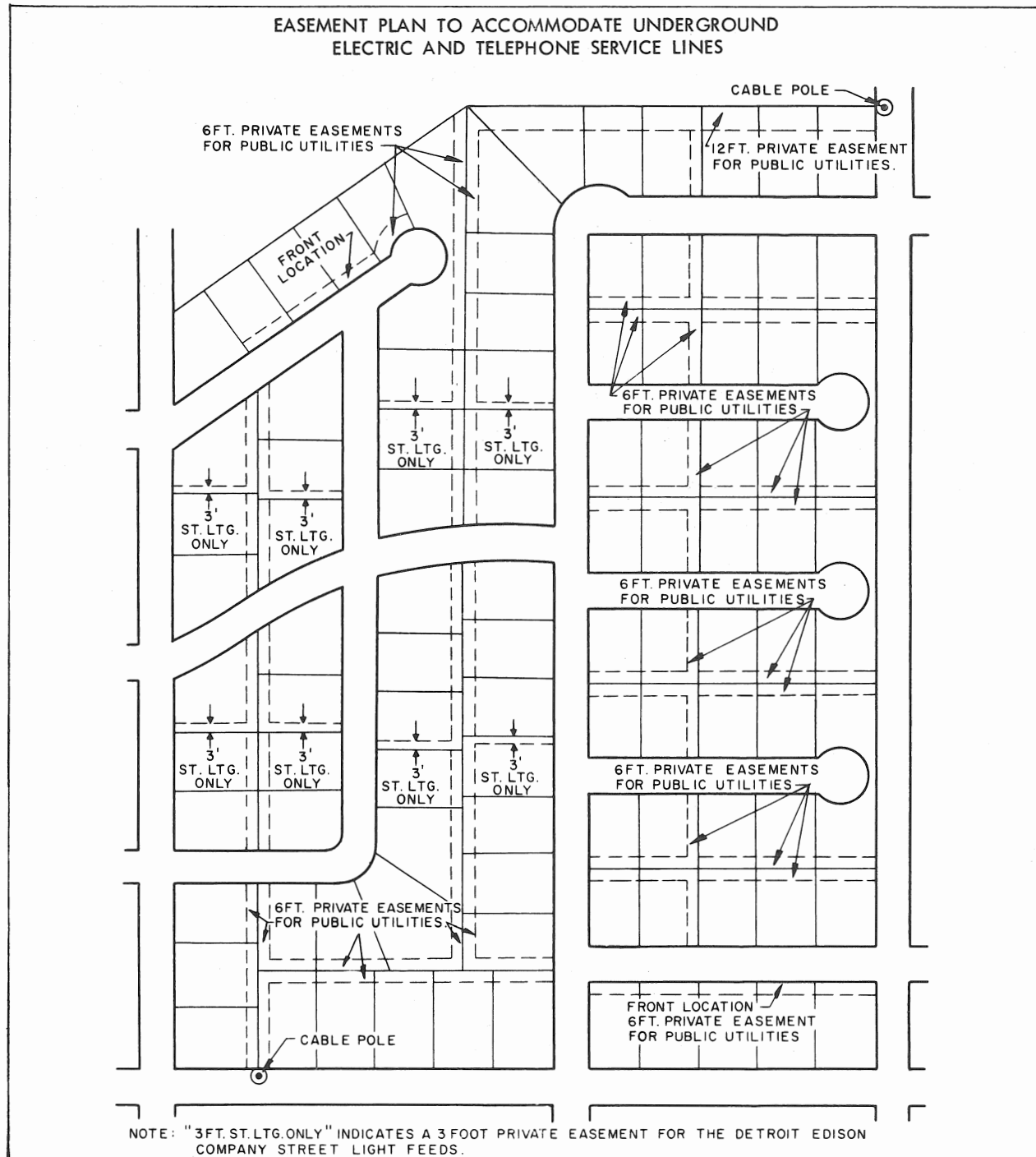
In general, the locations of easements for underground service lines are similar to those required for overhead service lines, in that easements should be located along rear or side lot lines, or should be provided across lots in some cases. In addition, easements along front lot lines will be required at some locations.

Subdivision layout, topography, natural obstructions and the use of these easements for water, sewer, and drainage facilities will influence the design of an easement system adequate for an underground distribution system.

Width of Easements

Easement widths required to accommodate underground service lines and other utilities including water lines, sewers, etc., are as shown in Table 1.

Figure 5



From Easement Planning for Utility Services, Detroit Edison Co. -- Michigan Bell Telephone Co., 1962.

Table 1

EASEMENT WIDTHS REQUIRED TO ACCOMMODATE UNDERGROUND SERVICE LINES

<u>Easement and Function</u>	<u>Minimum Width (Ft.)</u>	<u>Remarks</u>
Along two adjacent parcels to accommodate all utilities	6 (each parcel) 12 (total)	One-half of total easement (6') to be used jointly for electric or telephone underground facilities, and the other half for other utilities.
Along two adjacent parcels to accommodate either/or both electric and telephone facilities only	6 (one parcel only) 3 (one parcel only)	For either/or both electric and telephone underground facilities For street light and underground only.
Through a parcel to accommodate electric and telephone underground facilities only	6	
Along edge of one parcel only	12	One-half of total assessment (6') to be used jointly for electric and telephone underground facilities and the other half for other utilities.
Along edge of one parcel only to accommodate either/or both electric and telephone underground facilities only	6	

Adapted from Easement Planning for Utility Services, Detroit Edison Co. -- Michigan Bell Telephone Co., 1962.

Duct and Direct Burial. There are two methods of installing underground distribution systems -- duct and direct burial. In a duct system, the cables are pulled through tubes which may or may not be encased in concrete. In the burial system, cables are buried directly in the earth. While direct burial is increasing in use, the introduction of new types of power and telephone cables means that ducts must still be used to prevent cable damage in rocky soils and filled land and under roadways.

Telephone companies utilize direct burial almost exclusively (except where ground conditions require use of ducts), but use of this method by power companies is not so widespread. The Electrical World 1961 survey (see Figure 6) showed that 48 per cent of U. S. utility companies and 50 per cent of Canadian

Figure 6

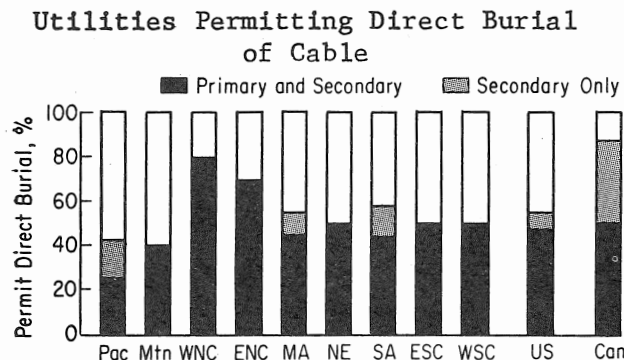


Figure 7

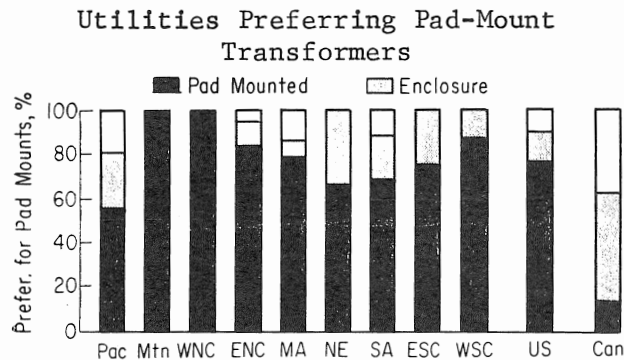
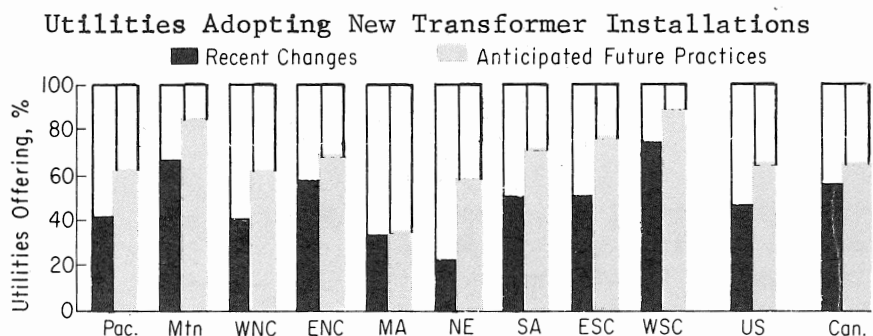


Figure 8

utility companies practiced direct burial of primary cables. Direct burial of secondary cables averaged 55 per cent in the U. S. and 88 per cent in Canada.

Transformers. Early underground electrical distribution installations used semi-buried transformer housings that required expensive



excavation and waterproofing. The development of the surface-mounted transformer and enclosure is playing an important part in lowering underground installation costs. Here a standard overhead transformer in a metal housing, or a new, specially-built transformer, is placed on a prefabricated concrete pad. Costs could be lowered still further if pad-mounted transformers were standardized, but manufacturers hesitate to freeze experimentation at this time when new developments might lead to more desirable and economical designs. Figures 7 and 8 indicate the degree of acceptance of pad-mounted transformers by U. S. and Canadian utility companies: Figure 7 shows those which prefer pad-mounted transformers for use in future underground residential distribution, while Figure 8 shows the per cent of companies which have adopted this type of installation in the last five years, and the per cent which anticipate adoption within the next five years. Figure 9 shows a pad-mounted transformer.

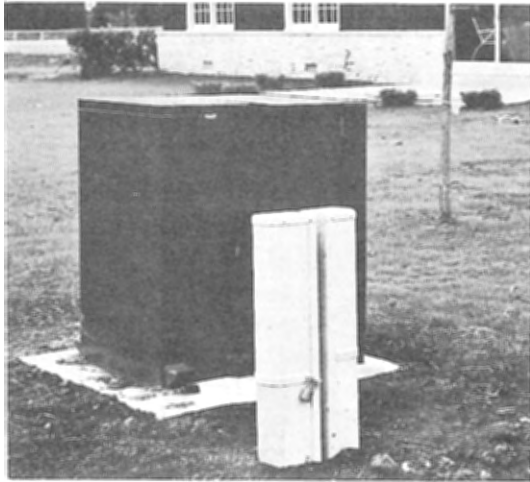
From *Electrical World*, February 6, 1961, © copyright 1961, McGraw-Hill Publishing Co., Inc. All rights reserved. Note: Pac, Mtn, WNC, etc., refer to regions.

Service Pedestals. To simplify service connections and reduce callback costs, telephone and power companies have developed above-ground connection points called service pedestals (Figures 10 and 11). These post-type terminals offer a convenient means of adding a new service or disconnecting one.

Trenches. Trench depths vary from two to four feet, most installations being placed at the two- to three-foot level (see Figure 3). Power and telephone lines in many underground distribution systems are still being laid separately, but in a number of areas communication circuits and power conductors are in-

Figure 9

Pad-Mounted Transformer
with telephone service pedestals

**Figure 10**

Typical Underground Wiring Pedestals
Telephone

**Figure 11**

Power



(Photos courtesy of Illinois Bell Telephone Company)

stalled in the same trench. The power cables are placed in the bottom of a 36-inch trench which then is backfilled 12 inches for placement of the telephone cables.

In 1956, the Edison Electric Institute-Bell System Joint Committee appointed a subcommittee to test direct burial of power and telephone cables side-by-side in a common trench. Field-trial cables were placed together in the bottom of a trench with no effort to maintain separation. Initial fears that high-voltage power would jam telephone signals proved unfounded and the joint committee recommended that random separation be tried on a trial basis. At the present time, however, random separation is in violation of the National Electrical Safety Code and is prohibited by state safety codes. In 1961, a joint petition filed by Illinois Bell and Commonwealth Edison requesting waiver of the separation rule received approval by the Illinois Commerce Commission on a trial basis. The limited experience with this type of installation to date does not yet permit an evaluation of its efficiency, but company officials are confident that such construction methods will permit substantial savings. With random separation, for example, a 30-inch deep trench can be utilized, trimming six inches from the old method. Both telephone and power cables can be laid in a single operation, thus eliminating the backfill operation previously required to maintain cable separation.

Costs. The ratio of overhead and underground installation costs has narrowed in recent years. On the one hand, the irregularities of today's curvilinear and cul-de-sac residential street layouts induces pole-guying problems. As opposed to this, underground service components are cheaper than they formerly were, and improved trenching equipment is reducing the labor costs involved. With telephone companies moving their lines off poles and going underground, power utility companies can no longer count on sharing pole installation costs.

The real cost of underground electrical wiring is the difference between the

cost of installing an overhead distribution system (the basis of electric rates) and the cost of installing an underground system to provide the same service. The cost ratio between the two systems varies widely. House and Home reported an astounding variety of installation prices across the country.⁷ Quoted utility company charges for providing underground service ran from \$50 to \$10,000 per lot. While cost ratios depend upon ground conditions, power load, method of construction, and the number of homes to be served, such a wide range of prices may well "reflect a difference in attitude more than a difference in real costs."⁸

Underground costs in many areas may be reduced if the developer or builder does the trenching and excavating work himself. Trenching crews already on the job for foundations, sewer and water lines may be able to do the work more cheaply than can utility crews. In the Chicago area, however, field tests undertaken by the Commonwealth Edison Company and the Illinois Bell Telephone Company indicated that the two companies could cut labor costs by 35 per cent by using special crews for trenching and backfilling work, instead of requiring these operations to be performed by the subdivider. The policy now in effect in their joint service area is to have the subdivider pay a flat charge of \$50 per lot to the power company (there is no charge for telephone installation).

To do this work efficiently, the power and telephone companies require easement strips accessible to company equipment. All obstructions within the strips must be removed. Lot line and finished grade stakes must be placed at suitable intervals and grades in the easement must be approximately at final elevation. A fairly large number of lots in the subdivision must be ready at any one time for installation operations to proceed to best advantage. In all residential subdivisions within the service areas of the two companies where underground installations are to be supplied, each company digs one-half of the trench footage and bills the other at a mutually agreed-upon flat rate per foot. (This procedure is used to equalize the costs of digging through unexpected obstructions.)

According to engineers of Commonwealth Edison, the per lot underground installation charge quoted above is based on the difference between the cost of overhead and underground service for a subdivision of 24 or more contiguous lots having an average rear lot line dimension of less than 125 feet. Any additional costs incurred by crossing under streets, alleys or other areas paved prior to trenching are to be paid by the builder. If there are less than 24 lots, the builder is required to pay a minimum charge of \$1,200, exclusive of any additional costs.

Efficient organization of the underground installation program depends on proper coordination between the builder and the utility companies. Considerable time and expense can be saved by detailed site investigation followed by intelligent planning before construction work is started. Underground wiring should not be added as an afterthought when all other subdivision design work has been completed. Rough grades should be established before any work is started. The cables must be laid in rapid succession behind the trenchers, with immediate backfilling to minimize cave-ins or cable damage.

A telephone company official listed some of the problems of builder-utility company coordination:⁹

. . . Coordination needs to start at the time the area is being subdivided in order that plans can be made for all the services.

The builder needs to be brought into the picture and his plans adjusted to the overall development. One major hindrance to economic buried construction today results from the builder piling up the material from basement excavation at the rear of the property. Under such conditions it may cost less to place a few poles than to trench through these piles of dirt. Ultimate levels are also not apparent. Planned disposal of this material could solve this problem. . . . If the power utility finds conditions so difficult that it has to place poles and aerial wire at this stage, it will usually prove economical for the telephone utility to use the same poles jointly later on.

The Detroit Edison Company and Michigan Bell Telephone Company have prepared a pamphlet to guide land developers in installing underground electric and telephone services in new subdivisions.¹⁰ This guide, reproduced in the Appendix, and especially the Developers Checklist contained therein, spell out the specific responsibilities of the two utility companies and the developer during the construction phase of underground wiring installation.

In order further to reduce builders' underground wiring costs, some companies offer financial rebates upon guarantee of increased power consumption. By including electric heating or other 240-volt equipment in the home, the builder may receive a series of rebates up to the entire amount of his underground costs.

Maintenance costs of underground wiring systems installed today are difficult to provide on any reliable basis. A recent survey of Canadian utility companies revealed that only a small proportion of respondents could estimate the percentage decrease of underground maintenance costs as compared with those associated with overhead distribution systems.¹¹ Estimates of such decreases ranged from 30 to 90 per cent. Six Canadian communities having policies of providing underground wiring reported a decrease of at least 80 per cent in maintenance costs. Five respondents stated that their maintenance costs were negligible.

An arrangement that may lead to further maintenance cost reductions is still in the development stage. The ownership, installation and maintenance of underground electric service connections to the individual dwelling is usually the responsibility of the customer. Telephone companies, however, have assumed such responsibility within their service areas. If power companies adopt a similar policy, then joint installation of both telephone and electric services from the lot line to the house is possible. If a single service cable containing both power and telephone conductors connected to a single joint-service pedestal can be developed, further cost reductions for both companies are likely.

Commonwealth Edison is one company that recently instituted a policy of assuming underground service responsibility.¹² Utility company ownership permits installation of the service system to be made jointly with Illinois Bell in the same manner as the underground distribution system construction arrangement previously described. Under this policy a flat customer fee of \$1.00 per trench foot is charged by the power company to install, own and maintain the underground service connection from the underground distribution system to the house. The charge is uniform regardless of cable size, but does not apply to underground services tapping an overhead system.

LOCAL DEVELOPMENT CONTROLS

Power and telephone companies are subject to complex public controls. Rates are established by state and federal governments; equipment must meet the minimum specifications of the National Electrical Safety Code and counterpart state safety codes; and local regulations may influence the location of distribution system and plant. Public officials are often uncertain about the effect of state utility laws on their own powers of utility control. Can cities require the installation of underground wiring in new residential areas? Utility regulations raise many legal questions that the ASPO Planning Advisory Service cannot answer.

Many cities have made agreements with utility companies under which overhead wires are removed from a definite number of miles of street per year, mainly those in congested central business districts. There are few cities, however, that require utility companies to install underground telephone and power lines in new subdivisions. McQuillin's Municipal Corporations reports that:

Wire-using companies may be compelled to place their wires underground or in subsurface conduits, when convenience or the good government of the municipality requires. To illustrate, it has been held that requiring a telephone company to build conduits through ungraded streets in suburban parts of the city and the open country, to carry its wires, was clearly an unreasonable exercise of the police power. . . . But creating an underground district and requiring all poles and wires in use therein to be removed from the surface. . . . where the underground section is the congested center of the city, is a valid exercise of the police power.

Two California cities -- Palo Alto and Palm Springs -- require the developer to install underground wiring in new residential areas. The developer, presumably, must pay for the difference in cost between underground and overhead facilities. The underground wiring requirements of the Palo Alto ordinance, adopted in 1960, are simple:

Electric, telephone and all other utility facilities shall be installed underground by the subdivider unless, in the opinion of the City Engineer, special conditions require otherwise. In such event such installations shall be as directed by the City Engineer.

The Palm Springs Subdivision Ordinance spells out underground installation in more detail. High voltage lines have been excluded from the provisions:

All subdivisions shall be connected with the gas, electric power and telephone utilities supplying service to the City. In addition, the subdivisions may be connected with the local television service. All utility and television lines, whether subject to the jurisdiction of Public Utilities Commission or not, shall be underground in those locations indicated upon the plat now on file in the office of the Planning Director of the City of Palm Springs. The following utility lines are excepted from this provision:

1. Electric lines rated at 33,000 volts or more.
2. Electric lines designed or built to carry 2,000 kilovolt amperes or more.

All utility lines, whether controlled by the Public Utilities Commission of the State of California or their successors in interest, shall be required to install underground only "service drops" at those locations on the referred-to plat indicating only underground service drops.

All telephone and electric power utility installations shall be underground in accordance with the service utility's specifications and with its rules and regulations on file with the Public Utilities Commission.

The referred-to plat is a plat developed by the Planning Director, is dated October 28, 1959, and is adopted herein as if fully set forth.

Underground wiring installation in Deerfield, Illinois, (a Chicago suburb) is not mandatory. However, developers providing underground distribution systems must meet the following subdivision ordinance provisions:

Where telephone and electric service lines are placed underground entirely throughout a subdivided area, said conduits or cables shall be placed within easements or dedicated public ways, in a manner which will not conflict with other underground services. Further, all transformer boxes shall be located so as not to be unsightly or hazardous to the public.

In a preliminary report to the plan commission, the city manager of Greenville, Illinois (population 5,000), pointed out that requiring underground wiring in new subdivisions might be unreasonable in the typical small development found in that city. The cost to the developer of installing underground wiring in a 12-lot subdivision was almost three times the installation cost in a 48-lot subdivision, he reported. Per-lot underground installation cost in the 12-lot areas was estimated at approximately \$480, while in the 48-lot area the figure was approximately \$180. The report concluded:¹³

The key question of underground wiring for the small operation would seem to be whether the requirement of underground wiring is proper. It does not seem that this is a fair requirement. The cost for the small operation would probably be so high that only the more expensive subdivisions would be able to bear the cost without undue hardship. Caution must be taken to assure that regulations are not imposed that might hamper the building of new housing. It seems that underground wiring is too expensive for the small subdivision of the size that Greenville might contemplate. . . .

A proposed amendment to the Park Forest, Illinois, subdivision regulations would require underground distribution and service installation in all multi-family residential and commercial areas. Overhead distribution would still

be permitted along rear lot lines in single-family and industrial areas.

A report on the need for underground wiring prepared for the city of Oakland, California, clearly sets forth the background for legislation requiring underground installation of wire utilities in new residential subdivisions, industrial and commercial areas. Unsightly overhead wiring would be gradually removed in Oakland's built-up residential areas by establishment of underground districts, wherein property owners would share the costs of the changeover to underground installations.

The high cost quoted by some utility companies has, no doubt, discouraged local officials from adopting underground wiring requirements, even though subdivision ordinance provisions commonly require construction of other improvements without compensation to the developer. Underground wiring requirements will not be held to be valid police power measures unless courts find that they are substantially related to public health, safety, morals, or general welfare. Although there has been relatively little litigation relating to the constitutionality of subdivision controls, the courts have generally upheld regulations that require subdividers to spend large amounts of money on construction of such necessary improvements as streets, sewer and water lines as a condition of subdivision plat approval.

A While no litigation involving underground wiring provisions in subdivision regulations has come to the attention of the ASPO Planning Advisory Service, some courts might conclude that such requirements are within the limits of reasonableness. In two respects, however, legal disputes regarding underground wiring requirements may be expected to differ from other subdivision improvement litigation. In the first place, underground wiring requirements are to a large extent based on aesthetic considerations. Secondly, the dispute hinges not on whether the subdivider shall provide a needed facility, i.e., a wiring system, but rather on the kind of facility to be provided -- overhead or underground.

Where utility installation charges are low, mandatory underground wiring requirements are probably well within the limits of reasonable municipal policy. In high installation-cost areas, compelling subdividers to install underground wiring may be considered an unreasonable policy by some municipal officials. At this time, unfortunately, there are no specific yardsticks which can be offered to measure such reasonableness. However, municipal policy should recognize that the need to provide a constant supply of power to the home is much more important today than it was ten years ago. Heating, air-conditioning, refrigeration, cooking, and illumination depend on electricity. Power failures are a serious inconvenience to residents, and underground distribution facilities, unaffected by storms and other accidents, are much more reliable than overhead systems.

In some communities the "improvement district" approach might be utilized to provide underground systems in new residential areas, in the same manner as it has been used to remove overhead systems in built-up areas. The special assessment might fall initially on the developer, but would then pass on to the home buyer, either as a part of the purchase price of the house, or as a special municipal assessment.

At the very least, municipal influence should be exerted to bring utility and

home builder representatives together to work out a common approach to the utility line installation problem. There is enough operating experience in the utility industry to show that underground installation costs for residential areas can be kept at a reasonable level. Municipal officials can thus point to many successful examples in this field to convince their local utility companies of the practicability of underground wiring.

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UNDERGROUND ELECTRIC and TELEPHONE SERVICE IN NEW SUBDIVISIONS

*PREPARED FOR USE IN AREAS
SERVED JOINTLY BY*

**THE DETROIT EDISON COMPANY
AND
MICHIGAN BELL TELEPHONE COMPANY**

1962

APPENDIX

REQUIREMENTS

1. SEPARATE AGREEMENTS

Each utility will require a separate signed agreement with the developer. The agreements will define in detail the responsibilities of the developer and each utility.

2. JOINT DECLARATION OF RESTRICTIONS

Property restrictions for joint underground systems shall be recorded PRIOR to utility installations. The wording for the restrictions will be furnished to the developer by the utilities.

One of the more important property restrictions is that buried service facilities to each customer being served from an underground system is mandatory.

3. EASEMENTS

It shall be the developer's responsibility to provide easements acceptable to both utilities for electric, telephone and street lighting service. These easements shall be recorded on the subdivision plat as private easements for public utilities or easements provided by separate instrument.

4. INSTALLING FACILITIES PRIOR TO PLAT RECORDING

A. The Detroit Edison Company

Conduit for street crossings may be installed by a special agreement prior to the recording of the plat and property restrictions. However, the installation of all other facilities will not be started until plat and property restrictions have been recorded. Special consideration will be given in specific cases.

B. Michigan Bell Telephone Company

Telephone facilities will not be placed until plat and property restrictions have been recorded. Special consideration will be given in specific cases.

5. COORDINATION WITH OTHER PROPOSED UTILITIES

When other utilities are proposed adjacent to the jointly buried electric and telephone facilities which occupy one half of the normal 12' easement, special coordination is required as follows:

A. Sewers

When sewers are proposed, they shall be located in the other half of the 12' easement and installed far enough in advance to avoid soil settlement in the route of the jointly buried job. All sewer line taps, which will cross under the jointly buried facilities, shall be installed at the time the main sewer is constructed. Such sewer line taps shall be made accessible for connection at a point 3 feet outside the platted easement strip. The extended sewer tap will reduce possible damage to the buried electric and telephone facilities and will facilitate the connection of individual sewer lines.

B. Drainage Tile

Wherever drainage tile is to be installed along the rear property line to care for surface water, electric and telephone facilities will not be placed in the same 6' easement with the tile, except at crossings. Such drainage tile shall be shown in plan and profile on the storm sewer drawings.

Scheduling the installation of drainage tile with the utilities is necessary.

C. Gas and Water

Electric and telephone facilities will not be placed in the same trench with gas or water lines.

When buried electric and telephone facilities are to be located in proximity to proposed gas and water mains, scheduling and coordination of all utilities is absolutely necessary.

6. GRADING

Final grading in the main trench route must be completed before trenching is started for buried electric and telephone facilities.

7. REQUIRED STAKING

The developer shall accurately stake all lot lines along the main trench routes. After trenching is completed, he shall re-stake where necessary to identify all lot lines adjacent to the trench to assure proper location for above ground equipment, such as transformers, secondary pedestals, telephone terminals, etc.

8. TRENCHING AND BACKFILLING MAIN TRENCH

The developer shall provide all trenching and backfilling for the joint buried facilities as shown below.

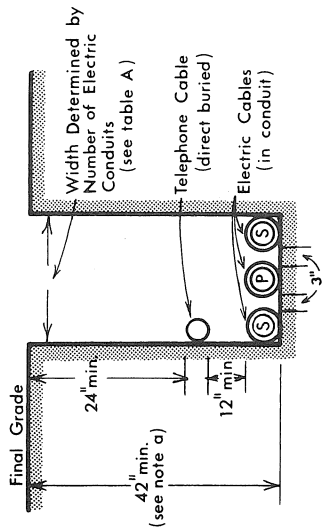


FIGURE 1
JOINT OCCUPANCY TRENCH

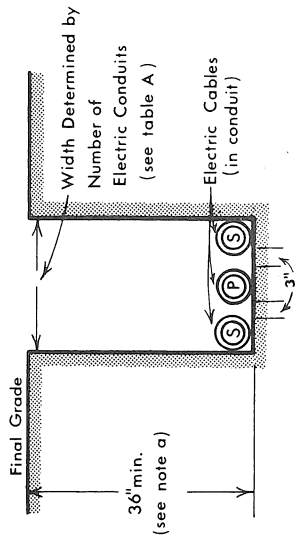


FIGURE 2
TRENCH OCCUPIED SOLELY BY ELECTRIC FACILITIES

TABLE A
(For use with Figs. 1 & 2)

NUMBER OF ELECTRIC CONDUITS	Estimated TRENCH WIDTH
1 to 3	16"
4	20"
5	26"
6	30"

NOTE: Actual width to be specified on trenching drawing.

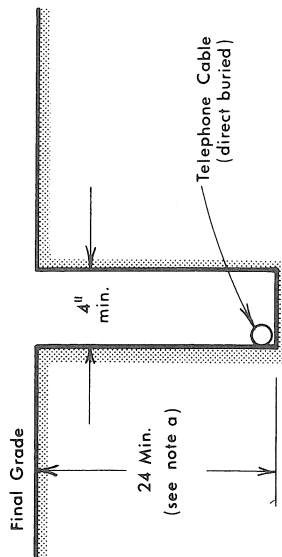


FIGURE 3

TRENCH OCCUPIED SOLELY BY TELEPHONE FACILITIES

NOTES:

- a. Although minimum depths are shown in Figures 1, 2, and 3, greater depths may be required due to other existing or proposed buried facilities or obstructions
- b. All backfill shall be free of rubble and clods of hard or frozen dirt, and shall not contain material which can cut, puncture, or in any other manner damage electric or telephone facilities. The use of the trench spoil as backfill shall rest with the judgment of the Public Utilities. If the spoil should become frozen while the trench is open, the developer shall provide sand for the two-stage backfill as follows: 12" of sand over the Electrical Conduit, 12" of sand over the Telephone Cable and a final 12" of regular spoil
- c. All jointly occupied trenches must be backfilled in two stages.
 - Stage 1. After power facilities are installed, a well-tamped backfill to provide 12" minimum cover is required.
 - Stage 2. After the telephone facilities are installed, the backfill shall be completed.
- d. All obstructions in trench routes shall be removed to permit telephone facilities to be laid in. Pulling telephone facilities through or under an obstruction is generally not practical. Special consideration will be given in specific cases.
- e. All dimensions relate to final grade.

TELEPHONE TRENCH BY-PASSING ELECTRIC TRANSFORMERS & SECONDARY PEDESTALS

Usually a trench occupied solely by telephone facilities is required to by-pass Detroit Edison transformers and secondary pedestals. The by-pass trenches are a part of the main trench system.

Figures 4 and 5, indicate the location of the by-pass trenches.

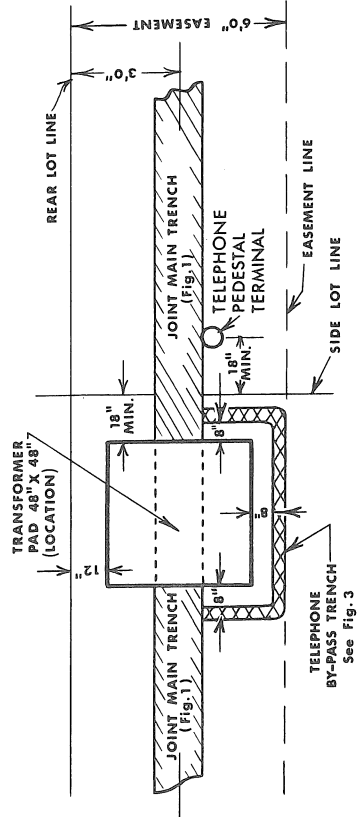


FIGURE 4

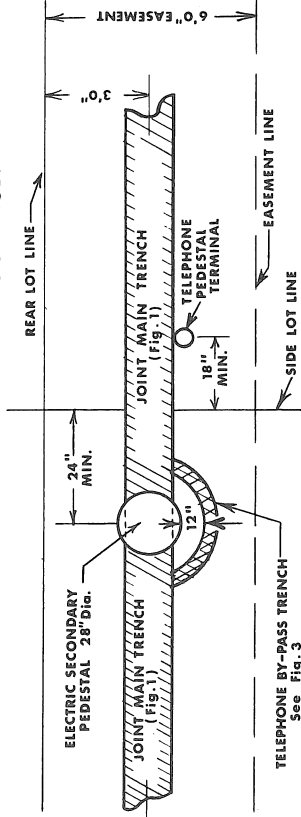
TELEPHONE BY-PASS TRENCH
AT TRANSFORMER LOCATION

FIGURE 5

TELEPHONE BY-PASS TRENCH
A SECONDARY PEDESTAL LOCATION

9. MAIN TRENCH FACILITIES

A. The Detroit Edison Company

All electric facilities in the main trench will be furnished, installed, and maintained by The D.E. Company, with the exception of the service cables which are provided, installed, and maintained by the customer.

B. Michigan Bell Telephone Company

All telephone facilities in the main trench, with the exception of the conduit, as covered under 12B, will be furnished, placed, and maintained by the M.B.T. Company.

10. TRENCHING AND BACKFILLING-SERVICE TRENCH

(between main trench and building)

The developer or lot owner shall provide all trenching and backfilling for the joint buried electric and telephone service wires and cables as shown below.

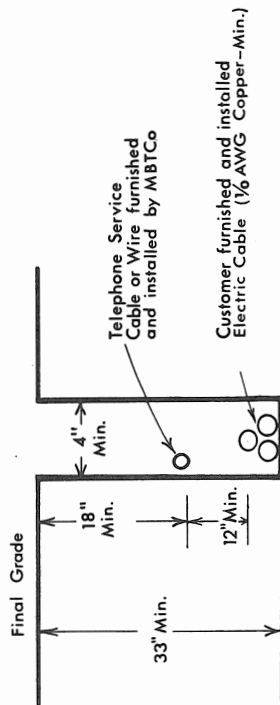


FIGURE 6
JOINT OCCUPANCY SERVICE TRENCH

NOTE:

All backfill shall be free of rubble and clods of hard or frozen dirt, and shall not contain material which can cut, puncture, or in any other manner, damage electric or telephone facilities.

11. SERVICE TRENCH FACILITIES

A. The Detroit Edison Company

All electric facilities in the service trench will be furnished, installed, and maintained by the customer.

Service cable to be installed by the customer from transformer or secondary pedestal to the residence will be 3-1/C 1/0 AWG copper or larger, Type RHW rubber insulated and neoprene jacketed. The cable shall be type U.S.E. These cables are to be installed in accordance with D.E. Company specifications.

Where customer installed service cables occupy

the main trench, The D.E. Company will provide conduit in the main trench from transformer or secondary pedestal to a point in the main trench nearest to the customer's property line.

B. Michigan Bell Telephone Company

All telephone facilities in the service trench will be furnished, placed, and maintained by the M.B.T. Company.

C. Customer Requests for Electric & Telephone Service

Requests for electric and telephone service must be placed with the respective companies. A joint trench as shown in Fig. 6 is used for these installations. Inasmuch as the electric facilities are always placed below the telephone facility, The D.E. Company will notify the M.B.T. Company so that telephone work in the trench may be done promptly upon completion of the first stage of backfill. While desirable, it is not necessary that the order for telephone service be placed prior to this step.

12. CONDUIT FOR STREET CROSSING, ETC.

A. The Detroit Edison Company

All conduit for street crossings will be furnished, installed and maintained by the D.E. Company. All trenching and backfilling or pipe pushing will be done by the developer.

B. Michigan Bell Telephone Company

The M.B.T. Company will furnish and the developer shall place all conduit necessary under roadways and alleys proposed as telephone facility routes.

Where it is necessary to install telephone facilities across other land proposed for public use, the developer shall furnish and install the necessary conduit.

All conduit shall extend the full width (property line to property line) of roadways and alleys, as set forth in the subdivision plat.

After placement, the conduit furnished by the M.B.T. Company shall remain, and the conduit furnished by the developer shall become, the property of the M.B.T. Company.

NOTE:

In both A and B above, it is the developer's responsibility that all backfilling required in road crossings shall comply with all regulations of public authorities having jurisdiction over roads.

13. STREET LIGHTING

When underground street lighting is required by governmental agencies, all facilities pertaining thereto, including trenching and backfilling, other than the main trench will be provided by the D.E. Company.

14. COORDINATION MEETING PRIOR TO CONSTRUCTION

In order to assure an economical job to the developer and the two utilities, it is required that the developer's trenching contractor and the D.E. Company and M.B.T. Company field foremen meet on the job site prior to the start of trenching work.

At this meeting, agreements on trenching and backfilling will be reconfirmed and the scheduling of work will be established.

No D.E. Co. or M.B.T. Co. construction work will be started prior to this meeting.

15. NOTE FOR INFORMATION

If additional information is required, please call the following.

The Detroit Edison Company

Mr. _____ Tel. No. _____

Michigan Bell Telephone Company

Mr. _____ Tel. No. _____

DEVELOPER'S CHECK LIST

This list is provided as an aid for checking requirements in their usual order of completion by the developer and utilities. All requirements must be met before utility construction is started in new subdivisions.

D - By Developer, U - By Utilities		Date Completed
D	1. Provide 3 copies of the proposed subdivision plat to The Detroit Edison Co.	_____
D & U	2. Hold informational meeting between the developer, The Detroit Edison Co. and the Michigan Bell Telephone Co.	_____
D	3. Provide street paving plans to each utility.	_____
D	4. Provide sanitary sewer plans to each utility (In plan and profile).	_____
D	5. Provide storm sewer plans to each utility (In plan and profile).	_____
D	6. Provide topographic plans to each utility (If such plans are made).	_____
U	7. Provide proposed layout for underground electric facilities to developer. (The Detroit Edison Co.)	_____
U	8. Provide easement plans for underground electric and telephone facilities to the developer. (The Detroit Edison Co. and the Michigan Bell Telephone Co.)	_____
D & U	9. Hold meeting between the developer, D.E. Co. and M.B.T. Co. to review requirements, discuss layouts, and obtain information for preparation of agreements.	_____
D & U 10.	Complete special agreement with The Detroit Edison Co. for equipment in street crossings if equipment is to be installed before the plat and property restrictions are recorded.	_____
D & U 11.	Complete special agreement with the Michigan Bell Telephone Co. if telephone facilities (except conduit for street crossings) are to be installed before the plat and property restrictions are recorded.	_____
D	12. Provide, prior to recording, a final plat of subdivision to each utility.	_____
D & U 13.	Complete formal agreement between the developer and The Detroit Edison Co.	_____
D & U 14.	Complete formal agreement between the developer and the Michigan Bell Telephone Co.	_____
D	15. Complete recording of final plat with easements acceptable to The Detroit Edison Co. and the Michigan Bell Telephone Co.	_____
D	16. Complete recording of property restriction as specified by The Detroit Edison Co. and the Michigan Bell Telephone Co.	_____
U	17. Provide developer with final trenching drawing. (2 copies)	_____
D & U 18.	Hold coordination meeting with The Detroit Edison Co. and the Michigan Bell Telephone Co. field foremen and developer's trenching contractor on the job site.	_____

ACKNOWLEDGMENTS

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Overhead Wiring



Photo courtesy of Central Mortgage and Housing Corporation, Ottawa, Ontario.

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