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TELEPHONE OUTSIDE PLANT
RECORDS

Thesis for Degree
of
CIVIL ENGINEER
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1930

1 THESIS

103361

CHAPTERS

- I. Introduction
- II. Types of Records
- III. Steps in Preparing Records
- IV. Maintaining Records
- V. Mortality Studies
- VI. Filing Records

Exhibits

CHAPTER I.

This thesis deals with one of the important phases of the telephone business, namely, the making and maintaining of all outside plant records.

Accurate records of outside plant investments are as important to a telephone company as monetary records, for there is more investment involved and the proper use of this plant investment, via adequate records, will add greatly to the income derived from the investment. The introduction of certain new records has brought about savings of time and material far beyond their original cost.

Possibly the best way to get an understanding of telephone outside plant records is to consider the history or evolution of these records. There was a time in the history of telephone companies when such data was probably unnecessary. This was the case when the forces working with the outside plant were entirely familiar with all of the features and locations of the plant with which they had to deal, but as the business expanded the time came when it was not humanly possible for these forces to be thus familiar with all of this data, and the need for tabulation of such information became desirable, even necessary. The more intricate types of plant felt this need first and these records were first designed, such as, Toll and Exchange Cable, Toll Wire and Circuit data. The history of this part of the telephone development would prove very interesting had we the time to consider it here as this was a pioneering job fraught with many hardships.

We have come to very near the end of this evolution period, in that we now have records of all types of outside plant with one exception, namely, Exchange Open Wire, which is under consideration at this time. With the

development of more intricate plant operations and material these records will be continually changing. Experience has taught us that the perfect record of today is soon inadequate, due to these changes.

There are a good many features of the record job of today about which there is considerable question, for it is now our endeavor to not only make records for the present, but to insofar as possible, make them adequate for future development. Very early in the growth of the telephone business there came a distinct division of business and its associated plant, whereby all traffic within a city or metropolitan area was called Exchange business and from one such area to another was called Toll business; the plant serving such traffic having been likewise divided. Due to the large growth of some of our metropolitan areas there has come into the business, of late, several combinations of these two and in the case of Cable plant has been given the name of composite plant.

The record job likewise resolves itself into these divisions for we have Toll records and Exchange records. In the Record Department Organization there are men in charge of the making and maintaining of Toll Records and others in charge of the Exchange Records. Under these headings we have in the organization, employees assigned to the making and maintaining of each one of the different records under these two classes. It has been found highly desirable in this connection to allocate the responsibility for each one of the records to an individual or group of individuals under one supervisor in the Department. This matter will be dealt with to a greater extent in Chapter IV. There are also the field and office jobs which enter into the organization picture and will be discussed later.

CHAPTER II

INDEX TO SECTIONS

<u>SECTION</u>	<u>RECORD</u>
I	Underground Conduit
II	Underground Cable
III	Aerial Cable
IV	Block and Building Cable
V	Cable Schematics
VI	Assignments
VII	Combined
VIII	Toll Cable
IX	Testboard Cable
X	City Pole
XI	Rural Pole
XII	Toll Pole
XIII	Toll Wire
XIV	Transposition Diagram
XV	Toll Route Maps

UNDERGROUND CONDUIT RECORD

The underground conduit record, which shows the manholes and ducts through which the underground cables are carried is made under two classifications, exchange and toll. The exchange record as the name implies shows the conduit within cities and towns, while the toll record shows conduit placed in conjunction with a particular toll cable between two cities.

The conduit record plate is divided into two sections. The first or upper section is composed of a geographical sketch showing street and alley lines, sidewalks, building lines, railroad tracks, etc., in relation to the location of the conduit run. The manholes, which are numbered, are located from the center to the inner sidewalk, building or alley line, fire hydrant or other suitable permanent object.

The trench feet or wall measurement of the main conduit is also shown in the same sketch. This measurement is taken from the face of the ducts in one manhole to the face of the ducts in the next manhole. In case of two duct runs terminating in the same manholes, but placed at different times, each run is shown separately. The ducts are shown according to kind, number and formation in each section. The following kinds of ducts are apt to be encountered in various places on the record, multiple tile ducts, single tile ducts, sewer tile ducts, fiber ducts, creosoted wood ducts or iron pipe.

Each kind of duct has its own symbols on the record. Multiple tile (M.T.D.), is made up of the same number of squares as called for in the section, and these are all joined together. Single tile (S.T.D.), is made up of separate squares. Sewer tile (S.T.), fiber (F), and iron pipe (IP) are all shown round. Creosoted wood (C.W.D.) is shown as a circle within a

square.

Bell conduit is shown as a solid line, while the purchased plant former Citizens Telephone Company appears on the record as a dashed line.

The depth of the conduit run is indicated by the cover measurement shown above the cross section diagram. The method of protection for the conduit if known is also shown, such as, concrete above and below the ducts, concrete above only or in some cases creosoted plank.

Lateral measurements are included in the same section of the drawing containing the main conduit measurements. The distance from the wall of the manhole to the end of the conduit is indicated, and also, the kind and number of ducts.

In the case of lateral ducts in the main trench, the lateral measurement is considered from the point where the ducts leave the main trench. However, the total measurement shown opposite the lateral number is from the manhole and is taken to the top of the pole pipe.

The lower portion of the record is divided into three tabular parts, manhole, main conduit and lateral data. All work shown in heavy in the sketch will be detailed here. Conduit shown light will be found on adjacent plates and is shown only for reference.

Manhole numbers and types are shown in the first two columns. Immediately following these come the dimensions of the manhole, length, width and headroom. The headroom measurement is from the floor of the manhole to the roof. Total depth of excavation, kind of walls, roof, floor, shape and weight of cover are also given.

In addition to the above, the date of construction is given where such information is available.

The main conduit data repeats the measurements shown in the sketch. On new work the total number of feet of each type of surface is shown for

each section. The same principle in regards to construction dates.

In the lateral block the measurements are taken to the pole instead of the end of the conduit. Spaces are provided for the number and size of pole, pipes and bends.

Toll conduit follows the same general plan except that toll pole numbers are shown on the laterals.

The wall to wall and lateral measurements are used at various times by the engineering department as a basis for ordering cable, and due to the fact that very little allowance is made for cutting lengths, it is essential that all measurements be very accurate.

Another bit of valuable information listed shows the percentage of ownership the American Telephone and Telegraph Company or any other company or city has in the various items of plant.

This record also shows in detail any special construction such as bridge crossings, special loading manholes or subsurface structures avoided.

Other public utilities and the city forces very often have occasion to consult the telephone company and this record in laying out their subsurface structures, that they may not conflict with our underground plant and vice versa. All the larger city engineering offices have copies of this record for reference and for contractors and others doing street subsurface work, that our plant may not be damaged.

This record is used primarily by the engineering forces in designing additional cable and conduit plant besides being a record of this plant which is kept for inventory purposes. Birth dates are indicated on this record for the different units of plant for mortality study purposes, as will be brought out later.

The underground cable record is a skeleton record of all cables in an underground system and is used primarily by the engineer in laying out additional cable plans or in making rearrangements in the existing plant.

The distinctive feature of this record is the fact that it gives the engineer a complete picture of all the underground cables in a locality.

This record carries what are known as interval cable measurements, that is, the measurements from the wall of the manhole to the wall of the adjacent manhole through which the cable runs. The size and gauge of the cable is indicated and the splicing detail, such as, stub cables off main cable, etc.

This record continues the cable plant as far as the junction of the underground cable with the aerial cable with a cross reference to the aerial cable data. The street names only are shown. The manholes are made large enough to include all the splicing details and may be enlarged upon the addition of another cable or more detailed splicing arrangements. The number of ducts in each section are indicated as a ready map reference to the duct fill of the run. All cable numbers and counts are also indicated.

There was a time when it was thought desirable to indicate on this record, the duct location of each cable in each section, but this data was found almost impossible to maintain and of questionable value, it was therefore eliminated.

This record is primarily for the engineers use in conjunction with the more detailed cable record shown as the schematic, and as indicated above gives him an overall picture of the underground cable plant, which cannot be derived from any of the other cable records.

It is only necessary to make and maintain this record in the larger

exchanges where our underground plant is extensive and intricate enough to make its use necessary.

The aerial cable record is very much like the underground cable record described above, in design and use, for it is made primarily to aid the engineer in his planning of cable work.

The distinctive feature of this record is the fact that it gives a complete picture of the aerial cable plant for any locality, and brings out features regarding cable situations which could not be readily seen from the individual cable records (schematics). This feature is very helpful to the engineer in designing his aerial cable distribution plant and making rearrangements in the same when it becomes over-loaded.

The record is drawn to a scale of approximately 1" - 150', and indicates street lines on the reverse side of the tracings in red ink, which materially facilitates the drafting work of correction and addition. It is not drawn to a true scale, however, as the streets have to be somewhat distorted to make room for the cable information shown therein. There are reference numbers in the margin of the plates which refer to the adjacent plates. Changes in the cable data on the face of the record does not involve the street lines, and the red ink prints light in relation to the cable data shown in black and gives a proper tone proportion to the record.

The size and gauge is indicated, the cable and terminal numbers and counts, also any splicing details. The record indicates the relative locations of the cables as to the side of the street and of the terminals, but does not, however, bear any measurement data which must be secured from the individual cable record (schematic).

As was stated in connection with the underground cable record this aerial cable also is only necessary in the larger exchanges where the aerial distribution plant is extensive.

The Block and Building Cable Record is one which gives in greater detail the location of all cable and terminals within a building or group of buildings which according to certain well defined accounting rules of the company designates such plants as block and building cable plant.

The two main reasons for such a record of cable which is often times shown on some other record is the fact that these other records do not permit of the detail which is possible on this block and building record, and also the involved accounting which specifies the capital accounts to which such plant is charged, and also the matter mentioned under assignment maps as that of the use for assignment purposes of this record.

This is the record which it should be remembered is made up from fire maps of the block and building layouts, and where it is desirable, floor and riser plans are shown as a part of the details of this record. The record is only necessary in the larger exchanges where such plant is encountered. The connection of this record with our underground and aerial cable records is given by all the information regarding cable numbers, counts, sizes and gauges, and in some cases, the wire limits which it was found impossible to indicate on the assignment maps.

To get the proper relation, the building lines are shown light weight with the more importance cable lines heavier. The record also has houses or building address numbers, and indicates the type of building. In the case of floor and riser plans, the closet or cabinets where the cables are terminated are indicated, and also where conduit has been provided in the building for telephone distribution wires, such plant is shown. These features are coordinated on the record with other permanent building units, such as stairways, elevator shafts, light wells, pipe shafts, etc.

This record is made the same size as the assignments, and is used by the testmen in conjunction with their schematics, as in a few cases where the block or building cable plant is extensive, such plant has been omitted from the schematics and reference made to this record. In the case of the larger exchanges, key maps of this record are also made a part thereof and numbered in accordance with the numbering of the plates.

Another of the details shown on this record, which it is well to mention, is the type of terminal which is an outgrowth of the recent Reconciliation, as in this study we were asked to classify all terminals under certain general headings, and it was found necessary in a great many cases to conduct an investigation to determine in just what particular class many of the terminals should be covered. This has now been made a part of the block and building record by appropriate symbols, shown in the exhibits.

The Individual Cable Record better known in the Bell System as a Schematic is a detailed account of the distribution of an individual central office cable throughout its entire underground and aerial system. In this respect it may be considered as the unit from which all other cable records are derived.

Because of its various uses, of which more will be said later, it will be seen that this record is a most important one, and must be in every detail, absolutely correct.

Some of the features which the schematic embodies are:

1. Cable numbers and counts.
2. Central Office mainframe termination data.
3. Splicing and stubbing details in manholes.
4. Size and gauge of cables, both underground and aerial, main feeder or distributing.
5. Terminal data.
6. Mortality dates on cable.
7. Cumulative measurements by gauges.

Each individual cable terminated in and leaving the Central Office must be numbered and recorded. It is necessary from an engineering as well as a maintenance standpoint, that this cable number be maintained throughout the entire cable system. These numbers begin with 2 and continue for all the cables terminated in the central office.

The termination of the cable on the central office mainframe is brought into the record in note only, giving the number of, length, size and gauge of the terminating cables. These cables, known as "tips" are silk and cotton insulated, and the splice at which this cable is spliced to the out-

side distributing paper insulated cable is known as the "S & C" splice, and it is from this point that the schematic record measurements are accumulated.

From the "S & C" splice the cable is followed throughout its entirety in both the underground and in the aerial plant. The underground cable is indicated by a single narrow line. All splicing and stubbing details on the main feeder cable are shown in their respective manholes, as well as all subsidiary or lateral cable details. To closer associate the cable record with the field, each manhole is numbered, and the street names in which the manhole runs are located are shown together with all intersecting streets with reference to manhole location.

The aerial distributing cable is shown as a single heavy line. The entire network of distributing cable is pictured with reference to streets, alleys, R. R. tracks or other permanent topographical features.

All cables, both underground and aerial, main feeder or distributing must be labeled at regular intervals with the size and gauge of the cable, also the cable number, and the count of the pairs working in the cable. In the case of a subsidiary cable branching off the main feeder in the underground and terminating in a cross connecting junction terminal, it is absolutely essential that the aerial cable terminated in, and feeding out of, the junction terminal be numbered correctly, and given the correct count.

A cross connecting junction terminal, is a large wooden box in which the underground cable is terminated on a strip known as the underground strip, and the aerial cable leaving the box is terminated on a so-called aerial strip. By a process of "jumping" or cross connecting, using jumper wire, any pair on the underground side may be cross connected with any pair on the aerial side, the aerial cable thereby losing all identity as far as pair numbers or counts with reference to the underground cable is concerned.

It follows that the cable cannot be given the same number or count on the aerial side as it has on the underground side. The aerial cable count then reverts back to 1 since the identity of the cable pairs is lost it must follow that the cable number should no longer be the same. In such case the underground cable number is retained as the first half of the aerial cable number. For example: Cable number 2 in the underground, becomes 201 beyond the junction box. In the case of two or more cross connecting boxes appearing on the same cable, the cables beyond the boxes, are numbered serially as they appear in order of installation in plant from the Central Office out, thus -- Cable #201, #202, #203, etc. The exact detail of the cross connections in each junction box, is recorded in specially prepared cable books which are not maintained by the Record Department, but by the local Assignment Clerk's office.

However, such is not the case where a lateral cable leaves the underground and is spliced direct to the aerial, here the sequence of pair counts and the cable number remains the same in both the underground and aerial cables.

Wherever there is a change in either the number of pairs or gauge of the cable, or both, it is indicated by a small square denoting a section splice and an arrow head pointing in directing from the larger to the smaller cable, generally away from the Central Office.

Terminals, the last outposts of a distributing cable system are indicated with a short narrow line projecting perpendicularly from the cable. Above this terminal line is indicated the terminal number, below the line is given the actual pair numbers which are terminated therein. This last is known as the terminal count and is given as the first and last pair numbers inclusive.

No attempt is made to draw this record to scale, but some semblance of order is preserved in planning and laying out this record by having the distributing cables branching off the main feeder on consecutive intersecting streets at least 2 or 2½ inches apart. Terminals are spotted according to spans rather than to scale; .6" being allowed for an interval of 1 span, 1.2" for 2 spans, etc. In cases of cables feeding into the fringe areas of the city, with terminals at intervals of 10 or 20 spans, the .6" scale is dropped and the distance considerably shortened on the record. In laying out and planning this type of record the record man is guided by the engineer's estimate of proposed cable and by the final completed construction prints. Every consideration must be given to the future growth of various sections of the city covered on the record and to the subsequent cable extension in that direction. Through experience it has been found the most economical practice is to allow room on the original drawing of the record for these future extensions and changes in plant, rather than to redraw the record in the near future because of lack of space for these additions.

Among its various other uses the Schematic also serves as a guide to the cable tester, where centralized trouble locating is employed. Besides enabling him to follow the exact wanderings of the particular pair of wires he is testing, the record also supplies him with a measurement at each and every point on the cable at which that pair is spliced or terminated. This measurement is cumulative from the Central Office "S & C" splice out. Since the resistance encountered by an electric current in traveling over a pair of wires varies with a change in the gauge of the wires, the measurements must be cumulative with respect to gauge. The testman in testing for trouble with a bridge obtains a reading in ohms of resistance encountered.

This reading is transposed to feet by gauge, and if the measurements and gauges are accurately recorded, the testman can quite definitely locate his trouble in his tests.

In conjunction with Mortality dates on all sections of cable; A. T. & T. Co. Specifications stipulate that at regular intervals an actual field inspection covering the physical condition of the cable be made by the engineers on all cable 10 or more years of age. The Schematic is the record used by the engineers in this field survey, thus it is the logical record on which birth dates of cable should appear, as this will also serve the purposes of the Mortality Study for all cable.

The terminal data shown on the Schematic is also used by the Assignment Clerk in drawing up or redrawing his terminal assignment cards and cable books, in which are kept detailed accounts of working lines in terminals, individual as well as party lines, pair cross connections in junction terminals, etc. Aside from all other uses mentioned above, if the use of the Schematic were limited to engineering only, there would be cause enough to maintain the record in the most accurate manner possible, for without correct cable and terminal counts and cable numbers to assist in making cable throws; without correct measurements for making cable removals and replacements; without correct terminal numbers and locations with respect to neighboring terminals or branch splices; without correct terminal counts to assist in properly bridging out cable pairs in the terminals; the most efficiently engineered and constructed projects would come to naught.

From the testman's standpoint as well as the engineer's it is essential that all cable counts and terminal numbers and counts be absolutely correct.

ASSIGNMENTS

Section VI.

The Assignment Maps are really not a record, but a working diagram, as there is on these maps no record of any physical plant which is not shown on other records of the company.

A brief discussion of the commercial order and installation routines will prepare us for a description of these maps. The commercial order routine provides for a prospective subscriber signing a contract in the commercial or business office for new service. From this contract is prepared what is known as the commercial order, addressed to the Plant Department, whose responsibility it is to complete the order by installing the instrument called for on the order and establish service thereto.

There are several different types of instruments and service all of which is specified on the order. This order is passed to the Assignment Department who place on the order the assignment of Central Office and outside plant facilities to establish the type of service called for. This must be done from records of the available Central Office and outside plant facilities, one of which, namely, the assignment maps, it is the task of the Record Department to prepare and maintain. The rest are maintained by the local forces, and are not at this time considered a part of the general record department responsibilities.

These Assignment Maps indicate the streets and alleys and the cable terminals and pole plant available for the distribution of the telephone lines. The only plant with which the assignment clerk must be familiar are the cable terminals and the poles. He knows nothing about underground conduit or cable or even aerial cable, unless there are terminals on the same, making available these cable facilities, therefore only the items of plant which may be used for distribution from these cables are shown on

this record.

The other feature of the record is the heavy line shown around each terminal. These lines if followed out will be found to completely enclose the terminal, and assignments should only be made to a terminal from within these bounding lines. These lines are known as wiring limits, meaning that they limit the wiring from the terminal shown in any particular enclosure.

Block or Building Cable will in a great many cases be cross referenced to our detailed record of such plant. In some cases, however, the wiring limit detail is shown for this type of plant on these assignment maps where it will not cause too much congestion.

The trees, buildings and other obstructions, and the appearance of exposed lines governs the location of these lines. There are street address numbers given for each of these lines, and also the terminals, which tell the Assignment Clerk in just what bounded territory the address given on the commercial order appears, and from this map he can assign the particular terminal to which the wires or drop to the house must be connected. This allows the central office forces to have the service available on the line in the cable to this terminal before the installer gets to the premises to use the same. These maps and this advanced work system have materially aided the company in their efforts to provide service sooner or even on an appointment basis with the prospective subscriber, and have done much to improve our public relations.

These wiring limit lines are shown for all new or rearranged plant on the completed prints for such work as mentioned in Chapter IV, thus allowing us to maintain this record once it is prepared.

This record is only feasible for the larger exchanges where there is

enough installation activity to warrant their use, namely, the Common Battery Exchanges.

The combined record is the youngest record in the department and was designed to serve the purpose of all of the other cable records for those small towns whose cable plant was not extensive nor involved.

By combining the distinctive features of each one of the different cable records into one combined record we have made extensive savings and designed a very useful record. The record has also been furnished to the field in a much shorter time than would have been possible had we attempted each one of the different records for each of the small exchanges. This type of record is not adaptable to exchanges where there is any great amount of underground plant. We have, however, used it in some exchanges where there are as many as eight or ten underground sections, but have found it unadvisable to continue much beyond this point, however. This record fits approximately 75% of the exchanges in this division.

It is drawn out in map form with a distorted scale of approximately 1" - 150' showing street lines, the locations, sizes and counts of all cable and terminals, pole data in connection with the cable, and accumulative measurements from the Central Office by gauge of cable.

This record serves the purpose of the individual cable record (schematic), the aerial cable record and the underground cable record and has proved very useful to the local plant forces and the engineers. The record also has reference numbers in the margins referring to adjacent plates, and where desirable a city map has been cross-sectioned and numbered as a key map to the record.

This record is a schematic drawing of the toll or long distance telephone cables, extending from one city to another, and also smaller cables placed within a city to provide adequate facilities into the Central Office. The latter type of plant is being used in down-town and congested areas to eliminate conflicting conditions while the former is used to replace heavily loaded open wire lines which are very difficult and costly to maintain.

As there is a decided trend toward cable taking the place of heavy toll wire lines, it has been necessary to design a new Cable Record which is very accurate and complete.

A toll cable is generally composed of 16, 19 and 22 gauge paper insulated copper wires segregated by quads (2 pairs) and by layers, and grouped according to operation in colored binders, encased within a flexible lead sheath. Loading coils or units are placed on special aerial fixtures or in specially built manholes and spaced approximately every 6000 feet, which tends to overcome the distortion due to long distance transmission of voice frequencies. This Cable Record might be divided into three units: cable, loading, and termination at the offices.

CABLE

There are usually two terms used in referring to cable -- aerial and underground. It will be noted that the aerial section is indicated with a wider line than that used for the underground section. This is in accordance with our code and conventions for cable records and enables one to differentiate between the two at a glance.

We have shown the splices with a filled-in circle on the cable line and also given the pole number and direction from the pole, such as S. of pole #320. If the splice is not over three feet from the pole it is then shown as being at the pole. The exact distance to all splices is carried on another record called the Testboard Cable Record.

The number and letter "S" shown in the cable line gives the total number of pairs in the cable while the "S" is an abbreviation for special. The arrow leading to this number has at the other extremity the specification number and make-up of the particular section of cable. This specification number is used to classify the cable according to make-up, segregation, and color binders. The small square and cross is used in this connection to indicate quads and pairs, respectively. Six pairs are usually left unquaded to be used for "Broadcast Program" operation, these being equally divided into the "Northbound" and "Southbound" conductor groups.

Measurements shown on this record are from the center of one splice to the center of the next. They are obtained in the field after the cable has been placed and spliced and are checked for accuracy with the Testboard Cable Record.

The line representing the route of the cable, while not drawn to scale, has all angles and turns shown correctly. In addition to this,

names of roads, private property, road intersections and other information available is shown for the purpose of location.

The section covering underground cable varies slightly from that for aerial cable, as the splices are in manholes instead of at or near poles, such splices are shown in a small rectangle for the manhole with the manhole number above and to the right of the manhole symbol.

Due to the distance between some of the manholes being shorter than the average, it has been found advisable to pull through some intermediate manholes without a splice, which is indicated by the use of an abbreviation (NS) no splice.

In this part of the record the cross-section arrangement of the conduit is indicated by grouping small squares for the two, four, six and nine multiple tile ducts. The position of the cable is indicated by a small dot shown in the square representing the duct in which the cable has actually been placed. This enables one to readily locate the cable in the field.

With the foregoing exceptions this section is in accord with that indicating aerial cable.

LOADING

A star has been used at all "Loading Points" for the purpose of attracting attention to their locations on the drawing. They are numbered in consecutive order from the originating office to the terminating office.

The complements of loading are numbered consecutively and in the sequence of the dates they were placed in service. The type of loading case used is shown opposite the complement with the kind and number of coils or units on the next line. Under this and on the next line the serial number is given for reference in rearrangements of loading. In the small circle at the left of the complement number, the year of placing the complement has been indicated by using the last two digits of the proper year.

However, on the line representing the cable, the "Main" and "Balloon" splices are shown in their relative positions. The main splice being the one out of which the first complement of loading is taken while the balloon splice is placed to facilitate future or additional loading. A very small rectangle has been used to indicate the loading case in its proper position to the main or balloon splice and is also connected to the splice involved. The numeral within this rectangle is the complement number for that individual case.

TERMINATION

As the terminating of a toll cable is one of the important phases in the construction of an inter-city cable, it has to be accurately recorded here. This is accomplished by a plan view of the office with all unnecessary items eliminated. The termination on the fuse-frame is the starting or ending point of the cable so far as engineering and plan records are concerned. In terminating, silk and cotton cable is always used from the last or "S & C" splice to the frame which is almost invariably composed of quaded 19 gauge conductors. However, in a few exceptional cases 13 or 16 gauge conductors have been used. The cable sheath is removed from the conductors at the frame and the tips are then connected to the frame by individual pairs. It is necessary to use three or four frames to terminate the larger cables.

Our detail of office termination shows the number of quads, gauge of wire, and measurement of each individual tip and an average measurement of the total tips. This average is the measurement given in the Testboard Cable Record. The distances between the other splices are also shown as well as the cable make-up.

A protective measure has now been taken in order to eliminate danger from high-voltage electrical currents being carried to the fuse-frame. This is accomplished by splicing in a section of quaded 24 gauge cable, not less than five feet in length and not to exceed fifteen feet. This functions as a fuse. It is included on the record and detailed according to specification number, number of quads, gauge of wire and length. On branch cables this is placed at the junction of the main cable or between the aerial and underground sections. Naturally the name of the office is shown in all cases.

In conclusion, there are a few items worthy of mention such as the dimensions of drawings, title block, northpoint, current corrections and data, and percentage of ownership and quad assignments.

The drawings measure 16" wide (vertically) by 34" long and have a 1/4" border on each side, except at the left which is 1 1/2" for binding purposes. This size is quite convenient and will fold to letter size with a very slight deviation.

A title block is located in the lower right hand corner giving the name of the cable, scale, our Company name, department, and City in which our department is located. In the right-hand section of the block the date drawn, number of drawings, drawing number, and initials of the draftsman, tracer, and checker are shown. The block measures 1 1/2" high and is 5" long.

The "North-point" is one in general use in this office for drawings and records of this size or larger.

At the extreme right of the drawing extending from the top margin to the title plate, a space has been separated for the listing of the date the cable is placed in service or effective, and the Estimate number under which the plant was engineered and constructed. This space is also divided into five sections under the heading "Corrected". Each section has a sub-heading as follows: Estimate or Job Order and Date, Loading Section, Complement and Date, Main Cable Section and Date, Subsidiary Cable Section and Date. When additional plant is placed or rearrangements made in the existing plant, the Estimate or Job Order is listed with the date the work was completed. The section involved and the date completed is then listed under the proper sub-heading of Loading, Main Cable, or Subsidiary Cable.

The ownership in percent and quads assigned to each company in jointly owned toll cables is also placed on this record.

TESTBOARD CABLE RECORD

Section IX.

Due to the increasing size and importance of the toll cable plant, it is essential that the locating of toll cable trouble from the toll testboard be both quick and accurate, so that the out of service time on toll circuits can be reduced and the expense incidental to false locations can be minimized. As the make-up of toll cable plant is complicated, due to various gauges, loading and arrangements used, it is necessary to provide for systematically correcting the Wheatstone Bridge measurements made of trouble locations, so that the effect of loading coil resistance, temperature difference in aerial and underground sections, etc., can be eliminated and accurate locations made. To accomplish this a system of special records have been arranged and are collectively known as the Toll Testboard Cable Record.

A complete Testboard Cable Record of a City to City cable is composed of the following: Cable Data (Form E-606), Classification of Loading by Complements (Form E-607), Classification of Loading by Pairs (Form E-608), Spacing of Loading (Form E-609), Locations and Distances (cable lengths) (Form E-610), Office Resistances (Form E-611) and Temperature Correction Curves. Some of the terms may be defined as: Test Station -- this term when used indicates a point where all pairs of a toll cable or all pairs of a major group in a toll cable are terminated for testing or service. Test Section -- this term when used shall be interpreted to indicate that portion of a toll cable between two Test Stations. Branch Cable -- this term indicates a distinct branch or spur from a main toll cable and includes the entire branch from its junction with the main cable to the office in which it terminates.

"Cable Data" (Form E-606), shows the cable lay-up between two test

stations. It is divided into the necessary sections with proper headings. In the space provided at the top, the name of the cable, designated on the M.D.F. (Main Distributing Frame) and name of the office is given. This form is then divided under the headings of Section of Cable, Cable Specification Number, Cable Layup by layer number, quads or pairs, gauge, and binder color, and Remarks.

Under "Section of Cable" separate entries are made for each section of cable where the make-up changes. These entries are listed in the order in which the sections occur in the complete run of cable.

Under "Cable Specification Number" is shown the specification number covering the section of cable being recorded.

Under "Cable Layup" the layers are given starting with the core or center layer and numbering consecutively to the outside layer. The quads or pairs have been listed by total number of quads or pairs according to gauge and layers. In addition to this the gauge and binder color is given for each item.

Under "Remarks" the color code used for designating binder colors has been shown. This is the extent of the information given on this form.

"Classification of Loading by Complements" on Form E-607 has the name of the cable and the section covered shown at the top of the sheet. The sheet number and in effect date are shown in the upper right-hand corner. The loading is then classified under the headings, Complement, Date in Service, Load Case Code Number, Side and P X Coils, Pair Count, Gauge, Type of Circuit, and Remarks.

The complement number according to sequence of placing is given under "Complement" while the date on which the complement was placed in service is given under "Date in Service".

As there is almost invariably a different code number for each complement of loading placed on a toll cable, this must be shown in the column headed "Load Case Code Number".

Under "Side Coils and P X (Phantom) Coils" is listed the number and code number pertaining to the pair group or the type of circuit operation. However, there is now a newer type of loading in use, consisting of loading units instead of coils. One unit, loading one quad or two pairs, and also serving the purpose of a side coil and a P X Coil.

In the column headed "Pair Count" is listed the pair numbers of the pairs loaded by, and corresponding to the various types of coils or units. They are further segregated by gauge and type of circuit.

Under "Gauge" appears the number of the gauge of wire according to the Brown and Sharpe Standard.

In the column "Type of Circuit" the circuits are shown according to their operation, whether 2-wire operating in both directions or 4-wire operating in one direction. The letter N, S, E, or W, is used to designate the direction of the 4-wire circuits whether North, South, East or West. This form does not have all of the conductor pairs shown as it is by complements and therefore covers only those conductors which are loaded.

"Classification of Loading by Pairs" on Form E-603 duplicates the type of circuit, load case code number, and code number of side and P X (phantom) coils shown on Form E-607. However, on Form E-608 the pair numbers have precedence and the entire number of pairs in the cable are listed in numerical order at the extreme left.

In addition to these items there is a column in which is shown the pair or sleeve binder colors. Also columns headed "Code Number and Loop Resistance of Coils" under which appear the side coil code number and

resistance and P X or phantom coil code number and resistance, with the total resistance per load pertaining to each group of pairs.

"Spacing of Loading" on Form E-609 is used for the purpose of giving the distances between loading points, the cumulative distance and percent of total distance at each loading point. A separate record is prepared for the test station at each end of a test section.

The name of the cable is shown at the top with name of office for which the record is prepared entered after the word "From" and the name of the office at the other end of the test section entered after the word "To".

Under "Load Point Number", the load point numbers are shown as counted consecutively from the originating office or beginning of the cable being recorded.

Under "Load Points from Far End", the load point numbers are shown as counted from the terminating office or far end of the test section.

Under "Manhole or Pole" the manhole number or pole number, in or on which the load cases are located has been listed.

Under "Length of Loading Section", the length of cable to nearest foot (decimals omitted) between points listed in the "Manhole or Pole" column or the length from the preceding load point to the load point opposite the measurement has been shown.

Under "Cumulative Distance in Feet" the cumulative cable measurements to the nearest foot have been shown at each load point located as indicated in the manhole or pole column.

In the final column under "Percent of Total Distance" the total distance is considered as the test section and the cumulative percent of this length is shown at each load point and to the right of its corresponding cumulative measurement.

"Locations and Distances" on Form E-610, gives the distance from each preceding pole or manhole to the next pole or manhole; the cumulative distance at each pole and manhole from the preceding load point to the next load point and vice versa; the general route of the cable, whether on private right-of-way, road or street; intersecting streets, roads or crossings, and any landmarks or points that may be of value in directing those engaged in locating cable trouble. In the space provided, loading points, splices and their location, as well as incidental remarks have been shown.

The data on Form E-610 for a testing section is now being compiled by individual loading sections and end sections; an end section being one from the office to the first load point. This was originally compiled for a complete cable and a change such as an extension of underground section, retermination at an office, reroute of the cable and cutting in or out of cable would involve a revision of both sets of cumulative distances from the point of change to the office. A correction, therefore, involved a considerable number of sheets and one in which the labor and expense would run rather high. In order to reduce this to a minimum, the measurements on this form are now being accumulated from one load point to the next rather than from the originating office to the terminating office.

The name of the toll cable and test section is shown at the top of this form. Also sheet number and in effect date. These sheets are numbered consecutively for the entire test section.

In the "Pole or Manhole" column, the number of each manhole or pole, through or on which the cable being recorded extends, has been listed.

Under "Feet" we have shown the measurement to the nearest foot from the originating or preceding point to the point opposite the measurement as listed in the "Pole or Manhole" column. Much consideration is given in

converting the measurements carrying the tenths of a foot as taken in the field, into the measurement to the nearest foot. In eliminating the tenths, any tenth less than .5 is dropped, one over .5 is added, and the .5 is added on the even numbers and dropped on the odd numbers. This system balances very satisfactorily with a total in which the tenths have been carried. These measurements are from the center of poles in the aerial section and splices in the underground section.

Under "Cumulative Distance in Feet From Last Load Point" two double columns are provided. The smaller load point number is posted at the top of the first or left-hand column after the word "From" and the larger load point number at the other end of the loading section is posted at the top of the second column. In the left half of each column we have shown the cumulative cable measurement at each pole or manhole from the load point shown at the top of the column. The right half of each column provides space for changed or corrected measurements.

In the next column under "Location" the location of the cable line is shown as being either on a highway by giving name of road, or street, or on private right-of-way; also names of cross-streets or roads where manholes or poles are located at an intersection, city limits division boundaries and any landmarks or other points which may be of value in making field locations on the cable.

Under "Remarks--Load Points--Ft. to Splice, Etc." the load points have been shown as counted from the beginning of the section of cable being recorded. This is entered on line with pole or manhole where loading is located as listed in the "Pole or Manhole" column. Location of splices has been indicated by the number of feet ahead (+) or back (-), of nearest pole. However, in most cases the sign (+) has been omitted, as this is

not available in typing. This is entered on line with the pole number nearest the splice, as listed in the "Pole or Manhole" column. The word splice as mentioned herein means only such points where all wires in the cable are spliced.

"Office Resistances and Capacitance Readings", Form E-611, is used to give the office resistance and capacitance readings, as well as data relative to the standard underground pair at the office for which the record is prepared. Each record contains data pertaining to the office at each end of a test section.

This data is for the use of the toll testman in computing the location of crosses, grounds, and opens in the toll cable conductors.

"Temperature Correction Curves", are prepared for each test station covering each test section entering the office. These curves are plotted on 8 $\frac{1}{2}$ " x 11" cross section tracing paper so that blue print or blue line copies can be made for distribution.

If the resistance of the cable can be assumed to be uniformly distributed along its length a temperature correction would not be necessary. This assumption is only justified for cables which are entirely aerial or entirely underground and this condition does not exist in the larger cables requiring Testboard Cable Records up to the present time. Where the cable is made up partly of aerial and partly of underground section, however, the resistance per unit of length of the aerial is very apt to differ from the resistance per unit of length of the underground, due to the different temperatures of the air and the earth. This introduces an error, the magnitude of which depends upon the relative lengths of the aerial and underground sections and upon their difference in temperature.

The curve as plotted is in accordance with the general case of a cable

having an underground section at each end and an intermediate section of underground somewhere between the two end sections, with aerial sections between this intermediate section and the two end sections. The dotted vertical line corresponds to the underground pole or dividing point between the aerial and underground sections and indicates the relative variations. The curve on Exhibit was plotted for the Jackson-Lansing "A" Cable, the "A" indicating this to be the first cable placed between these two points. This covers the Jackson-Lansing Section and reads from left to right as indicated below the curve by the figures 0 - 10 - 20 - etc., over "Percent Distance from Jackson". These figures indicate the percent of the total distance at the heavy line which they bisect, the 0 representing the Jackson Office and the 100 the Lansing Office. By referring to spacing of these figures, it may be observed that two squares represent 1 percent of the distance.

The positive and negative figures reading from the 0 axis (0 to 1.2 and 0 to -1.2) shown at the Jackson end of the curve is an index for "Corrections in Percent". The junction point corrections, plus and minus, are plotted as ordinates against apparent percentage distances from the measuring end (Jackson) as abscissae. These junction point corrections and apparent percentages are determined through a series of mathematical calculations based on the actual measurements and the variations between the average resistance per unit length and the resistance per unit length of the underground sections. The points pertaining to each curve, one for the unit underground resistance higher than average unit resistance (O A B C D O) and one for the unit underground resistance lower than average unit resistance (O E F G H O), are joined in proper sequence by straight lines and the curve marked with its proper index number. This completes the

plotting of the "envelope" curves.

The process for plotting the intermediate curves can be explained by reference to the Exhibit, where the curves marked by the index numbers 7.00 and 5.70 are the "envelope" curves just discussed. Corresponding points of maximum correction on these two curves are joined by straight lines (shown dashed on the drawing). Each of these lines is divided into a number of equal parts corresponding to the difference in the index numbers of the "envelope" curves (in this case 7.00 --- 5.70, or 10) and corresponding points of division are taken as points for new curves, each curve being marked with its proper index number (6.87, 6.74, 6.61, etc.). The resulting group of curves will be complete enough to cover all normal differences in resistance likely to be encountered in practice.

The index is placed at any convenient point on the curves, care being used in reading a given correction to find the proper curve, taking the crossing of the zero axis into consideration.

The foregoing method is applicable to all systems of aerial and underground cable. Another typical curve is illustrated by an Exhibit for the same cable and reads from the Lansing to the Jackson Office.

In maintaining the Testboard Cable Records, it is very important that when additions to or changes in a toll cable are made, the records involved be corrected immediately and copies of the revised sections distributed.

The Exchange Pole Record is divided into two parts, the City Pole Record and the Rural Pole Record.

The City Pole Record is made up of two units, (1) the pole record description sheets and (2) the pole and terminal record sheets. The pole record description sheets are divided into many headings and columns for data pertaining to the location, size and history of poles. Of the six headings the City Record uses only three, the "Sheet Number", the "Exchange Name", and the "In Effect" date. Each city block in a town is assigned a number and is shown on the sheet bearing the same number in the heading of "Sheet Number". The name of the town or city is shown in the heading "Exchange Name". The date the sheets are drawn up is shown in the heading "In Effect".

Of the eleven columns pertaining to the location, size and history of poles, the City Record uses only eight, the ones for the "Pole Number", the "Location Diagram", the "Length and Class", the "Kind", the "Date Set", the "Lowered or Top Cut off", the "Removed", and the "Right-of-Way". In the column headed "Pole Number" is shown the numbers of the poles which are listed in "Location Diagram". In the second column is drawn a small square or rectangle to represent a particular block of the city. At the outside edge and through the center of this square are placed small circles representing poles. The number of each pole is placed on the inside of the square and next to the pole. The North-point is also placed in this column in the lower right-hand corner.

The next three columns, used by the City Record, are the "Length and Class", the "Kind", and the "Date Set". The first of these columns indicates the length of the pole in feet and the Class Letter (viz. circumference).

The second of these three columns, the "Kind", tells whether a pole is an Eastern Cedar, "EC", a Western Cedar, "WC", or a Creosoted Yellow Pine, "CP". Also, in this column is shown the butt treatment of the poles that are treated. "C" is for Perforation Treatment and "S" is for Brush or Spray Treatment. The third column is the "Date Set" column and shows the year in which the pole was placed in service. The next column used is the "Lowered or Top Cut Off". The year a pole is reset, the top, or the butt is cut off five or ten feet, is recorded in this column. The "Removed" column shows the year in which a pole was taken out of service. The "Right-of-Way" column carries the file number of the permit for placing poles, guys and anchors in private right-of-way.

These description sheets are bound in loose leaf binders. Each binder contains the sheets for a number of towns, in alphabetical order, in a particular Engineering District.

The second unit is the Pole and Terminal Record Sheets. These sheets are divided into six columns and have twenty-five lines on a sheet. In the first column is shown the year in which the Terminal was placed in the field. The second column lists the Poles and Terminals numerically from one up to as many as there are in the town. In this column is also shown the "C" Type Terminals (a new type terminal for which we are keeping a special record). These terminals are designated by a "C" being placed after the Terminal Number. In the third column appears the sheet number of the description sheets on which the Poles and Terminals appear. In case the Terminal is on a Foreign Company Pole an "F" takes the place of the sheet number, and if the Terminal is on a Block Cable or in a Building a "B" takes the place of the sheet number. A "T" takes the place of the sheet number when a Terminal is on a Toll Pole.

In the fourth column is shown the number of the Cable out of which the Terminal feeds and in case there is not a Terminal on the Pole, this space is left blank.

The fifth column is the Address column, in which the addresses of all Poles and Terminals are given, and if the Terminal is on a Toll Pole, the Toll Pole Number is also shown.

The sixth or last column shows the number of the Job Order or Estimate that placed the Poles or Terminals.

These Pole and Terminal Record sheets are bound in loose leaf binders, but of a different style than those used for the Description sheets, and each binder contains the towns in alphabetical order for a particular Engineering District.

These two units of City Pole Record are radically different and each has its separate functions, but still one unit depends upon the other to make the whole Pole or Terminal Record complete.

The Rural Pole Record is composed of four major units: the Pole Record sheet, the Individual Key Map, the Combined Key Map and the Index. Though each of these units has its own distinct feature, they are dependent on one another, and together form the Rural Pole Record.

The pole record sheet, which in reality is a detailed description and location sheet, is the most important unit of this combination. The junction or starting point, such as a cable terminal number, toll pole number, or city pole number, is given at the bottom of the first sheet of each lead. Above this is an outline of the road on which the lead appears, with its cross roads, drives, rivers and creeks. Then the poles with their guys, anchors and push-braces are spotted in their places with reference to these topographical features. This sheet is made to read from the bottom to the top, so that the data will appear in the same relative position on the record as it does on the ground, the sheet reading away from you as the poles appear in the field. Opposite the poles on the sketch are several columns devoted to history and description. Not all of these involve the rural pole record, as this form is made to fit all pole records. Length, class and kind columns are for the description of the pole, and the date set, lowered or cut off, and date removed columns pertain to the history. A right-of-way file number column is provided for recording cases of private right-of-way. The authority for placing, resetting or any other kind of work done is placed in the last column. This authority is generally represented by job orders, and estimates. Poles numbered in the field are numbered correspondingly on the record for reference.

The individual key map is made on tracing cloth. It pictures the leads with reference to lakes, rivers, roads, railroads or any other per-

manent topography. This map shows one or more main leads with all of its branches; often two or more associated key maps numbered consecutively, are necessary. The information which appears on these maps are the leads, their numbers, highway numbers, section numbers, townships and counties. A rural lead is represented by a heavy full line, toll lead by a heavy dashed line, and cable by a thin solid line. These key maps are then numbered for reference purposes in the upper left corner in the best numerical order possible.

The combined key map differs from the individual key map in that it gives a picture of the whole exchange. This feature enables one to locate a lead relative to the exchange or central office. The information given on this map is the same as on the individual map, with the exception of junctions and highway numbers. The original of this map is made on a cloth blue line county map and photostated on an 8½" x 11" print, so that it may be filed in the same binder with the remainder of the record.

The index is the key to the whole record and consists of a sheet divided into four columns. In the first, the lead numbers are listed in numerical order, in the second, junctions are given. The third column lists the individual key map numbers on which the lead appears. The last column locates the lead by section numbers and townships. This information is typed on 8½" x 11" sheets of vellum so that blue prints can be furnished the field forces.

Copies of the rural pole record when sent to the Departments that require them are bound in loose-leaf binders in the following order: the index, the combined key map, the individual key map and the pole record sheets. When key maps and indexes only are necessary, the record is furnished in red press board binders.

TOLL POLE RECORD

Section XII.

This record as the title implies, is one covering all major details pertaining to the classification and location of the various toll pole lines. It is composed of two sections, one at the top of the form giving miscellaneous data, and an itemized section with a column for each individual item relating to the pole shown on the same line.

The top section shows the Sheet Number, Name of Line, Number of Poles, Name of District, Location by City or Township and County, In Effect Date, and the Rewritten Date.

The sheets are numbered serially from one end of the line to the other, beginning with the end of the line first mentioned in the name for the same, but in the case of Aerial Toll Entrance Cables they are numbered from the office out to the Terminal pole.

The "Name of Line" is uniform throughout the organization and the line is usually named from South to North and East to West giving consideration to the importance of the Cities involved. The branch lines are named according to the town at which they terminate and are called "Spurs".

Usually the first and last pole number on the sheet is shown after "Poles".

As the organization is divided into Districts and named according to the City in which that District Office is located, the "Name of District" is shown to facilitate the distribution of the record.

The "Location" is given for the section of poles on each sheet by the name of City, Town or Township and the County.

After "In Effect" the date (Month and Year) is entered according to the time the record is being compiled.

After "Rewritten" the date for a rewritten sheet is entered according

to the time it is revised to indicate any changes in the pole line or errors found in the original record.

The "Itemized Section" is divided into vertical columns and also by horizontal lines. One line is used for each individual pole and its corresponding data as listed in the various columns. Reading from left to right these columns are headed as follows: Pole Number, Location (Poles, Stubs and Guys), Span, Length and Class, Kind, Date Set, Reinforces, Lowered or Top Cut Off, Removed, Joint Owner File No., and R/W (Right-of-Way) File No. There is also a $1\frac{1}{2}$ " margin at the extreme right of the sheet for binding purposes.

The pole numbers are shown in this first column as they appear in the field and the sheet is made to read from bottom to top, as one would be looking at the line in the field in the direction of the line or in which the numbers increase.

Under "Location", an inked drawing is made showing the road or street lines, and if the line is on private Right-of-Way, fence lines. The Poles are indicated by a small circle in their proper location. A Stub is a pole used in conjunction with a guy strand for the purpose of balancing a force or pull caused by a corner in the line of poles. These are used where a guy anchored in the ground near the pole might be an obstruction or otherwise objectionable. A push-brace is a pole used to hold a pole located on a corner in the line where the conditions do not permit the use of a stub or guy.

All Street, Road, Railroad, Creek and River Crossings have been shown to assist in the locating of sections of the pole line. The Township and County lines have also been shown as well as City Limits where they can readily be determined. Notes have been used at all Junction Points with

other lines or spurs to cross-reference the sheets so that they may be easily associated with one another.

All the symbols used on this record are covered by a standard symbol setup.

In the "Span" column the measurement is shown in feet from the center of one pole to the center of the next. The span or measurement appears opposite the pole to which it is taken in the direction of the numbering of the lead.

Under "Length and Class" the total length of the poles in feet and a letter designating the approximate circumference of the pole at the top and bottom is listed according to inventories and reports from the field forces. The designation "AAA" is the maximum classification and "G" the minimum classification with the intermediate letters designating the various sizes.

Under "Kind" an abbreviation has been used to indicate the kind of wood, such as EC for Eastern Cedar, WC for Western Cedar and CP for Creosoted Pine poles. The letter "O" is now being used before the EC and WC to indicate that the butt of the poles have been perforated and treated.

Under "Date Set" the year the pole is placed has been shown in all cases where it was possible to determine this by checking through the old files. However, the more recent dates are listed following the completion of the construction work.

"Reinforced" is a term used to refer to the placing of a short pole adjacent to another pole carrying the attachments. This is done when it would be almost impossible to replace the existing pole due to bad field conditions. It is very seldom that this type of construction is necessary. The date that the reinforcement was made is entered in this column.

Under "Lowered or Top Cut Off" the year in which the pole was lowered or the top cut off has been listed. The lowering of a pole is accomplished by pulling the butt out of the ground, sawing it off above the deterioration line and dropping the pole back into the same hole. This is done quite extensively where the deterioration at and below the ground line has reduced the strength of the pole to such an extent that it is below the necessary requirements. The top of the pole is very seldom cut off although there may be an occasional case where this is advisable.

Under "Removed" the date the old pole is removed is shown unless it is found necessary to rewrite the entire sheet.

Under "Joint Owner File No." the file number is listed for jointly owned poles where it can be determined. In addition to this the Companies involved and their respective percentages have been listed.

Under "R/W File No." the file number is shown for each section of poles placed on private right-of-way.

The Toll Pole Record was originally drawn in pencil, but was found to be undesirable for printing purposes and also one which would not stand up under much use. These records are now being checked in the field for accuracy; a new record typed with a heavy ribbon; and the diagram inked in. This makes a very neat and permanent record, and requires only approximately one-third the time to complete as compared with the old method.

The Toll Wire Records consist of two sections, the Wire History Record and the Wire Diagrams. The Wire History Record is compiled on letter size sheets and separate entries are made covering each additional wire circuit or wire replacement upon completion of the work. The Wire Diagram is a large drawing on which each circuit (2 wires) is designated by a single line and the cross-connection at all junction points shown.

The pin numbers, 1-2 and 3-4 for example, make up one group containing 2 physical circuits, one circuit on 1-2 and the other on 3-4. In order to create another circuit over these same wires, coils are placed at each end of these existing circuits and two theoretical wires are obtained, one corresponding to each of the physical circuits. This theoretical circuit is known as a "Phantom Circuit" and the various circuit groups must be transposed at certain points to reduce induction from electrical lines and cross-talk in the circuits to a minimum. The various systems of this transposing is fully explained under "Transposition Diagrams".

These pin numbers shown under the above records are numbered in the direction of the line, that is, facing the direction that the numbers of the poles on the line increase or toward the terminating office. This series of numbering starts on the top line and on the pin at the extreme left as No. 1, and number consecutively across this crossarm. The standard crossarm contains ten pins carrying ten wires which are numbered from one to ten inclusive. The second arm would then number from eleven to twenty with the remaining arms continuing in this order.

The Wire History Record form has the name of the line shown at the top and to the left with the pin numbers shown at the top and at the right. The sheet is then divided into columns with the data pertaining to the

Physical Circuits shown at the left and that for the Phantom Circuits shown at the right side of the sheet. Reading from left to right under Physical Circuits, the columns are headed as follows: Pins, Between Poles, Placed Single Wire Miles, Gauge and Kind, Date; and Removed Single Wire Miles, Gauge and Kind. Under Phantom Circuits reading from left to right the columns are headed, Pins, Between Poles, Date Phantomed, and Date Unphantomed. A column headed Remarks has been placed between the Physical Circuit group and the Phantom Circuit group for miscellaneous remarks pertaining to entries under either group.

In compiling this record, one sheet is used for each circuit and listed under the two pin numbers corresponding to the circuit. These pin numbers are shown at the top of the sheet and also in the column headed "Pins". In the column headed "Between Poles" pole numbers have been listed for a section limited by the date of placing or removing and gauge of wire. Under "Placed, Single Wire Miles" the total amount of wire in the particular section is shown by miles carried to the nearest hundredths of the mile. This is obtained by multiplying the lineal measurement in this section by two, which gives the amount of wire for one circuit or on the two pins. Under "Placed, Gauge and Kind" the gauge of wire is listed for a section according to the New Britain Standard Wire Gauge. Under "Date" either the date of placing or removing is shown opposite the entry under either of these headings. Under "Removed, Gauge and Kind" the gauge of wire is shown covering the wire removed. However, we have eliminated any designations showing the kind of wire as the gauge of copper and iron wire are not the same so that the gauge indicates the kind of wire.

In the Phantom Circuit group under "Pins" the first pin number and the last pin number of the wires involved in the Phantom Circuit have been

shown. Under "Between Poles" the pole numbers for a given section corresponding to the Physical Circuit section have been shown for Phantom Circuits. Under "Date Phantomed" the date has been shown in all cases where it could be determined. Under "Date Unphantomed" the date is shown on which the Phantom Circuit has been eliminated. The abbreviation "Unk" is given for dates unknown.

Under "Remarks" the job order or estimate number authorizing the work effecting the record has been listed as well as the bill of sale file number selling and consequently removing wire from our plant.

This record has been devised to show all current changes and additions in the toll wire plant as well as the amount placed or removed during any given number of years.

"Wire Diagrams" have been designed to show all toll circuits in service or available for service. These diagrams are posted to show all additions or changes as soon as the Estimate or Job Order authorizing the work has been approved.

Each physical circuit is shown by a single line and the pin numbers for the wires composing the circuit indicated in the line. The gauge of wire is also indicated after the pin numbers.

A rectangle is used to indicate the junction poles where the toll circuits branch off and also the office pole at each end of the line. At the various junctions the circuits branching off at the junction poles are each arrowed to two numbers indicating the pin positions taken by the circuits on the branch or spur line. The circuits on the spur are designated in a similar manner to those on the main line.

The Phantom Circuits are indicated by crosses between the lines representing the Physical circuits from which the Phantom is obtained.

At each end of the Phantom group this cross is enclosed within a square to represent the coils and their locations. The Phantom Groups are located on pins 1 to 4 and 7 to 10 on the top crossarm and on pins 11 to 14 and 17 to 20 on the second crossarm and continue in this order on the remaining crossarms. However, where there are two or four arms carrying wire, additional groups are obtained by transposing the circuits on pins 5 and 6 on the top or first arm with the one on pins 15 and 16 on the second arm, also by transposing the circuits on pins 25-26 and 35-36 in a like manner.

The Circuit Designation is a name applied to each physical or phantom circuit in service. Those not in service are shown as spare. In naming the circuits an abbreviation is used for the names of the terminating towns and a numeral is added after the designation in all cases where there is more than one circuit between two points.

The small numbers shown below the diagram refer to the pole numbers at the points where any exchange circuits either leave the toll line or are terminated. The exchange circuits as well as these pole numbers have been shown as an aid to the Engineer in wire rearrangements involving the exchange circuits.

As the transposition sections are governed primarily by the distances between junction points, the "S" points or the dividing point between the various transposition sections have been indicated below the diagram with the pole number shown at which these "S" points occur. The type or system of transposing is also shown between the "S" points as well as the distance from one to another. The distance is a lineal measurement and is shown in miles, carried to the nearest hundredths of a mile. The distance between the various junction points are also shown on the Wire Diagrams.

This record is used by the General Transposition Engineer and the Division Toll Lines Engineers in assigning or rearranging toll circuits.

The standard systems of transposing now in use are the "E", "L" and "R" and are used in the transposing or in retransposing of all new sections. On some of the older lines there still exist obsolete types of transpositions which must be encountered in the stringing of additional circuits. These are the "A", "Z", "Y" and "X" systems. However, these obsolete systems do not give as efficient results as the new systems.

The obsolete "A" section corresponds to the "E" section, the obsolete "Z" and "Y" sections correspond to the "L" section, while the obsolete "X" section corresponds to the "R" section. The "E" section is used where the length of the wire to be transposed is 8320 feet to 20,800 feet, or 20,800 feet to 42,430 feet. The "L" section is used where the length is 4160 feet to 8320 feet, or 8320 feet to 20,800 feet, depending upon circuits being either phantom transposed or non-phantom transposed. The "R" section is used where the wire length is 800 feet to 2640 feet and is generally used at the terminating ends of the lines or near junction points where any future rearrangements are contemplated.

In order to describe the Transposition Diagram the standard "E" section on the Grand Rapids-Belding open wire line has been shown by an Exhibit. On this Exhibit numbers reading across the top of the sheet from #33 to #383 are the pole numbers at each end of this transposition section. Intermediate numbers are the pole numbers at each transposition point indicated as "E-2", "E-4", "E-6", and so on up to "E-S". The numbers shown to the left of the diagram are the pin numbers on which the wire composing the circuits has been placed. The cross-over at E-2 and opposite pins #1 and #2 indicates that the wire on pin #1 takes pin #2 and the wire on pin #2 takes pin #1, completing a physical transposition.

At "E-4" a phantom transposition is shown with the wire on pin #1 taking pin #3, the wire on pin #2 taking pin #4, the wire on pin #3 taking pin #2 and the wire on pin #4 taking pin #1. This completes the transposing of the circuit group on pins #1 to #4 at this point. The small numeral 3 has been shown at this point to indicate the type of phantom transposition. There are four different types of phantom transpositions used, numbering from one to four. These have been clearly indicated at the various transposition points.

The numbers across the diagram shown above pin #37 are the interval measurements from one transposition point to the next. This is an aid to the Toll Testman in locating and clearing trouble on the open wire lines.

The data at the bottom of the sheet shows the direction of the line and the direction in which it is transposed; also, the transposition system, drawing number, section length in feet and in miles and the average spacing of the transposition sections, that is, from E-2 to E-4 and E-4 to E-6. The date that the drawing is made is also shown. The name of the line, in this case "Grand Rapids-Belding", is shown at the bottom of the sheet with a section pertaining to the portion of the line from one junction point to the next, with the pole numbers (#33 to #363) indicating the "S" poles at each end of the transposition section.

These Transposition Diagrams are used primarily by the Construction Forces in transposing additional wire and also by the Toll Testman in clearing trouble.

There are two separate maps indicating the route of the toll lines which have been devised to meet the necessary requirements, of the engineering, construction and maintenance departments. They are the Individual Toll Route Map and District Storm Route Map.

The "Individual Toll Route Map" has been limited to a drawing 11" high by 34" long with a $1\frac{1}{2}$ " margin at the left side for binding. This is a very convenient size for general use although the longer toll lines may require three or four drawings.

In drawing these maps, a county map with the scale of 1" equal to a mile is used and a complete portion is traced approximately four or five sections or miles from the road on which the toll line is located. This will then show all roads, section lines, section numbers, railway lines, towns, townships, rivers, etc. However, the convention for open wire lines and cable lines differ respectively for the roads and section lines. A double line represents the road and a single line the section line on the cable route maps, while a single line represents the road and a dashed line the section line on open wire route maps. The paved and graveled roads have been indicated on the route maps showing cable lines so that the forces engaged in clearing cable trouble may use the best roads in reaching the cable.

A heavy line is used to indicate the open wire or aerial cable route and a dashed line to indicate underground cable. The pole numbers are shown at all road crossings and at any point where the pole line crosses from one side of the road to the other. A small filled-in circle is used to indicate all loading points on the cable lines.

This makes a very suitable route map and as it is corrected in

connection with our Toll Pole Records following the completion of the construction work, it is one which is very dependable and gives a true picture of the line for which it is drawn.

The "District Storm Route Map" is one which covers a group of toll lines within the District Limits and is used in connection with the locating of sections effected by sleet and wind storms. This map gives a general conception of the connection between the toll lines in a given district. However, this map is nothing more than a schematic drawing representing the general route of the toll lines and the connecting or terminating Villages or Cities. The pole number is shown at each consecutive hundredth pole and also at the District Boundary and at the various towns involved. The cable lines are differentiated from the open wire lines by showing them heavy and light respectively.

These District Maps are revised each year to show any changes in the existing lines or any additional lines constructed within the past year.

CHAPTER III.

The general steps in preparing most of the outside plant records in this discussion are briefly as follows:

Our first sources of information are city, county and road maps, an up-to-date file of which is maintained in the Record Department. From these can be taken the general layout of the territory in which the plant appears for which it is desired to make the record. We do on occasion also use the fire maps maintained by the Fire Insurance Companies from which we can secure the building layout of the different city blocks in connection with our Block and Building Cable Record. Our city and county maps are the accumulation of several years effort in securing such data. Tracings of all city and county maps have been prepared and are now being maintained as an adjunct to the record job. The city maps are generally on the scale of 1" - 300' and 1" - 600', and the county maps are generally on the scale of 1" - 1 Mile. Prints from these map tracings can be run off at any time for use in the office and in the field, and have proved very valuable to the several departments of the company.

From these maps our draftsmen make what we call the Layout Plates, which is an enlargement of this map to scale by means of proportional dividers to the different records, such as the Assignment Record, the Aerial Cable Record and the Block and Building Record. No attempt is made on the City, Rural and Toll Pole Records to maintain any correct scale, nor are the Underground Conduit, Underground Cable, Wire and Schematic Records confined to any particular scale except occasionally as a means of maintaining the proper spacing of the data on the record, such as the case of the spacing of the terminals on aerial cable runs on the Schematics.

Our indifference to the scale on drawings is often difficult for new

draftsmen to understand, but in this connection it should be borne in mind that our records are not maps or geographical plates, but are records of telephone plant and the geographical data shown on these records is for location reference only, and it is therefore unnecessary to maintain an accurate scale, except where it materially effects the location aspect of the record. On most all of our records it will be seen that the widths of the streets and roads are very distorted with relation to the size of the city blocks, pole spacing, etc. The reason for this is that most of the telephone plant is located along the streets or roads, and additional space is needed therein in which to show this data. On some of the record plates where we have a scaled layout, it has been found very advantageous to have a so-called $\frac{1}{2}$ " lap border which is repeated on the adjacent plates for cross reference, and aids materially in referring from the detail on the edge of one plate to the line detail on the next adjacent plate. Adjacent plate numbers are shown on the four borders of the plate, and where there are enough plates to make it desirable, a key map is furnished, which is a small scale map of the territory showing the location and numbers of the different plates.

When this layout job is completed, Blue Line Prints of these plates are made for the use of the field forces in securing the record data which is to appear thereon. It has been our experience that the added cost of the Blue Line Prints is overcome many times in savings, due to the legibility of the data which the fieldmen return on these prints.

As indicated above the record fieldmen take these prints into the field and indicate thereon the location and other data regarding the plant for which we are making the record. We have set up standard systems and symbols for showing all the different types and kinds of plant, what data

should and should not be shown, all of which will be discussed to a greater extent later in the section covering the training of these fieldmen for these different jobs, as this step in preparing the record, in our estimation, is the most important of the many record jobs. When these field sheets are returned to the office the field data thereon is transcribed to the layout tracings by the draftsmen who are familiar with the methods for indicating this kind of plant on their particular record. The final step in preparing the record is a complete 100% check of all the data shown, by one of the first line supervisors in the department who is capable of picking out any omission or discrepancies which may have crept into the record during its preparation.

Prints of the record are then made and distributed to all departments and field forces for whose use the record was prepared. These prints are generally cloth blue line, as they are more durable and the record is generally of a more or less permanent nature.

CHAPTER IV.

This chapter deals with the many aspects of maintaining the different records described throughout this thesis, and is roughly divided into two parts, that of the office or drafting job and the other the field or outside job.

Preliminary to a discussion of the maintaining of our records it will be well to spend a little time on the routine which makes information regarding plant construction activity available to the record department. This is what is known as the estimate and job order routine and provides for the issuing of job orders and estimates by the engineers who plan their layout, and covers the scope of approval for these orders and their methods of handling and distribution. We also have what are known as routine orders or work orders which provide for minor items of work that will not in any way change any of the plant records. This work order is the most elementary unit in the routine. The next unit is the job order on which work that will affect the records may be done, but the limit of the expense involved on job orders is \$3500.00, beyond this are the estimates.

Work orders during their course throughout the company organization do not pass through the record department, as this is unnecessary. All the other types of orders do, however, so that this department may be fully informed of all plant construction activity. Copies of all estimates and job orders upon approval are forwarded to the record department that we may be informed at all times of all the construction activity and govern our record making job accordingly. Upon the completion of these job orders and estimates, the construction forces who did the work, make up what is known as a completed print, showing with colored pencil on a copy of the plans just what work was done, with all the data necessary to correct the

records. These completed prints are forwarded to the record department, and are the means in this office of maintaining all of the different plant records.

The record department forces have been organized according to the different record jobs in the department, so that we have one supervisory employee in charge of each of the records, and as many draftsmen under him as are necessary to perform the work of maintaining his record. We have made it the responsibility of each one of these record supervisors to keep his record up-to-date and accurate. We have made each one of the supervisors feel that his record is his own responsibility and have found with this system that the results are very satisfactory, as each supervisor in this way takes a personal pride in his own job and has a certain feeling of ownership and direct responsibility to the rest of the company organization, as regards his record. All questions regarding any of the records, all the maintenance work on the records and the furnishing of the records to the field forces for their use is part of the job of these supervisors. In some cases it is only necessary that we have the supervisor to maintain the record, while in other cases it has been found necessary to have several draftsmen under him, and it is also the responsibility of these supervisors to train these workmen.

We also have general supervisors who have charge of the different groups of record, such as the exchange record supervisor, toll record supervisor and the mortality study supervisor, and over all we have the supervisor of records for the division. These general supervisors' responsibility is to coordinate and oversee the individual jobs and keep a check on their performance. We also have a clerical position which takes care of the maintaining of the files on preliminary and completed construction

prints under all the estimates and job orders that are issued for all of the exchanges, the date of their receipt in this office, the date they are posted to the different records, and their final filing, and also the mailing of the records to the field.

In connection with the furnishing of corrected records to the field, we have found that the use of a blueprint machine of our own under the charge of the supervisor of records, has materially aided in the dispatch with which these corrections are forwarded to the forces who need them to perform their work, and we have also made a material saving in the printing expense which is no small item with the extensive record work of today.

The other part of the task of maintaining the records is the field job of securing the data for the original records all of which for this company is now complete. But for a company organizing and building up a record department and all of the different plant records, this is a sizeable task. The first problem to be dealt with is the organization and size of the field crews with which the data is secured. It has been found most advantageous in the case of any work, which does not require measurements, to have the crews organized in four man groups with one supervisor who has a car with which he can distribute the men in the field and carry them from one part of the job to another, in the meantime covering in the field for checking purposes the work of the four fieldmen. In some cases where the work is difficult or the men are new and yet unseasoned two or three men is all one supervisor can handle.

It is also desirable in this connection to have the crews allocated to certain territories, thus making a saving in traveling expenses, as this must be borne by the company for the crews going from town to town and not located in one city long enough to establish a residence. Also,

having the crews allocated gives the added advantage of the crews being familiar with the territory and the plant therein. Any additional data which must be secured in connection with the making up and revision of the records can be taken care of by these crews. It is also found necessary at times to check the completion reports furnished by the construction forces.

We feel that these crews should furnish all the data in connection with construction activity for correcting the records, rather than for the construction man who is not an engineer or a record man, to furnish this data. We have not been able as yet to try out this plan of organization, but it is felt that such a system should be tried, as it has considerable merit and should eliminate many of the difficulties now encountered under the present system of having the construction man furnish all such data.

The training of these field crews is a very sizeable task, and they must be conversant with our engineering principles and details, and also construction methods. They also must be able to identify the different types and kinds of plant, their size, etc., most of which must be gained by actual field experience. When it has been found necessary to make material increases in the field force for some special record job, it has been found desirable to give these men group instruction in the office on the general outlay of the task and then for the crew supervisors to carry on this instruction, in detail, in the field under actual conditions, giving each man very close supervision. The better the field crews are trained the easier the record task in the office will be, as complete and accurate field data makes the drafting job of the final record comparatively easy, while an incomplete or in the least inaccurate field job makes the task of drawing the final record well nigh impossible, and generally in-

involves a field check of at least part of the record before the data is reliable, which, of course, is very costly. It will be seen from such a program that by the time an employee has become an efficient and reliable record man he will be able to assume many of the elementary responsibilities of an engineer's job and the record department has been in the past a fertile field for such men. This in turn reverts back to the necessary training program to take care of new men to replace these advancements, as well as, the training of the men to assume those engineering responsibilities. No place in the company is there more training required, and this has been one of our major tasks aside from the job of merely making record pictures.

CHAPTER V.

PLANT MORTALITY STUDY

Mortality Studies were conceived as a means of determining the life of each unit of outside plant and as an aid to the company in fixing the amount to be set aside each year for the depreciation of this plant. The units of plant covered by the Mortality Studies include terminals, cables, cable loading equipment, poles, toll wire, underground conduit and manholes. The Mortality Study has been divided into two major divisions: The Original Mortality Study and the Continuing Mortality Study.

1. ORIGINAL STUDY

The Original Mortality Study covered the history of the plant from the earliest known period up to and including December 31st, 1923, and was necessary in order to obtain the birth dates for plant in service, as from this data the Chief Engineer began the study of the life of the Plant Units involved, and it also furnished the necessary birth dates for the Continuing Mortality Study Reports.

All classes of plant were not studied for there was a question as to the value of the information which could be obtained. Exchange and toll poles, exchange cable and toll aerial wire were covered. The entire toll plant was covered, but only certain typical exchanges were chosen for the exchange plant study. The information for this study was obtained from various sources, such as job order, estimate and field reports, and other written documents filed in the archives of the company. Field surveys also helped in some cases to determine the age and the types of plant, but this source of information was used only as a last resort.

Upon completion of this study and the posting of these birth dates to the Plant Engineering Records, the Continuing Mortality Study Routine took effect.

2. CONTINUING STUDY

Beginning January 1st, 1929 all poles, cable, and wire, both exchange and toll, either placed or removed were reported to the Plant Accountant on Continuing Mortality Forms.

These Reports furnish the Plant Accountant with a day by day report of all Plant placed or removed on the Plant Engineering Records. Previous to this study the only check the Plant Accountant had on materials dispersed or recovered was through an itemized statement made to him by the Construction Department after the completion of each job. With the advent of the Continuing Mortality Study the Plant Accountant was able to check the Engineering reports against the disbursement and recovery material tickets of the Construction forces and thus determine whether the Plant Engineer was receiving the same information for his records as that received for the Plant Unit Record. The information for these reports is obtained from completed and corrected prints of Orders and Estimates furnished by the Construction forces upon completion of the job. All plant shown removed on the order or estimate is checked against the Engineering records for differences in measurements and classification. If such are found they are noted on the Continuing Mortality Reports, thus giving the Plant Accountant the complete picture, and the dates for plant removed are also obtained from the records at the same time. The Continuing Mortality Reports of all plant retired show the date the plant was retired and, whenever available, the date at which that particular unit of plant was placed in service, thus

giving the life of the unit of plant. The report also shows the number of units retired and the type of unit, together with the accounting code to which it is charged. This form also shows any plant retired from service through sale to some other company or transfers from toll to exchange accounts, or vice versa. All additions to plant shown on the print are accepted as a rule without question. The Plant Addition Reports show the class of plant added, the year added, the number of units, and the code to which the addition is charged. This form also shows the addition of any plant purchased from a foreign company and wherever possible the year the plant was placed in service by that company.

If any disagreement is found between the Construction Report and the Plant Engineering Continuing Mortality Report, by the Plant Accountant, the report is returned with the differences noted. An adjustment is then made either by the Construction Department or the Engineering Records Department, whichever one is found in error, and the corrected report is returned to the Plant Accountant.

A constant check is maintained on all orders and estimates issued by the Engineering Department from Monthly Progress Reports. Thirty days after an order or estimate is completed, if the completed and corrected prints have not been received by the Engineering Department, a letter is written to the Construction Department notifying them of their failure to forward such prints.

At the end of each year there are certain jobs which are carried over from one year to the next. In the case of these jobs, two reports are necessary, one showing the work completed up to and including the last day of the year, and the other showing the work completed the following year. The reports, however, are not made until the completed and corrected prints

of the entire job are received by the Engineering Records Department.

Beginning the year 1930, the company finding the study of more and more value, added the following units of plant to be reported, exchange and toll underground conduit and manholes, cable terminals, loading coils and equipment.

3. RECONCILIATION

It was found necessary at the end of the year 1929 to reconcile the plant engineering records with the Plant Accountant's unit records, so that for the first time in the history of the company there would be a complete balance between the two records.

In the reconciliation, all the plant shown in service by the plant engineering records was summarized by units of plant and by Exchanges, in case of exchange plant, and by Divisions in case of toll plant. Field checks were made of all doubtful records so that as complete a story as was possible could be given the Plant Accountant. The Plant Accountant was also reconciling the units of plant shown on his books - the two reports to be compared and the differences adjusted, either through a field check or through the acceptance of the plant engineering summary by the plant accountant.

Future additions to or retirements from this reconciliation, if found necessary, will be taken care of by the engineering department through reconciliation adjustment reports. All current additions and retirements from plant will be taken care of by the continuing mortality study reports so that the records of the two departments will always be in balance in the future.

CHAPTER VI.

To protect the investment already made in drawing up and maintaining the record tracings, no small effort has been made to perfect a filing system adequate for the purpose.

Such a system must be, to a certain degree, permanent, and at the same time flexible enough to allow for the minor revisions and additions in connection with the normal changes in the record. The tracings must be filed in such a manner as to preserve them physically as much as possible, to prevent wrinkles, curling of the edges, and to protect them from dirt and dust.

These tracings used to be filed loosely in the flat drawers of filing cabinets, but this practice was soon found to be far from satisfactory. In continually going through the drawers to find one or two particular plates for current correction, the remaining plates were, in a sense, abused, being pushed about, pulled out of shape and wrinkled.

This unsatisfactory condition has been remedied through the use of binding books. These pressboard binders are covered with gray canvas, reinforced black leather corners, and are equipped with non-protruding sectional end post hinges.

The Schematics, Combined Records, Assignments, Aerial Cable, Underground Cable and Conduit record tracings are all filed separately in books of special dimensions to accommodate the sizes of the various records.

In filing these individual records, they are first separated into the four districts, and arranged alphabetically by the exchanges within

the districts themselves, thus limiting the search for a particular plate to one book. The records themselves, as previously explained, being made up of units small enough to allow for many minor corrections without re-drawing or removal from the books. If it is found necessary to remove the plate from the book, this can easily be accomplished with the use of a key which detaches the cover. The pole record sheets are likewise bound by districts and exchanges.

To further protect the records from fire and like dangers, three large fire-proof safes have been provided to care for all records other than pole records. The pole record books being of much smaller dimensions than the other books cannot be economically filed in the larger safes. Two small, fire-proof, four-drawer filing cabinets accommodate these books. The large safes are equipped with roller shelves of about eight to a safe, which greatly facilitate the movement of books on these shelves.

An effort has also been made to group the various types of records to separate safes, for instance: all schematic and combined record books are assigned to safe number one, the assignment and conduit books are assigned to safe number two, the aerial cable, underground cable, block and building, and toll cable record books are assigned to safe number three.

In addition to the eight or nine roller shelves, the safes are equipped with three large drawers each, in which are kept all temporary records or records in the process of tracing.

INDEX TO EXHIBITS

<u>SUBJECT</u>	<u>PAGES</u>
Estimate Details	1 - 17
Job Orders	
City	18
Rural	19
Toll	20
Keep Cost	21
Mortality Study Reports	
Additions	22
Retirements	23
Plant Symbols	24 - 29
Records	
City Poles	30 & 31 *
Rural Poles	32 - 38 *
Toll Poles	39 & 40 *
Aerial Cable	41
Underground Cable	42
Schematic	43
Block and Building Cable	44
Toll Cable	45
Toll Entrance Cable	46
Toll Testboard Cable	47 - 53
Conduit	54 - 57
Assignment Map	58
Combined (Small Town)	59
Toll Wire History	60
Toll Wire Diagram	61
Toll Wire Transpositions	62
Toll Cable Route Map	63
Toll Wire Route Map	64
Toll Route Storm Map	65
Organization Chart	66

* These Exhibits are bound on the right hand side of the sheet as they appear this way in the regular Record Books.

(NAME OF COMPANY)

AUTHORIZATION, ESTIMATE No. _____

TITLE _____

DATE _____

192

DIV. _____

STATE _____

FIXED CAPITAL ACCOUNTS:

GROSS ADDITIONS \$	PLANT DISPLACED \$	NET ADDITIONS \$
--------------------	--------------------	------------------

RESERVES:

REMOVING \$	PLANT DISPLACED \$	SALVAGE \$	NET \$
EX. REPAIRS \$		SALVAGE \$	NET \$
			NET TO RESERVES \$

WIRING GAIN & LOSS:	WIRING LOSS \$	WIRING GAIN \$	NET \$
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GROSS EXPENDITURE \$	SALVAGE & WIRING GAIN \$	NET REQUIREMENT \$
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MAINTENANCE: (TO BE EXPENDED IN ADDITION TO THE ABOVE)

GROSS \$	SALVAGE \$	NET \$
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WORK TO BE STARTED ABOUT

192 AND COMPLETED ABOUT

192

NATURE AND NECESSITY OF WORK:

PRINTED IN U. S. A.

APPROVED:

DATE

APPROVED:

DATE

EXECUTIVE COMMITTEE BY:

SECRETARY

THE UNIVERSITY OF CHICAGO

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**CHARGE { CLEARED MONTHLY
CONSTRUCTION WORK IN PROGRESS**

ACCOUNTS	GROSS ADDITIONS (a)	NET ADDITIONS (b)=(a-c)	* PLANT DISPLACED (c)	* SALVAGE (d)	* COST OF REMOVING (e)	EXTRAORDINARY REPAIRS	
						Ø GROSS (f)	Ø SALVAGE (g)

Ø NOT INCLUDING TRANSFERS FROM EXTRAORDINARY REPAIRS (CAPITAL AND RESERVE ADJUSTMENTS.)

DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT

FIELD CODE

DETAIL OF MATERIAL		QTY.	PRICE	AMOUNT
TOTAL MATERIAL..... SUPPLY EXPENSE.....% OF MATERIAL				
LABOR—NATURE OF WORK	CLASS OF LABOR	HOURS	PRICE	AMOUNT
TOTAL LABOR..... *OVERHEAD EXPENSE.....% OF LABOR..... OTHER EXPENDITURES.....				
*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES				
4 TOTAL ESTIMATED COST				

Journal of Management Studies, 39(6), 708–724.

1993-1994

2. *Phragmites* (common)

0-123456789

• • • • •

2000 40 34 100 5 100

[illegible]

... ..

1. *Journal of the American Medical Association*, 1997; 277: 1039-1043.

• **What is the purpose of the study?** The purpose of the study is to determine the effect of the use of a mobile phone on the performance of a simulated driving task.

Figure 1. The effect of the concentration of the solution on the adsorption of the dye. The concentration of the solution was 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 7.0, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 8.0, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 10.0, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9, 11.0, 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9, 12.0, 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 13.0, 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 13.9, 14.0, 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, 14.9, 15.0, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.9, 16.0, 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9, 17.0, 17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 17.9, 18.0, 18.1, 18.2, 18.3, 18.4, 18.5, 18.6, 18.7, 18.8, 18.9, 19.0, 19.1, 19.2, 19.3, 19.4, 19.5, 19.6, 19.7, 19.8, 19.9, 20.0, 20.1, 20.2, 20.3, 20.4, 20.5, 20.6, 20.7, 20.8, 20.9, 21.0, 21.1, 21.2, 21.3, 21.4, 21.5, 21.6, 21.7, 21.8, 21.9, 22.0, 22.1, 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9, 23.0, 23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 24.0, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24.8, 24.9, 25.0, 25.1, 25.2, 25.3, 25.4, 25.5, 25.6, 25.7, 25.8, 25.9, 26.0, 26.1, 26.2, 26.3, 26.4, 26.5, 26.6, 26.7, 26.8, 26.9, 27.0, 27.1, 27.2, 27.3, 27.4, 27.5, 27.6, 27.7, 27.8, 27.9, 28.0, 28.1, 28.2, 28.3, 28.4, 28.5, 28.6, 28.7, 28.8, 28.9, 29.0, 29.1, 29.2, 29.3, 29.4, 29.5, 29.6, 29.7, 29.8, 29.9, 30.0, 30.1, 30.2, 30.3, 30.4, 30.5, 30.6, 30.7, 30.8, 30.9, 31.0, 31.1, 31.2, 31.3, 31.4, 31.5, 31.6, 31.7, 31.8, 31.9, 32.0, 32.1, 32.2, 32.3, 32.4, 32.5, 32.6, 32.7, 32.8, 32.9, 33.0, 33.1, 33.2, 33.3, 33.4, 33.5, 33.6, 33.7, 33.8, 33.9, 34.0, 34.1, 34.2, 34.3, 34.4, 34.5, 34.6, 34.7, 34.8, 34.9, 35.0, 35.1, 35.2, 35.3, 35.4, 35.5, 35.6, 35.7, 35.8, 35.9, 36.0, 36.1, 36.2, 36.3, 36.4, 36.5, 36.6, 36.7, 36.8, 36.9, 37.0, 37.1, 37.2, 37.3, 37.4, 37.5, 37.6, 37.7, 37.8, 37.9, 38.0, 38.1, 38.2, 38.3, 38.4, 38.5, 38.6, 38.7, 38.8, 38.9, 39.0, 39.1, 39.2, 39.3, 39.4, 39.5, 39.6, 39.7, 39.8, 39.9, 40.0, 40.1, 40.2, 40.3, 40.4, 40.5, 40.6, 40.7, 40.8, 40.9, 41.0, 41.1, 41.2, 41.3, 41.4, 41.5, 41.6, 41.7, 41.8, 41.9, 42.0, 42.1, 42.2, 42.3, 42.4, 42.5, 42.6, 42.7, 42.8, 42.9, 43.0, 43.1, 43.2, 43.3, 43.4, 43.5, 43.6, 43.7, 43.8, 43.9, 44.0, 44.1, 44.2, 44.3, 44.4, 44.5, 44.6, 44.7, 44.8, 44.9, 45.0, 45.1, 45.2, 45.3, 45.4, 45.5, 45.6, 45.7, 45.8, 45.9, 46.0, 46.1, 46.2, 46.3, 46.4, 46.5, 46.6, 46.7, 46.8, 46.9, 47.0, 47.1, 47.2, 47.3, 47.4, 47.5, 47.6, 47.7, 47.8, 47.9, 48.0, 48.1, 48.2, 48.3, 48.4, 48.5, 48.6, 48.7, 48.8, 48.9, 49.0, 49.1, 49.2, 49.3, 49.4, 49.5, 49.6, 49.7, 49.8, 49.9, 50.0, 50.1, 50.2, 50.3, 50.4, 50.5, 50.6, 50.7, 50.8, 50.9, 51.0, 51.1, 51.2, 51.3, 51.4, 51.5, 51.6, 51.7, 51.8, 51.9, 52.0, 52.1, 52.2, 52.3, 52.4, 52.5, 52.6, 52.7, 52.8, 52.9, 53.0, 53.1, 53.2, 53.3, 53.4, 53.5, 53.6, 53.7, 53.8, 53.9, 54.0, 54.1, 54.2, 54.3, 54.4, 54.5, 54.6, 54.7, 54.8, 54.9, 55.0, 55.1, 55.2, 55.3, 55.4, 55.5, 55.6, 55.7, 55.8, 55.9, 56.0, 56.1, 56.2, 56.3, 56.4, 56.5, 56.6, 56.7, 56.8, 56.9, 57.0, 57.1, 57.2, 57.3, 57.4, 57.5, 57.6, 57.7, 57.8, 57.9, 58.0, 58.1, 58.2, 58.3, 58.4, 58.5, 58.6, 58.7, 58.8, 58.9, 59.0, 59.1, 59.2, 59.3, 59.4, 59.5, 59.6, 59.7, 59.8, 59.9, 60.0, 60.1, 60.2, 60.3, 60.4, 60.5, 60.6, 60.7, 60.8, 60.9, 61.0, 61.1, 61.2, 61.3, 61.4, 61.5, 61.6, 61.7, 61.8, 61.9, 62.0, 62.1, 62.2, 62.3, 62.4, 62.5, 62.6, 62.7, 62.8, 62.9, 63.0, 63.1, 63.2, 63.3, 63.4, 63.5, 63.6, 63.7, 63.8, 63.9, 64.0, 64.1, 64.2, 64.3, 64.4, 64.5, 64.6, 64.7, 64.8, 64.9, 65.0, 65.1, 65.2, 65.3, 65.4, 65.5, 65.6, 65.7, 65.8, 65.9, 66.0, 66.1, 66.2, 66.3, 66.4, 66.5, 66.6, 66.7, 66.8, 66.9, 67.0, 67.1, 67.2, 67.3, 67.4, 67.5, 67.6, 67.7, 67.8, 67.9, 68.0, 68.1, 68.2, 68.3, 68.4, 68.5, 68.6, 68.7, 68.8, 68.9, 69.0, 69.1, 69.2, 69.3, 69

DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT

FIELD CODE

DETAIL OF MATERIAL		QTY.	PRICE	AMOUNT
TOTAL MATERIAL..... SUPPLY EXPENSE.....% OF MATERIAL				
LABOR—NATURE OF WORK	CLASS OF LABOR	HOURS	PRICE	AMOUNT
TOTAL LABOR..... *OVERHEAD EXPENSE.....% OF LABOR..... OTHER EXPENDITURES.....				
*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES				
5				TOTAL ESTIMATED COST

DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT

FIELD CODE

DETAIL OF MATERIAL		QTY.	PRICE	AMOUNT
TOTAL MATERIAL..... SUPPLY EXPENSE.....% OF MATERIAL				
LABOR—NATURE OF WORK	CLASS OF LABOR	HOURS	PRICE	AMOUNT
TOTAL LABOR..... *OVERHEAD EXPENSE.....% OF LABOR..... OTHER EXPENDITURES.....				
*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES				

DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT

FIELD CODE

DETAIL OF MATERIAL		QTY.	PRICE	AMOUNT
TOTAL MATERIAL SUPPLY EXPENSE 6 % OF MATERIAL				
LABOR—NATURE OF WORK	CLASS OF LABOR	HOURS	PRICE	AMOUNT
TOTAL LABOR *OVERHEAD EXPENSE % OF LABOR OTHER EXPENDITURES				
*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES				
7				TOTAL ESTIMATED COST 73.00

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785. 1000

DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT _____

FIELD CODE _____

DETAIL OF MATERIAL

QTY.

PRICE

AMOUNT

TOTAL MATERIAL.....

SUPPLY EXPENSE.....% OF MATERIAL

LABOR—NATURE OF WORK

CLASS OF
LABOR

HOURS

PRICE

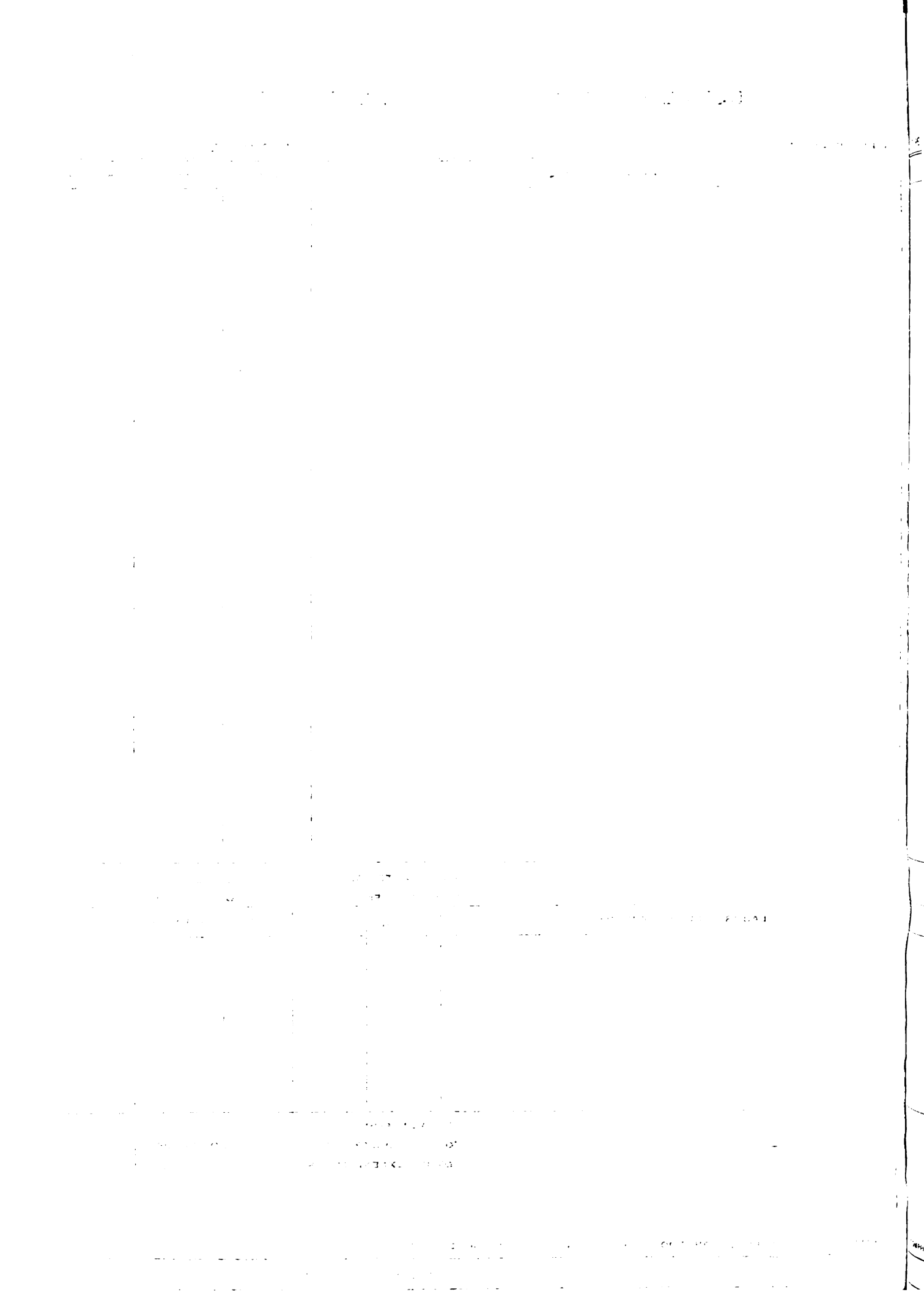
AMOUNT

TOTAL LABOR.....

*OVERHEAD EXPENSE.....% OF LABOR

OTHER EXPENDITURES.....

*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES



DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT

FIELD CODE

DETAIL OF MATERIAL		QTY.	PRICE	AMOUNT
TOTAL MATERIAL..... SUPPLY EXPENSE% OF MATERIAL				
LABOR—NATURE OF WORK	CLASS OF LABOR	HOURS	PRICE	AMOUNT
TOTAL LABOR..... *OVERHEAD EXPENSE% OF LABOR OTHER EXPENDITURES.....				
*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES 9 TOTAL ESTIMATED COST				

Journal of Management Education 30(6)p.789-804

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1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 84

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1. *Journal of the American Medical Association*, 1997; 277: 1033-1036.

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J. J. G. J.

3.9. $\text{H}_2\text{O} + \text{C}_2\text{H}_5\text{OH} + \text{H}_2\text{O}^+$

ARTICLE 1001-92-01-70

DETAIL SHEET—CONSTRUCTION, ESTIMATE No. _____

TYPE OF PLANT

FIELD CODE

DETAIL OF MATERIAL

QTY.

PRICE

AMOUNT

TOTAL MATERIAL.....

SUPPLY EXPENSE.....% OF MATERIAL

LABOR—NATURE OF WORK

CLASS OF
LABOR

HOURS

PRICE

AMOUNT

TOTAL LABOR.....

*OVERHEAD EXPENSE.....% OF LABOR.....

OTHER EXPENDITURES.....

*COMPRISES—PLANT SUPERVISION, TOOL, ENGINEERING AND GENERAL EXPENSES

FIELD CODE[illegible]

[Faint, illegible text spanning the main body of the page, possibly a list or a series of entries.]

FIELD CODE[illegible]

FIELD CODE

| DETAIL OF UNITS | PLANT DISPLACED | | | SALVAGE | | |
|---|-----------------------|-------|----------------|---------------|-------|--------|
| | QTY. | PRICE | AMOUNT | QTY. | PRICE | AMOUNT |
| | | | | | | |
| | TOTAL PLANT DISPLACED | | | TOTAL SALVAGE | | |
| LABOR—NATURE OF WORK | | | CLASS OF LABOR | HOURS | PRICE | AMOUNT |
| | | | | | | |
| TOTAL LABOR _____
* OVERHEAD EXPENSE _____ % OF LABOR
OTHER EXPENDITURE _____ | | | | | | |
| * COMPRISES—PLANT SUPERVISION, TOOL AND ENGINEERING EXPENSES. | | | | | | |
| 14 TOTAL ESTIMATED COST OF REMOVING | | | | | | |

DETAIL SHEET—REMOVALS, ESTIMATE No. _____

TYPE OF PLANT Exchange

FIELD CODE 000

[illegible]

| MATERIAL | FIELD CODE | QTY. | PRICE | AMOUNT | CLASS OF LABOR | HOURS | PRICE | AMOUNT |
|----------|------------|------|-------|--------|--|-------|-------|--------|
| | | | | | | | | |
| | | | | | EXPENDITURE SUMMARY | | | |
| | | | | | MATERIAL
SUPPLY EXP.
LABOR
OVERHEAD EXP.
OTHER EXPEND. | | | |
| | | | | | GROSS EXPEND.
SALVAGE
NET EXPEND. | | | |

| MATERIAL | FIELD CODE | QTY. | PRICE | AMOUNT | CLASS OF LABOR | HOURS | PRICE | AMOUNT |
|----------|------------|------|-------|--------|--|-------|-------|--------|
| | | | | | | | | |
| | | | | | EXPENDITURE SUMMARY | | | |
| | | | | | MATERIAL
SUPPLY EXP.
LABOR
OVERHEAD EXP.
OTHER EXPEND. | | | |
| | | | | | GROSS EXPEND.
SALVAGE
NET EXPEND. | | | |

| MATERIAL | FIELD CODE | QTY. | PRICE | AMOUNT | CLASS OF LABOR | HOURS | PRICE | AMOUNT |
|----------|------------|------|-------|--------|--|-------|-------|--------|
| | | | | | | | | |
| | | | | | EXPENDITURE SUMMARY | | | |
| | | | | | MATERIAL
SUPPLY EXP.
LABOR
OVERHEAD EXP.
OTHER EXPEND. | | | |
| | | | | | GROSS EXPEND.
SALVAGE
NET EXPEND. | | | |

DETAIL SHEET-MAINTENANCE-ESTIMATE NO. _____

| MATERIAL | FIELD CODE | QTY. | PRICE | AMOUNT | CLASS OF LABOR | HOURS | PRICE | AMOUNT |
|----------|------------|------|-------|--------|---------------------|-------|-------|--------|
| | | | | | EXPENDITURE SUMMARY | | | |
| | | | | | MATERIAL | | | |
| | | | | | SUPPLY EXP. | | | |
| | | | | | LABOR | | | |
| | | | | | OVERHEAD EXP. | | | |
| | | | | | OTHER EXPEND. | | | |
| | | | | | GROSS EXPEND. | | | |
| | | | | | SALVAGE | | | |
| | | | | | NET EXPEND. | | | |
| | | | | | EXPENDITURE SUMMARY | | | |
| | | | | | MATERIAL | | | |
| | | | | | SUPPLY EXP. | | | |
| | | | | | LABOR | | | |
| | | | | | OVERHEAD EXP. | | | |
| | | | | | OTHER EXPEND. | | | |
| | | | | | GROSS EXPEND. | | | |
| | | | | | SALVAGE | | | |
| | | | | | NET EXPEND. | | | |
| | | | | | EXPENDITURE SUMMARY | | | |
| | | | | | MATERIAL | | | |
| | | | | | SUPPLY EXP. | | | |
| | | | | | LABOR | | | |
| | | | | | OVERHEAD EXP. | | | |
| | | | | | OTHER EXPEND. | | | |
| | | | | | GROSS EXPEND. | | | |
| | | | | | SALVAGE | | | |
| | | | | | NET EXPEND. | | | |

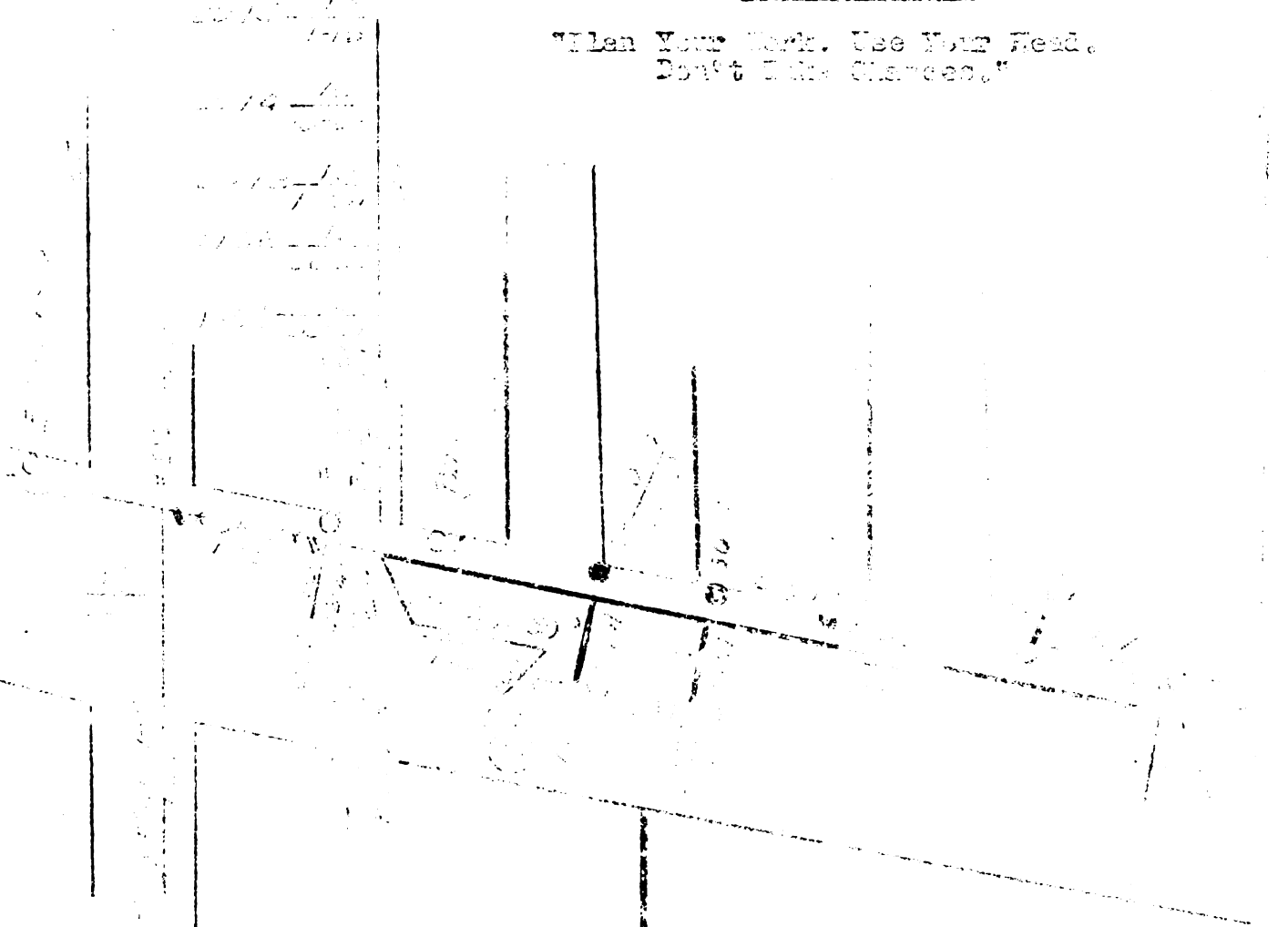
To Div. Constr. Dept. DISTRICT Illinois DATE Nov. 12, 1920

LOCATION Battle Creek DIVISION Southern TO BE COMPLETED 12/1/1920

Do work as shown in sketch to relieve congestion in the vicinity of Springfield Place. Future relief in this section will be obtained by extending the 800 pr. cable.

SPECIAL INSTRUCTIONS

"When Your Work. Use Your Head.
Don't Take Chances."



COMPLETED _____ 192

SIGNED _____ FOREMAN

| ACCT. CHARGEABLE | ESTIMATED COST | PLANT DISPLACED | SALVAGE | LABOR | | MATERIAL |
|------------------|-----------------|-----------------|---------|-------|-------|---------------------------|
| | | | | CLASS | HOURS | |
| 1C | \$ 95.00 | \$130. | | D | 107 | 6 100' D Poles T C |
| 1X | 5.00 | | | G | 02 | 1 100' guy with str. ins. |
| 2C | 530.00 | | | | | 1 anchor with 1" rod |
| 2X | 15.00 | | | | | 800' 3-22 cable |
| | <u>\$345.00</u> | | | | | |
| 201 | \$20.00 | | | | | |

| | | | |
|----------------|------------|----------------|------------|
| APPROVED _____ | DATE _____ | APPROVED _____ | DATE _____ |
| APPROVED _____ | DATE _____ | APPROVED _____ | DATE _____ |

Line Const Supt. Ann Arbor March 12, 30

Ann Arbor Southern 4/1 30

Replace pole and do all other work as described below.

This work is necessary on account of pole being deteriorated and unsafe to climb

Recommended by Farm Line Repairman on Form #2242, dated 3/6/30

Location: Lead #37, pole #1 1st pole of lead starting west from W. Liberty Road at the Big Oak Replace a 30' pole with a 20'E pole. Transfer 2 crossarms, 1 tree guy and 14 wires Replace 2 wooden pole brackets.

COMPLETED 192

SIGNED

| ACCT.
CHARGEABLE | ESTIMATED
COST | PLANT
REPLACED | SALVAGE | LABOR | | MATERIAL |
|---------------------|-------------------|-------------------|---------|-------|-------|---------------------|
| | | | | CLASS | HOURS | |
| LC | 18.00 | 15.00 | | D | 16 | 1, 30'E c.y.p. pole |
| LX | 2.00 | | | | | |
| | <u>20.00</u> | | | | | |
| LM | 8.00 | | | | | |
| LM | 2.00 | | | | | |

Div. Const Supt. Lansing, Mich. 8-23-50 192
 LOCATION South Lyons DIVISION Southern TO BE COMPLETED 192

DETROIT-LANSING (INT.) ROAD LEAD

This job order provides for rerouting a short section of the Detroit - Lansing (Int.) Toll Road located north of South Lyons.

This work required to eliminate poor condition at corner which is involved in road improvement work. It is contemplated that this corner is to be cut back during the improvement of this road. The location of this lead on private property will avoid the necessity of rebuilding the corner in its present location and will provide permanent clearance from trees.

This private right-of-way is available.

COMPLETED 192 SIGNED FOREMAN

| ACCT.
CHARGEABLE | ESTIMATED
COST | PLANT
DISPLACED | SALVAGE | LABOR | | MATERIAL |
|---------------------|-------------------|--------------------|---------|----------|-------|------------------------------|
| | | | | CLASS | HOURS | |
| 1TC | \$283.00 | | | | | 1 - 35'A C. Y. P. Pole |
| 1TK | 103.00 | \$345. | \$34. | D | 200 | 6 - 30'A C. Y. P. Poles |
| 2C-S Lyons | 133.00 | | | G | 20 | 28- 10' 10 pin Crossarms |
| 2K " | 30.00 | 200. | 38. | | | 1 - 6M Pole Guy |
| 9TC | 60.00 | | | | | 1 - 6M Anchor Guy |
| 13TC | 536.00 | | | | | 1 - 5/8" Rod and Pat. Anchor |
| 13TK | 65.00 | 380. | 140. | | | 774' 23 pr. 24 ga. Cable |
| | <u>\$1018.00</u> | | | | | 1 - 14B Terminal |
| 2M-S.L. | 16.00 | | | | | 5 12 Wt. M1. 104 Copper Wire |
| 23M-S.L. | 5.00 | | | | | 33 " " 123 Copper Wire |
| APPROVED | | DATE | | APPROVED | | DATE |
| | | | | | | |

Divn. Const. Supt.

Lansing

April 9, 1930.

HOWELL

Southern

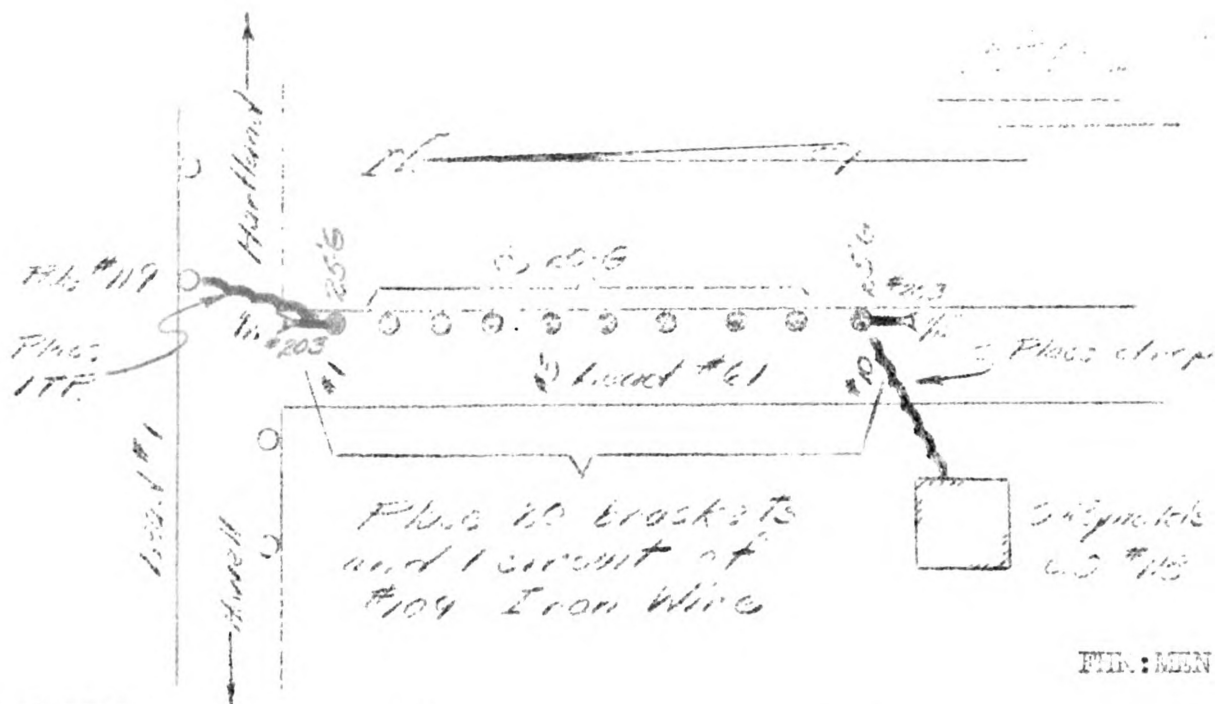
4-19-30

Place poles and wire as shown below. This work is necessary to furnish service to Mr. C. Reynolds, a Detroit business man.

Mr. Reynolds has agreed to pay \$75.00 of the cost of this work and he should be billed for this amount.

This job has been approved by the Manager on the above basis, as there is sickness at the Reynolds farm, and telephone service is imperative.

Bill Mr. C. Reynolds, R. F. D. #1, Howell, Michigan for \$75.00 upon the completion of this work.



E.H.M.

COMPLETED

1C
13C \$150.00
23C

D 74.6 8, 20'G Poles. (C.Y.P.)
2, 25'G " "
20, Wood Pole Brackets.
1/2 mile #109 iron wire.
2, Pat. Anchors with 1/2" x 7' Rods.

ESTIMATE NO. 10
ORDER

HOLLAND

EXCHANGE

GRAND RAPIDS

DISTRICT

DIVISION SOUTHERN

| ITEM | UNIT OF QUANTITY | ACCT. CODE | ENGINEERING RECORDS | | | PLANT ACCTG. RECORDS | DIFFERENCE (PLANT ACCOUNTING RECORDS) | | ADJUSTED BY |
|-------------------------|------------------|------------|---------------------|-------------------------------------|----------|----------------------|---------------------------------------|-------|-------------|
| | | | PLACED THIS YEAR | MORTALITY AREA PLACED PRIOR YEARS x | TOTAL | | OVER | UNDER | |
| 30' U | Ea. | 1C | 2 | | 2 | | | | |
| 35' T | " | 1TC | 10 | | 10 | | | | |
| 40' CP | " | 1TC | 5 | | 5 | | | | |
| 20' RT | " | 1C | 20 | | 20 | | | | |
| 25' RCP | " | " | 1 | | 1 | | | | |
| 30' T-P | " | " | | 1/3 (10) | 1/3 (10) | | | | |
| 25' U-C | " | " | 3 | | 3 | | | | |
| Cable 26 Pr.-24 Ga. | Ft. | 2C | 452 | | 452 | | | | |
| { 4 Qd-16 Ga. 37.7% | " | 2TC | | | | | | | |
| Cable 7 Qd-19 Ga. | " | " | 11205 | | 11205 | | | | |
| { 101 Pr.-22 Ga. 62.3% | " | 2C | | | | | | | |
| Cable 101 Pr.-22 Ga. | " | 25C | 723 | | 723 | | | | |
| { 22 Qd-19 Ga. A.T&T | " | | | | | | | | |
| { 9 Qd-16 Ga. Co. | " | | | | | | | | |
| { 4 Pr-16 Ga. 26.5% | " | - | | | | | | | |
| Cable 10 Qd-16 Ga. Toll | " | | 8046 | | 8046 | | | | |
| { 42 Qd-19 Ga. 54.1% | " | 15TC | | | | | | | |
| { 4 Pr-16 Ga. Exch. | " | | | | | | | | |
| { 227 Pr-22 Ga. 45.9% | " | 15C | | | | | | | |
| Terminal 14C (A) | Ea. | 2C | 4 | | 4 | | | | |
| Loading Coil Cases | Ea. | 15TC | 2 | | 2 | | | | |
| 22 F with 50-#613 Coils | | | | | | | | | |
| Conduit 10-M | Tr. Ft. | 14TC | 2380 | | 2380 | | | | |
| Manholes "A" | Ea. | " | 9 | | 9 | | | | |

* Cross out words not applying.

x This column to be used only for plant purchased. Show year placed in upper half of each space used.

† Enter only items on which differences exist.

DATE OF REPORT May 12

19 30

CORRECT

For Division District Engineer

POSTED TO SUMMARY

[illegible]

NOTE: Also report on this form poles reset or reinforced.

* Cross out words not applying.

† For reset and reinforced poles retired show year reset or reinforced.

DATE OF REPORT May 12

CORRECT

Robert J. Hall

POSTED TO SUMMARY

Conventions

Pole Symbols

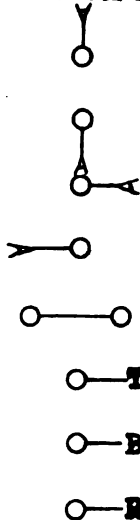
Poles Specially owned
by one Company

Poles Jointly owned by
M. B. T. Co. & another Co.

| | | |
|---|-------------------------------------|---|
| ○ | Michigan Bell Telephone Co. | |
| △ | American Telephone & Telegraph Co. | ① |
| ○ | Citizens Telephone Co. | |
| I | Independent Telephone Co. | ① |
| X | Electric Light & Power Co. | ① |
| R | Railroad Companies (Steam) | ① |
| T | Street Railway Companies (Electric) | ① |
| W | Western Union Telegraph Co. | ① |
| P | Postal Telegraph Co. | ② |
| M | Municipal Service (Fire & Police) | ③ |

Anchor & Guy Symbols

Guy without
Strain Insulators



Anchor & Guy ahead

" " " back
" " " right
" " " left

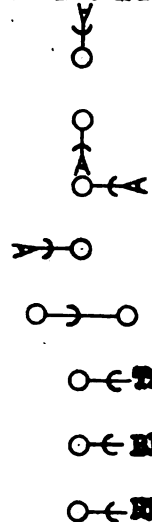
Head Guy

Tree Guy

Building Guy

Rock Bolt Guy

Guy with
Strain Insulators

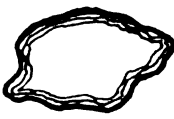
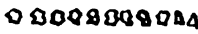
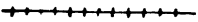
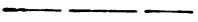
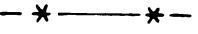
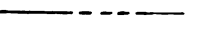
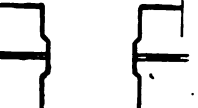


Note: Numeral indicates number of guys or anchors.

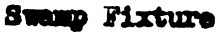
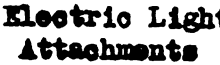
Braces

○—PB Push Brace Push Pull Brace PFB—○—PFB

Geographical Symbols

| | | | |
|---|----------------------|--|-----------------------|
|  | Fence (Wire) |  | River, Stream & Creek |
|  | " (Rail) |  | Lake |
|  | " (Hedge) |  | Railroad (Steam) |
|  | " (Rock) |  | Railway Electric |
|  | County Line |  | R.R. Right-of-Way |
|  | Township Line |  | Electric Tower Line |
|  | City Limits |  | " Pole Line |
|  | Drive |  | North Point |
|  | Continuation |  | Road |
|  | Crossroad |  | Road Junction |
|  | Bridge over Railroad |  | Bridge over water |

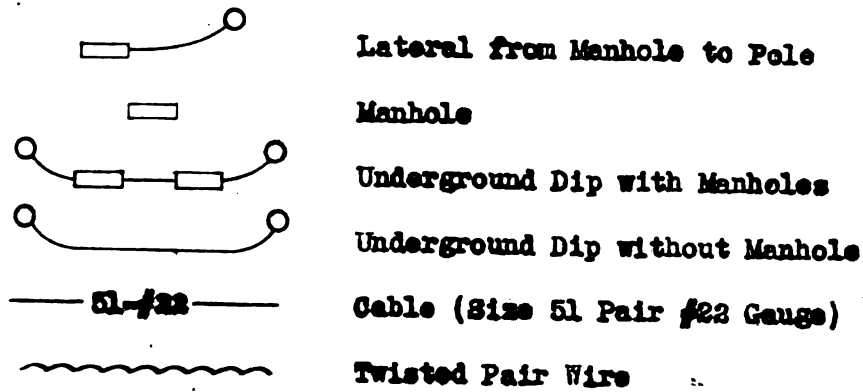
Special Construction

| | | | |
|---|-------------------------|--|-------------------------------------|
|  | H-Fixture |  | Extention Arm - Ext. Arm |
|  | Loading Fixture |  | Swamp Fixture - Swamp Fixt. |
|  | A-Fixture |  | Ground Brace - Gr. B. |
|  | Bridge Fixture |  | Electric Light - E.L.A. Attachments |
|  | Special Loading Manhole | | |

Building Symbols

| | | | |
|---|-------------------------------|---|---------------------------------------|
|  | House |  | Church |
|  | Barn |  | School |
|  | Garage |  | Gas Station |
|  | Connecting Co. Central Office |  | Michigan Bell Tel. Co. Central Office |

Symbols



| | | | |
|----------|---------------|--------|--------------------|
| Term. | Terminal | Tr.W. | Tree Wire |
| U.G.Pole | U.G. Pole | L.S. | Loadstation |
| Jct.Pole | Junction Pole | M.T.D. | Multiple Tile Duct |
| | | S.T.D. | Single Tile Duct |

Poles

| Kind of Poles | Treatment of Poles |
|----------------------------|---------------------------|
| EC - Eastern Cedar | O - Perforation Treatment |
| WC - Western Cedar | S - Brush or Spray Method |
| CP - Creosoted Yellow Pine | P - Entire Pole Treated |

Revised Symbols for Inside Building Terminals

Distributing Terminals Only

| | | |
|-------------------|---|---|
| $\frac{24}{1-26}$ |  | Protected - M.B.T. Co. Owned Box |
| $\frac{25}{1-26}$ |  | Unprotected - M.B.T. Co. Owned Box
Wood Type - 23, 19, HL, etc. |
| $\frac{26}{1-16}$ |  | Unprotected - M.B.T. Co. Owned Box
Metal Type - 14, "C", HL, HS, etc. |
| $\frac{27}{1-26}$ |  | Protected - Bldg. Owned Box |
| $\frac{28}{1-16}$ |  | Unprotected - Bldg. Owned Box |
| $\frac{29}{1-16}$ |  | Unprotected - M.B.T. Co. Owned Box
* Cable bridged out and carried on (Loop Terminal)
Metal Type HL, HS, etc. |
| $\frac{30}{1-26}$ |  | Unprotected - M.B.T. Co. Owned Box
* (Loop Term.) - Wood Type - 19, 23, etc. |
| $\frac{31}{1-26}$ |  | Unprotected - Bldg. Owned Box
* (Loop Term.) |

Cross Connecting Terminals Only

| | | |
|-----------------------------------|---|------------------------------------|
| $\leftarrow \frac{HC.1-26}{G-26}$ |  | Protected - M.B.T. Co. Owned Box |
| $\leftarrow \frac{HC.1-26}{G-26}$ |  | Unprotected - M.B.T. Co. Owned Box |
| $\leftarrow \frac{HC.1-26}{G-26}$ |  | Protected - Bldg. Owned Box |
| $\leftarrow \frac{HC.1-26}{G-26}$ |  | Unprotected - Bldg. Owned Box |

Straight Connecting Terminals Only

| | | |
|-----------------------------------|---|----------------------------------|
| $\leftarrow \frac{301-326}{G-26}$ |  | Protected - M.B.T. Co. Owned Box |
| $\leftarrow \frac{301-326}{G-26}$ |  | Protected - Bldg. Owned Box |

NOTE: Wherever the term "protected" is used, it denotes fused protection only. Where Carbon block equipment is mounted in the terminal it is signified with a dash (—) above the symbol inside the square.

OUTSIDE PLANT SYMBOLS

All construction to be shown as follows.

Existing.

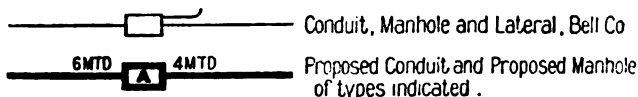
Proposed.

To be Removed.

CONDUIT AND POLES

KIND OF DUCTS TO BE INDICATED BY LETTERS PLACED AFTER NUMBER OF DUCTS THE FOLLOWING LETTERS TO BE USED.

| | | |
|-----|---|-------------------------------|
| MTD | — | VITRIFIED CLAY MULTIPLE TILE. |
| STD | — | VITRIFIED CLAY SINGLE TILE |
| ST | — | SEWER TILE. |
| CW | — | CRESOTED WOOD |



Existing Bell Co. Pole



Proposed Bell Co. Pole of Length and Class indicated.



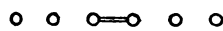
Bell Co. Pole to be Replaced with Pole of Length and Class indicated



Bell Co. Pole to be Removed



Bell Co. "H" Fixture across line



Bell Co. "H" Fixture along line



High Tension Pole.

Pole solely owned by another company.

Pole jointly owned by Bell Co. and another company.

| | | |
|---|--|---|
| X | Electric Light Co. | ⊗ |
| W | Western Union Tel. Co. | ⊗ |
| P | Postal Tel. Co. | ⊗ |
| A | American Tel. & Tel. Co. Long Lines Dept. (This symbol to be used by Assoc. Cos) | ⊗ |
| B | Associated Company (This symbol to be used by the L.L. Dept. of the A.T.&T. Co) | ⊗ |
| M | Municipal. | ⊗ |
| T | Street Railway. | ⊗ |
| R | Steam Railway. | ⊗ |
| I | Independent Tel. Co. | ⊗ |

Proposed Pole to be Jointly Owned by Bell Co. and another company (In this case Bell Co. and Electric Light Co.)

● RP. $\frac{30'C}{35'B}$ BELL CO'S. POLE TO BE REPLACED (30'C INDICATES LENGTH AND CLASS OF EXISTING POLE. 35'B INDICATES LENGTH AND CLASS OF PROPOSED POLE).

● $\frac{-2}{+3}$ CROSSARMS TO BE REMOVED OR ADDED (2 TO BE REMOVED. 3 TO BE ADDED).

● RP $\frac{30'C - 2}{35'B + 3}$ COMBINATION SYMBOL COVERING REPLACEMENT OF POLES AND THE REMOVAL OR ADDITION OF CROSSARMS.

| | |
|----|----------------|
| ← | Guy. |
| → | Anchor Guy. |
| RB | Rock Bolt Guy. |
| TR | Tree Guy. |

When necessary indicate number and size of Guys as follows.
 → 1-6M One 6000 Lb. guy strand to anchor.

| | |
|-----|----------------------|
| PB | Push Brace. |
| PPB | Push and Pull Brace. |

CABLE AND TERMINALS

5X-19 5 pair #19 gauge cable. For less than 25 pair add "x" to designation of size.

25-22 25 pair #22 gauge cable. For 25 pair or more and less than 100 pair

150-19 150 pair #19 gauge cable. For odd sizes larger than 100 pair

9-22 900 pair #22 gauge cable. For 100 pair or multiples of 100 pair

7-00 136 1-14
 18-00 166 15-50
 6-PR 166 51-56
 101-PR 196 57-157
 157-5

Composite Cable

25-22 10 25 pair #22 gauge inside cable such as silk and cotton insulated, etc

9-22 Stub in Manhole

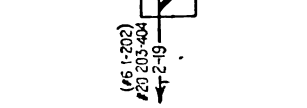
2-22 3-13 Change in Size, or Gauge of Cable

Proposed Splice. In general to be shown on existing cable only

Existing Splice. To be shown only when splice would not otherwise be apparent

Cable to be cut

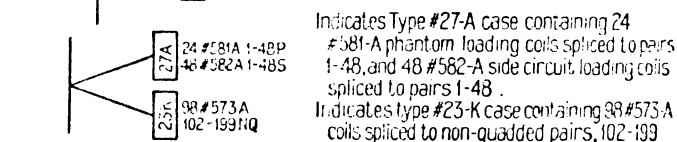
Method of showing Transfer and new and old cable numbers and pair counts. (Old number and count in parentheses)



Insulating Joint.

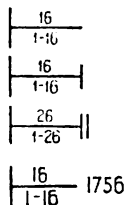
Municipal Cable. Indicate ownership of other foreign cables by the letters used to indicate ownership of poles

Loading pole on aerial or underground cable



Indicates Type #27-A case containing 24 #581-A phantom loading coils spliced to pairs 1-48, and 48 #582-A side circuit loading coils spliced to pairs 1-48.

Indicates type #23-K case containing 98 #573-A coils spliced to non-quadded pairs, 102-193



#14 Terminal Size and count as indicated

#8 Terminal Size and count as indicated

Building cable distributing terminal. Size and count as indicated

FOR AERIAL CABLE TERMINALS SHOW TERMINAL NUMBER ADJACENT TO SYMBOL.

FOR U.G. JUNCTION CABLE TERMINALS SHOW TERMINAL NUMBER AND COUNT IN FRACTIONAL FORM.

1-22 Fused straight connecting terminal

2-22 Fused crossconnecting terminal

50-19 Distributing terminal. Fuses only

50-19 Distributing terminal. Binding posts only

3-22 Crossconnecting terminal unprotected

2-22 Indicate protector block equipment mounted in terminal by horizontal line above symbol for the terminal

Cable terminal with protectors in auxiliary box. Number in < indicates number of pairs of protector mountings to be placed.

1-22 Indicates additional plant shown on another diagram

OUTSIDE PLANT SYMBOLS

All construction to be shown as follows.

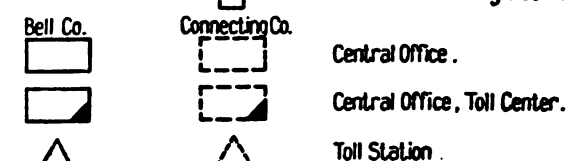
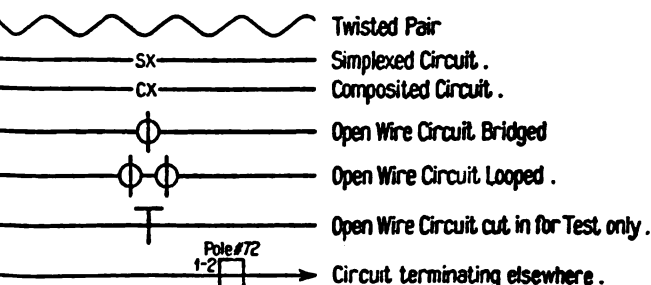
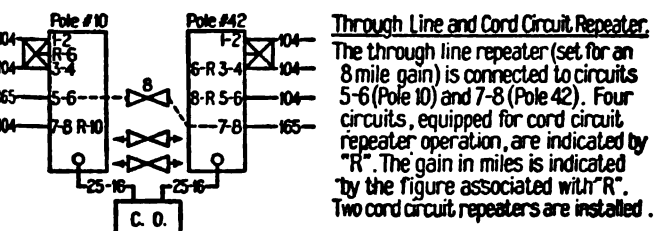
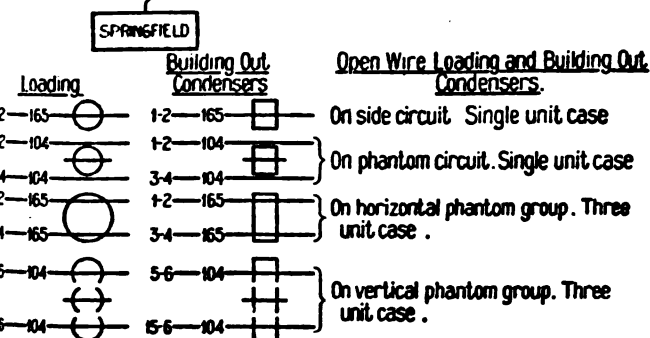
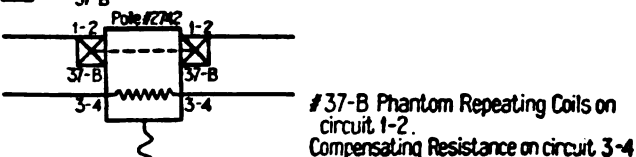
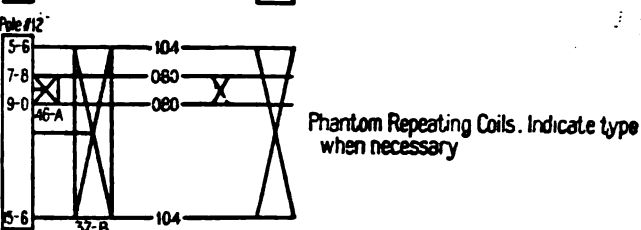
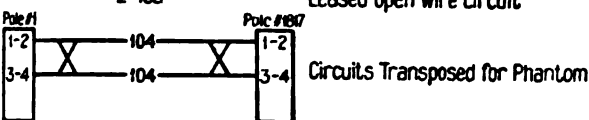
Existing.

Proposed.

To be Removed.

WIRE

| | |
|----------|---|
| 104 | Open Wire Copper Circuit. Number indicates diameter in mils |
| 109 | Open Wire Iron Circuit. Number indicates diameter in mils. |
| 6-109 | Grounded Iron Circuit |
| CON. 080 | Connecting Company's open wire circuit |
| L 165 | Leased open wire circuit |

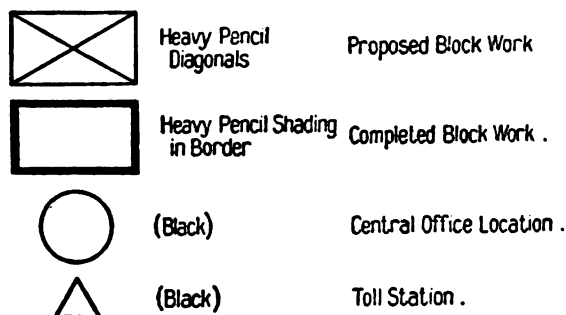


MAPS

| | Associated Company | Long Lines Dept. of Am. Tel. & Tel. Co. |
|--|----------------------|---|
| U. G. Conduit and Manhole | ---□---□--- (Black) | ---□---□--- (Black) |
| U. G. Cable | --- (Black) | --- (Black) |
| Underground Terminal Pole | ● (Black) | |
| Exchange Aerial Wire | --- (Red) | |
| Exchange Aerial Cable | --- (Red) | |
| Toll Aerial Wire | --- (Green) | --- (Yellow) |
| Toll Aerial Cable | --- (Green) | --- (Yellow) |
| Foreign Line Carrying Telephone Company's Plant, Type of Plant (wire) is indicated by the symbol | ---W---W--- (Red) | ---X---X--- (Yellow) |
| Foreign Line not Carrying Telephone Company's Plant | ---X---X--- (Brown) | ---P---P--- (Brown) |
| High Tension Transmission Line | ---*---*--- (Purple) | ---*---*--- (Purple) |

♦ In general the U. G. Cable Symbol alone will indicate both cable and existing conduit.
Indicate proposed conduit or existing conduit not containing U. G. Cable by the proper conduit symbol.

† Indicate ownership of Foreign Lines by letters used to indicate ownership of individual poles
Indicate joint ownership of lines by symbols used to indicate joint ownership of individual poles



(Copyright—1921—by Michigan State Telephone Company)

NUMERICAL RECORD POLES AND TERMINALS

Exchange Portland

| Pole and Terminal Number | Pole Record Sheet Number | Cable Number | Address | Est.—J. O. Number |
|--------------------------|--------------------------|--------------|---|-------------------|
| 276 | 83 | | At alley on Brush bet. Grant & Lincoln | |
| 277 | 93 | | 1st Pole E. of East on Brush | |
| 278 | 93 | | 2nd Pole E. of East on Brush | |
| 279 | 93 | | Cor. Brush & Caroline | |
| 280 | 93 | | 1st Pole S. of Brush on Caroline | |
| 281 | 84 | | Cor. Danby & Brush on Danby | |
| 282 | 85 | | (& Smith)
1st Pole in ally N. of Brush bet. Danby | |
| 283 | 85 | | 2nd Pole S. of Academy bet. Danby & Smith | |
| 284 | 74 | | 1st Pole E. of Smith on Brush | |
| 285 | 74 | | 2nd Pole E. of Smith on Brush | |
| 286 | 74 | | N.E.Cor. Danby & Brush | |
| 287 | 74 | | 1st Pole on Danby S. of Brush | |
| 288 | 74 | | 2nd Pole on Danby S. of Brush | |
| 289 | 74 | | S.W.Cor. Danby & Hill | |
| 290 | 74 | | 1st Pole W. of Danby on Hill | |
| 291 | 74 | | 1st Pole S. of Smith on Hill | |
| 292 | 74 | | Cor. Smith & Hill | |
| 293 | 78 | | (& Grant)
1st Pole in alley S. of Brush bet. Lincoln | |
| 294 | 78 | | (& Grant)
2nd Pole in alley S. of Brush bet. Lincoln | |
| 295 | 78 | | 2nd Pole E. of Lincoln on Hill | |
| 296 | 78 | | 3rd Pole E. of Lincoln on Hill | |
| 297 | 78 | | (On Grant)
Pole in Middle of block bet. Hill & Brush | |
| 298 | 79 | | Cor. Grant & Hill | |
| 299 | 79 | | (& Grant)
1st Pole in alley S. of Brush bet. Kearney | |
| 300 | 79 | | 1st Pole E. of Grant on Hill | |

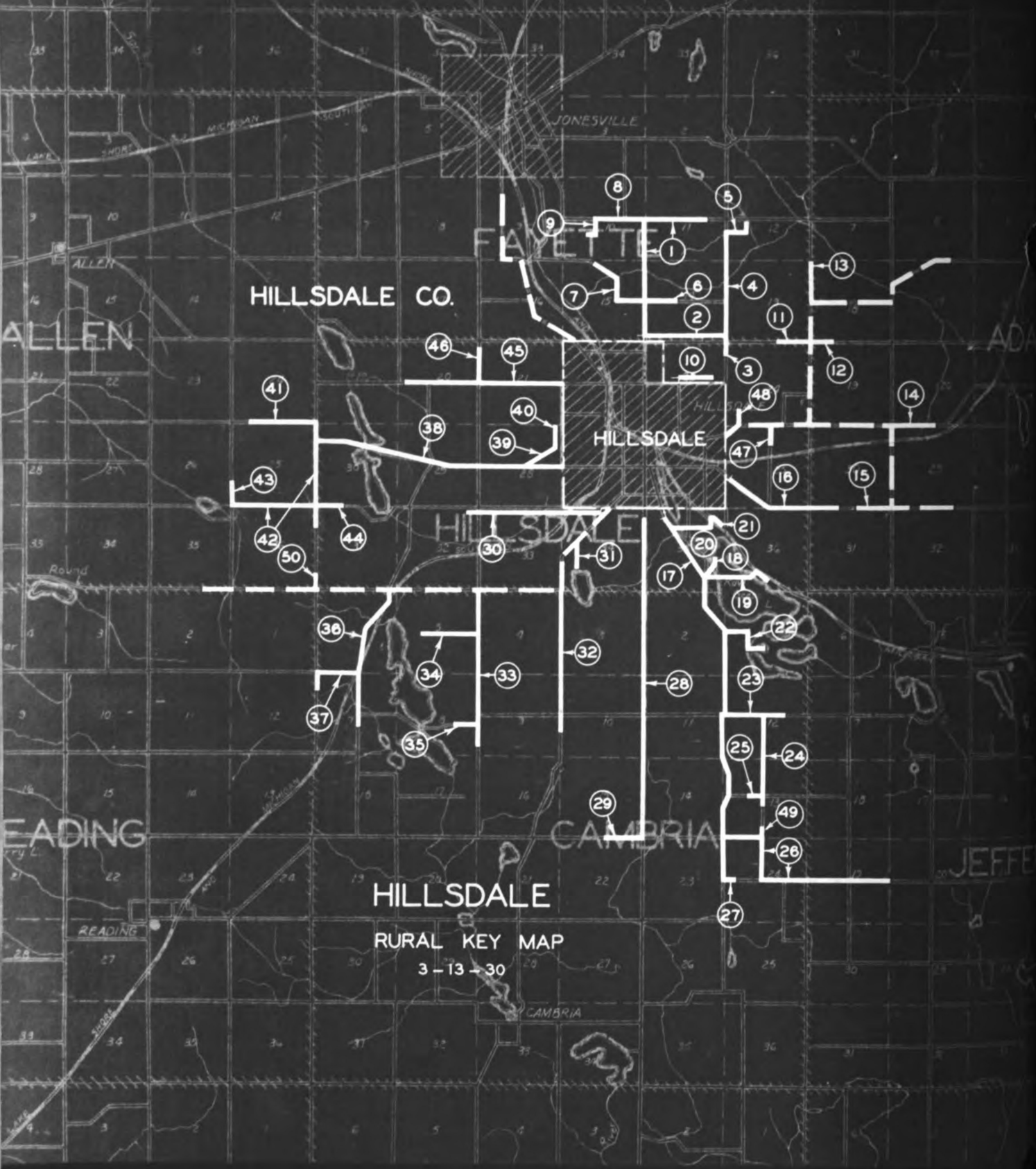
HILLSDALEINDEX

| <u>LEAD NO.</u> | <u>JUNCTION</u> | <u>KEY MAP</u> | <u>LOCATION</u> |
|-----------------|--------------------|----------------|---------------------------|
| 1 | Term. #58 | 1 | Sec. 15-14 Fayette Twp. |
| 2 | Lead #2 Pole #31 | 1 | Sec. 14 Fayette Twp. |
| 3 | Lead #2 Pole #31 | 1 | Sec. 23-24 Hillsdale Twp. |
| 4 | Lead #4 Pole #31 | 1 | Sec. 14-13 Fayette Twp. |
| 5 | Lead #4 Pole #31 | 1 | Sec. 12 Fayette Twp. |
| 6 | Lead #1 Pole #24 | 1 | Sec. 14 Fayette Twp. |
| 7 | Lead #1 Pole #24 | 1 | Sec. 15 Fayette Twp. |
| 8 | Lead #1 Pole #56 | 1 | Sec. 10 Fayette Twp. |
| 9 | Lead #8 Pole #26 | 1 | Sec. 10 Fayette Twp. |
| 10 | Term. #55 | 1 | Sec. 23 Hillsdale Twp. |
| 11 | Toll Pole #33 | 2 | Sec. 24 Hillsdale Twp. |
| 12 | Toll Pole #33 | 2 | Sec. 18-19 Adams Twp. |
| 13 | Toll Pole #49 | 2 | Sec. 13 Fayette Twp. |
| 14 | Toll Pole #1407 | 2 | Sec. 20-29 Adams Twp. |
| 15 | Toll Pole #1364 | 2 | Sec. 30-31 Adams Twp. |
| 16 | Term. #70 | 3 | Sec. 25 Hillsdale Twp. |
| 17 | Term. #121 | 4 | Sec. 35 Hillsdale Twp. |
| 18 | Lead #17 Pole #13 | 4 | Sec. 35 Hillsdale Twp. |
| 19 | Lead #17 Pole #13 | 4 | Sec. 35 Hillsdale Twp. |
| 20 | Term. #121 | 4 | Sec. 35 Hillsdale Twp. |
| 21 | Lead #20 Pole #15 | 4 | Sec. 35 Hillsdale Twp. |
| 22 | Lead #17 Pole #18 | 4 | Sec. 1 Cambria Twp. |
| 23 | Lead #17 Pole #35 | 4 | Sec. 12 Cambria Twp. |
| 24 | Lead #23 Pole #19 | 4 | Sec. 12 Cambria Twp. |
| 25 | Lead #24 Pole #36 | 4 | Sec. 13 Cambria Twp. |
| 26 | Lead #7 Pole #130 | 4 | Sec. 13-24 Cambria Twp. |
| 27 | Lead #17 Pole #147 | 4 | Sec. 24 Cambria Twp. |
| 28 | Term. #89 | 5 | Sec. 34-35 Hillsdale Twp. |
| 29 | Lead #28 Pole #122 | 5 | Sec. 15-22 Cambria Twp. |
| 30 | Toll Pole #30 | 5 | Sec. 34 Hillsdale Twp. |
| 31 | Toll Pole #62 | 5 | Sec. 34 Hillsdale Twp. |
| 32 | Toll Pole #95 | 5 | Sec. 3-4 Cambria Twp. |
| 33 | Toll Pole #139 | 6 | Sec. 5-4 Cambria Twp. |
| 34 | Lead #33 Pole #20 | 6 | Sec. 5 Cambria Twp. |
| 35 | Lead #33 Pole #61 | 6 | Sec. 8 Cambria Twp. |
| 36 | Toll Pole #185 | 6 | Sec. 6 Cambria Twp. |
| 37 | Lead #36 Pole #35 | 6 | Sec. 6-7 Cambria Twp. |
| 38 | Term. #20 | 6 | Sec. 28 Hillsdale Twp. |
| 39 | Lead #38 Pole #24 | 5 | Sec. 28 Hillsdale Twp. |
| 40 | Lead #39 Pole #14 | 5 | Sec. 28 Hillsdale Twp. |
| 41 | Lead #38 Pole #122 | 6 | Sec. 24-25 Allen Twp. |
| 42 | Lead #38 Pole #115 | 6 | Sec. 25 Allen Twp. |
| 43 | Lead #42 Pole #26 | 6 | Sec. 25-26 Allen Twp. |
| 44 | Lead #42 Pole #26 | 6 | Sec. 30-31 Hillsdale Twp. |
| 45 | Toll Pole #53 | 7 | Sec. 21 Hillsdale Twp. |
| 46 | Lead #45 Pole #54 | 7 | Sec. 20-21 Hillsdale Twp. |
| 47 | Toll Pole #1468 | 2 | Sec. 25 Hillsdale Twp. |
| 48 | Toll Pole #1477 | 2 | Sec. 25 Hillsdale Twp. |
| 49 | Lead #26 Pole #16 | 4 | Sec. 13 Cambria Twp. |
| 50 | Toll Pole #229 | 6 | Sec. 36 Allen Twp. |

LINE _____ TOLL EXCH. _____ (MUNICIPALITY OR TAX DISTRICT NO.) _____

POLES _____ IN EFFECT 1-12-30 REWRITTEN 5-12-30

| POLE NUMBER | LOCATION DIAGRAM
POLES, STUBS AND GUYS | SPAN | LENGTH
AND
CLASS | KIND | DATE
SET | REIN-
FORCED | LOWERED
OR
TOP CUT OFF | REMOVED | JOINT
OWNER
FILE NO. | R/W
FILE NO. |
|-------------|---|------|------------------------|------|-------------|-----------------|------------------------------|---------|----------------------------|-----------------|
| 517 | BRUSH ST. | | 25'c | EC | | | | | | |
| 284 | | | 40'c | WC | | | | | | |
| 285 | | | 35'c | WC | | | | | | |
| 75 | | | 35'c | WC | | | | | | |
| 286 | | | 30'c | WC | | | | | | |
| 287 | | | 25'c | WC | | | | | | |
| 288 | | | 25'c | WC | | | | | | |
| 290 | | | 35'c | WC | | | | | | |
| 291 | | | 35'c | WC | | | | | | |
| 292 | | | 30'c | WC | | | | | | |
| 289 | | | 30'c | WC | | | | | | |



HILLSDALE

RURAL KEY MAP

3-13-30

KEY MAP

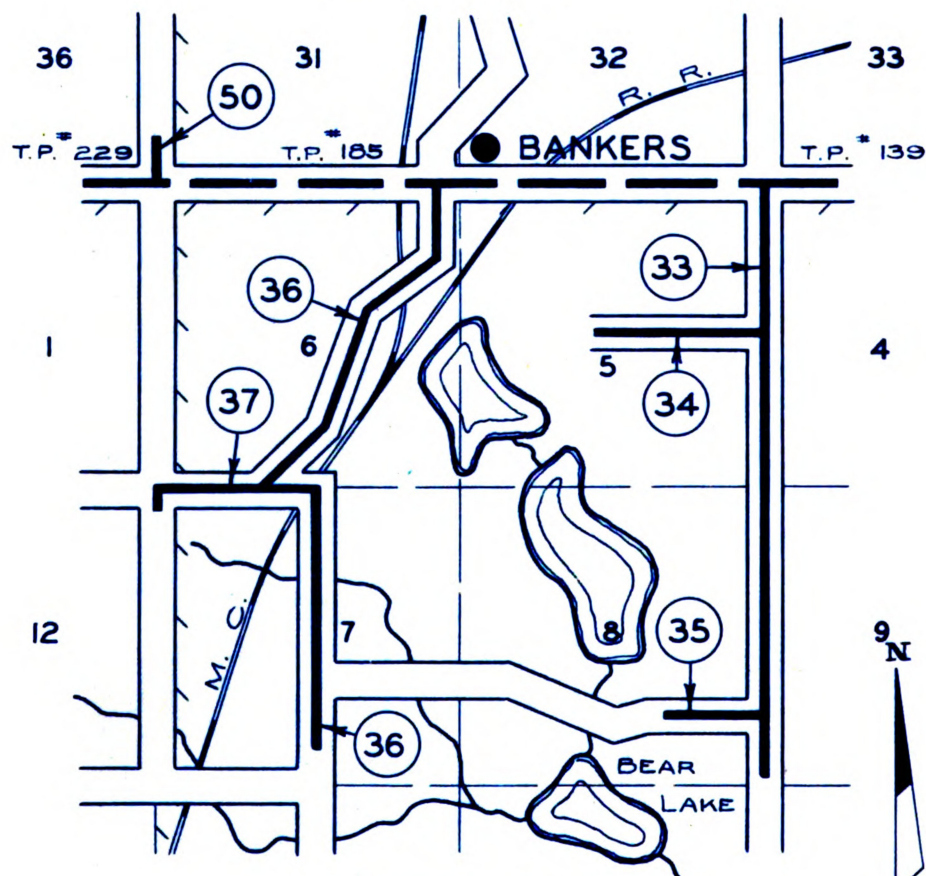
EXCHANGE

HILLSDALE

/// COUNTY LINE
/// TWP. LINE

— TOLL & RURAL
— RURAL
— CABLE

HILLSDALE TWP.



CAMBRIA TWP.

HILLSDALE CO.

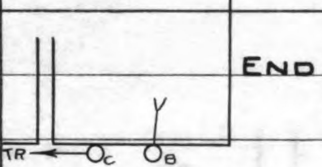
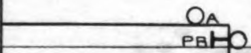
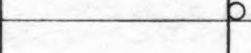
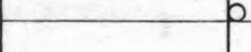
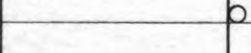
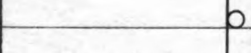
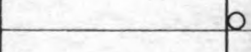
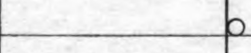
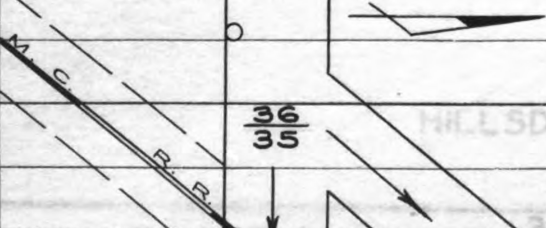
SHEET NO. 1EXCHANGE HILLSDALE

FORM E

LINE LEAD # 37TOLL
EXCH.

(MUNICIPALITY OR TAX DISTRICT NO.)

POLES 1-16IN EFFECT 3-10-29 REWRITTEN 4-28-30

| POLE
NUMBER | LOCATION DIAGRAM
POLES, STUBS AND GUYS | SPAN | LENGTH
AND
CLASS | KIND | DATE
SET | REIN-
FORCED
LOWERED
OR
TOP CUT OFF | REMOVED | JOINT
OWNER
FILE NO. | R/W
FILE NO. |
|----------------|---|------|------------------------|------|-------------|---|---------|----------------------------|-----------------|
| 16 - C | | | 20' C | EC | | | | | |
| 16 - B | | | 20' C | EC | | | | | |
| 16 - A | | | 25' D | EC | | | | | |
| P.B. - 16 | | | 20' C | EC | | | | | |
| |  | | | | | | | | |
| 16 |  | | 20' C | EC | | | | | |
| 15 |  | | 20' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| 10 |  | | 16' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| |  | | 16' D | EC | | | | | |
| |  | | 20' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| 5 |  | | 20' C | EC | | | | | |
| |  | | 20' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| |  | | 16' C | EC | | | | | |
| 1 |  | | 20' C | EC | | | | | |

1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x \frac{1}{1+t^2} dt$$

It is shown that the function $f(x)$ is increasing and concave down on the interval $(-\infty, \infty)$. Moreover, the function has a horizontal asymptote at $y = \frac{\pi}{2}$ as $x \rightarrow \pm\infty$.

In the second part of the paper, we consider the function $g(x)$ defined by the equation

$$g(x) = \int_0^x \frac{t}{1+t^2} dt$$
 and study its properties. It is shown that the function $g(x)$ is an odd function and has a horizontal asymptote at $y = \frac{\pi}{2}$ as $x \rightarrow \pm\infty$.

Finally, in the third part of the paper, we consider the function $h(x)$ defined by the equation

$$h(x) = \int_0^x \frac{1}{1+t^4} dt$$
 and study its properties. It is shown that the function $h(x)$ is an even function and has a horizontal asymptote at $y = \frac{\pi}{2}$ as $x \rightarrow \pm\infty$.

The results of the paper show that the functions $f(x)$, $g(x)$, and $h(x)$ have many interesting properties and are of great interest in the theory of integration.

The author would like to thank the referee for his/her valuable comments and suggestions.

SHEET NO. 1EXCHANGE HILLSDALE

FORM E2

LINE LEAD # 36TOLL
EXCH.MUNICIPALITY OR TAX DISTRICT NO.
(MUNICIPALITY OR TAX DISTRICT NO.)POLES 1-23IN EFFECT 3-10-29 REWRITTEN 4-26-30

| POLE
NUMBER | LOCATION DIAGRAM
POLES, STUBS AND GUYS | SPAN | LENGTH
AND
CLASS | KIND | DATE
SET | REIN-
FORCED
OR
LOWERED
TOP CUT OFF | REMOVED | JOINT
OWNER
FILE NO. | R/W
FILE NO. |
|----------------|---|------|------------------------|------|-------------|---|---------|----------------------------|-----------------|
| | | | 20' D | EC | | | | | |
| | | | 20' D | EC | | | | | |
| | | | 20' D | EC | | | | | |
| 20 | | | 20' D | EC | | | | | |
| | | | 15' D | EC | | | | | |
| | | | 20' D | EC | | | | | |
| | | | 20' D | EC | | | | | |
| | | | 20' D | EC | | | | | |
| 15 | | | 20' C | EC | | | | | |
| | | | 20' D | EC | | | | | |
| | | | 20' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| 10 | | | 35' C | EC | | | | | |
| | | | 30' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| 5 | | | 25' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| | | | 25' C | EC | | | | | |
| | | | 25' C | SEC | | | | | |

Subscription price, Five Dollars Per Annum in Advance

Single Copies, Fifteen Cents

Entered as Second-Class Matter, October 3, 1917, Post Office at Chicago, Ill., under No. 323,661

Acceptance for mailing at Special Rate of Postage provided for in Act of October 3, 1917

Published for the American Medical Association
535 North Dearborn Street, Chicago, Ill.
Telephone: AB 5-2121

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Printed in U.S.A.

CONTENTS

Original Articles

Editorial

Department of Medicine

Department of Surgery

Department of Pediatrics

Department of Obstetrics and Gynecology

Department of Ophthalmology

Department of Otorhinolaryngology

Department of Dermatology and Syphilology

Department of Radiology

Department of Pathology

Department of Bacteriology

Department of Pharmacology

Department of Physiology

Department of Anatomy

Department of Zoology

Department of Botany

Department of Geology

Department of Chemistry

Department of Mathematics

Department of Physics

Department of Astronomy

Department of Meteorology

Department of Climatology

Department of Oceanography

Department of Hydrology

Department of Geophysics

SHEET NO. 2

EXCHANGE HILLSDALE

LINE LEAD # 36

TOLL
EXCH.

(MUNICIPALITY OR TAX DISTRICT NO.)

POLES 24-48

IN EFFECT 3-10-29 REWRITTEN 4-26-30

| POLE
NUMBER | LOCATION DIAGRAM
POLES, STUBS AND GUYS | SPAN | LENGTH
AND
CLASS | KIND | DATE
SET | REIN-
FORCED | LOWERED
OR | TOP CUT OFF | REMOVED | JOINT
OWNER
FILE NO. | R/W
FILE NO. |
|----------------|---|------|------------------------|------|-------------|-----------------|---------------|-------------|---------|----------------------------|-----------------|
| 37-A | | | 20' C EC | | | | | | | | |
| | | | 25' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| 45 | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| 40 | | | 20' D EC | | | | | | | | |
| | | | 20' C EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 25' C EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 25' C EC | | | | | | | | |
| | | | 40' C 0EC29 | | | | | | | | |
| | | | 35' C EC | | | | | | | | |
| | | | 30' C 0EC29 | | | | | | | | |
| 35 | | | 25' C EC | | | | | | | | |
| | | | 30' C EC | | | | | | | | |
| | | | 15' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |
| 30 | | | 25' C EC | | | | | | | | |
| | | | 25' E 0EC29 | | | | | | | 78 | |
| | | | 25' E 0EC29 | | | | | | | 78 | |
| | | | 20' D EC | | | | | | | | |
| | | | 15' D EC | | | | | | | | |
| 25 | | | 15' D EC | | | | | | | | |
| | | | 20' D EC | | | | | | | | |

LINE Charlotte-Gd.Rapids

TOLL

Nashville Twp.

Barry Co.

(MUNICIPALITY OR TAX DISTRICT NO.)

POLES 670-693

IN EFFECT July 1926

REWRITTEN Nov. 1929

| POLE NUMBER | LOCATION DIAGRAM
POLES, STUBS AND GUYS | SPAN | LENGTH
AND
CLASS | KIND | DATE
SET | REIN-
FORCED | LOWERED
OR
TOP CUT OFF | REMOVED | JOINT
OWNER
FILE NO. | R/W
FILE NO. |
|-------------|---|------|------------------------|------|-------------|-----------------|------------------------------|---------|----------------------------|-----------------|
| 693 | | 89 | 30B | EC | 26 | | | | | |
| 692 | | 126 | 30B | EC | 26 | | | | | |
| 691 | | 131 | 30B | EC | 26 | | | | | |
| 690 | | 110 | 30B | EC | 26 | | | | | |
| 689 | | 109 | 30B | EC | 26 | | | | | |
| 688 | | 144 | 30B | EC | 24 | | | | | |
| 687 | | 151 | 30C | EC | 24 | | | | | |
| Stub | | | 25B | EC | | | | | | |
| 686 | | 113 | 35C | EC | 26 | | | | | |
| 685 | | 107 | 30C | EC | 26 | | | | | |
| 684 | | 108 | 30B | EC | 26 | | | | | |
| 683 | | 120 | 25B | EC | 26 | | | | | |
| 682 | | 125 | 30C | EC | 26 | | | | | |
| 681 | | 100 | 35C | EC | 26 | | | | | |
| 680 | See Nashville
Spur | 137 | 35C | EC | 26 | | | | | |
| 679 | | 144 | 35C | EC | 26 | | | | | |
| 678 | | 62 | 30A | WC | | | | | | |
| 677 | | 132 | 35C | EC | 26 | | | | | |
| 676 | | 133 | 25C | EC | 26 | | | | | |
| 675 | | 136 | 25C | EC | 26 | | | | | |
| 674 | | 129 | 25B | EC | 26 | | | | | |
| 673 | | 102 | 25C | EC | 26 | | | | | |
| 672 | | 126 | 25B | EC | 26 | | | | | |
| 671 | | 133 | 25B | EC | 26 | | | | | |
| 670 | | 135 | 25B | EC | 26 | | | | | |

LINE Detroit-Ann Arbor "B" Cable

TOLL
EXCH.

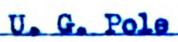
Ann Arbor Tw. - Washtenaw Co.

(MUNICIPALITY OR TAX DISTRICT NO.)

POLES 619-632

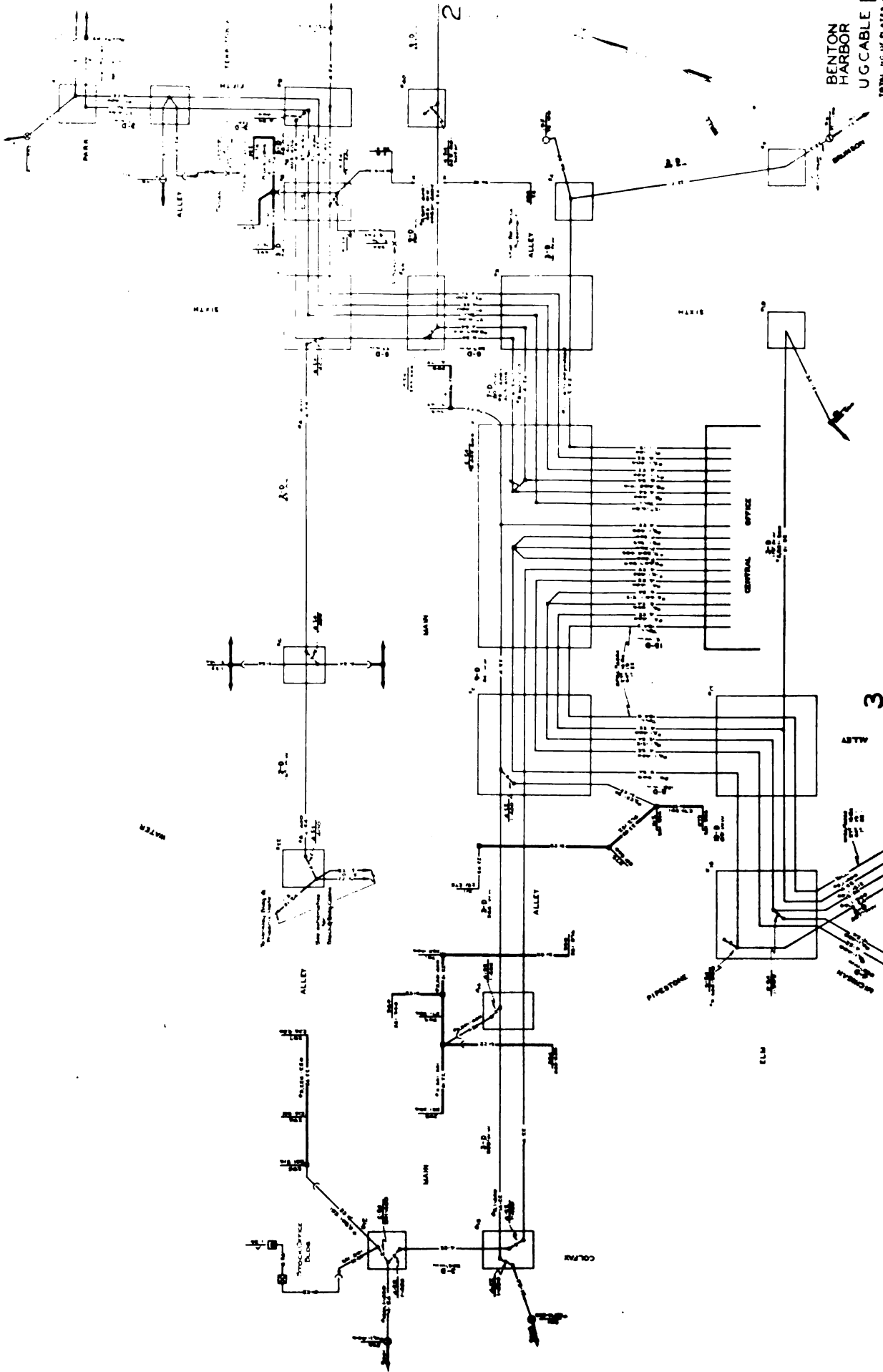
IN EFFECT July 1929

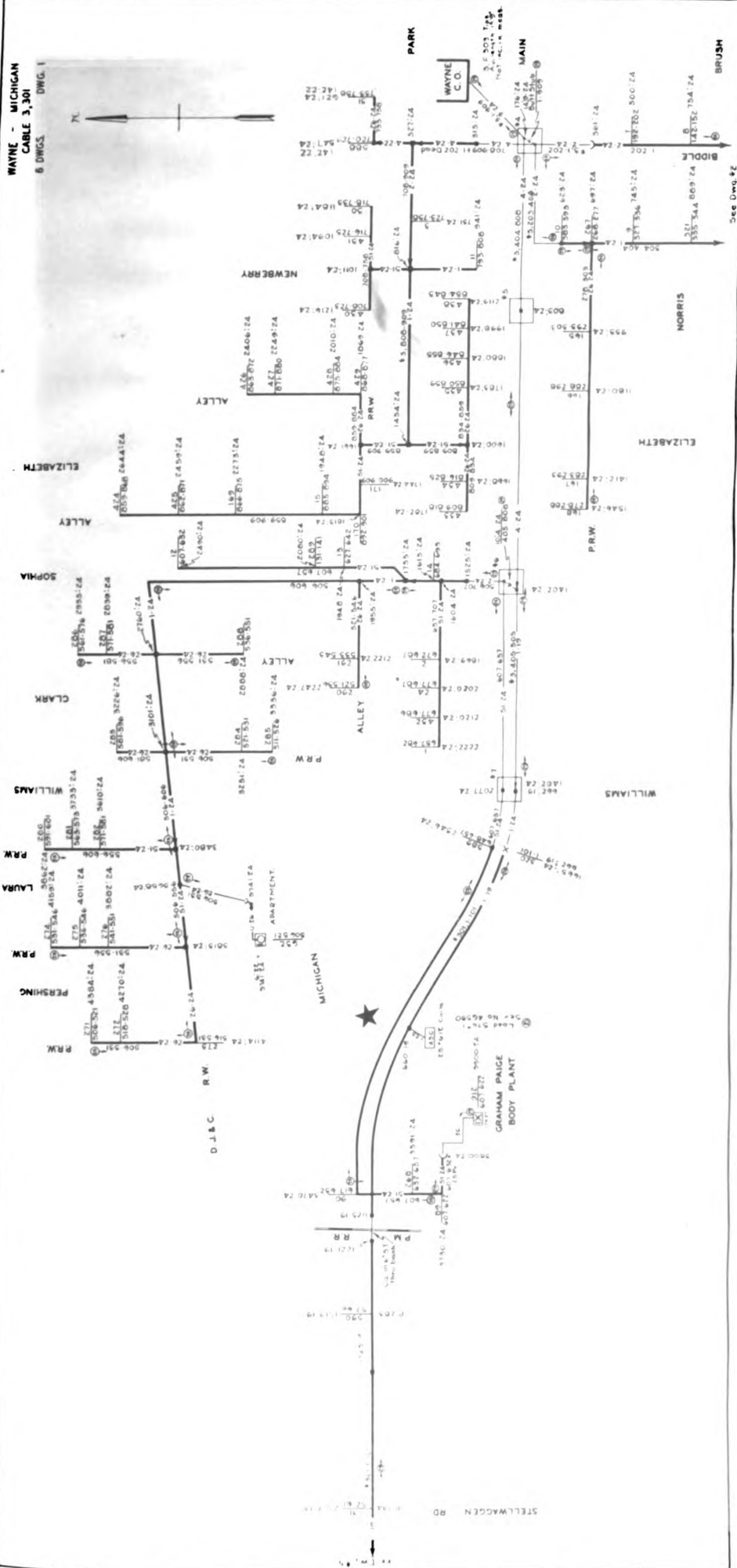
REWRITTEN

| POLE
NUMBER | LOCATION DIAGRAM
POLES, STUBS AND GUYS | SPAN | LENGTH
AND
CLASS | KIND | DATE
SET | REIN-
FORCED
LOWERED
OR
TOP CUT OFF | REMOVED | JOINT
OWNER
FILE NO. | P/W
FILE NO. |
|----------------|---|------|------------------------|------|-------------|---|---------|----------------------------|-----------------|
| 632 |  | 115 | 25C | CP | 28 | | | | |
| 631 |  | 106 | 22C | CP | 28 | | | | |
| 630 |  | 106 | 20B | CP | 28 | | | | |
| 629 |  | 104 | 25C | CP | 28 | | | | |
| 628 |  | 103 | 25C | CP | 28 | | | | |
| 627 |  | 105 | 30C | CP | 28 | | | | |
| 626 |  | 101 | 30C | CP | 28 | | | | |
| 625 |  | 90 | 25C | CP | 28 | | | | |
| 624 |  | 93 | 22B | CP | 28 | | | | |
| Stub |  | | 22A | CP | 28 | | | | |
| M.H. |  | 435 | | | | | | | 2-40 |
| M.H. |  | 655 | | | | | | | 2-41 |
| |  | | | | | | | | |
| |  | | | | | | | | |
| M.H. |  | 93 | | | | | | | |
| Stub |  | | 25A | CP | 28 | | | | |
| 623 |  | 88 | 25B | CP | 28 | | | | |
| 622 |  | 108 | 25C | CP | 28 | | | | |
| 621 |  | 105 | 25B | CP | 28 | | | | |
| 620 |  | 103 | 25C | CP | 28 | | | | |
| 619 |  | 102 | 25C | CP | 28 | | | | |

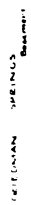
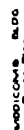
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HARBOR
UG CABLE 1

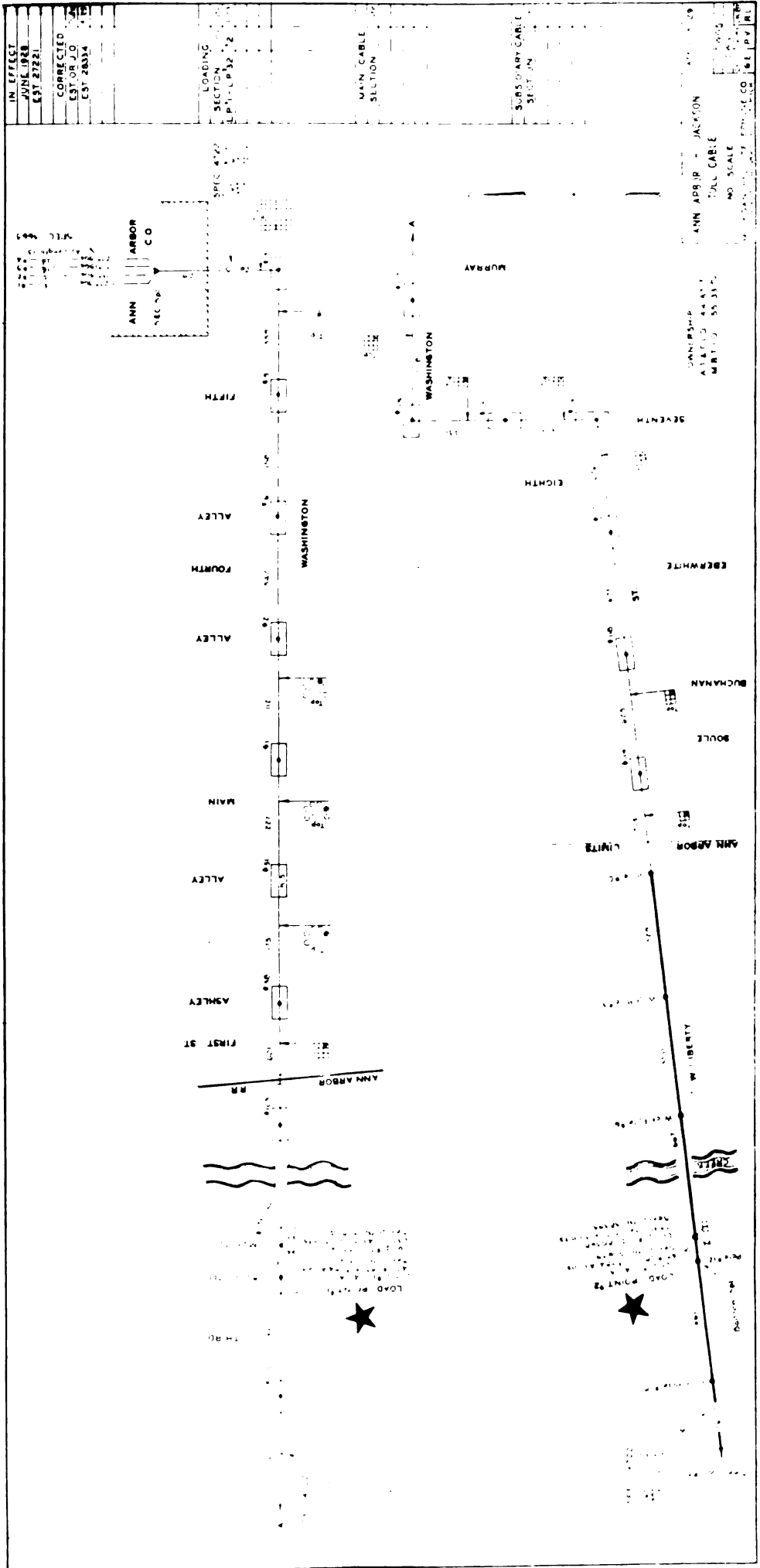
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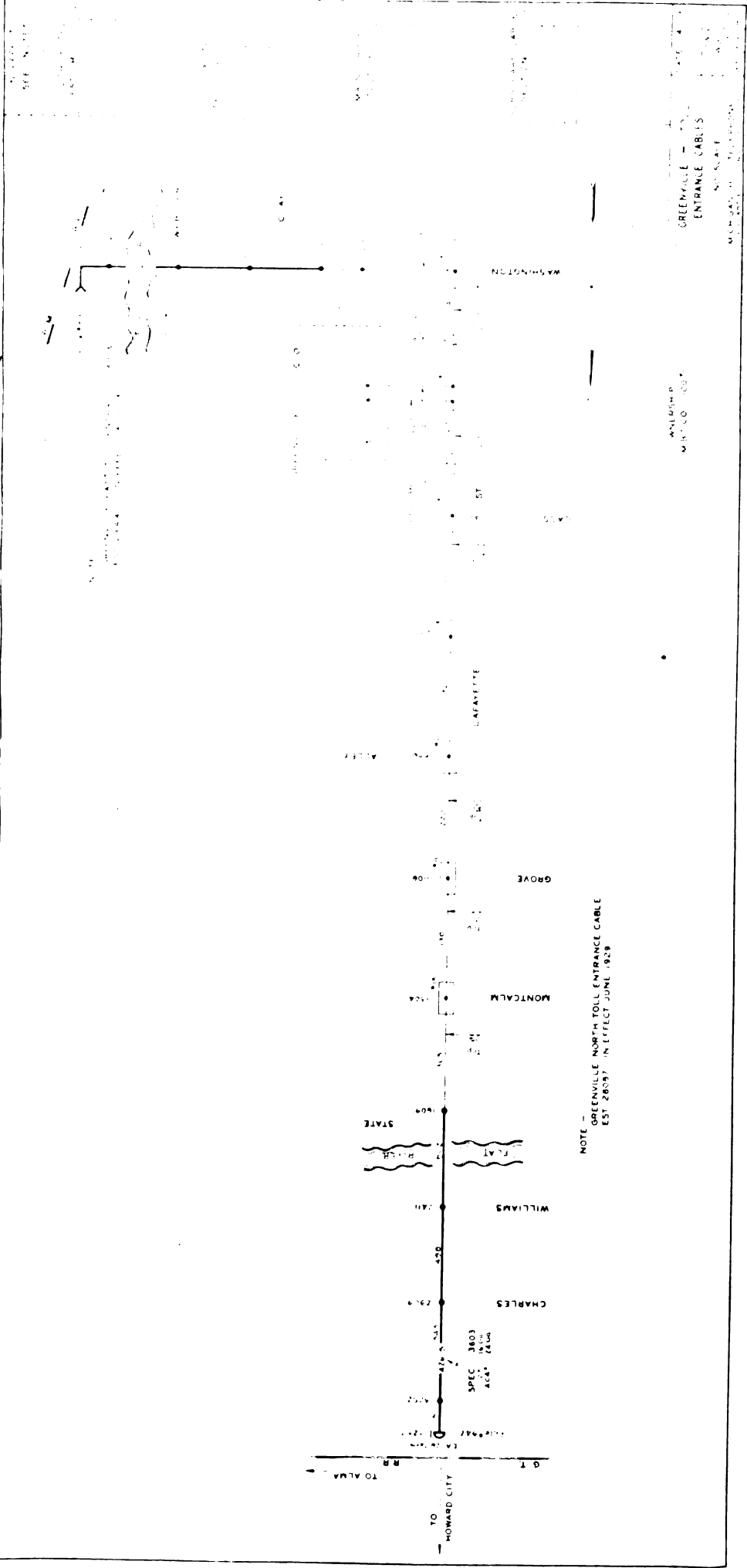




See DWG #2







NOTE -
GREENVILLE NORTH TOLL ENTRANCE CABLE
EST 28097 IN EFFECT JUNE 1929

TEST BOARD CABLE RECORD

SHEET NO. 1
IN EFFECT 4-1-30

CABLE Jackson-Lansing "A"

RECORD FROM Jackson

TO Lansing

CLASSIFICATION OF LOADING BY COMPLEMENTS

[illegible]

TEST BOARD CABLE RECORD

SHEET NO. 1

IN EFFECT 4-1-30

CABLE Jackson-Lansing "A" RECORD FROM Jackson TO Lansing

CLASSIFICATION OF LOADING BY PAIRS

[illegible]

SHEET NO. 1
IN EFFECT 3-15-30

RECORD FROM Jackson

TO Lansing

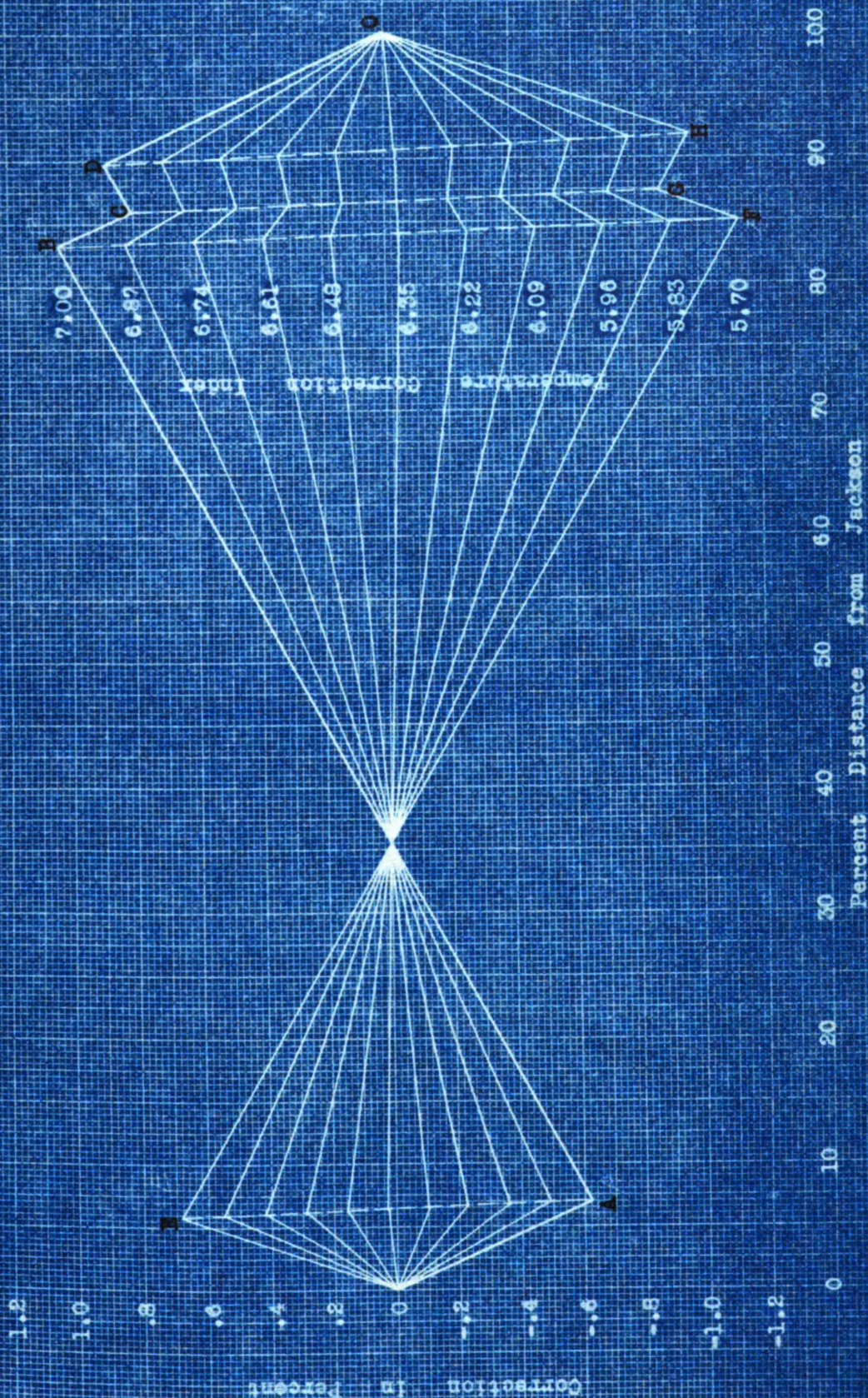
50

SHEET NO. 3
IN EFFECT 3-15-30

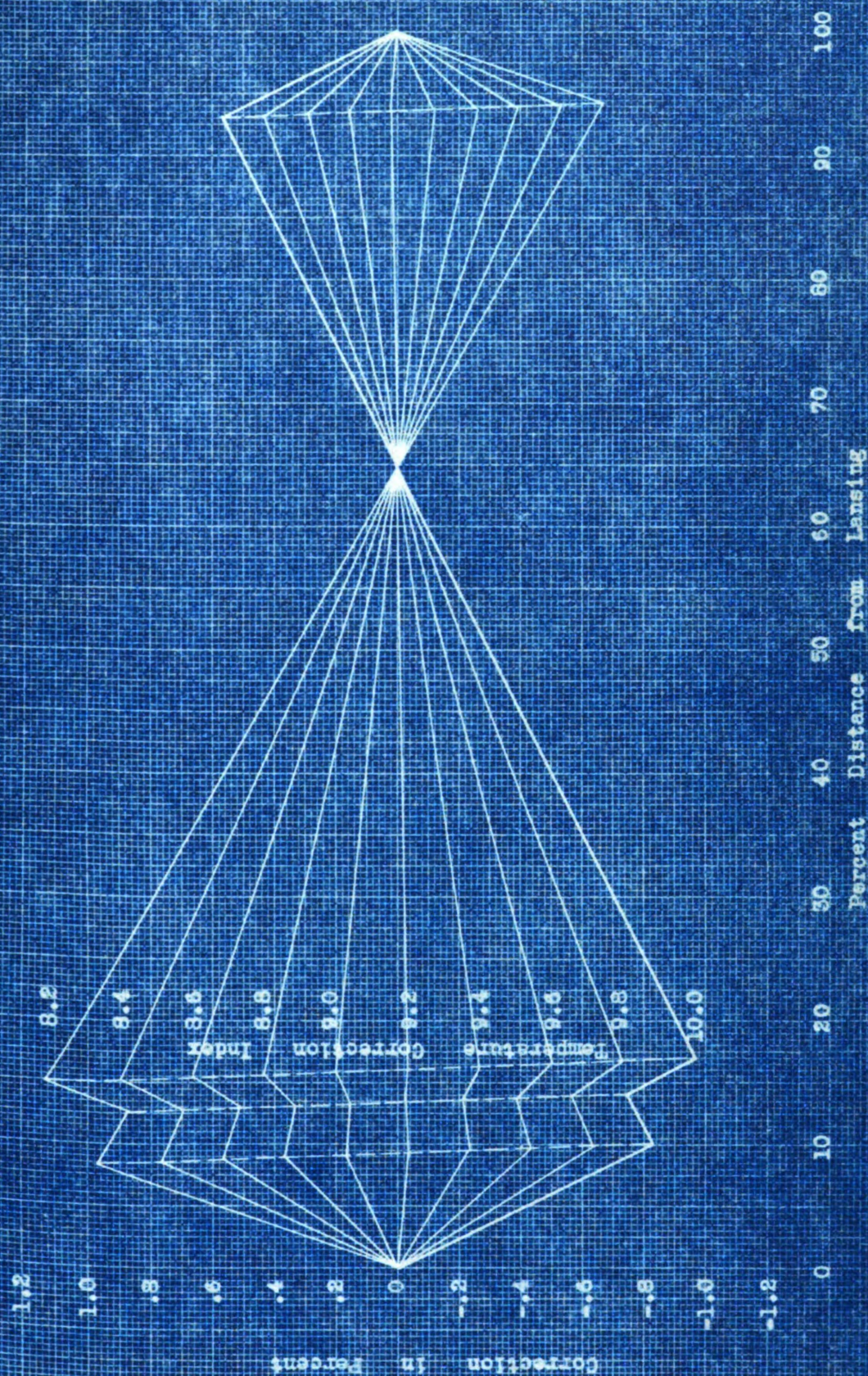
CABLE **Jackson-Lansing** **SECTION** **Jackson-Lansing**

| POLE OR
MANHOLE | FEET | CUMULATIVE DISTANCE IN FEET
FROM LAST LOAD POINT | | | | LOCATION | REMARKS
LOAD POINTS,
FT. TO SPLICE, ETC. |
|--------------------|------|---|--|--------------|--|--------------------|--|
| | | FROM L.P. #2 | | FROM L.P. #3 | | | |
| M.H. 79 | | 0 | | 6026 | | Clinton at Madison | Load Point #2 |
| 80 | 217 | 217 | | 5809 | | " at Monroe | |
| 81 | 544 | 761 | | 5265 | | " at Dewey | |
| 82 | 571 | 1332 | | 4694 | | " | |
| 83 | 575 | 1907 | | 4119 | | " at Comm'lth | City Limits |
| 84 | 600 | 2507 | | 3519 | | " Road | |
| 290 | 504 | 3011 | | 3015 | | " " | |
| 85 | 92 | 3103 | | 2923 | | " " | |
| 86 | 608 | 3711 | | 2315 | | " " | |
| 87 | 608 | 4319 | | 1707 | | " & Co. Hse. Rd. | |
| P. 0 | 221 | 4540 | | 1486 | | County House Rd. | 3 U.G. Poles |
| 1 | 114 | 4654 | | 1372 | | " | |
| 2 | 118 | 4772 | | 1254 | | " | |
| 3 | 114 | 4886 | | 1140 | | " | |
| 4 | 120 | 5006 | | 1020 | | " | |
| 5 | 121 | 5127 | | 899 | | " | |
| 6 | 122 | 5249 | | 777 | | " | 42 |
| 7 | 121 | 5370 | | 656 | | " | |
| 8 | 122 | 5492 | | 534 | | " | |
| 9 | 123 | 5615 | | 411 | | " | |
| 10 | 72 | 5687 | | 339 | | " | |
| 11 | 110 | 5797 | | 229 | | " | |
| 12 | 117 | 5914 | | 112 | | " | |
| 13 | 100 | 6014 | | 12 | | " | 9 Balloon Spl. |
| Main Spl | 12 | 6026 | | 0 | | " | Load Point #3 |

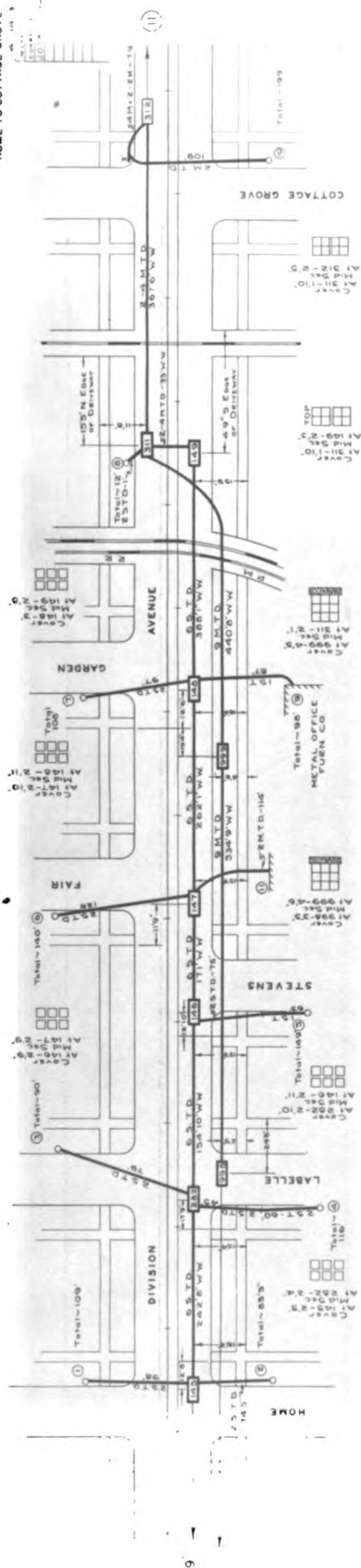
Temperature Correction Curve
Jackson-Lensing "A" Cable
Jackson-Lensing Section



Temperature Correction Curve
Jackson-Jansing "A" Cable
Lansing-Jackson Section



GRAND RAPIDS-MICH DIVISION AVENUE HOME TO COTTAGE GROVE

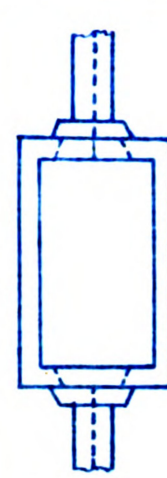
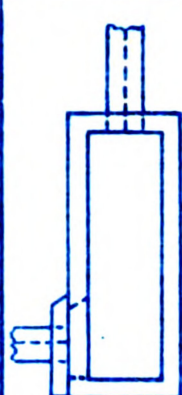
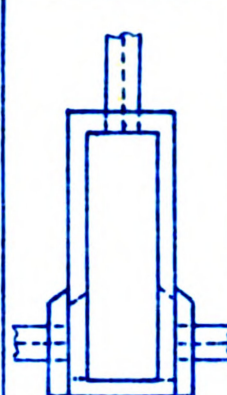
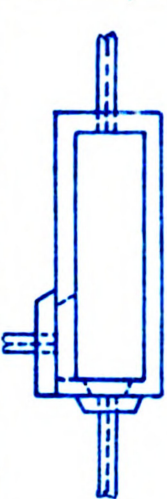


| MAIN HOLES | | | | | | | | | |
|------------|------|---------------|----------|-------------|----------------|------|-----|------|---------------|
| NO | DATE | DEPTH | DIAMETER | LOCATION | REMARKS | DATE | NO | DATE | DEPTH |
| 145 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 195 | 145 | Y | 5'-34"-4'-8" |
| 282 | B | 7'-0"-3'-8" | 6" | Brick Can | 230 N. 350' 0" | 196 | 282 | B | 7'-0"-3'-8" |
| 146 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 197 | 146 | Y | 5'-34"-4'-8" |
| 147 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 198 | 147 | Y | 5'-34"-4'-8" |
| 148 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 199 | 148 | Y | 5'-34"-4'-8" |
| 149 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 200 | 149 | Y | 5'-34"-4'-8" |
| 311 | B | 15'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 201 | 311 | B | 15'-34"-4'-8" |
| 999 | A | 6'-35"-5'-8" | 6" | Can Can Can | 230 N. 350' 0" | 202 | 999 | A | 6'-35"-5'-8" |
| 999 | A | 6'-35"-5'-8" | 6" | Can Can Can | 230 N. 350' 0" | 203 | 999 | A | 6'-35"-5'-8" |

| MAIN CONDUIT | | | | | | | | | |
|--------------|------|---------------|----------|-------------|----------------|------|-----|------|---------------|
| NO | DATE | DEPTH | DIAMETER | LOCATION | REMARKS | DATE | NO | DATE | DEPTH |
| 145 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 195 | 145 | Y | 5'-34"-4'-8" |
| 282 | B | 7'-0"-3'-8" | 6" | Brick Can | 230 N. 350' 0" | 196 | 282 | B | 7'-0"-3'-8" |
| 146 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 197 | 146 | Y | 5'-34"-4'-8" |
| 147 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 198 | 147 | Y | 5'-34"-4'-8" |
| 148 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 199 | 148 | Y | 5'-34"-4'-8" |
| 149 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 200 | 149 | Y | 5'-34"-4'-8" |
| 311 | B | 15'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 201 | 311 | B | 15'-34"-4'-8" |
| 999 | A | 6'-35"-5'-8" | 6" | Can Can Can | 230 N. 350' 0" | 202 | 999 | A | 6'-35"-5'-8" |
| 999 | A | 6'-35"-5'-8" | 6" | Can Can Can | 230 N. 350' 0" | 203 | 999 | A | 6'-35"-5'-8" |

| LATERALS | | | | | | | | | |
|----------|------|---------------|----------|-------------|----------------|------|-----|------|---------------|
| NO | DATE | DEPTH | DIAMETER | LOCATION | REMARKS | DATE | NO | DATE | DEPTH |
| 145 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 195 | 145 | Y | 5'-34"-4'-8" |
| 282 | B | 7'-0"-3'-8" | 6" | Brick Can | 230 N. 350' 0" | 196 | 282 | B | 7'-0"-3'-8" |
| 146 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 197 | 146 | Y | 5'-34"-4'-8" |
| 147 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 198 | 147 | Y | 5'-34"-4'-8" |
| 148 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 199 | 148 | Y | 5'-34"-4'-8" |
| 149 | Y | 5'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 200 | 149 | Y | 5'-34"-4'-8" |
| 311 | B | 15'-34"-4'-8" | 6" | Brick Can | 230 N. 350' 0" | 201 | 311 | B | 15'-34"-4'-8" |
| 999 | A | 6'-35"-5'-8" | 6" | Can Can Can | 230 N. 350' 0" | 202 | 999 | A | 6'-35"-5'-8" |
| 999 | A | 6'-35"-5'-8" | 6" | Can Can Can | 230 N. 350' 0" | 203 | 999 | A | 6'-35"-5'-8" |

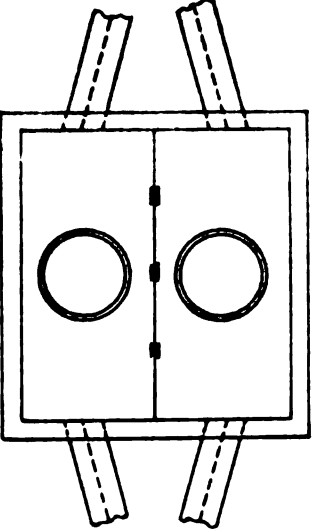
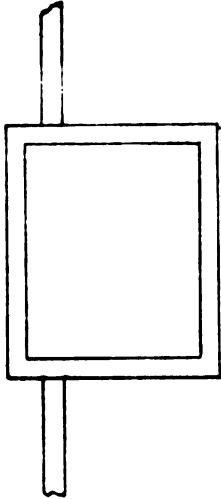
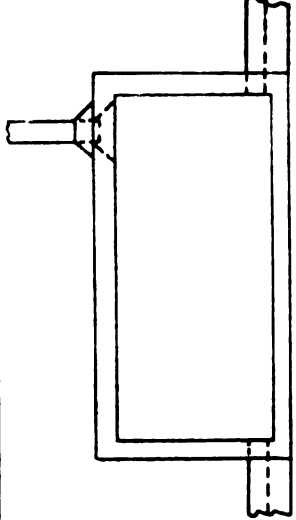
SIZE AND TYPES OF MANHOLES

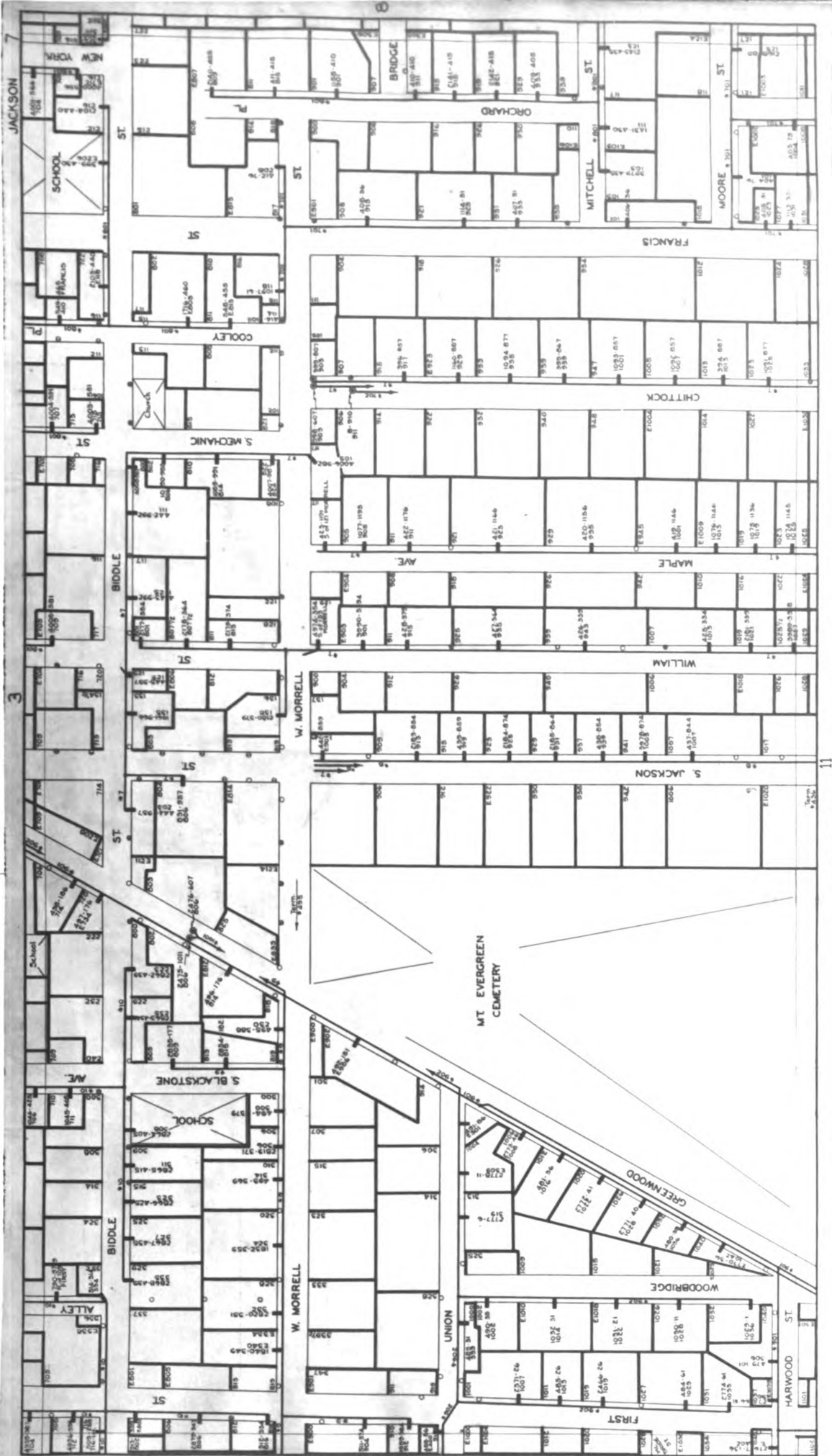
| KIND | TYPE | WIDTH OF
RCH L.
SIDE WALL | WIDTH | LENGTH | MINIMUM
HEADROOM | FIGURE |
|--------------------|------|---------------------------------|-------------------------|-------------------------|-------------------------|--|
| Two Way Manholes | A | ---- | 3' 6" | 8' 0" | 5' 6" |  |
| " | B | ---- | 3' 6" | 6' 0" | 5' 0" |  |
| " | L | 2 Ducts
3 "
4 " | 3' 6"
3' 6"
3' 6" | 6' 0"
6' 6"
9' 0" | 5' 6"
5' 6"
5' 6" |  |
| Three Way Manholes | T | 2 Ducts
3 "
4 " | 4' 0"
4' 0"
4' 0" | 8' 0"
8' 6"
9' 0" | 5' 6"
5' 6"
5' 6" |  |
| " | J-3 | 2 Ducts
3 "
4 " | 3' 6"
3' 6"
3' 6" | 8' 0"
6' 6"
9' 0" | 5' 6"
5' 6"
5' 6" |  |

| Kind | Type | Width of Run in Side Wall | Width | Length | Minimum Headroom | Figure |
|---|------|---------------------------|-------------|-------------|------------------|--------|
| "V" Manholes
Minimum width
At Apex of "V"
for width of Duct Run.
Rectangular Portion.
Shortest "V" Wall. | V-1 | 2 Ducts | 1'9" | - - - | 5'0" | |
| | | 3 " | 2'2" | - - - | - - - | |
| | | 4 " | 2'6" | - - - | - - - | |
| | | - - - | 3'6" | 9'0" | - - - | |
| | | | | 6'0" | | |
| "V" Manholes | V-2 | Same as V-1 | Same as V-1 | Same as V-1 | Same as V-1 | |
| | | | | | | |
| | | | | | | |
| "V" Manholes | V-3 | Same as V-1 | Same as V-1 | Same as V-1 | Same as V-1 | |
| | | | | | | |
| | | | | | | |
| Four-Way Manholes | J-4 | 2 Ducts | 4'0" | 8'0" | 5'6" | |
| | | 3 " | 4'0" | 8'6" | 5'6" | |
| | | 4 " | 4'0" | 9'0" | 5'6" | |
| | | | | | | |

SIZE AND TYPES OF MANHOLES

| KIND | TYPE | WIDTH OF RUN IN SIDE WALL | WIDTH | LENGTH | MINIMUM HEADROOM | FIGURE |
|---|------|------------------------------|----------------|----------------------------------|------------------|--|
| Center - Rack Manholes
Without Side Runs
With Side Runs

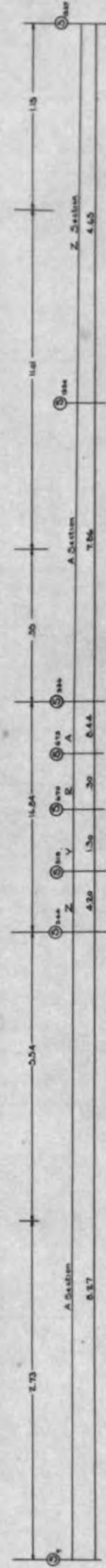
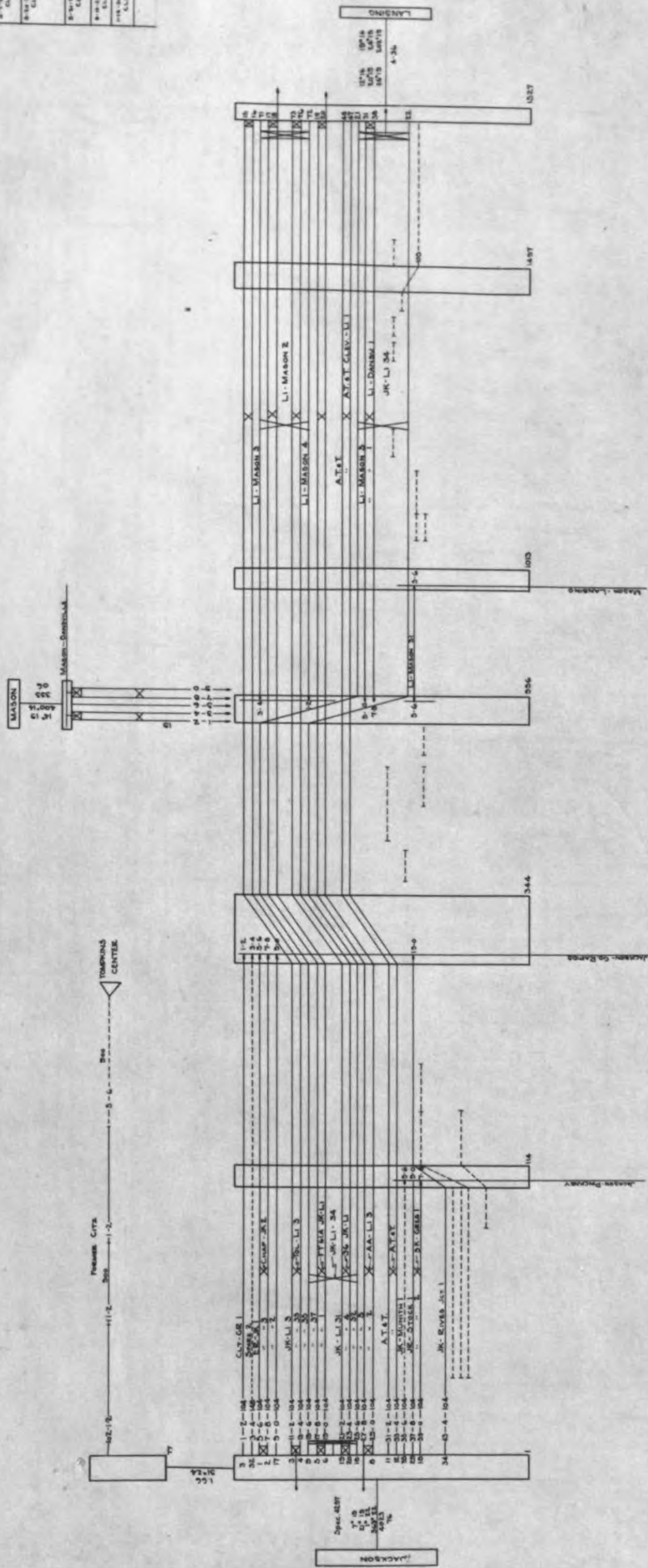
Cable Single Racked
" Double Racked | --- | ---
2 Duots
3 "
4 " | 7' 6"
8' 0" | 8' 0"
8' 0"
8' 6"
9' 0" | 5' 6" |  |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Service Boxes | X | | 3' 0" | 4' 0" | 3' 2" |  |
| | Y | | 3' 0" | 6' 0" | 4' 0" |  |



PINS 1-2

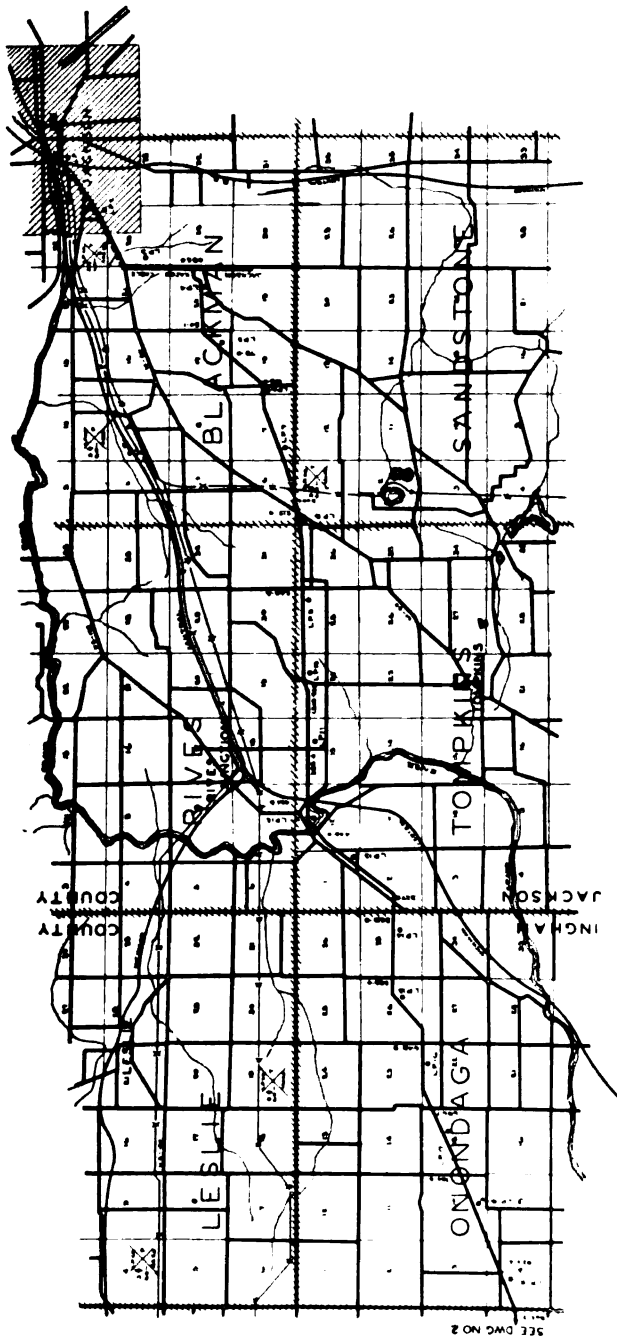
[illegible]

| |
|------------|
| IN 1771.1 |
| 18.3.34 |
| CORRECTION |
| 5.10.34 |
| 8.10.34 |
| 10.10.34 |
| 12.10.34 |
| 14.10.34 |
| 16.10.34 |
| 18.10.34 |
| 20.10.34 |
| 22.10.34 |
| 24.10.34 |
| 26.10.34 |
| 28.10.34 |
| 30.10.34 |
| 31.10.34 |



| |
|----------|
| JACKSON |
| 10.10.34 |
| 12.10.34 |
| 14.10.34 |
| 16.10.34 |
| 18.10.34 |
| 20.10.34 |
| 22.10.34 |
| 24.10.34 |
| 26.10.34 |
| 28.10.34 |
| 30.10.34 |
| 31.10.34 |

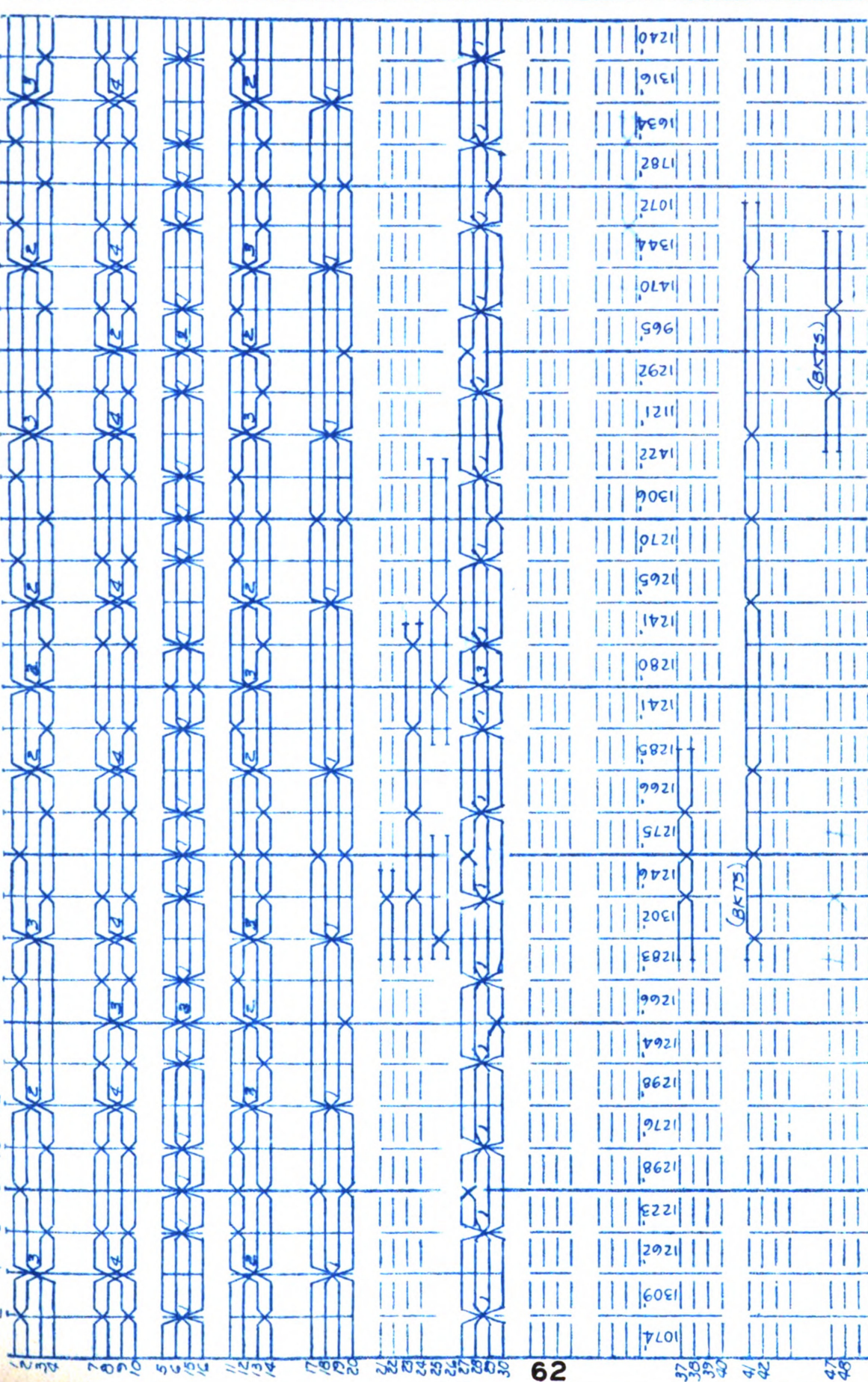
JACKSON-LANSING
TOLL VINE RECORD



JACKSON-LANSING
TOLL CABLE
ROUTE MAP
SCALE 1:100,000
MICHIGAN BELL TELEPHONE CO.
DWG. NO. 2

NO DWG. 2
DWG. NO. 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62



TRANSPOSITIONS

#1 29146

SYSTEM "E" SECTION DRAWING NO. 93-E-364 SECTION LENGTH 41,188 FT. 7.8 MILE-AVERAGE SPACING OF TRANSPOSITIONS 1271'

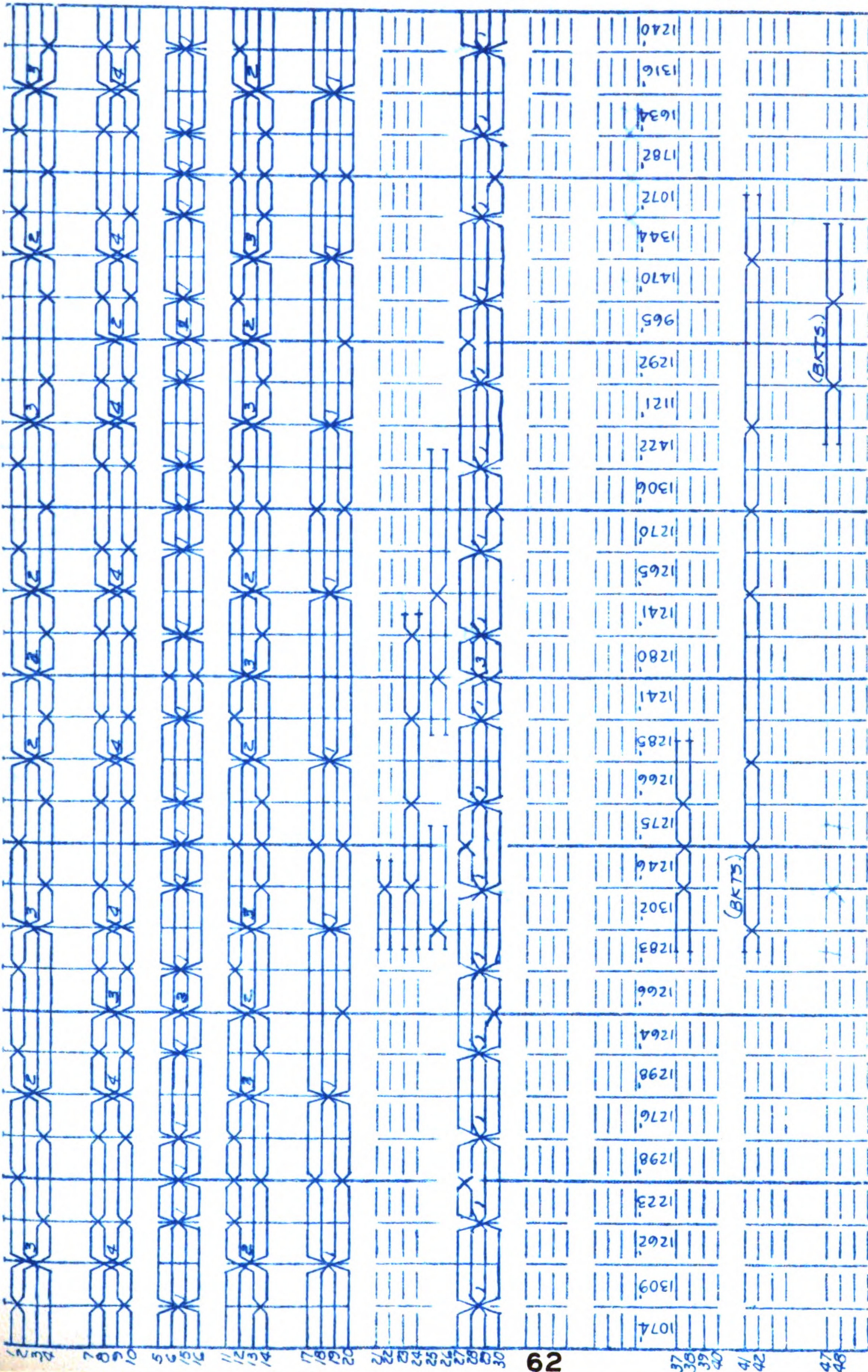
DATE LAID OUT 10-2-25 BY W.S.T. DATE CHECKED BY TO POLE NO. 383 (469)

LINE GRAND RAPIDS - BELDING SECTION U.G. POLE - PLAINFIELD JCT. POLE

PLANT ENGINEERING DEPT.
M.B.T. CO.
DETROIT, MICH.

NOTES:
TRANSFER ALL COPPER CIRCUITS ACCORDING TO THE
SEPARATE INSULATOR METHOD

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 5



TRANSPOSITIONS

#1 29146

SYSTEM E SECTION DRAWING NO. 93-E-364 SECTION LENGTH 41.188 FT. 7.8 MILE-AVERAGE SPACING OF TRANSPOSITIONS 1271.1'

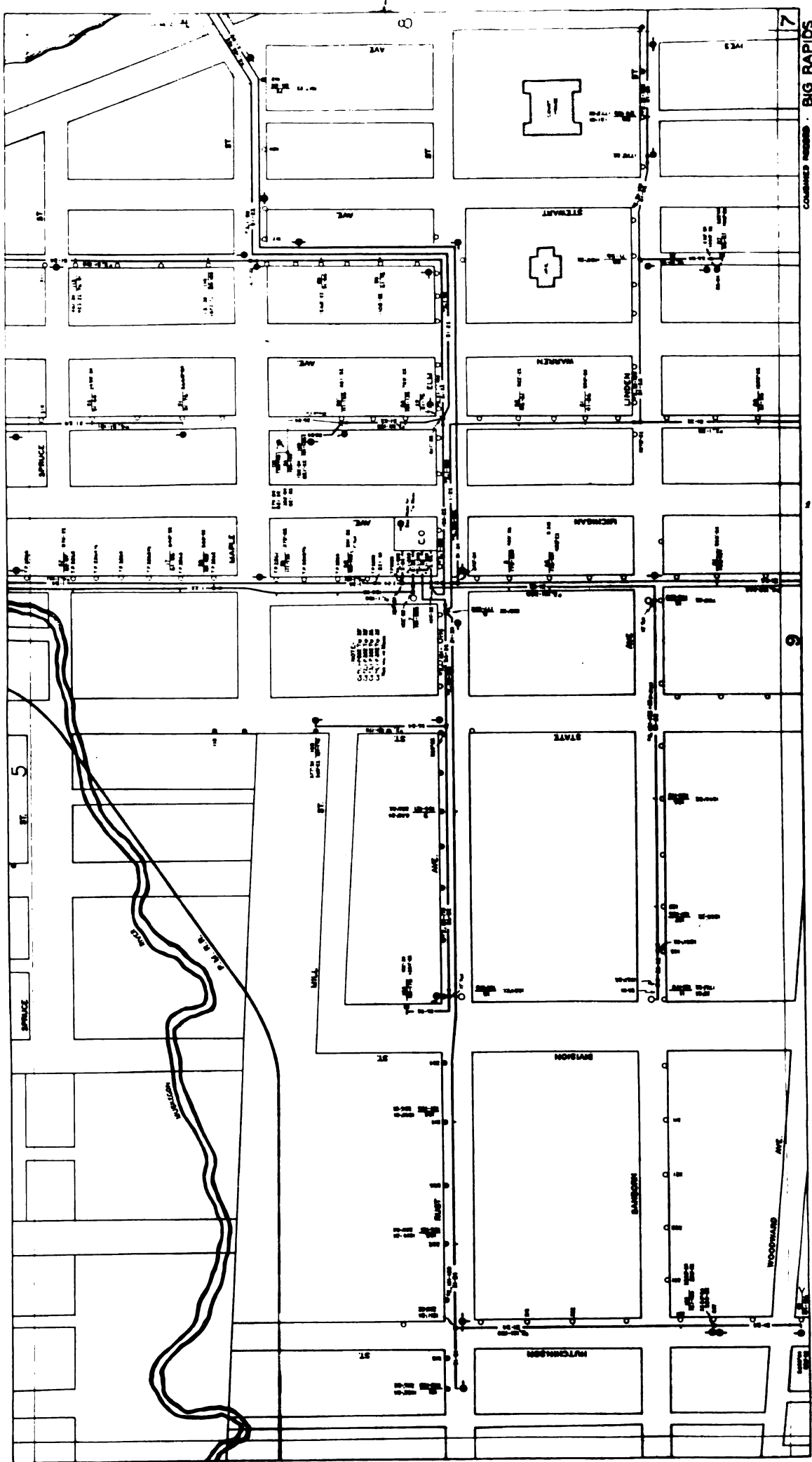
DATE LAID OUT 10-2-25 BY W.S.T. DATE CHECKED BY ISSUE NO.

LINE GRAND RAPIDS - BELDING SECTION U.G. POLE - PLAINFIELD JCT. POLE TO POLE NO. 383 (469)

PLANT ENGINEERING DEPT.
M.B.T. CO.
DETROIT, MICH.

NOTES:

TRANSFER ALL COPPER CIRCUITS ACCORDING TO THE SEPARATE INSULATOR METHOD.



BIG RAPIDS
COMBINED RECORD

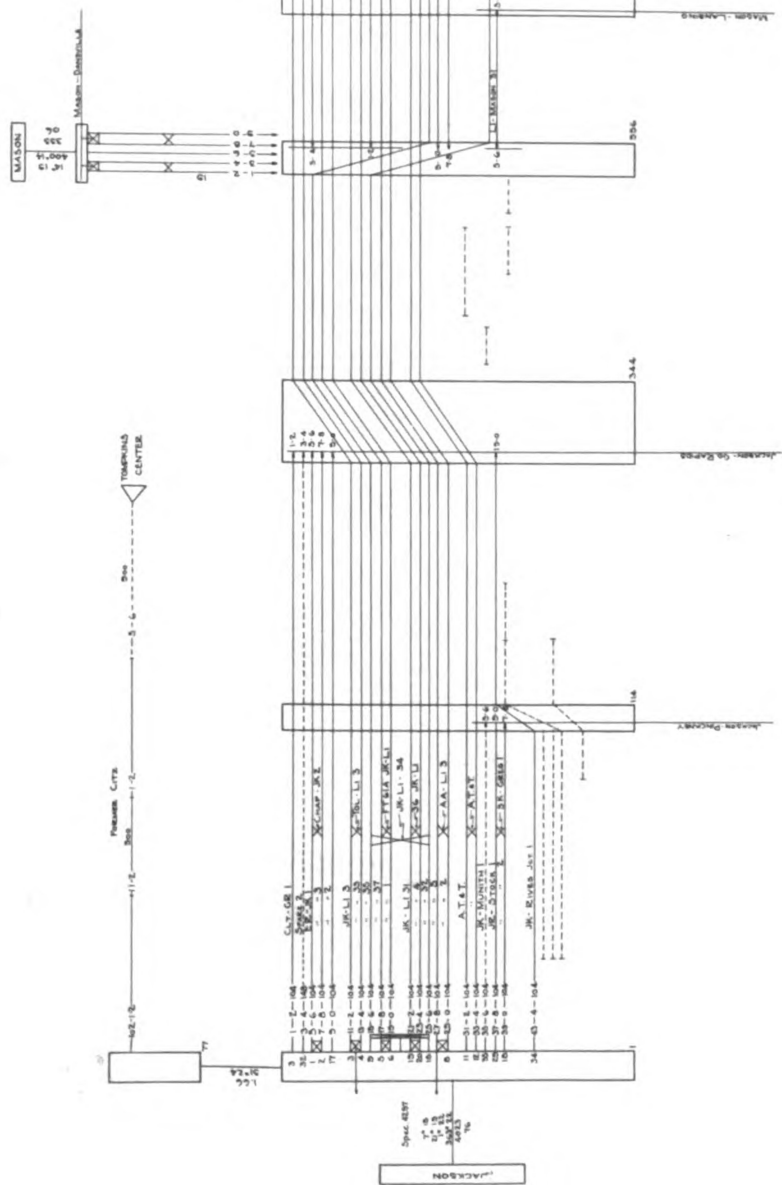
7

9

5

PINS 1-2

[illegible]

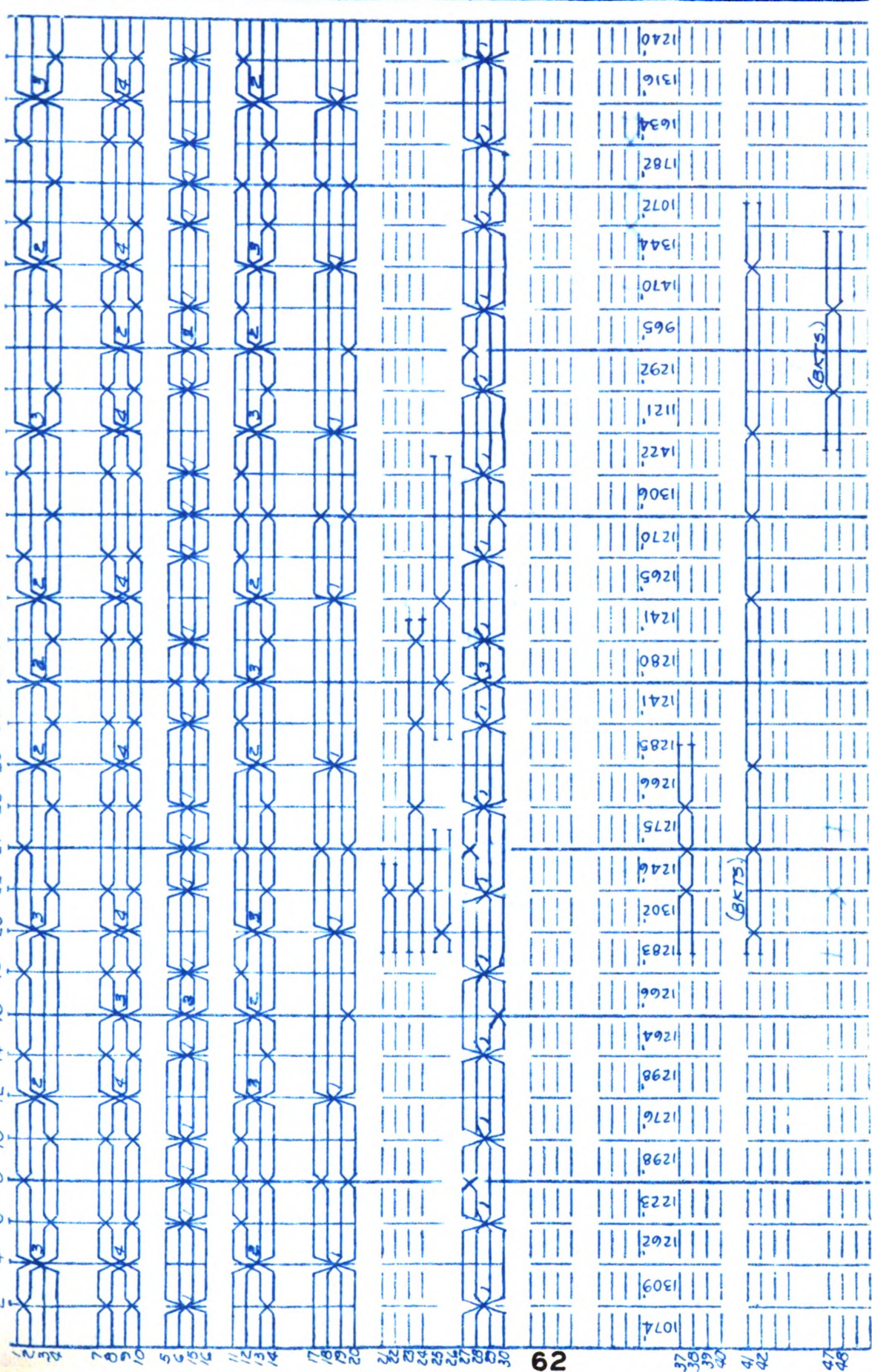
[illegible]

| JACKSON | |
|----------------------|--------|
| IN USE | SPARES |
| NO. OF DAYS TOLL COT | 483.5 |
| " " " " " " | 16.5 |
| " " " " " " | 2.03 |
| " " " " " " | 5.5 |
| " " " " " " | 10.5 |



JACKSON-LANSING
TOLL FREE RECORDS

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 5



TRANSPOSITIONS

#1 29146

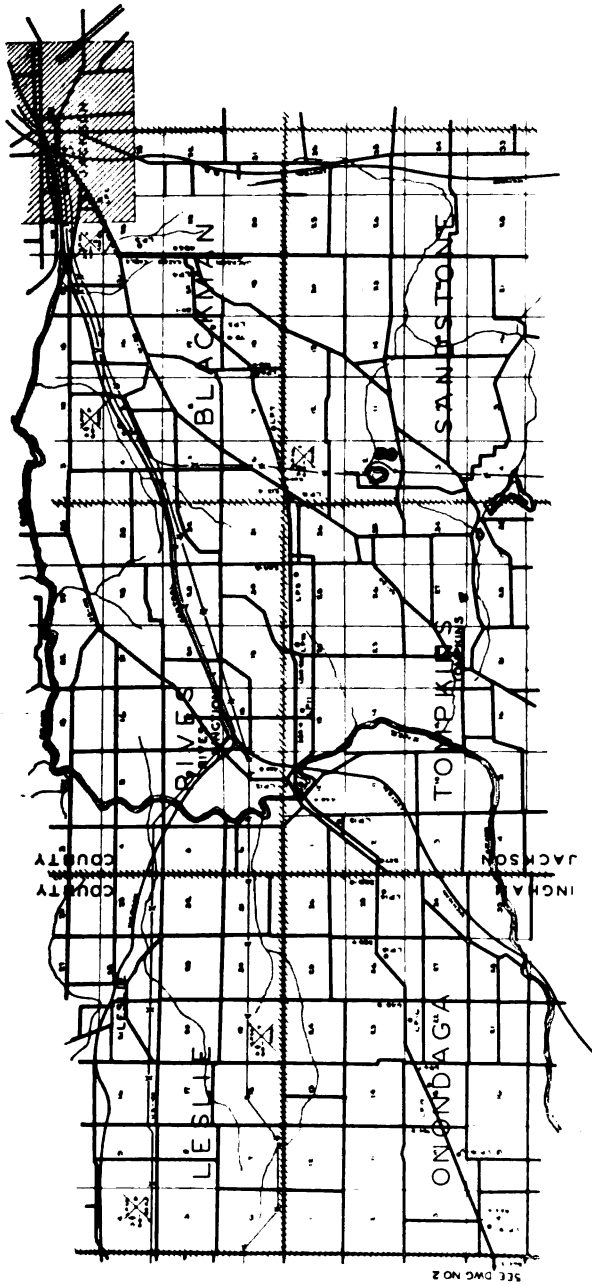
SYSTEM "E" SECTION DRAWING NO. 93-E-364 SECTION LENGTH 411.88 FT. 7.8 MILE-AVERAGE SPACING OF TRANSPOSITIONS 1271.1'

DATE LAID OUT 10-2-25 BY W.S.T. DATE CHECKED BY TO POLE NO. 383 (469)

LINE GRAND RAPIDS - BELDING SECTION U.G. POLE - PLAINFIELD JCT. POLE POLE NO. 33

PLANT ENGINEERING DEPT.
M.B.T. CO.
DETROIT, MICH.

NOTES: TRANSFER ALL COPPER CIRCUITS ACCORDING TO THE SEPARATE INSULATOR METHOD



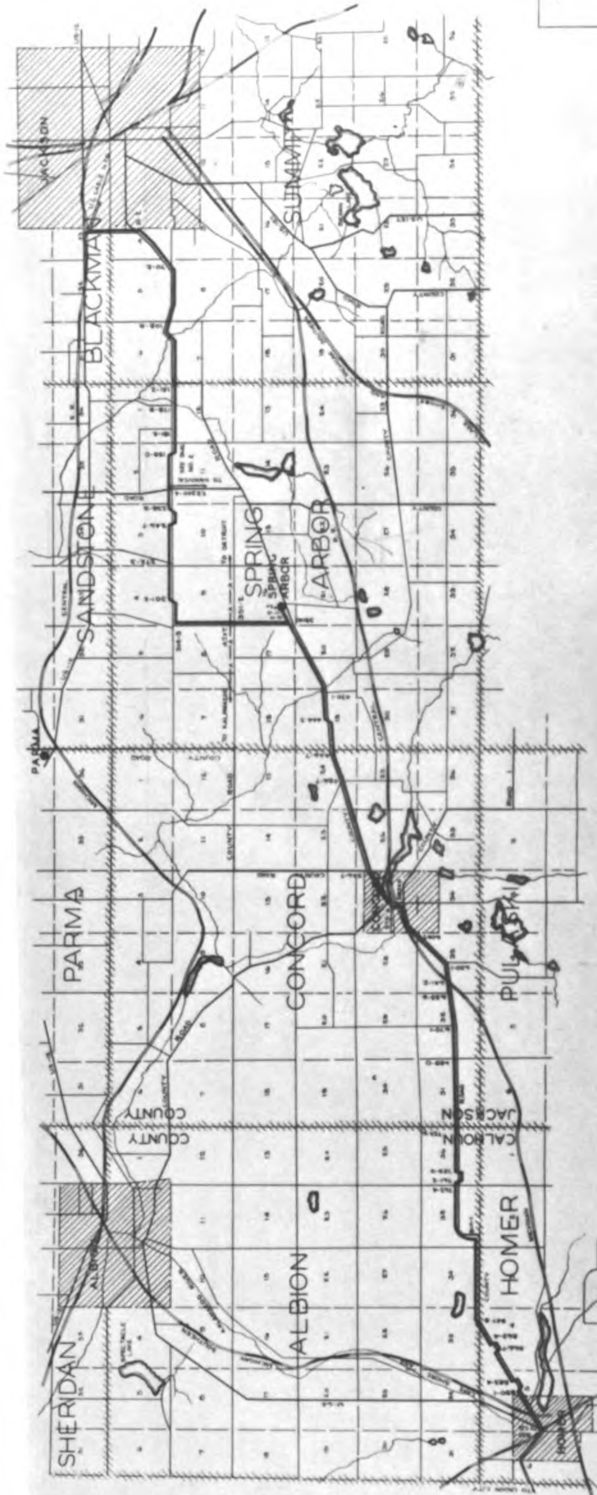
SEE DWG NO 2

JACKSON-LANSING
TOLL CABLE
ROUTE MAP
SCALE
MICROFILM
TELEPHONE CO
DWG NO 1

NO DWG 2
DWG NO 2

Z

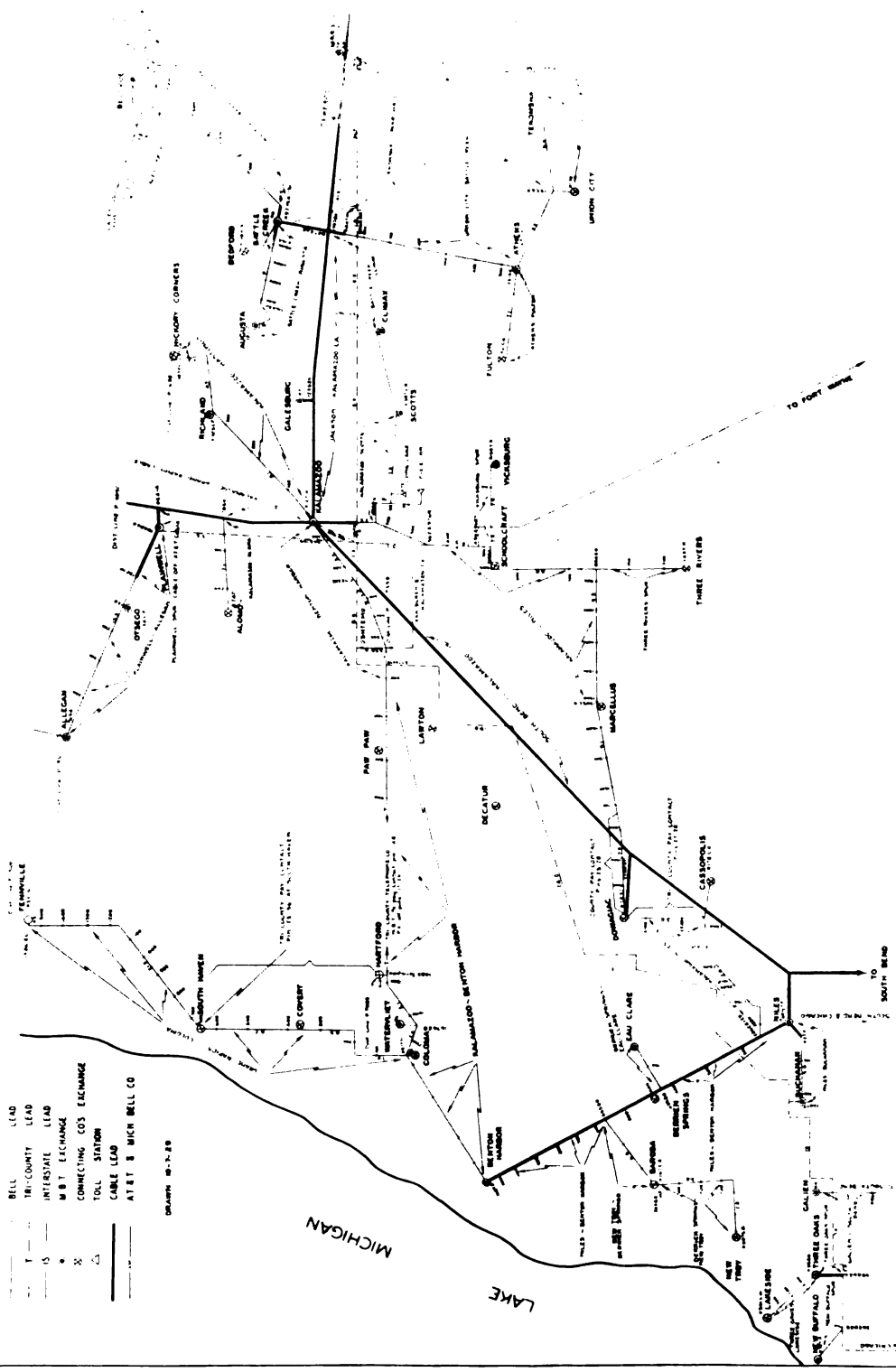
1. TOLL CABLE
2. ROUTE MAP
3. SCALE
4. MICROFILM
5. TELEPHONE CO
6. DWG NO 1



JACKSON HOMER
ROUTE MAP
SCALE 1/4 MI
MICHIGAN BELL TELEPHONE CO.
1957

STORM CHART OF KALAMAZOO DISTRICT

| CODE | AT & T | LEAD |
|------|--------------------------|------|
| --- | CITIZENS | LEAD |
| --- | BELL | LEAD |
| --- | TRU-COUNTY | LEAD |
| --- | INTERSTATE | LEAD |
| --- | M & T EXCHANGE | |
| --- | CONNECTING CO'S EXCHANGE | |
| --- | TOLL STATION | |
| --- | CABLE LEAD | |
| --- | AT & T & MICH BELL CO | |



DRAWN BY T-28

| | | | | |
|----------------------------------|--|------------------------|---------------------------|------------|
| J. B. Lazell
Supv. of Records | Field Crews | | R. Ten Hoor, Chas. Kirker | |
| | A. Jaquith, S. Baarda | | | |
| | R. G. Bertsch
Mortality Study Supv. | M. Slabbekoorn - Clerk | | |
| | | L. Crozier - " | | |
| | | G. Bosscher - " | | |
| | F. J. Blaszczyk | | Exchange Record Supv. | |
| | D. Weldon
Stenographer | | | |
| | R. K. Lyon
Toll Record Supv. | G. Effinger - Drftsmn. | | |
| | | M. Dunn - " | | |
| | | P. Cline - " | | |
| J. B. Lazell
Supv. of Records | R. S. Rymar | | | |
| | Blue Printing | | J. Faasse | |
| | Ditto & Mimeograph | | | |
| | Rural Pole | | R. Wisneski | - Drftsmn. |
| | | | L. Dominski | - " |
| | | | F. Ward | - " |
| | Conduit | | W. Simpson | - Drftsmn. |
| | | | J. Van Slooten | - " |
| | Schematics | | P. DeClark | - Drftsmn. |
| | | | E. Westerhouse | - " |
| J. B. Lazell
Supv. of Records | Combined | | F. Joslin | - Drftsmn. |
| | Assignments | | F. Oesterle | - Drftsmn. |
| | Block & Bldg. | | G. Wordhouse | - Drftsmn. |
| | Aerial Cable | | E. Brandt | - Drftsmn. |
| | U.G. Cable | | R. Lewis | - Drftsmn. |
| | Typist | | G. Towne | - Drftsmn. |
| | City Pole | | A. Helms | - Drftsmn. |
| | General Drafting | | P. Vanderhout | - Tracer |
| | | | K. Karcher | - " |
| | | | P. Freeland | - Drftsmn. |
| J. B. Lazell
Supv. of Records | | | G. Mullian | - " |
| | | | F. Clark | - " |

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