

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G41.410.1
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AT&T Co Standard

MAIN CONDUIT
REPAIR AND REARRANGEMENT

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1. GENERAL

1.01 This section is reissued principally to include the changes resulting from the provision of factory split straight clay conduit. It replaces Section G41.410, Issue 1.

1.02 In large scale excavation involving the location of an existing conduit line, arrangements must be made for supporting the conduit and cables temporarily. Special supporting provisions for situations not covered herein will be included in the detail plans.

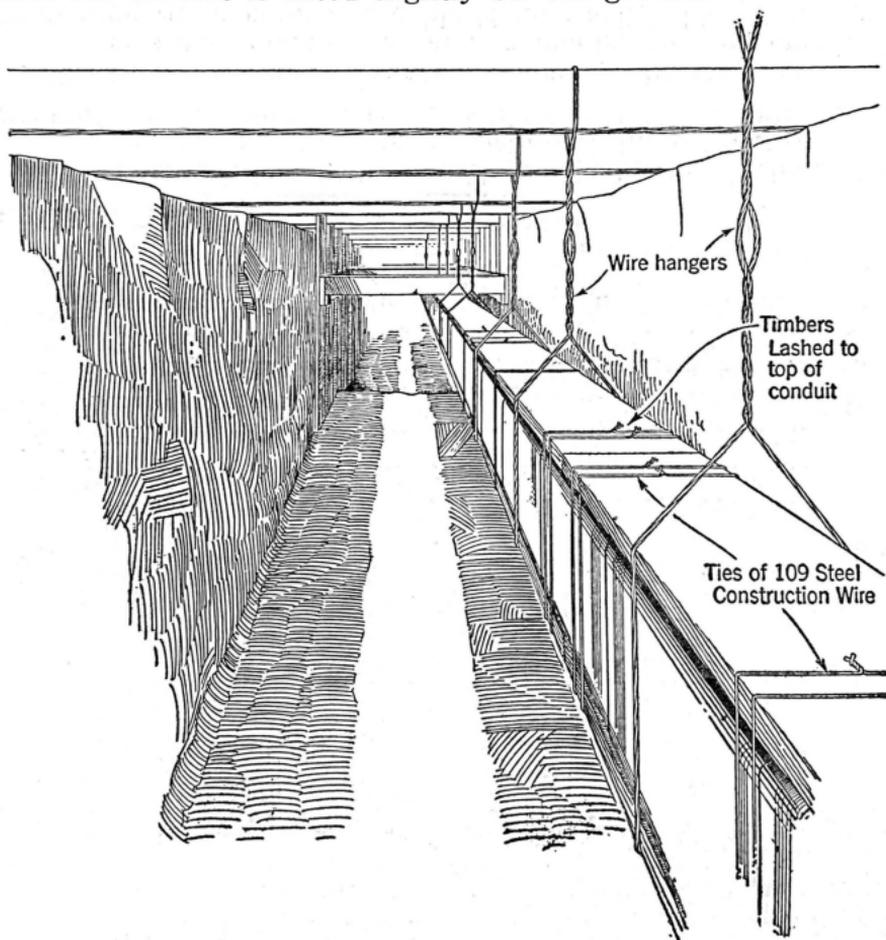
1.03 If repeated shifting of the conduit and cables is not required, it will be practicable to maintain the ducts reasonably intact. Removal of some units may be necessary, however, in order to obtain flexibility and ease in handling the conduit sections. Exercise care in handling the conduit to prevent excessive breakage. Replace broken units in accordance with Part 5.

1.04 After restoring the conduit and backfilling the trench, mandrel spare ducts to detect any damage that may have occurred during the rearrangement work.

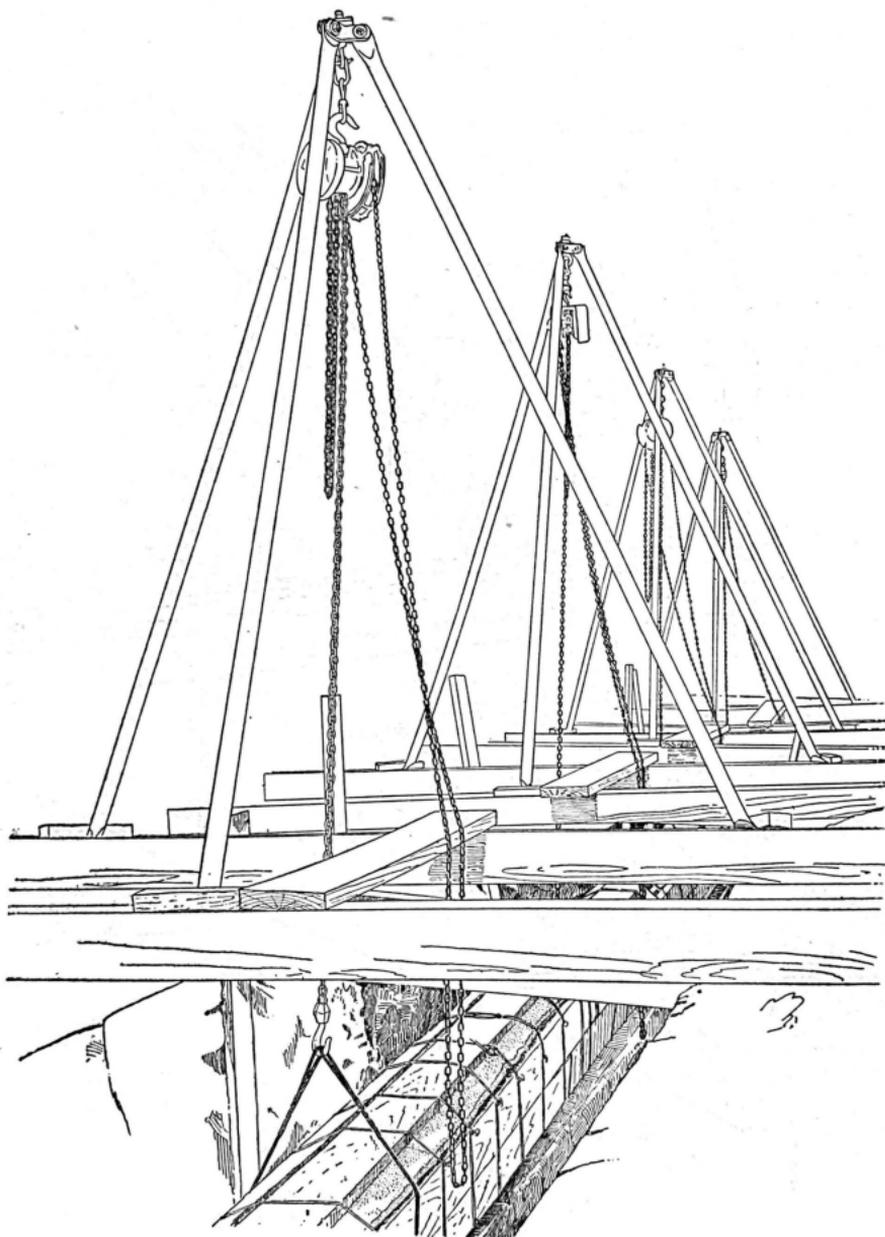
2. TEMPORARY SUPPORT OF DUCTS

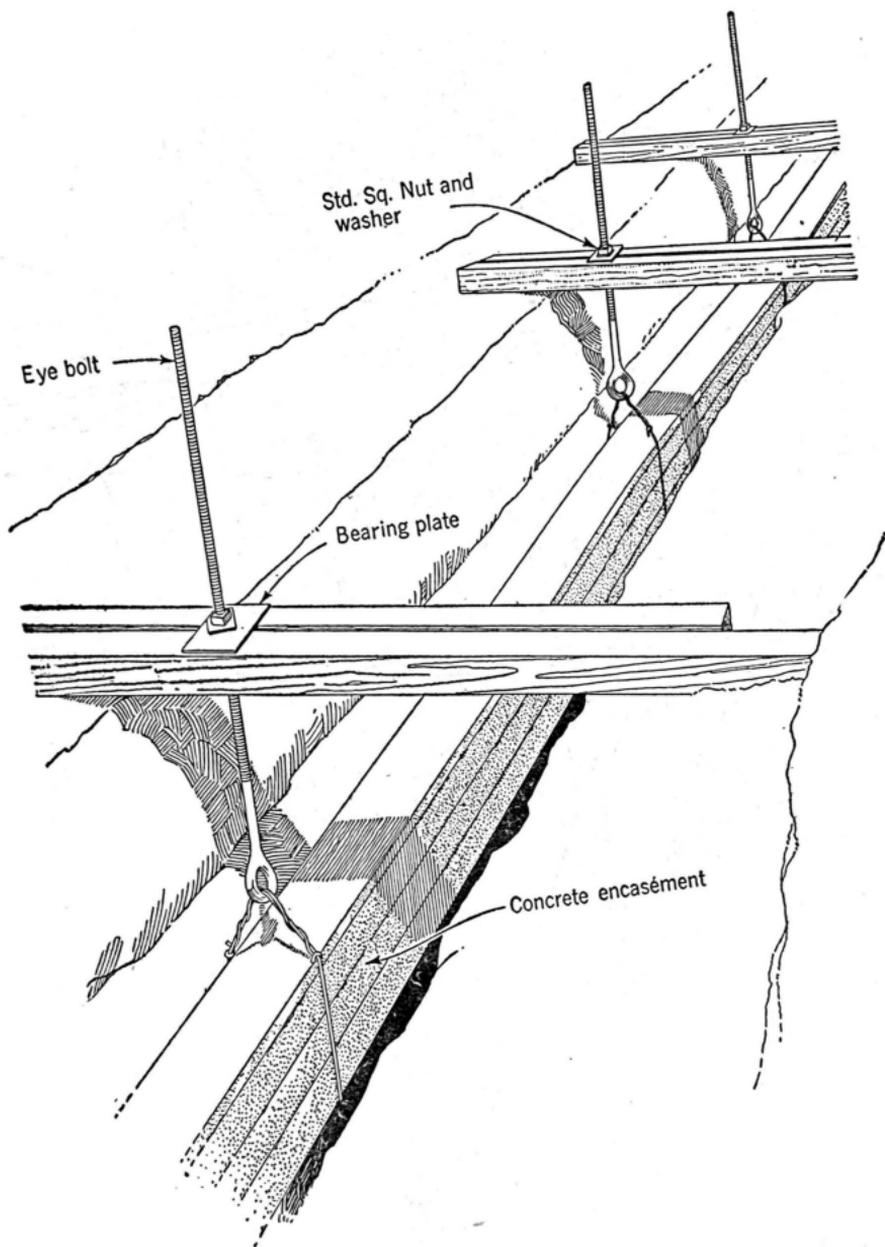
2.01 After excavating to the bottom of the conduit or concrete base, it is advisable to stiffen the duct line by lashing timbers to the top of the ducts, as illustrated. Use 109 steel construction wire or equivalent, placing one or more lashings around each unit of conduit.

2.02 If the width of the excavation is such that it can be spanned by light timbering, the simplest method of supporting the ducts is to space 4 in. by 4 in. or 6 in. by 6 in. timbers across the excavation at intervals of 6 to 8 feet and suspend the conduit from them. Hangers of 109 steel construction wire, strand or other steel cable are slipped under the conduit and the ends are twisted or clamped together, as shown below. The hanger is then twisted in the manner of a tourniquet until the conduit is lifted slightly off the ground.



2.03 Where the conduit is to remain in a suspended position for only a short time, some advantage may be gained by the use of hoists as shown. A simpler method employs long eye bolts with the conduit suspended from the eye. The threaded portion of the bolt passes through a bearing plate supported on timbers spanning the trench and carries a standard nut and washer by means of which the conduit may be raised or lowered.





3. LOWERING GRADE OF CONDUIT

3.01 When it is necessary to change the grade of an existing conduit line in order to provide clearance for other structures or to secure greater depth in advance of highway regrading operations, it will generally be practicable to make the change without demolishing the conduit. However, where greater depths involving sheeting and heavy timbering are necessary or blasting is required because of rock, the removal of the conduit may be advisable.

3.02 Where obstructions, such as sewers, water or gas mains, prevent lowering the conduit to the new grade while retaining the existing formation, it may be necessary to break off the conduit for some distance on each side of the obstruction and rebuild the ducts with split conduit to secure a shallower formation. In this work the use of scored expanded web conduit to reduce the size of the units may be of advantage.

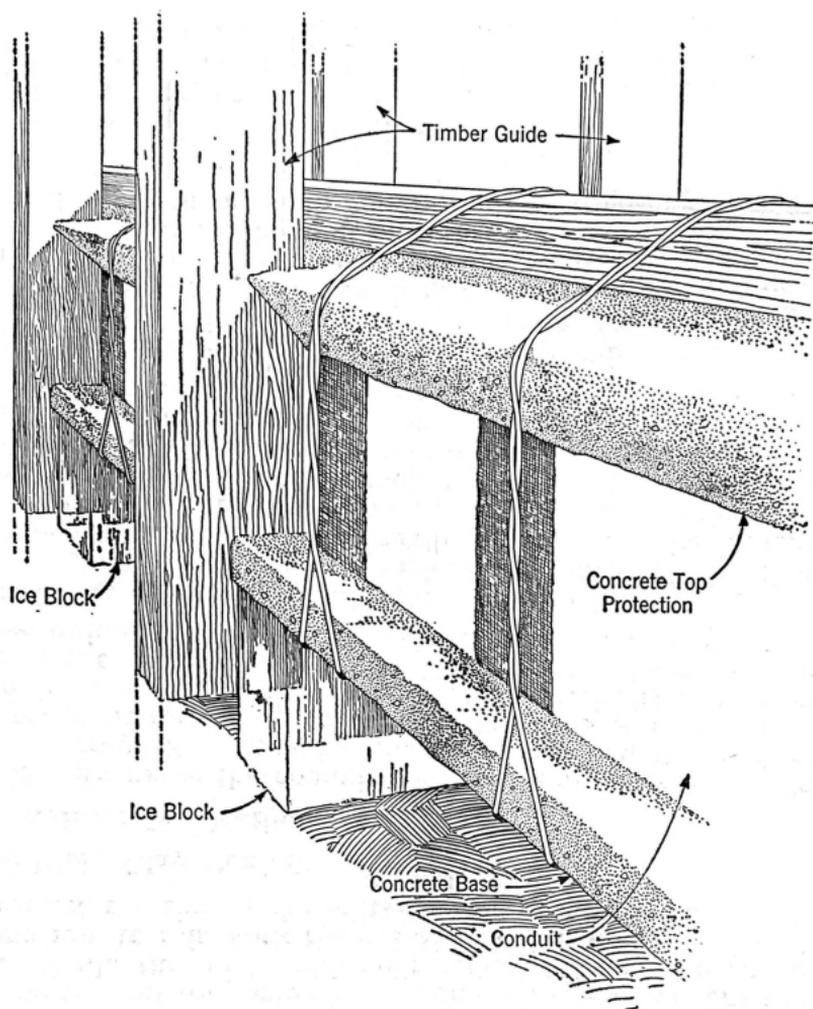
Multiple Clay Conduit

Melting Ice Method

3.03 Excavate the conduit and lash it, as described in Paragraph 2.01, applying the lashing so that it includes the top protection and base, if present. To serve as a guide for the conduit as it settles, erect wood planks vertically against each side of the conduit at about 12-foot intervals along the trench. These guides can be nailed to the cross bracing of the trench.

3.04 If practicable, obtain blocks of ice having the dimensions necessary to complete the lowering operation in one step. Standard ice cakes usually measure 42 inches in length, 22 inches in width and 11 inches in thickness. Thus, if the conduit is to be lowered 21 inches, for example, one cake can be cut to make two blocks measuring 21 inches by 11 inches by 22 inches, and the blocks would be set crosswise of the conduit with the 21 inch dimension vertical.

3.05 Under every other 3-foot unit of conduit or at a maximum of 6-foot intervals, excavate crosswise trenches 12 inches wide and 21 inches deep and place the ice blocks in position in them. Force the blocks up to firm bearing against the underside of the conduit structure by prying up their ends and packing sand or earth solidly underneath them.



3.06 When all the ice blocks have been firmly set in the section to be lowered, remove the earth from beneath the conduit between ice blocks to a depth of about 7 inches. To prevent too rapid melting of the sides of the ice blocks and to concentrate the melting at the upper surface, the excavation under the conduit is not carried to the full depth of the blocks at once but is dug out gradually as the conduit settles, thereby keeping the ice blocks partially covered until melting is complete.

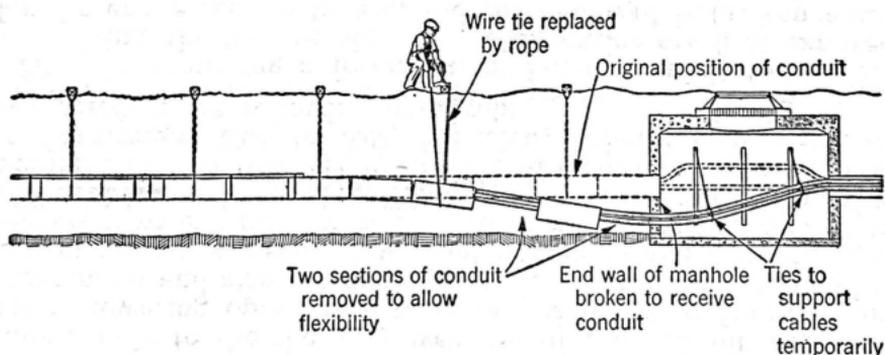
3.07 If further lowering is required, repeat the above described operations with additional ice blocks under alternate conduit units. This method of lowering works to best advantage in sandy, fast draining soil.

Suspension Method

3.08 In preparing to lower Clay Conduit by the suspension method, the procedure follows that outlined in Paragraphs 2.01 and 2.02 until the conduit is suspended by the ties for a full manhole section, where practicable. The trench is then carried down to the required depth.

3.09 If it is not required to lower the manholes as part of the regrading operation, the end wall is broken out below the duct entrance to permit lowering the conduit at that point.

3.10 When the bed of the trench has been prepared to receive the conduit, the first two or more units of conduit nearest one manhole are broken off, as shown below, to permit flexibility in the line. If any sections have been broken during the suspending of the conduit, the individual units may be slid back to provide the clearance at the manhole instead of removing good sections.



3.11 The first two or three units of conduit nearest the manhole are then supported by ropes held from above and the ties are cut. After removing the binding wires and planking, the ducts are lowered slightly by means of the ropes until the ducts can be slid down along the cable and adjusted into place at the new grade. New dowel pins are used in realigning the conduit, and, if the conduit is not to be encased, mortar

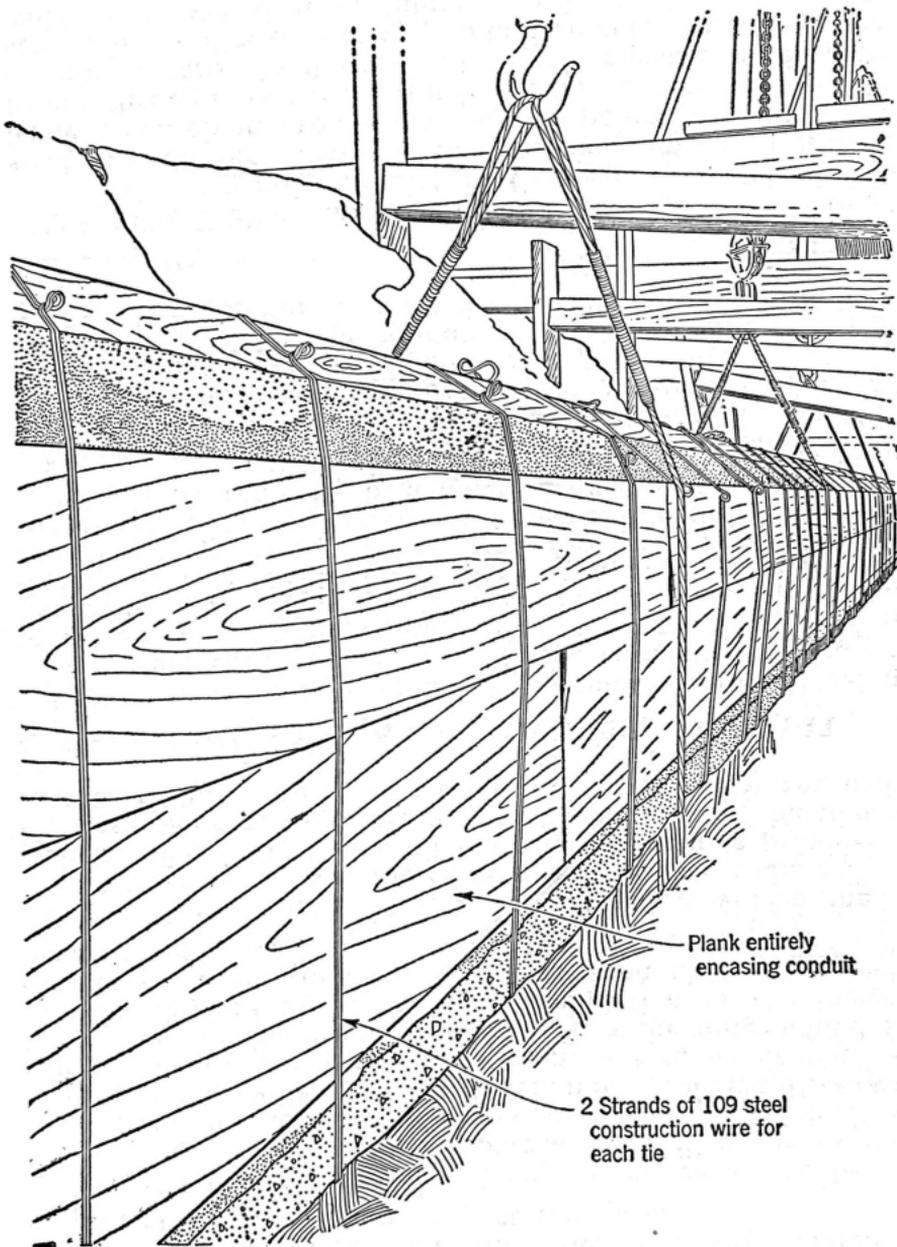
bandages are applied to each joint. The operation is repeated throughout the length of the section until the conduit is all rejoined. The gap remaining at the far end is then built up using split conduit, as explained in Part 5, and the manhole entrance is completed.

1-Duct Clay Conduit

3.12 Multiple formations of 1-Duct Clay Conduit will generally be found encased in concrete which is bonded quite rigidly to the tile. Any weaving of the conduit structure during lowering operations, therefore, is likely to fracture the encasement and also the ducts. Since it is practically impossible to remove the encasement without damaging the conduit, it is necessary to exercise extra care to avoid fracturing the ducts while raising and lowering. Where possible, conduit laid in this manner should be lowered by the use of melting ice as described in Paragraphs 3.03 to 3.07, inclusive; otherwise proceed as instructed in the following paragraphs.

3.13 In preparing a formation of 1-duct conduit for lowering, the top and sides of the formation are first exposed for the entire section length, and the end wall is broken away around each manhole entrance. A section of conduit 10 to 12 feet in length is then undercut to expose the bottom, and the exposed section is sheathed entirely around, using 2 in. by 10 in. planking on the sides and top and creosoted plank on the bottom. Bind the plank securely to the ducts with wire spaced at about 18-inch intervals.

3.14 A chain or wire rope sling is then placed around the structure and hooked to a chain hoist supported above the trench by means of a tripod derrick straddling the trench. Tension is then applied to the sling by means of the hoist until the hoist carries the weight of the section. Subsequent sections are undercut and sheathed until the entire section remains suspended from hoists spaced at 10- or 12-foot intervals along the trench.



3.15 The trench is then excavated to the new grade, and the conduit is lowered as a unit, operating the hoists so as to maintain the conduit in a straight line and avoid weaving. Remove the sheathing from the sides and top, leaving the bottom plank in place to support the base.

3.16 If it is impracticable to lower the entire section between two manholes in one operation, it will be necessary to remove the encasement and ducts for a length of 8 to 10 feet to expose the cables and allow flexibility. The length exposed will depend on the distance the ducts are to be dropped—the longer the gap between sections the less the longitudinal shift to accommodate the drop. Upon completion of the lowering, the ducts are restored using split 1-duct conduit and the encasement is replaced.

3.17 If the 1-duct conduit is not encased, it will be unnecessary to remove the conduit, as the formation will have sufficient flexibility to permit lowering in sections provided the work is done carefully. In this case, however, it will be advisable to encase the entire section after the new grade is reached.

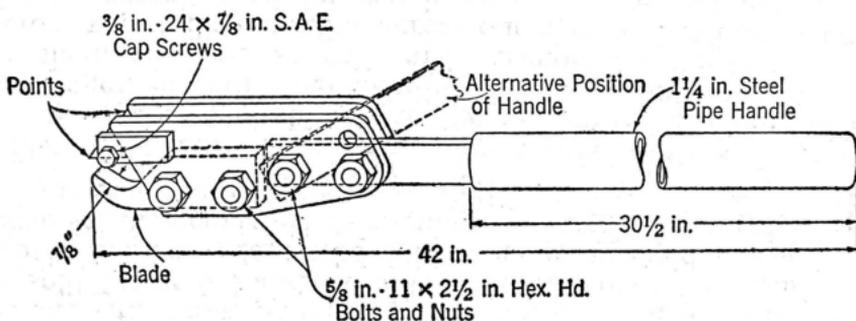
4. REMOVING IRON AND STEEL PIPE CONDUIT

4.01 Whenever it is required to remove iron or steel pipe duct containing cable, extreme care must be exercised to avoid damaging the cable, particularly if the cable is of such size as to occupy most of the space in the pipe. Various labor saving devices, including oxyacetylene torches and motor-driven emery disks, can be used for this purpose, but the successful use of either requires considerable skill and involves more than average risk of damage to the sheath.

4.02 Removing pipe by means of a manually operated pipe ripper, while somewhat slower and more laborious than other methods, is less apt to entail damage to the cable and is generally more readily adaptable to use under the various conditions in which pipe conduit will be found. One of the most satisfactory tools for use with this method is the B Pipe Ripper.

B Pipe Ripper

4.03 The B Pipe Ripper is a hand operated tool designed to cut a lengthwise slot in the wall of standard weight steel or iron pipe through the shearing action of a cutting blade which pivots around two fulcrum points. It is not intended to cut through couplings, which should be removed by sawing or other means. As illustrated, the tool consists of a hardened steel blade and two bearing points assembled in a head section which is attached to a tubular steel handle to provide the necessary leverage.



B PIPE RIPPER

4.04 Two positions are provided for attaching the handle to the cutting head, one position being in line with the head and the other at an angle of about 30 degrees to it. The angle position of the handle is more convenient when working on a vertical pipe, as it places the handle in a position permitting it to be grasped more readily from below.

4.05 The bearing points are triangular in shape and can be rotated to bring into use any one of the three points. This should be done whenever the points become worn to the extent that they slip on the pipe.

4.06 The blade and the points are readily replaced by removing the bolts which hold them to the head.

Use of B Pipe Ripper

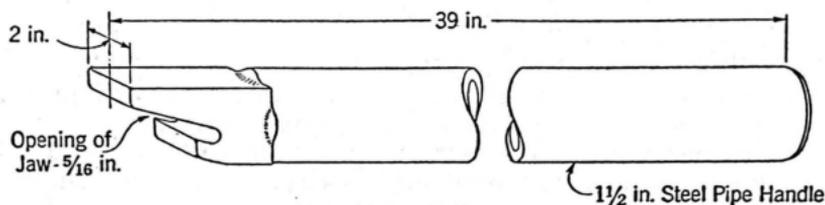
4.07 The tool can be used on a 3-inch or larger pipe containing a full size (2-5/8-inch diameter) cable or on any size pipe in which there is sufficient space between the cable and pipe wall to permit the blade to be inserted. If an end of the pipe is accessible, the tool can be started at that point by inserting the blade between the pipe and the cable and exerting a pull away from the pipe. At other points, the tool can be started by making a suitable opening in the pipe with a hack saw and inserting the blade of the pipe ripper at that point.

4.08 In operating the tool, the best progress will be made if the handle is not swung to the limit of its movement but is moved only far enough to advance the tool about 3/8 inch per cut. If a deeper cut is attempted the operator may encounter difficulty in restoring the tool for the next cut because of the resulting raggedness of the edges.

4.09 As the work progresses a ribbon of metal will be cut from the pipe leaving a slot about 1 inch wide. On completion of the ripping, a spreading tool, such as the B Pipe Spreader, should be inserted in the slot to open the pipe sufficiently to allow it to be removed from the cable.

B Pipe Spreader

4.10 The B Pipe Spreader consists of tubular steel handle terminating in a hardened steel fork which is designed to engage the edges of the pipe wall at the slot. There are no replacement parts to this tool.



B PIPE SPREADER

Use of B Pipe Spreader

4.11 B Pipe Spreaders are used in pairs to work on opposite sides of the cut made by the ripper. Engage the edge of the pipe wall in the jaw of the fork and pull away from the pipe. Using the leverage provided by the tool, bend the wall of the pipe outward on both sides of the cut until the opening has been enlarged sufficiently to permit the cable to pass.

5. RESTORING CLAY CONDUIT—USE OF SPLIT AND SCORED CONDUIT

5.01 All types and sizes of clay conduit intended for use in restoration work are designed to be separated into sections that can be fitted around existing cables. The manner in which the units divide is described in the section of practices on conduit types and uses. In assembling the conduit it is desired that the split sections be laid so that the seams will be in the vertical walls and webs. Since the 6-duct and 8-duct units may be laid either upright or flat, provision is made for these units to split 6-3 or 6-4 and 8-3 or 8-5. If the conduit to which the repair sections are to be joined is 6-duct laid 2 wide, for example, the repair pieces should be the type designed to split 6-4 for proper assembly.

5.02 All sizes of **Straight Clay Conduit** are split at the factory and shipped to the job with the related pieces held together with steel banding. To assist in reassembly in the field, all units so split are permanently marked at the factory with a diagonal line across one side wall. All other types of clay conduit used for repair or rearrangement are simply scored at the factory and must be split apart on the job.

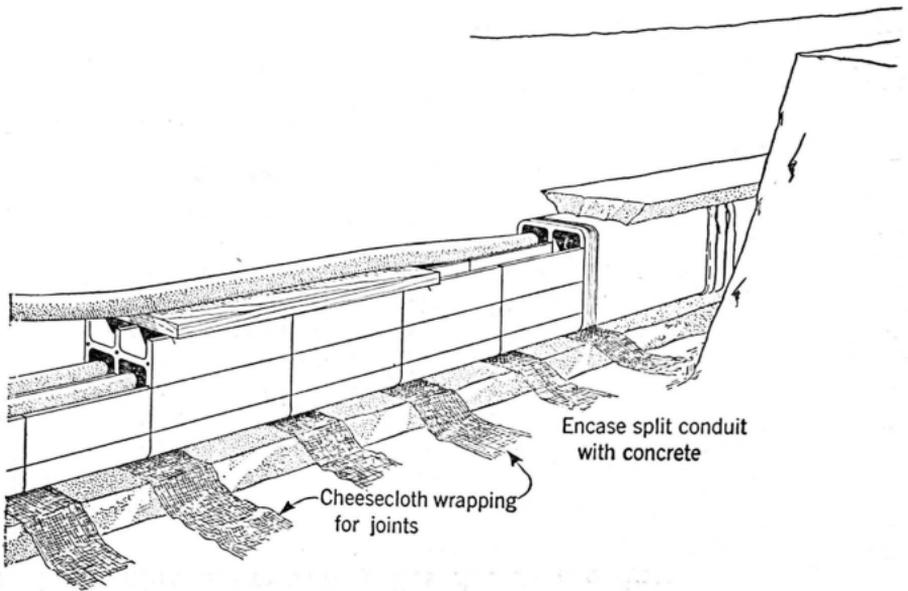
Laying Split Multiple Straight Clay Conduit

5.03 Prepare the bed of the trench by placing a 4-inch concrete base in accordance with the instructions for concrete encasement. If any of the old base remains, it should be broken up and replaced for the length of the section under repair. During this work, it will be advisable to support the cables temporarily by means of houseline or rope slings lashed to timbers spanning the trench.

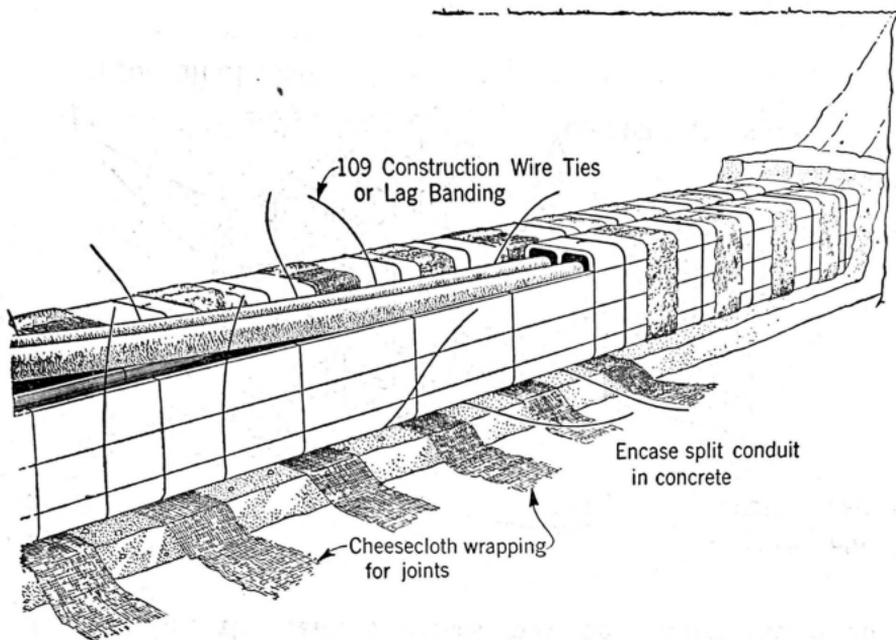
5.04 Separate the pieces of the split units by cutting the steel banding with lag band snips or similar tool. Lay the split units by the side of the trench, keeping the related parts of each unit together.

5.05 Place cheesecloth for joining in the manner prescribed for conduit to be encased and upon this place the bottom piece of the split multiple conduit, placing one dowel pin in each section in which dowel pin holes are available. Complete the laying of the lower section for the entire length under repair, bedding the tile in mortar wherever necessary to secure an even base.

5.06 If handling the cable has introduced offsets which will not permit the cable to lie reasonably flat in the ducts, place a plank on top of the bottom section as shown, lay the cables of the respective ducts upon the plank and straighten them. Slide the plank along the ducts, and continue the straightening operation until the entire length of the cables in the section under repair lies flat in the ducts.



5.07 Proceed with the remaining sections of split conduit, handling the cables in the manner described. Slip a length of 109 steel construction wire under each assembled length of conduit and twist the ends together until the split pieces are bound securely. If there are adjacent units of conduit, it may be advantageous to place the ties under the conduit as it is being laid. As an alternative, lag banding can be used in place of wire ties to bind the units together.



5.08 Complete the joints and encase the repaired sections in 3 inches of Class 2A concrete. Place and tamp the concrete carefully so as not to disturb the joints.

Laying Split 1-Duct Straight Clay Conduit

5.09 Separate the pieces of the 1-duct conduit in the manner described for multiple conduit, and place the halves so that they may be readily reassembled.

5.10 Lay the lower halves of the conduit on a 4-inch concrete base, bedding the sections in mortar. Straighten the cables where necessary, and lay them in place in the split conduit. Replace the upper halves of the split pieces, and trowel the vertical and horizontal joints with mortar. Repeat these operations for the successive layers of conduit.

5.11 Encase the ducts in 3 inches of Class 2A concrete, exercising care in placing and tamping the concrete so as not to disturb the joints.

Laying Scored Mitered, Expanded Web and Transposition Clay Conduit

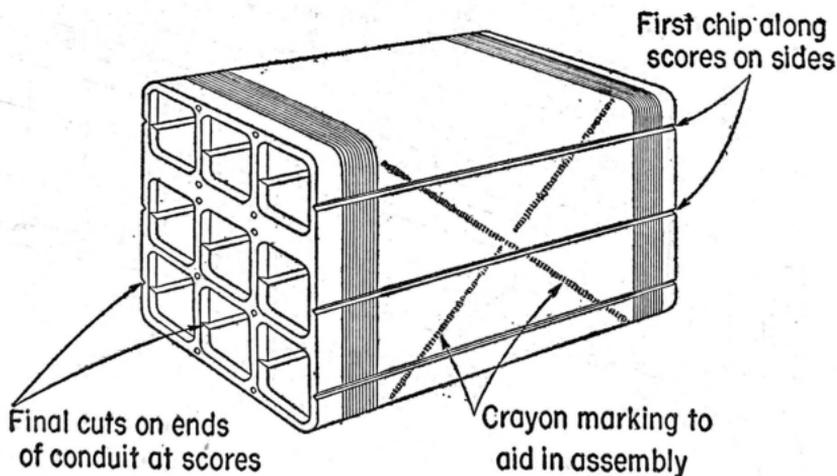
5.12 The various types of scoring arrangements in which Mitered, Expanded Web and Transposition Clay Conduit are available are described in the practices on conduit

types and uses. Mitered Conduit is scored to correspond with split Straight Clay Conduit in both the edge mitered and the flat mitered units. Make certain that the type obtained is of a scoring arrangement to permit the sections to be assembled in a horizontal position and to match the conduit already in place.

5.13 Scored Expanded Web and Transposition Clay Conduit provide only one arrangement for splitting in each type. In certain cases, as for example, where Type (4-4)-8 Expanded Web Conduit is laid flat (4 wide), the sections of the unit must be assembled with the pieces vertical. In such cases, the adjoining units of split straight conduit should be laid only to the point where the expanded unit is to be inserted. The sections of the split expanded unit are then inserted between and around the cables and thereafter bound and encased as for the rest of the repair section. Scored transposition conduit is handled in the same manner.

5.14 If necessary, closing pieces may be cut to approximate length by first filling a scored section with sand and chipping off the excess length before splitting. Ends so chipped should be rasped to a smooth bevel before placing.

5.15 Split the scored conduit on the job by carefully chipping along the scores with a 1-inch cold chisel and a 1-1/4-pound hammer or other suitable tools. Wear goggles while doing this work. The individual pieces of each split section should then be similarly marked or so placed by the side of the trench that the related pieces may be readily identified for assembly.



5.16 Straighten the cables and assemble the split sections around them as for split Straight Clay Conduit. Encase the assembled units in 3 inches of Class 2A concrete.

6. RESTORING PINE CONDUIT—USE OF SPLIT PINE CONDUIT

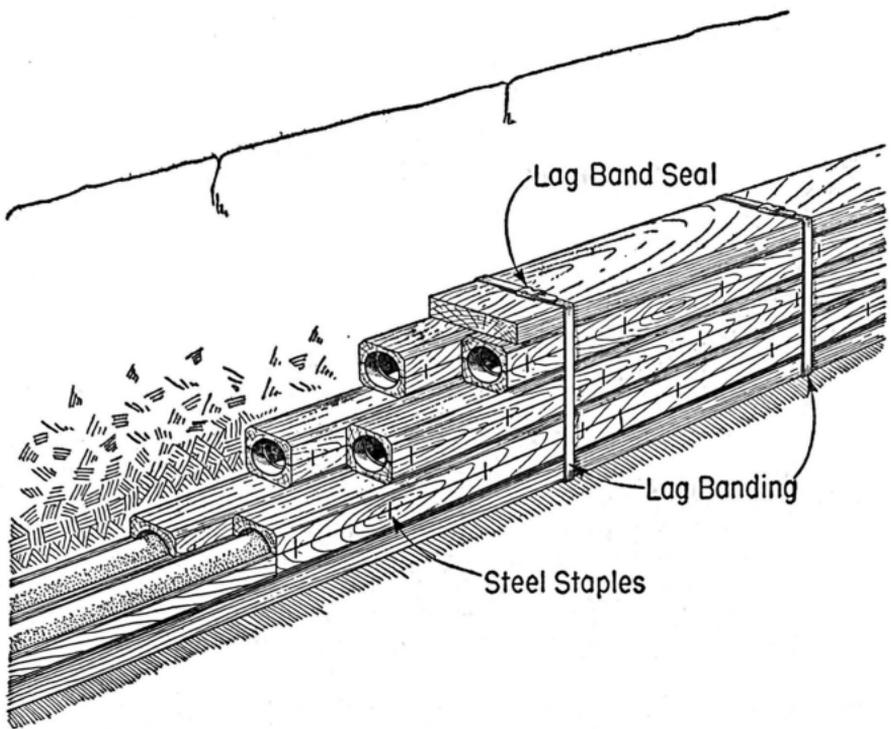
6.01 When Pine Conduit is involved in the rearrangement or repair of main conduit containing cables, reconstruction where necessary may be accomplished through the use of Split Pine Conduit.

6.02 Split Pine Conduit is furnished with the associated halves assembled with steel staples. In order to avoid misplacement of the halves of a piece, do not remove the staples until immediately before laying the conduit.

6.03 Lay one-half of the conduit on the bed of the trench and, after straightening the cable, place it in the split section. Fit the upper half of the conduit in place, and secure the two halves with the extra staples furnished for the purpose. Place the fasteners 2 inches from each end and approximately equally spaced between at intervals not exceeding 10 inches.

6.04 Proceed with the remaining sections, fitting the mortise and tenon joints of succeeding pieces as the assembly progresses.

6.05 Where Split Pine Conduit is laid in recently filled ground or in other locations where it is desired to increase the rigidity of the structure, the formation should be laid on creosoted plank. This material should also be placed along the top of the formation. Lengths of lag banding should be slipped under the plank base at intervals of 2 feet and should be bound tightly around the formation by means of the lag band stretcher.

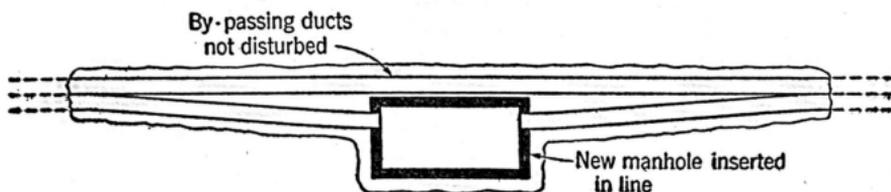


7. REARRANGEMENTS AT NEW MANHOLES

7.01 When an additional manhole is to be constructed in an existing subway containing cables, the necessary slack to permit racking the cables against the manhole walls can usually be obtained by splaying the ducts. In doing this work, the duct bank is split vertically and each half of the formation is carried into the manhole end wall as near to the side wall as possible in order to permit racking without bends in the manhole.

7.02 The ducts will be uncovered for a distance at either end of the manhole, depending upon the size of the formation and the amount of separation required between the duct units at the manhole.

7.03 If it is unnecessary to take the entire duct formation into the manhole, as in the case where the manhole is intended for loading purposes and only certain cables need enter the manhole, the separation between ducts and the amount of excavation may be reduced by diverting only a portion of the ducts and cables into the manhole. In this case the cables will be racked on only one side wall of the manhole.



7.04 The use of scored expanded web conduit may be found of advantage in dividing individual units for the purposes discussed above.