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Subject: Technical Letter 7
Water Transmission Costs

October 1967

This technical letter concerns the cost of water transmission lines, and represents one product of research on the cost of water resources development currently under way at the Illinois State Water Survey. Parallel studies are going forward on the cost of reservoirs, water treatment plants, and wells.

Use of this material will give an estimate of cost for transmission line projects of a given size, as well as the degree of uncertainty to be considered. This is intended only as an instrument for establishing orders of magnitude as a basis for comparisons, and of course, does not substitute for engineering studies.

This study is based on information from installations in Illinois. The data were obtained from the owner of the line (municipal or private water supply) or a consulting engineer. All cost figures were brought to the 1964 cost level by means of the Handy-Whitman index (Handy-Whitman Index of Water Utility Construction Costs; Whitman, Requardt and Associates, Baltimore, Maryland; Bulletin 20, 1966).

The search for information on cost of transmission lines is being continued, and the data will be gathered as they become available. This will ensure a continuous revision and substantiation of the results presented here.

Construction Costs

The accompanying chart is intended to be of aid in estimating the construction cost of a pipe line of known diameter. As used here construction cost covers pipe cost, transportation, installation, valves, and other appurtenances that are integral parts of a transmission line. Costs of right-of-way must be added to arrive at a project cost.

The solid line on the chart represents the average cost. The variability of the data around this average represents the uncertainty associated with the relationship. Thirty-four percent of the data lie within one standard deviation on each side of the average. Local variation of cost within the state has not been determined and is therefore a part of the uncertainty.

The opening and closing of a ditch usually is independent of pipe size for a range of pipe sizes. For example, a trenching machine may accommodate many sizes of pipe up to the capacity of the machine. Thus a 22-inch trencher can dig a hole for 6-inch to 16-inch pipe for the same cost. When a backhoe is used, there is little difference in the cost of laying 12- to 30-inch diameter pipe. Pipes greater than 42 inches in diameter are laid at a proportionally greater cost for opening and closing.

Pipe-cost curves have a definite break in slope at about 42-inch diameter because of a change in the manufacturing process for prestressed concrete cylinder pipe. Ductile iron has become competitive with prestressed concrete pipe in the 30- to 42-inch diameter pipe sizes.

No differentiation was made in the analysis between the qualities of pipe material. It was found that cast iron was usual for pipes of less than 20 inches in diameter, and prestressed concrete and ductile iron were used for 16-inch diameter pipe and larger. The upper limit of available data was 48 inches.

Project Costs

A generalized expression of project cost for a water transmission line is given by

$$C_p = 2.16(1.28) D^{1.2} + k(c)$$

where

- C_p = total project cost for a transmission line *per mile*
- D = pipe diameter in inches
- k = unit cost of land, easements, or rights-of-way
- c = units of land necessary
- 1.28 = factor for the upper enveloping curve enclosing 84.1 percent of data

Land, Easements, and Rights-of-Way

In Illinois both private and public water utilities seek easements to construct and maintain water transmission lines on both public and private lands.

The placement of transmission lines along state and county highways varies. Some state highways were acquired in fee title, in which case there may be no charge for easements. State highways acquired in fee title are usually 90 to 120 feet in width. The state and county highways (66 to 80 feet in width) acquired by easement are different in that adjacent property owners still retain their rights to the centerline of the road except for the granted easement to construct a highway. Transmission line construction along these highways would require an easement from the individual land owners. The cost of these kinds of easements, as long as they remained on the highway right-of-way, have run from 8 to 25 cents per foot.

Many easements on private lands have been given for \$1 and consideration, primarily because the land owner becomes a benefactor by the availability of finished water. The usual easement calls for some width of right-of-way for construction, perhaps 30 feet, and then reverts to 15 feet for operation and maintenance after the construction is completed.

On agricultural land the easement is given for a one-time charge plus the protection of soil production capabilities and any crop damage. Usually the top soil is stripped and then replaced after construction, and the work is done in a season of the year when no crop damage will occur. The maximum easement cost reported was \$2 per foot for crossing private agricultural lands.

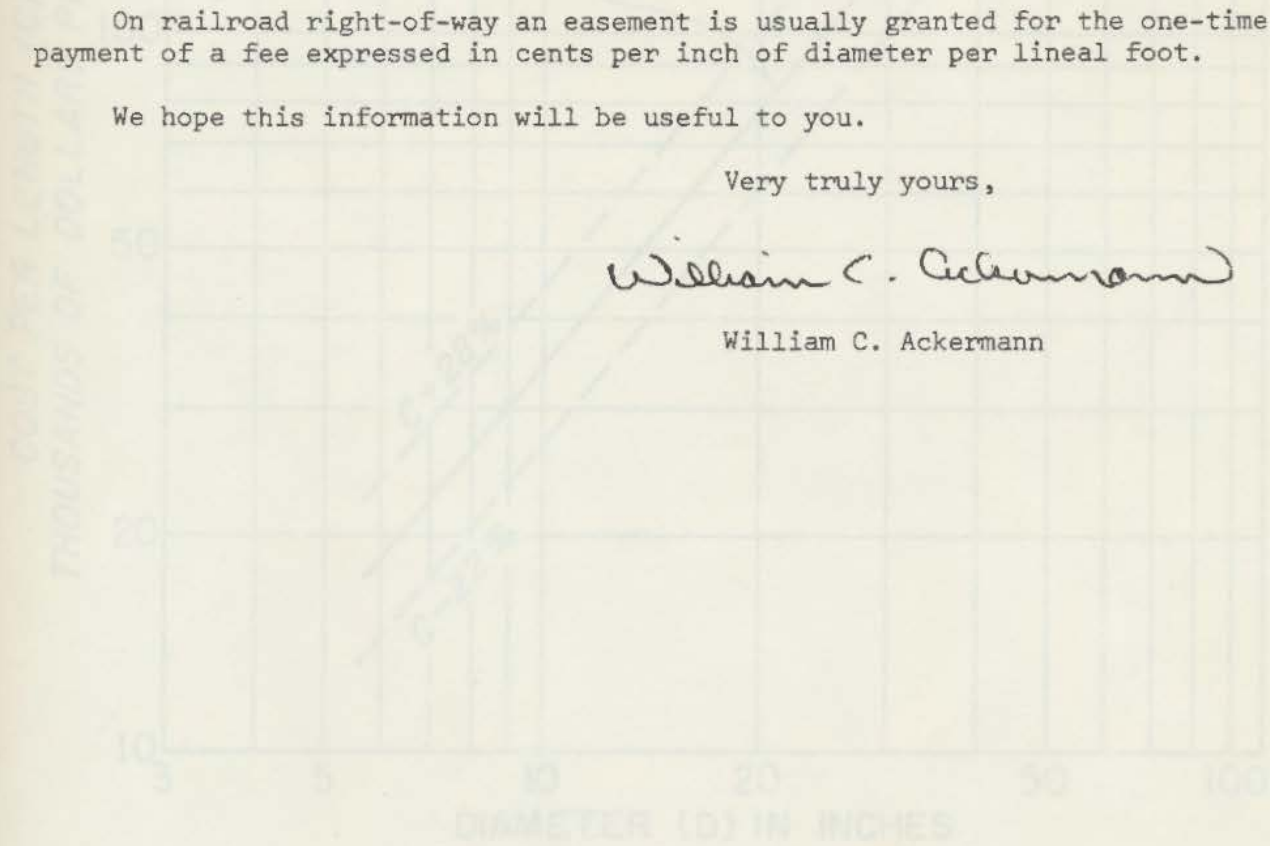
On railroad right-of-way an easement is usually granted for the one-time payment of a fee expressed in cents per inch of diameter per lineal foot.

We hope this information will be useful to you.

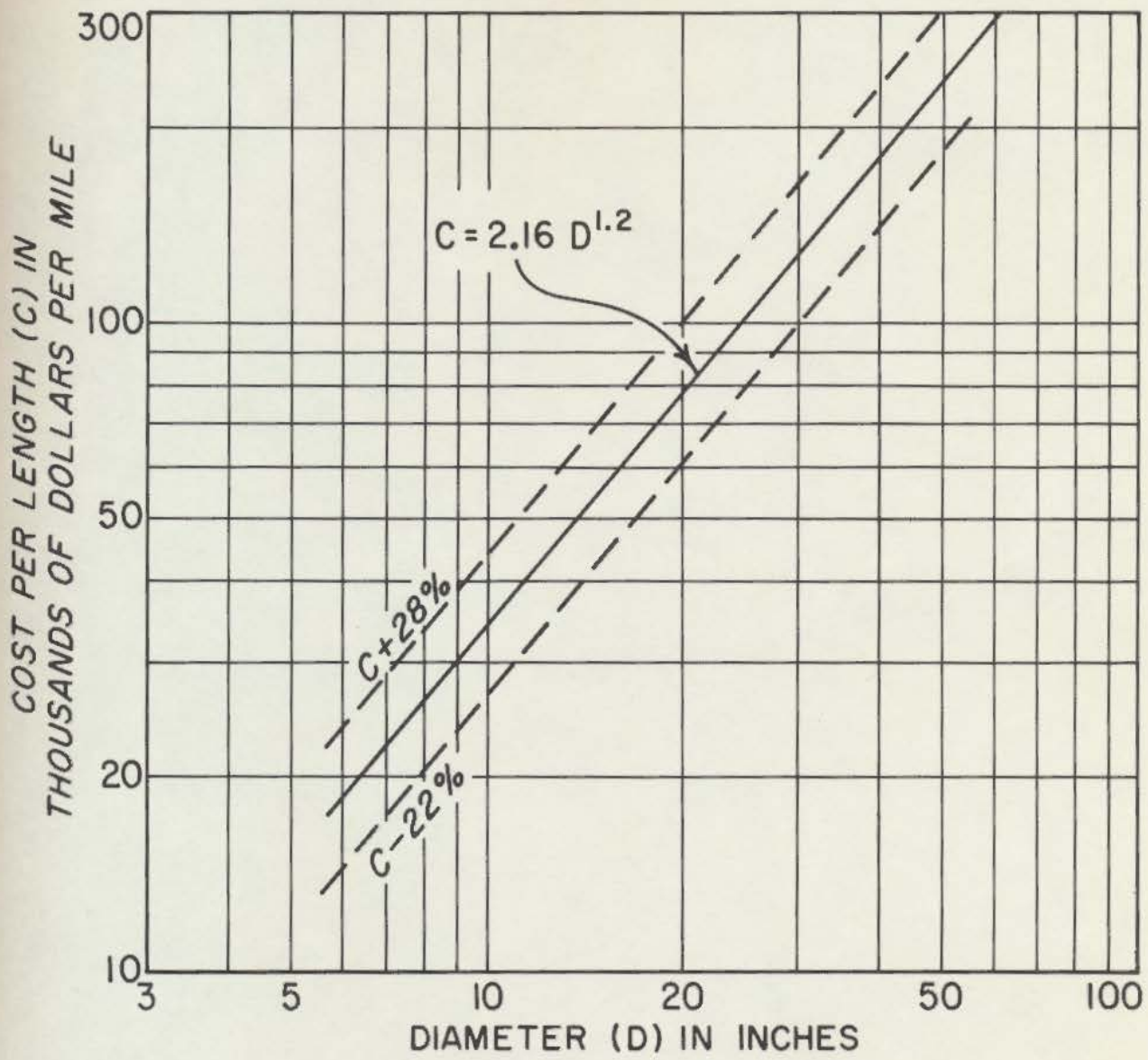
Very truly yours,

William C. Ackermann

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UNIT CONSTRUCTION COST FOR TRANSMISSION LINES, 1974 RELEASE



UNIT CONSTRUCTION COST FOR TRANSMISSION LINES, 1964 DOLLARS