"THE ENGINEERING OF BUILDINGS FOR TELEPHONE SERVICE"

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Above that marvelously beautiful entrance to the Transportation Building of the Columbian Exposition of 1893, there were two classical quotations; one by Lord Bacon:

> "There be three things that make a nation great and powerful: a fertile soil; busy workshops and easy transportation for men and goods from place to place."

The other by Thomas Macaulay:

> "Of all human inventions, the alphabet and printing press alone excepted, those inventions which have served to abridge distance have done the most for human civilization."

To these inscriptions so aptly placed and chosen, we shall hereafter refer.

The larger American cities have no parallel in history in magnitude or congestion. Even the exaggerations that have crept into the legends of the past fall short of picturing conditions that now exist in our large centers of population.

The very causes that make for and produce the great cities of today, go still further and develop those super-congested business structures which for lack of better words, we have learned to call "skyscrapers." In Chicago, for instance, one single twenty-story building stands on half an acre of ground, in the financial commercial district and houses for employment at least 6,000 people. On the basis of census statistics, this number of employes represents the business district and activities of a city of 30,000 inhabitants.

Such buildings are veritable "cities on edge," cities with no vacant lots, every house built and ready for occupancy served with elevators that function as street cars, and halls that serve as public highways. They have complete water, sewer, heating and lighting systems and supply janitor service to the tenants all included in the annual renting charges.

With all of these community conveniences and necessities, it is interesting, even fascinating, to note how little value they would have were it not for the telephone service,—the one thing that makes such congestion possible or endurable.

If the elevators should fail to operate, people could walk up and down the stairways, but if the telephone service should be taken away, business in such a building would practically cease until the service was restored.

If a building of this type were wholly self-contained, requiring no contact with the outside world, the management could and probably would install and maintain its own private inter-communicating telephone system with its attendant advantages. But the world is bigger than that; it has little use for the "Soviet Telephone."

The universality of such a country-wide system as that developed by the Bell Telephone Company gives to the telephone its chief and immeasurable value.

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In modern civilization, there is no room for a hermit—no place for a man or a business without a telephone.

In the development of the telephone industry, there have been many and intricate problems, and among them the one of providing adequate facilities for telephone service in the modern office building has been kaleidoscopic in its changing phases.

It not only involves cabling the building itself, but when Aladdin's Genii suddenly erect a great office building in a district already crowded with telephone service, new conditions are created. Very often a new line of conduit must be laid in the streets, additional office switchboard equipment and distribution facilities provided, together with a great volume of interdependent details unknown to the public and too often little known and appreciated by those in the business not directly engaged in such studies.

For the Telephone Company under normal conditions, to be prepared for a general increase in service, is a comparatively easy matter, but forecasting just where and when the next "skyscraping" office building will be erected is one affair, and forecasting correctly, far enough ahead to be able to provide underground facilities and central office equipment that shall be adequate, not wasteful, is quite another matter.

Estimating future service demands is properly the function of the Commercial Department; and the whim of an owner or the collapse of one of his financial ventures may at any time make a previous study of telephone requirements incorrect, however carefully prepared.

When a building has been planned and contracts let for its construction, the definite problem of cabling the building for telephone service is begun. Through the architects and owners, the telephone engineers undertak to obtain enough reliable information relative to the proposed building to warrant them in formulating a definite plan of supplying the building with the necessary telephone service. As before stated, this frequently includes, and must consider the question of additional underground cables and central office equipment together with the more specific problem of planning and installing cables and terminals in the building itself that shall meet the immediate demands, and anticipate the future requirements with the least amount of idle plant.

Through long established custom, no one questions the equity and justice of a building owner paying for the installation of pipes that distribute gas and water throughout the building; and with the advent of electric light and power service, and the concomitant fire risk attendant upon poor installation, the owners willingly undertook to furnish the conduit, wires and equipment necessary for such service in the building. But when the telephone entered the business field, there was an apparent reversal of form.

The Telephone Companies generally undertook to furnish the entire telephone equipment including the wires and instruments placed in the patron's property. This, however, never contemplated the placing of any conduit, moulding or the like which became a part of the permanent building plant. In this connection, the Telephone Companies have always reserved the right to remove whatever equipment they furnish, in cases of changes or discontinuation of service.

This practice was the logical sequence of good telephone service which in some respects differed from that of other public utilities.

The water, gas and electric light service is strictly an individual one insofar as any building is concerned. There is "no inter-relation" between buildings; not even between floors of the same building.

The failure of the water pipes in one building has no effect whatever on the service in another except the negligible tendency to improve it by a slight increase in pressure.

The same is true of gas and electric light, but with telephone service the uninterrupted intercommunication feature applied to a country-wide territory is its greatest single factor of value. Every telephone is on speaking terms with every other telephone.

With this fundamental in mind, together with a knowledge of the wretched service given in some of the European countries where subscribers keep their own instruments in repair, the Bell System undertook to control the entire plant, even at a sacrifice of earnings, in order to give better service.

This practice originated at a time before the telephone had come to its own in the field of importance.

In the evolution of the art, one telephone alone had no value—two became of scientific interest and held the potential power of one of the most important industries that go to make and maintain a higher order of civilization. Thus, the telephone growing in value to the public, in a geometrical ratio as their number increased has become so important and far reaching that the owner of a building should be, and naturally is, equally interested with the Telephone Company in providing means for supplying telephone service to his tenants. Without telephone service, his building is not rentable.

This fact being understood by the owner of a prospective building, little difficulty is experienced in persuading him to provide suitable cable and wire paths, such as conduit, runways and mouldings in which the Telephone Company may place the necessary equipment for serving the building as it is evidently to his own advantage. Usually the Field Engineer for the Telephone Company at the request of the Architect goes over the plans with him and indicates a suitable conduit system that will care for the estimated service, allowing a safe margin for growth and changes.

The density of service expressable in the number of square feet of rentable floor area per pair of available conductors is an important fundamental, and being once determined from the information obtainable, becomes a basis for the detailed plans of cabling the building.

Apart from the underground service that will be required, a building cable plan includes a main terminal or distributing frame usually located in the basement and from which one or more riser feeders lead by way of wire shafts to the several floors where, by means of branch cables, further distribution is effected to the several floor boxes or terminals. The floor cables are usually distributed by means of conduit and wire moulding of sizes and types approved by the Telephone Company. The floor terminals are placed with the idea of minimizing the wire runs necessary for the installation of subscribers' instruments, and the distribution of conductor pairs to these several terminals is intended to provide both a flexible and an economic installation.

The present practice of cabling office buildings for telephone service leans decidedly toward having a certain proportion of conductor pairs running directly from

the various floor terminals to the main frame in the central office and not appearing at the basement terminal. This system would be ideal if the estimated requirements for these "direct feeders" could be made reasonably correct. In the present state of the art, it is reasonably certain that there will be at least one direct feeder necessary for each office, and for every one of such feeders that is used, there is a distinct economy of cost of installation, which also minimizes annoyance to both landlord and tenant. If, however, there should be many unused direct feeders and the building involved a long distance from the Central Office, then the question of idle plant becomes a factor for consideration. This phase of the cabling problem is an example of the many that must be considered in planning cable distribution in the larger office building.

It has been suggested that the upper limit of telephone density in any office building would be one pair of conductors, or one instrument per "desk"; approximately one pair per hundred square feet.

Such a density seems hardly possible at the present state of the art, though we have in Chicago one building in the Board of Trade district that has one telephone to each 141 square feet.

This condition is abnormal and cannot be accepted as standard for other buildings even though indicating a possibility in future development.

The Telephone Engineer is concerned in providing adequate facilities for service with a minimum expense of installation and maintenance and so far as possible provide a system that shall anticipate future changes of tenancy and growth of service. In general, it is his business to blend technical experience with prophecy and make a success of it.

And now, let us for a moment turn back to the inscriptions over the entrance to the World's Fair Transportation Building of 1893. One that says:

> "There be three things that make a nation great and powerful: A fertile soil; busy workshops and easy transportation for men and goods from place to place."

The other saying:

> "Of all human inventions, the alphabet and printing press alone excepted, those inventions which have served to abridge distance have done the most for human civilization."

Had Lord Francis Bacon or Thomas Macauley been able to foresee the telephone and its possibilities, what encomiums they might have written, for no other invention has approached the telephone in abridgement of distance—it has annihilated it.

About the time the celebrated Brooklyn Suspension Bridge was designed and built, Bell invented the telephone.

The erection of the bridge was spectacular. At its completion, bands played and banners waved. Easy transportation for men and goods had been accomplished between two great cities.

Bell's invention, the telephone, was modestly, earnestly struggling for recognition. No great men made speeches, no bands played or banners fluttered, but had Bell invented the telephone twenty years earlier, the Brooklyn Bridge would have been long delayed. The bridge makes transportation easy; the telephone makes it unnecessary.