

**BELL SYSTEM PRACTICES**  
**Outside Plant Construction**  
**and Maintenance**

**SECTION G41.140**  
**Issue 1, July, 1943**  
**AT&T Co Standard**

**MAIN CONDUIT**  
**SPECIAL CONSTRUCTION**

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**1. GENERAL**

1.01 In general, specific instructions and drawings of construction details will accompany conduit plans involving departures from the usual construction practices. The recommendations of this section are of a general nature and shall be considered as supplementing the detailed instructions prepared for use in each particular installation.

1.02 Before starting any work, make certain that permit requirements have been satisfied in accordance with the established practices.

**2. CROSSING STEAM AND ELECTRIFIED RAILROADS**

2.01 The procedures outlined in the following paragraphs are in accordance with accepted practices prescribed for the construction of communication lines crossing the tracks of steam and electrified railroads, excepting street railways. Where any requirements of this section do not meet Municipal or State requirements such Municipal or State requirements shall govern.

2.02 The work should be done at such time and in such manner as not to interfere with the proper and safe use or operation of the property and tracks of the railroad company, previous arrangements having been made with the duily

authorized representative of the railroad company for date and time of commencement.

**Location**

2.03 The underground system on the railroad property should be so located as to be subject to the least practicable disturbance. Care should be exercised to avoid catch basins, pipes or underground structures which have been installed or are planned for the future. Manholes or handholes should, where practicable, be located off the railroad right-of-way.

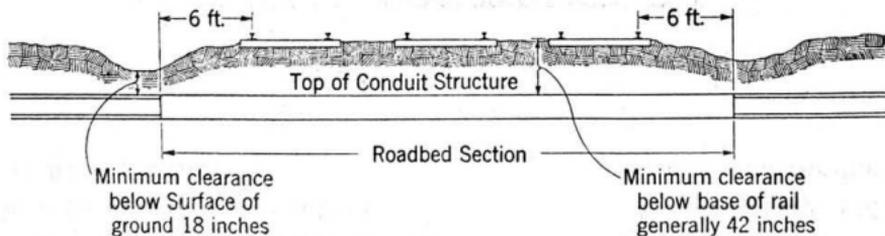
**Clearances**

2.04 **Below Base of Rail:** The top of all conduit protection within the roadbed section (within the limits of 6 feet beyond each outside rail), except as hereafter specified, shall generally be located at a depth of not less than 42 inches below the base of the rail, as shown below.

Note: Arrangements may sometimes be made with the railroad company, whereby this clearance may be reduced. In such cases, the reduced clearance will be indicated on the detail plans. When no arrangements have been made for reducing the clearance and it is found that due to rock or other conditions it will be unduly expensive or impracticable to obtain the clearance, the matter should be taken up with the supervisor or inspector. In no case, however, should the top of the conduit protection extend within 12 inches of the bottom of the ballast section which is subject to working or cleaning.

2.05 Where unusual conditions exist or where proposed construction would interfere with existing construction, a depth greater than specified above may be required.

2.06 **Below Surface of Ground Outside the Roadbed Section.** In no case shall the conduit structure be less than 18 inches below the surface of the ground in the portion of the right-of-way outside the roadbed section, as illustrated.



2.07 **Side Clearance from Rail:** Where underground conduit construction terminates at terminal poles, the side clearance of such poles from the nearest track rail shall be 12 feet. Where manholes or handholes which project above the surface of the ground are employed, the side clearance, unless physical conditions prevent, shall be not less than 12 feet from the nearest rail, except that at sidings a clearance of 7 feet may be allowed. At loading sidings sufficient space shall be left for a driveway.

### **Trench Work**

2.08 **Excavation:** The excavated material should be so placed as not to interfere with traffic. Excavated ballast material should be kept separate and free from earth.

2.09 **Shoring:** Where necessary to prevent caving, the sides of the trench should be supported by shoring or sheeting and bracing in accordance with G41.110. No bracing should extend above the base of the rail or be attached in any way to the rails or ties.

2.10 **Grading and Drainage.** The grading of the trench and provision for draining of the manholes, where required, should follow the instructions outlined in Section G41.110 and G43.110, respectively.

2.11 **Backfilling:** The trench should be backfilled with earth to the sub-grade line, using the better material next to the conduit structure. Observe the backfilling recommendations of G41.110 in order to obtain thorough consolidation and avoid subsequent settlement. Track ballast shall be replaced under railroad supervision.

2.12 **Removing Surplus Material:** All surplus material remaining after the work has been finished shall be removed, and, if disposed of upon railroad property, shall be placed under railroad supervision.

### **Duct Work**

2.13 **Conduit Formations:** The arrangement of ducts in the conduit system contemplated under these practices shall consist of a formation not wider than 4 ducts of Clay Conduit, 3 ducts of Pine Conduit or 4 ducts of Fibre or Cement Conduit. Where other arrangements are contemplated, additional strength of construction and protection may be required.

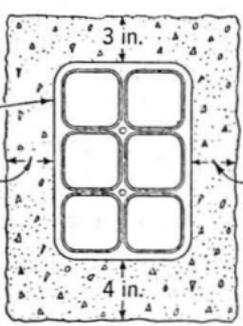
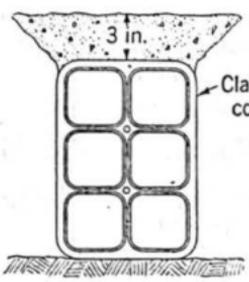
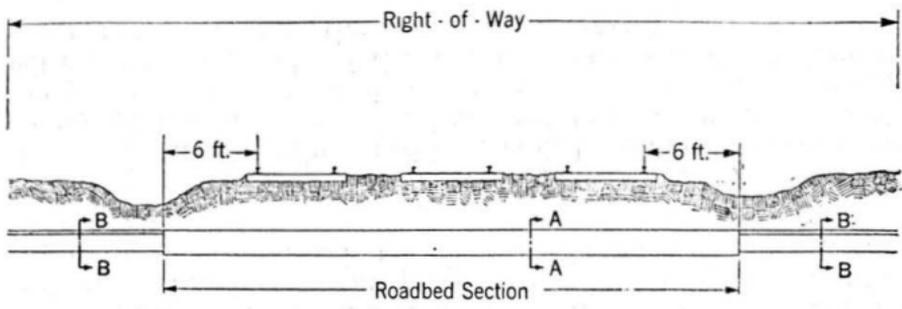
2.14 **Clay Conduit:** The ducts shall be laid in accordance with the instructions of Section G41.120 covering concrete encasement, except that the reinforcement is to be omitted. The encasement shall be continuous under the roadbed and extend for a distance of at least 6 feet beyond each outside rail.

In other sections on the right-of-way, a top protection of concrete placed in accordance with G41.120 or wood Plank not less than 1-1/2 inches thick shall be used. If it is more convenient to employ only one class of concrete for this work Class 2B can be used for both encasement and top protection.

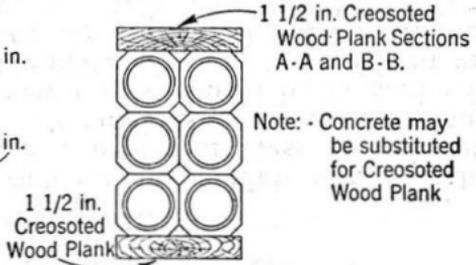
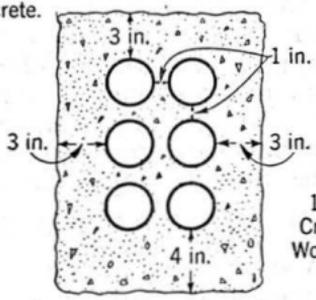
2.15 **Fibre Conduit or Cement Conduit.** The ducts shall be laid in accordance with the instructions of Section G41.126 or Section G41.128 covering Fibre Conduit or Cement Conduit, respectively, and shall be encased. The encasement shall extend the full width of the railroad right-of-way.

2.16 **Pine Conduit:** Wood Plank not less than 1-1/2 inches thick, or 3 inches of concrete, placed in accordance with G41.120, shall be provided on the top and bottom of Pine Conduit and shall extend for a distance of at least 6 feet beyond each outside rail. In other sections on the right-of-way, a top protection of 3 inches of concrete or wood Plank not less than 1-1/2 inches thick shall be used.

2.17 **Steel Pipe:** Steel pipe shall normally be encased in concrete as provided in G41.124. However, where physical or chemical conditions permit, a conduit system consisting of not more than four steel pipes not more than 4 inches in diameter may be laid or driven beneath the roadbed without requiring protection.



Note: - 1 1/2 in. Creosoted Wood Plank may be substituted for concrete.



Note: - Concrete may be substituted for Creosoted Wood Plank

**2.18 Exception to Clearance Requirements:** The construction described in 2.13 to 2.17 inclusive applies to the larger duct complements and requires that the 42 inch clearance specified in 2.04 be obtained. If not more than two steel pipes not exceeding 4 inches in diameter or two ducts of Pine Conduit not exceeding 6 inches square are required, they may be laid in the ground beneath railroad tracks without any form of protection at a minimum depth of 12 inches below the bottom of the ballast section, where physical or chemical conditions permit.

### 3. CROSSING STREET RAILWAYS

3.01 The distance between the top of the conduit structure and the base of the rail shall generally be not less than 30 inches in the case of crossings under the tracks of street railways. Where this is impracticable, or for other reasons, this clearance may be reduced by agreement with the owning company. In no case, however, should the top of the conduit structure extend within 12 inches of the bottom of the ballast section which is subject to working or cleaning.

3.02 Ordinarily the construction employed in the other portions of the conduit run will also be satisfactory for the crossing. Provide such additional protection as may be required to safeguard the conduit structure or to meet requirements of railway regulations or local ordinances.

### 4. SUBMARINE CABLE LANDINGS

4.01 Sewer pipe or thin wall cement conduit 5 or 6 inches in diameter, encased in 3 inches of Class 2B concrete, should be employed where the conduit is to be used for submarine cables. The bells of sewer pipe should be packed with oakum, paper or other suitable material to center the joint and prevent concrete from entering the bore. If the space available for placing the pipe is limited, the bells may be removed from the sewer pipe and the joints between the pipes made in the manner described for Clay Conduit encasement, Section G41.130, except that before placing the concrete the pipe should be bedded in mortar to prevent displacement.

4.02 In special cases where the soil conditions are such that it is not practicable to lay sewer pipe or cement conduit, steel pipe may be used.

### 5. CONDUIT TRAVERSING FILLED GROUND

5.01 Conduit which must be laid through earth fill which has only recently been placed and is subject to further settlement before becoming thoroughly consolidated should be constructed of Pine Conduit. This material has sufficient structural flexibility to enable it to conform to uneven settlement without seriously disturbing the alignment of the ducts, which might not be the case if a rigid material such as Clay Conduit were used.

5.02 Lay the conduit as described in G41.122 except that it should be reinforced by Plank base and top and should be bound together with lag banding. Lay the conduit so that the joints of the top and bottom tiers of ducts are staggered with the butted ends of the Plank. It is desirable to have this separation so that in the event of settlement the structure will

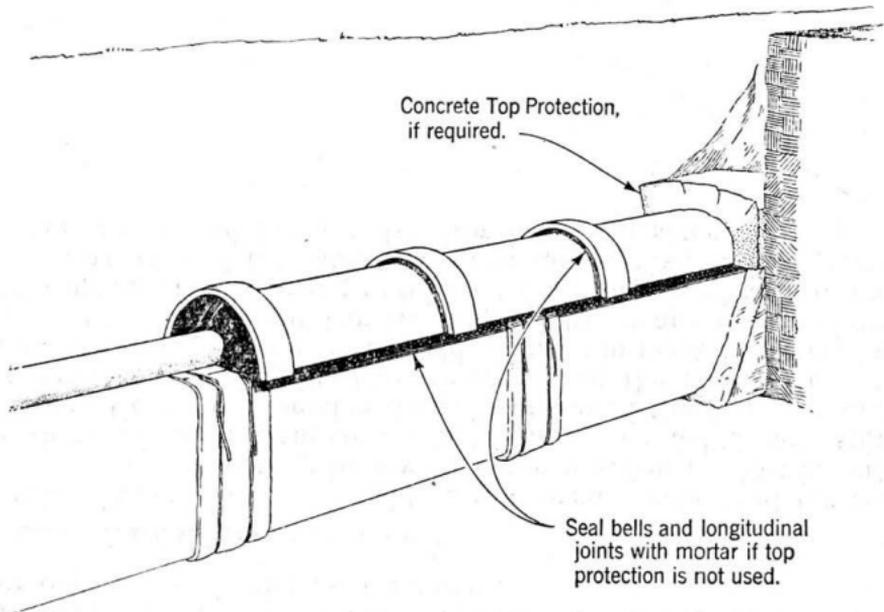
tend to perform as a unit without abrupt deflections at any point. Apply the banding as in assembling split Pine Conduit, Section G41.410.

## 6. MOVING AERIAL CABLE TO AN UNDERGROUND POSITION

6.01 When aerial cable is to be lowered and placed underground the selection of the method of protecting the cable will depend upon whether the work is to be done in conjunction with the construction of a paralleling conduit line or whether it is to be undertaken as a separate project.

### Cable Laid in Same Trench with Clay Conduit

6.02 Upon completion of the laying of the main conduit and after the backfill has been carried up to the level of the top of the conduit, the cable is removed from its aerial position and laid in the trench resting upon the conduit. Provision will, of course, have been made for admitting the cable to the manhole, usually by leaving slots in the end walls to be filled in after the cable is lowered. Half sections of split sewer tile of 10-inch diameter or smaller if sufficient to cover the splices, may then be laid over the cable.

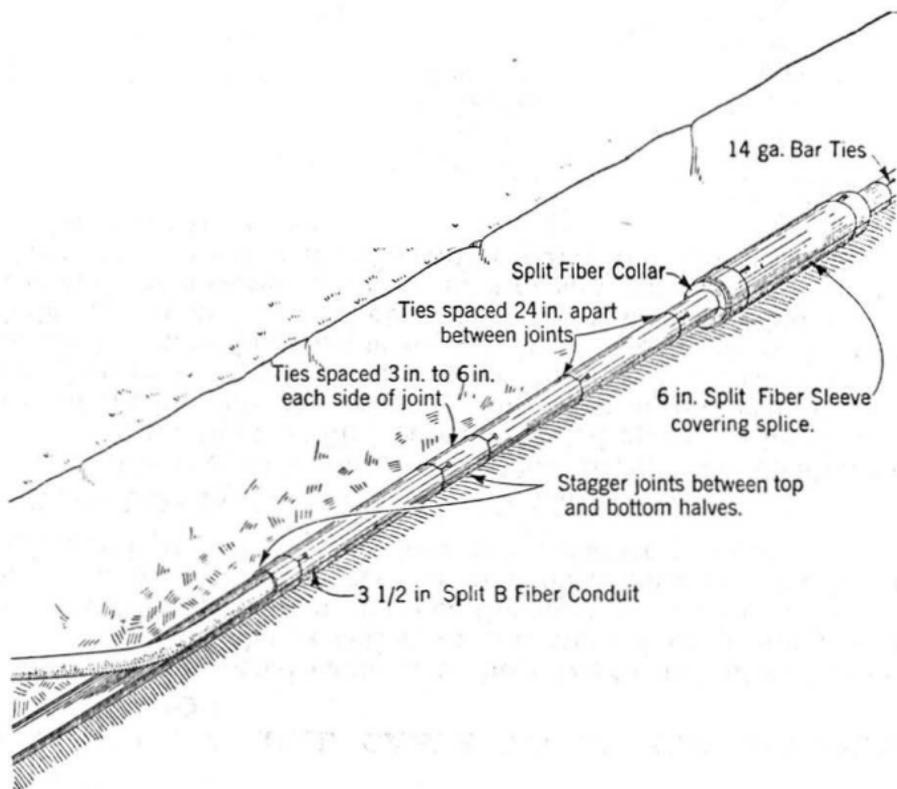


6.03 If concrete top protection is required, it may be placed so as to include the split sewer tile. If no protection is used, the bell joints and longitudinal joints between the sewer tile and Clay Conduit should be sealed with cement mortar.

6.04 As an alternative, the main conduit can be obtained specially scored so that the top ducts of one unit can be opened to receive the lowered cable. The sections of the split unit should be secured by lag banding using two bands to each full length piece. Splices should be boxed in and the cable tagged for duct splices in the usual manner.

### Cable Laid in Separate Trench

6.05 When the cable is placed in a trench excavated for the purpose it may be lowered into position resting in half sections of 3-1/2-inch split Pine Conduit or 3-1/2-inch split B Fibre Conduit. Assemble the split halves of the Pine Conduit as described in G41.410. The upper half of the split fibre sections, when replaced, may be held securely in position by means of 16-inch reinforcing bar ties applied by means of a bar tie twisting tool and placed 3 to 6 inches on each side of a joint and not more than 2 feet apart between joints. Stagger the joints of the upper and lower halves for increased strength.



6.06 Splices may be covered by means of special boxes constructed of creosoted timber or with split lengths of 6-inch fibre duct joined by means of split fiber collars to the 3-1/2-inch conduit as shown above. The two halves of the splice sleeves are bound together by means of two or three bar ties spaced along its length.

6.07 No further protection is provided for the cable, the earth simply being replaced to complete the backfill. In regard to such other considerations as marking the route, recording splices, etc., the cable should be treated as a buried cable.

## **7. BRIDGE AND OTHER SPECIAL INSTALLATIONS**

7.01 In general, the method to be followed in constructing conduit under the following conditions and circumstances will be fully covered in the detail plans:

- (a) In crossing over bridges, viaducts, culverts, etc.
- (b) In crossing brooks or small streams either over a specially designed supporting structure or in the bed of the stream.
- (c) Crossing under rivers.
- (d) When the ducts are to be laid through swamps or other unstable ground requiring piling or other means of support.
- (e) In crossing under railroad tracks or embankments by means of boring, jacking or by special tunneling methods.