

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G41.110
Issue 1, July, 1943
AT&T Co Standard

MAIN CONDUIT
TRENCH WORK

Part	Page
1. General	1
2. Location of Conduit and Manholes.....	2
3. Permissible Curves	3
4. Test Holes	5
5. Dimensions of Trench.....	6
6. Removing Pavement and Concrete.....	7
7. Excavating and Grading Trench.....	8
8. Trench Timbering	11
9. Foreign Structures Encountered.....	15
10. Preparing Trench Bed.....	19
11. Duct Entrances	19
12. Backfilling	20
13. Repaving	21
14. Removing Surplus Materials.....	22

1. GENERAL

1.01 Excavation in public streets and highways involves hazards due to the nature of the work and also to the movement of traffic and the occupancy of the public ways by other services. By the observation of proper precautions, the normal hazards incidental to such activity may be minimized, and the application of certain well established safety rules may be relied upon to reduce the hazards from other sources. As a corollary, the exercise of proper precautions for the safety of the workmen will, in general, increase the protection afforded the public. Workmen are expected to familiarize themselves with the safety practices discussed in this section and also with the general recommendations of G40.090 on "Precautions."

1.02 The disposition of materials, equipment, and spoil should be arranged in an orderly manner while keeping in mind the requirements of traffic, both vehicular and pedestrian. Where the work may be of several days' duration, suitable barricades and flags supplemented by warning lights at night should be used to outline the area under excavation. If the street is narrow it may be necessary to have "No Parking" signs placed along the clear side in order to leave the space free for two-way traffic and to avoid the hazards due to confining two-way traffic to a lane sufficient only for one-way traffic. The work may be of such a nature that the street should be closed entirely and traffic detoured elsewhere. Such matters involve the municipal authorities and arrangements should be made with them before anything is done.

1.03 In many situations there will be only a constriction of traffic for a brief period. In such cases a flagman, supplemented by warning signs, will be found useful in guiding traffic around the restricted area.

1.04 Accessibility to fire hydrants, fire alarm boxes and private driveways should be maintained, using temporary bridges over the trench where required. The necessary gutters to carry storm water away from the work should be provided and kept free of obstructions.

1.05 Where construction vehicles and other equipment such as compressors and trenching machines are employed in connection with the work, care should be exercised in their use to avoid creating hazards. Such equipment should be located with respect to the work so that it causes a minimum obstruction to the movement of traffic. Where indicated, flagmen, barricades and detour signs should be used to control traffic approaching and passing the point at which the equipment is operating.

1.06 **Permits** which are required to do work in accordance with the detail plans should be secured before starting the job. All permits, or a record of all permits, should be retained by the supervisor or inspector, ready for immediate reference, during the progress of the job. Operations for which specific permits may be required are listed in G40.090.

2. LOCATION OF CONDUIT AND MANHOLES

2.01 It is desired that conduit and manholes be located as shown on the construction prints. Upon excavating, however, conditions may be found which make it advisable to alter the locations shown on the plans, in which case the matter should always be taken up with the supervisor or inspector.

2.02 Considerations which might govern such a change are as follows:

- (a) Avoidance of sewer catch basins.
- (b) Locate manhole openings so that future work in the manholes will cause minimum interference with the normal flow of vehicular traffic.
- (c) The existence of foreign pipes at proposed manhole locations will require that a decision be made as to the practicability of (1) shifting the manhole or (2) arranging with the owning company for a change in the route of the pipe, in preference to including the pipe in the structure.
- (d) The presence of springs or underground streams may increase construction costs and should be avoided, if practicable.

3. PERMISSIBLE CURVES

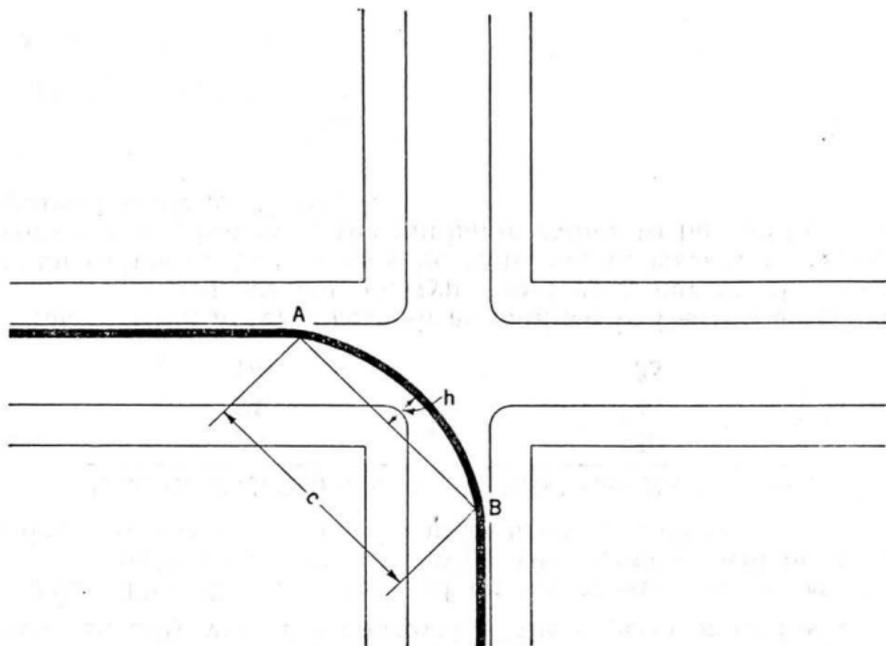
3.01 Curves not called for in the detail plans should be avoided whenever possible. Where major deviations from the desired line are necessary, such construction should proceed only with the approval of the supervisor or inspector.

3.02 The allowable radii of curves constructed of **straight units** of 1-duct or multiple Clay Conduit will be determined by the length of the units used, as follows:

<u>Length of Unit (inches)</u>	<u>Minimum Radius (feet)</u>
36	50
24	40
18	35

3.03 Using **mitered conduit** as outlined in G40.060 describing the various conduit types and uses, curves of a minimum radius of 10 feet may be constructed. Except for special construction, however, the minimum radius to be employed for general work is 20 feet.

3.04 The radius of curvature in a proposed conduit line can be approximated in the following manner. Assume the conditions are as shown in the plan below.



Measure with a tape the distance along a straight line connecting two points on the inside of the curve, such as the length c connecting points A and B above. For convenience this distance should be read to the nearest multiple of 10 feet but should not exceed 100 feet. At the midpoint of c and at right angles to it, measure the distance h to the inside of the curve in the duct line. The radius can then be determined by reference to the table. The figure so obtained can be used in conjunction with the information in G41.120 on laying mitered conduit to determine the assembly of conduit units required to produce the desired curve.

Example: Assume c to be 90 feet and h to be 13 feet.

The ratio of h to $c = \frac{h}{c} = \frac{13}{90} = .14$ to the nearest second

decimal place. Find the ratio .14 in the left hand column of the table and under $c = 90$ at the top of the table, this ratio will be found to correspond to a radius of 87 feet.

Ratio $\frac{h}{c}$	Length of c - feet									
	10	20	30	40	50	60	70	80	90	100
	Radius of Curve - feet									
.02	63	125	188	250	313	376	438	501	563	626
.03	42	84	125	167	209	251	293	334	376	418
.04	31	63	94	126	157	189	220	252	283	314
.05	25	51	76	101	126	152	177	202	227	252
.06	21	42	63	85	106	127	148	169	190	211
.07	18	36	55	73	91	109	127	146	164	182
.08	16	32	48	64	80	96	112	128	144	160
.09	14	29	43	57	72	86	100	115	129	143
.10	13	26	39	52	65	78	91	104	117	130
.11	12	24	36	48	60	71	83	95	107	119
.12	11	22	33	44	55	66	77	88	99	110
.13	10	21	31	41	51	62	72	82	92	103
.14		19	29	39	48	58	67	77	87	96
.15		18	27	36	45	55	64	73	82	91
.16		17	26	34	43	52	60	69	78	86
.17		16	25	33	41	49	57	66	74	82
.18		16	24	31	39	47	55	63	71	78
.19		15	23	30	38	45	53	60	68	75
.20		15	22	29	36	44	51	58	65	73

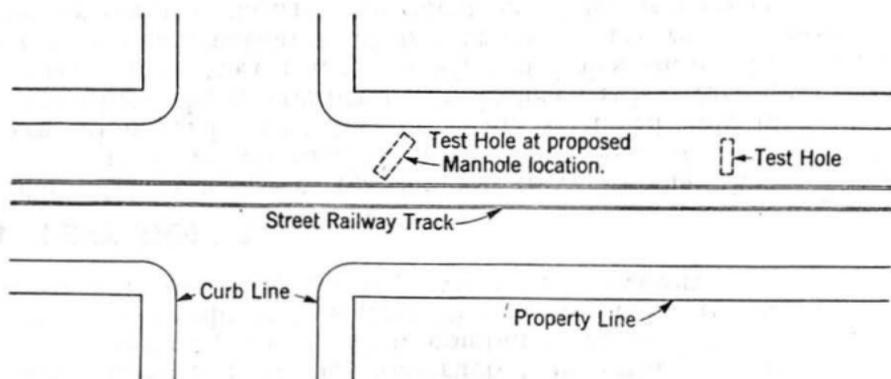
3.05 Curves may be constructed in either a vertical or horizontal plane, but combinations of both or reverse curves with radii of less than 50 feet are to be avoided except where authorized by the supervisor or inspector.

4. TEST HOLES

4.01 The purpose of test holes is to verify that the construction can be carried out as planned and to avoid false excavation. Ordinarily, test holes are required only in built-up areas where the possibility of undisclosed subsurface conditions exists. Where they are required, test holes should be sunk at the time construction work is started. Unless reliable information or records showing the location of foreign structures and character of soil are available, dig test holes at the following locations:

- (a) One at each point where a manhole is to be located.
- (b) At such intermediate points as may be necessary, as determined by the probable existence of unrecorded foreign structures or to determine the character of the soil.

4.02 The test holes at manhole locations should extend diagonally across the manhole and should be dug one foot deeper than the depth of the proposed manhole excavation, where practicable. Intermediate test holes should be made across the proposed conduit line and should be dug one foot deeper than the depth of the proposed conduit structure.



5. DIMENSIONS OF TRENCH

5.01 The width of the trench should be 8 inches greater than the width of the conduit structure, as indicated in G40.070 on conduit formations, in order to provide space for making the joints. With a deep trench and narrow conduit formation, however, this width may not be sufficient to afford satisfactory working conditions during excavation, in which case the width shown in the table below should be taken as the minimum. In the absence of paving, these widths may be exceeded slightly in order to facilitate hand trenching.

Depth of Trench (Inches)	Width of Trench (Inches)
30 or less	14
31 to 48	18
49 to 60	20
61 to 72	22
73 to 96	24

5.02 If sheeting is used, the width of the trench should be measured from inner surface to inner surface of the ranges or stringers (see 8.06) in order to allow for placing the conduit and making conduit joints.

5.03 Subject to local requirements such as municipal ordinances, the depth of trench should be sufficient to obtain a cover of at least 24 inches over the conduit structure including top protection where employed, except in the following cases where a cover of not less than 18 inches is satisfactory:

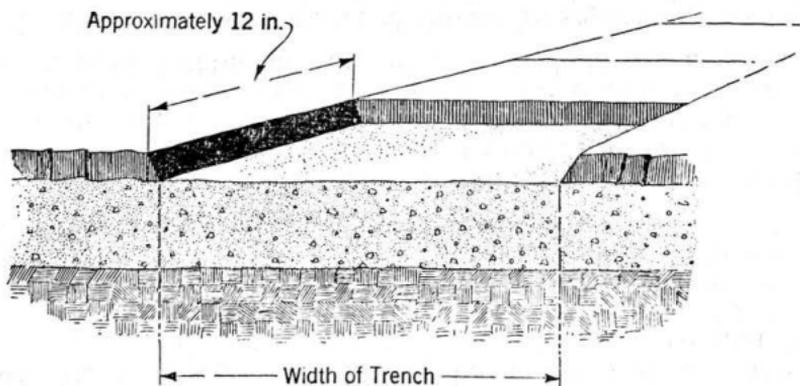
- (a) Where the conduit is within highway limits but outside the area reserved for present or future traffic.
- (b) Under boulevards or driveways where there is no heavy traffic.
- (c) In alleys or private right-of-way.

5.04 If it is found that the grade of the street is to be changed and the detail plans do not show the new grade, consult the inspector or supervisor.

6. REMOVING PAVEMENT AND CONCRETE

6.01 The line of trench should be clearly marked before starting to excavate. This should be done by stretching a line (1/4 inch rope or heavy chalk line) and marking along the line with crayon or a pick. The marking of the trench line should be carefully done so that no more pavement will be disturbed than is necessary. Short sections of pavement may be left intact at intervals along the trench, if such construction is acceptable to highway authorities.

6.02 In removing the pavement surface, save as much of the paving material as practicable for temporary reuse. The paving material should be kept separated from the other excavated material. If asphalt or similar paving material is removed, strips approximately 12 inches long and as wide as the trench should, so far as practicable, be removed in one piece as illustrated below.



6.03 In parkways and lawns, keep the sod and top soil separated from other excavated material so that it can be replaced properly. Place excavated earth on tarpaulins or burlap where necessary so as not to damage the grass. This work should be done with care and completed to the satisfaction of the authorities or property owners.

6.04 Asphalt or similar paving should be removed with an asphalt cutter or flat, chisel pointed tool. An air compressor and approved tools can be used to advantage in removing pavement, rock and other hard packed materials or soils where a considerable amount of this work is to be done.

6.05 Pavement base material should be separated from other excavated material so that it may be used for restoration of the base, if desirable.

7. EXCAVATING AND GRADING TRENCH

7.01 In manual excavation to depths beyond 84 inches in dry soil, a stage should be used to facilitate the removal of earth from the trench. In wet ground where the spoil is heavy, it may be advisable to employ staging when the depth of the trench exceeds 48 inches.

7.02 In deep excavations or in excavation in filled ground which may contain waste material in a state of partial decomposition, there is a possibility of oxygen deficiency or the presence of harmful gases. Likewise, even in shallow trenches in proximity to natural or manufactured gas mains there is a remote possibility of seepage of gas without its presence being detected by odor. Where there is any question as to the safety of the working conditions in such excavations, a check of the atmosphere should be made in accordance with G10.212, G10.214 or G10.216 for testing manhole atmosphere.

7.03 Where a large amount of trench is to be excavated, a trenching machine may be used to advantage except where the presence of numerous large boulders, rock or foreign service pipes would materially hinder the progress of the digging machine.

7.04 Where rock is encountered in the trench, consult the inspector or supervisor relative to the possibilities of avoiding the rock excavation by either changing the duct formation or moving the duct run. If rock excavation is unavoidable, the rock should be chipped out where present in small quan-

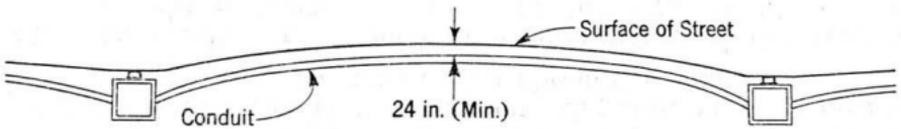
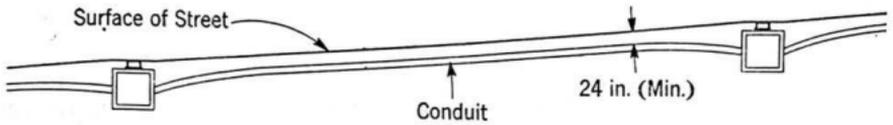
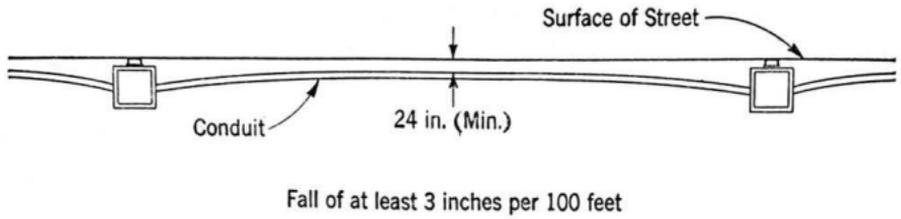
ties or blasted if large amounts must be removed, whichever is more economical.

Caution: Blasting shall be done by an authorized powder man as outlined in the instructions covering "Use of Dynamite," G10.320 to G10.323, inclusive, and only at the direction of the supervisor.

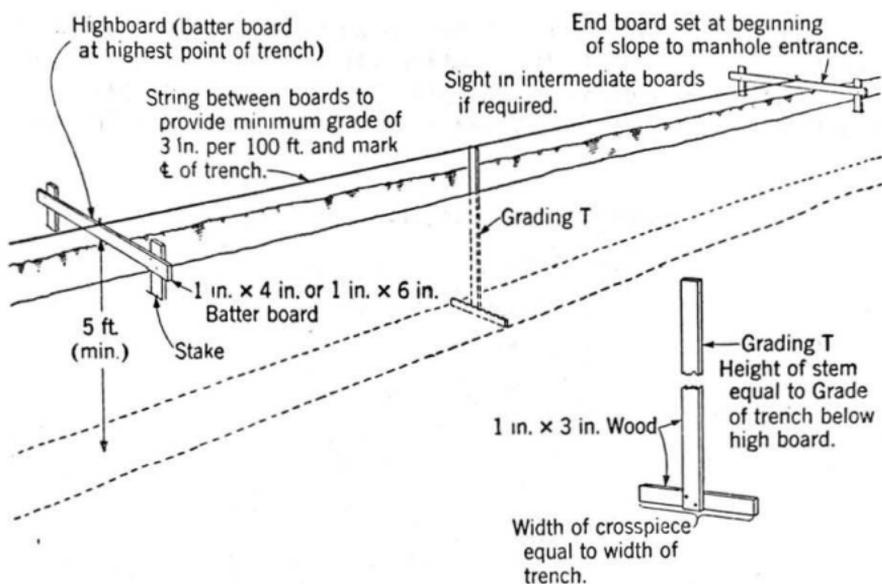
7.05 Where the spoil pile is located on the street side of the excavation, care should be taken to prevent loose stones and rock from rolling out into the driving area where they might be struck and hurled by the wheels of passing vehicles, with possible injury to persons or damage to property. Do not place excavated material nearer than 18 inches to the edge of the trench, and keep the shoulders clear of all loose objects that might fall on men in the trench.

7.06 Grade the trench so that it will have a fall of at least 3 inches in 100 feet toward the lower manhole or from the high point of the section toward both manholes. When an obstruction is encountered in the trench and it is necessary to dig a deeper trench than would otherwise be required, in order to obtain drainage, refer the matter to the supervisor to determine whether the extra excavation should be made.

7.07 In grading the trench, the high point of the trench should ordinarily conform to the high point of the ground surface, as shown. Where the ground surface between manholes is reasonably level, take the middle of the manhole section as the high point and grade each way. Where the surface slopes in one direction between manholes, locate the high point of the trench grade approximately 25 feet from the end wall of the higher manhole and grade toward the lower manhole.



7.08 Having established the high point of the trench grade, erect a batter board straddling the trench location at that point, as illustrated. Locate the top edge of the board an even number of feet above the grade of the trench, with a minimum of 5 feet to provide working space underneath. Steel pins or small wooden horses can be used to support batter boards in paved streets. At intervals of about 50 feet each side of the high point erect additional batter boards at the proper height above the grade of the trench, allowing for the required minimum fall of 3 inches per 100 feet. The end boards should be set at the proper elevation about 25 feet from the near end wall of each manhole, unless other arrangements are called for in the detail plans, see 11.02. From this point, the grade of the trench should be depressed uniformly to the level required by the location of the duct entrance in the manhole. A line level can be used for establishing the drop of the batter boards from the high point provided the level is always placed midway of the length of the string.



7.09 After locating the batter boards along the trench, stretch a line between them to mark the centerline and grade of the trench. During trenching, the grade of the trench bed can be checked by using a grading T or gauge similar to the one illustrated above. The length of the cross member should equal the desired width of the trench so that it can be used to gauge the width of the excavation. The T can be made of 1 inch by 3 inch lumber.

7.10 Where a trenching machine is used, the line can be stretched between stakes offset from the side of the trench so that the machine operator can gauge line and depth from it.

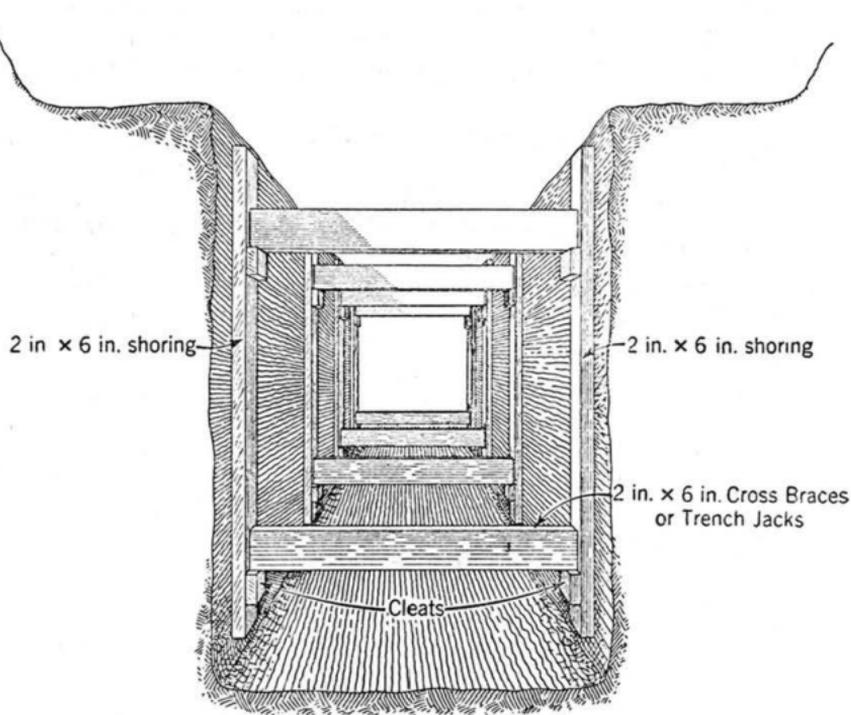
7.11 The amount of trench to be excavated at one time will depend on circumstances, such as location, character of the soil, existence of local regulations, etc. In general, in order to reduce traffic interference to a minimum and avoid loss of trench through caving, only enough trench should be opened to take the day's installation of conduit. If practicable, backfilling of the section should be completed the same day.

8. TRENCH TIMBERING

8.01 All timbers used for supporting the sides of excavations should be of good quality, reasonably straight grained and free from knots or other weakening defects.

8.02 Trenches 3 feet to 5 feet deep in which men are required to work should be supported by shoring, except when excavated in solid rock or when the sides are cut down to an angle which leaves a rise of not more than 1 foot for each one-half foot of horizontal measurement.

8.03 In firm soil, the shoring should consist of 2 inch by 6 inch or heavier planks placed vertically against the sides of the trench opposite each other and spaced not more than 6 feet apart throughout the length of the trench. Whenever possible, they should extend to the bottom of the trench. The shoring should be braced either with trench jacks or with 2 inch by 6 inch braces rigidly cleated or wedged.



Note. Horizontal spacing of shoring not to exceed 6 ft.

8.04 In soil likely to crack or crumble and sandy or filled-in soil, the timbering should be the same as recommended under similar conditions for trenches over 5 feet but not exceeding 10 feet in depth, as shown in the table following 8.05.

8.05 Trenches over 5 feet in depth should be supported by timbering the side walls in accordance with the requirements of the following tables, depending on the depth and width of trench and the stability of the soil. Driving of sheeting should progress as the excavation is carried downward.

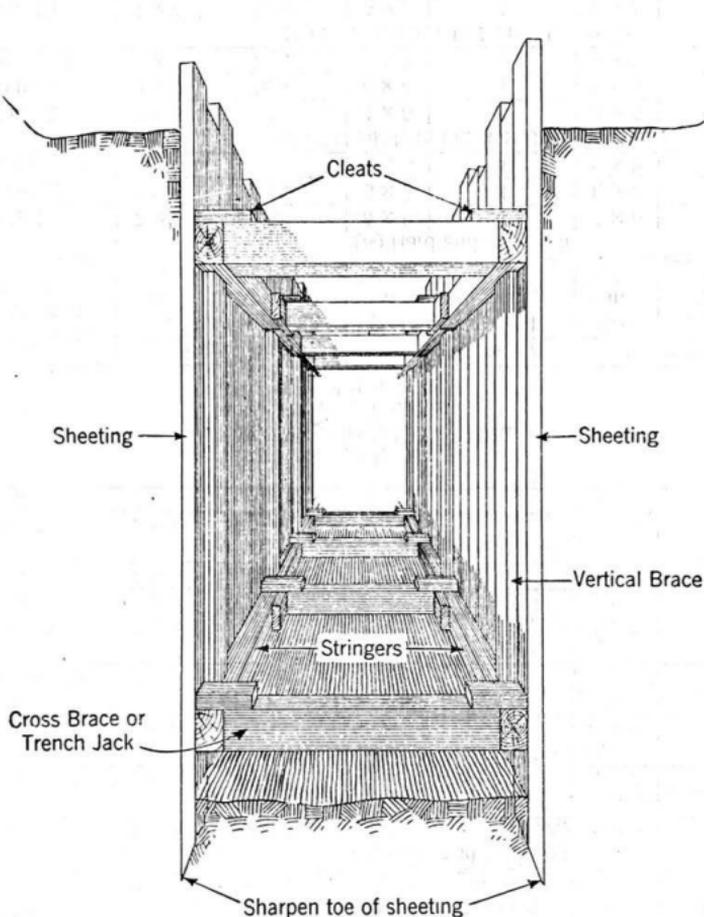
TABLE A
BRACING AND SHEET PILING
For Narrow Trenches
Not over 4 ft. in Width

Depth of Trench in Feet	Sheet Piling		Stringers		Cross-Bracing	
	Size in Inches	Horizontal Spacing in Feet	Size in Inches	Vertical Spacing in Feet	Size in Inches	Horizontal Spacing in Feet
	(A) Hard and Solid Soil					
5 to 10	2 x 6	6	4 x 6	6 (max.)	4 x 6	6
10 to 15	2 x 6	4	4 x 6	6	4 x 6	5
More than 15	2 x 6	Tight	4 x 8	4	4 x 8	6
	(B) Soil Likely to Crack or Crumble					
5 to 10	2 x 6	3	4 x 6	5	4 x 6	5
10 to 15	2 x 6	2	4 x 6	4	4 x 6	4
More than 15	2 x 6	Tight	4 x 10	4	4 x 10	6
	(C) Soft, Sandy, Filled-in or Loose Soil					
5 to 10	2 x 6	Tight	4 x 6	6 (max.)	4 x 6	6
10 to 15	2 x 6	Tight	4 x 6	5	4 x 6	6
More than 15	2 x 6	Tight	4 x 12	4	4 x 12	6
	(D) Where Hydrostatic Pressure Exists					
To 10	2 x 6	Tight	6 x 8	4	6 x 8	6
More than 10	3 x 6	Tight	6 x 10	4	6 x 10	6

TABLE B
BRACING AND SHEET PILING
For Wide Trenches
Over 4 ft. in Width

Depth of Trench or Excavation in Feet	Sheet Piling		Stringers		Cross-Bracing	
	Size in Inches	Horizontal Spacing in Feet	Size in Inches	Vertical Spacing in Feet	Size in Inches	Horizontal Spacing in Feet
	(A) Hard and Solid Soil					
5 to 10	2 x 6	6	4 x 6	4	4 x 6	6
10 to 20	2 x 6	Tight	6 x 6	4	6 x 6	6
More than 20	2 x 6	Tight	6 x 8	4	6 x 8	6
	(B) Soil Likely to Crack or Crumble					
5 to 10	2 x 6	3	4 x 6	4	4 x 6	6
10 to 20	2 x 6	Tight	6 x 6	4	6 x 6	6
More than 20	3 x 6	Tight	6 x 8	4	6 x 8	6
	(C) Soft, Sandy, Filled-in or Loose Soil					
5 to 10	2 x 6	Tight	6 x 6	4	6 x 6	6
10 to 20	2 x 6	Tight	8 x 8	4	6 x 6	6
More than 20	3 x 6	Tight	8 x 8	4	6 x 8	6
	(D) Where Hydrostatic Pressure Exists					
To 10	2 x 6	Tight	6 x 8	4	6 x 8	6
More than 10	3 x 6	Tight	8 x 10	4	6 x 10	6

8.06 The arrangement of the sheeting, stringers and bracing and suggested methods of preventing slippage of the braces and stringers are illustrated below.



8.07 Where excessive water is encountered, consideration should be given to the use of tongue and groove sheeting in order to reduce pumping requirements. See also 10.04.

8.08 All **tunnels** through soil should be adequately shored with the timber properly fitted and wedged in place. When a tunnel is of such length that men must work inside, the excavation should not be carried forward more than 18 inches before placing timber. All voids behind timbers should be filled with blocking or other suitable material to prevent

caving. The type and size of timbering to be used in each particular case will be selected by the supervisor.

8.09 When removing bracing, always remove the lower braces first, leaving the upper ones until last for protection.

9. FOREIGN STRUCTURES ENCOUNTERED

9.01 Where foreign structures are encountered in the trench, it may be necessary to go to a greater depth than would otherwise be required in order to obtain suitable clearance for the conduit. Where this is impracticable or undesirable, the foreign structure may be moved or the trench line shifted to obtain the required clearance. If a foreign structure must be moved to obtain clearance, arrange to have the work done by the owning company.

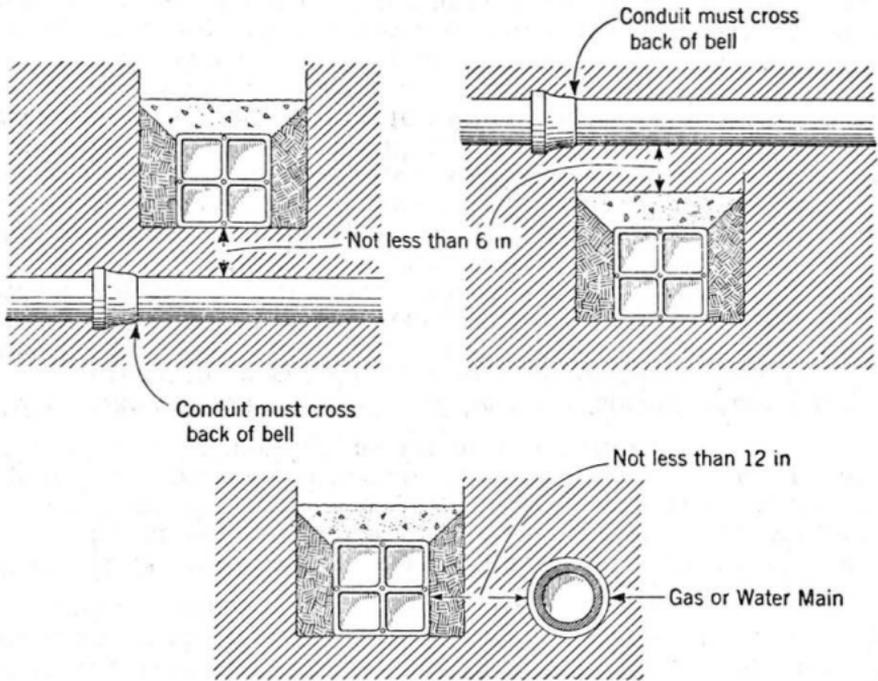
9.02 It is preferable to cross under gas, steam or water mains rather than above them provided, however, that the depth of the trench would not be excessively increased. A paralleling position either above or below gas, steam or water mains should be avoided, as far as practicable.

9.03 Gas and oil mains should be given special attention and precautions should be taken to guard against the fire hazards they present. Excavations in public streets should always be checked for gas leakage, even though gas mains or sewers are not directly encountered. Uncovering gas mains or working in the vicinity of such mains always involves the possibility of encountering gas leaks, with the resulting hazard of accumulated gas in the excavation. No open flame of any sort should be permitted around excavations when the odor of gas is detected. Workmen should not be permitted to smoke and precautions should be taken to prevent pedestrians from throwing lighted cigars, cigarettes or burning matches into such excavations. Where practicable, it is advisable to notify the owning company when excavation involving such structures is undertaken so that a representative may be present if desired.

9.04 The minimum desirable separations between foreign structures and telephone conduit and manholes are as follows:

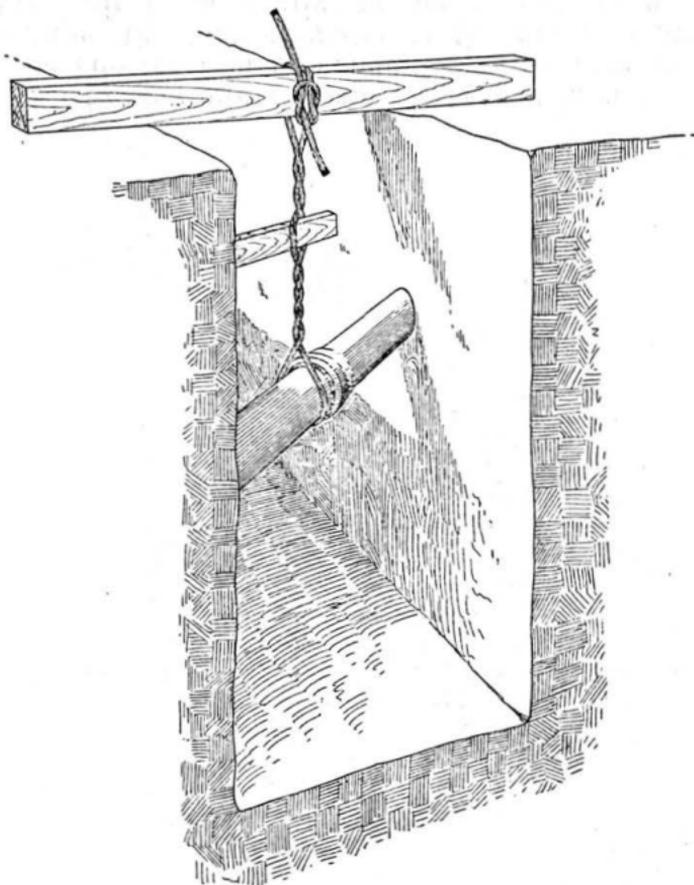
- (a) Electric light or power conduits—at least 3 inches of concrete, 4 inches of brick masonry or 12 inches of earth.

(b) Other foreign pipes such as gas, water, oil mains, etc.— separations of at least 6 inches when crossing and 12 inches when paralleling, as measured from the nearest part of the manhole or conduit structure in the positions illustrated. These clearances are provided to facilitate maintenance of the foreign structure and are subject to adjustment to meet particular conditions. In the event a question arises as to the practicability of the clearances given, consult with the owning company.

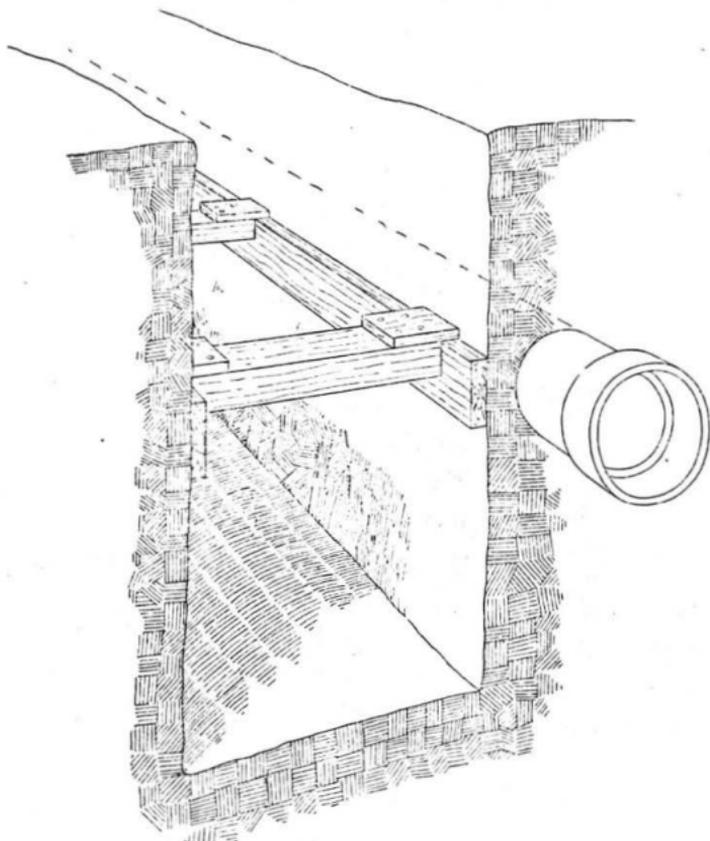


(c) For separations at railroad crossings and on bridges, see G41.140 on special construction.

9.05 Foreign pipes which cross the trench diagonally shall be supported when necessary.



9.06 Foreign pipes which parallel the trench and either extend partially into the trench or are located within 12 inches of the trench wall shall be braced laterally by shoring, except when the necessity for sheeting to support the trench walls furnishes adequate bracing for the pipe.



9.07 Where agricultural drain tile are cut in connection with the construction of conduit, provide temporary means for continuing the flow of water at the point of interruption unless the drain is inoperative at the time of the work. Maintain the drain clear at all times to avoid stoppage. In restoring the tile at the completion of the conduit construction, replace the drain with tile of the size removed and at the original grade.

10. PREPARING TRENCH BED

10.01 Level the trench bed by raking to form an even base for the conduit. In some cases it may be desirable to supplement the raking by the use of sand or screened earth to provide a stable bearing for the joints.

10.02 Ordinarily, no concrete base for the conduit is required. If, upon excavation, the trench bed appears to be incapable of affording firm support for the conduit, consult with the supervisor or inspector to decide whether a base should be provided.

10.03 Do not place dry concrete (dry cement and aggregates) for the purpose of absorbing water from the trench bed, as the concrete so produced is of little value as a base and the use of materials in this manner is wasteful. If the volume of water in the trench is too great to permit the conduit to be laid and joined properly, it can be disposed of by placing a layer of crushed stone in the trench bed through which the water can drain to a sump while the conduit is being placed. To facilitate laying conduit on a bed prepared in this manner, it may be desirable to add a thin layer of earth or sand or place building paper over the stone.

10.04 Where conditions are so severe that the water cannot be handled by the method described above, it may be advisable to employ a system of wellpoints paralleling the trench to lower the ground water level to a point below the bottom of the excavation. This system consists of a series of vertical pipes usually jetted to a point below the trench bed and spaced at intervals along one side of the trench, a header pipe which connects to and receives water from the wellpoints and a pump which receives water from the header and discharges it at a distance. In clear sand and under ordinary conditions, each wellpoint can pass from 35 to 40 gallons of water per minute. The equipment for such work can usually be rented from local construction contractors.

11. DUCT ENTRANCES

11.01 The corresponding duct entrances of the conduit run at opposite ends of the manhole should be at the same level and in the same position with respect to the side walls, where practicable, to facilitate duct rodding, cable placing and splicing.

11.02 The trench should be graded to the duct entrance of the manhole as called for in the detail plans. The points at which the trench grade to the manhole entrances should start will change with the various duct formations and will vary

if mitered conduit is used or if splaying is employed. The distance from the manhole at which to start the trench grade for the particular duct arrangement and the type of conduit to be employed will usually be shown on the detail plans.

12. BACKFILLING

12.01 Backfill next to the ducts should be free from stones or other material which might injure the ducts or duct joints. Large boulders should not be included in any part of the backfill when there is a possibility of heavy road machinery passing over the conduit location.

12.02 In tamping the backfill at the sides of the conduit use reasonable care not to damage the joints or shift the conduit structure. Backfilling and tamping alongside the ducts should be done in layers only an inch or two in thickness until the level of the top of the ducts is reached. Tamping at higher levels as filling proceeds cannot be expected to compact the fill at the sides of the ducts and any lack of initial consolidation at the latter point is likely to result in the creation of a path for water to follow the line of the ducts. The probable result of this is the creation of voids and a tendency toward settlement.

12.03 Backfilling around conduit joined with mortar bandages can proceed as soon as the joints are completed. Troweled joints should be allowed to set 24 hours before backfilling. Concrete top protection or encasement can be backfilled as soon as completed.

12.04 Above the ducts tamp all backfill thoroughly in 6 inch layers. In all cases mechanically tamped backfill will provide a better job than hand tamped backfill. Where a large amount of backfilling and tamping is to be done, a backfilling and tamping machine may be used to advantage. Compressed air tampers may be advantageously used for small jobs or on jobs where a tamping machine cannot be used. To avoid damaging the ducts, do not use mechanical tampers until the conduit structure has been covered with at least 12 inches of backfill.

12.05 Do Not Backfill With Cinders Around the Ducts.

Cinders near the ducts may contribute to a galvanic action with harmful results to any cable later placed in the ducts. Where cinders form a part of the soil, use clean earth for the backfill adjacent to the ducts and do not replace soil containing cinders until the ducts have been covered with at least 6 inches of cinder-free soil. In some instances, where the soil is composed mainly of cinders, it may be advisable to encase the ducts in 3 inches of concrete throughout the length of the

affected area, particularly if top and base concrete are already specified.

13. REPAVING

13.01 In general, paving and sometimes temporary paving also, is covered by Municipal, County or State regulations. Where such regulations are in existence, the restoration shall be made to conform. Whenever possible, arrangements should be made to have permanent paving restored by recognized local paving contractors using materials approved by the governing authorities. The procedure outlined below is for guidance where there are no local regulations.

13.02 When necessary, temporarily repave the trench. Ordinarily it will be satisfactory to replace the surfacing materials which were removed during the course of excavation. The top of the trench should be slightly rounded to provide for the packing of the replaced earth beneath.

13.03 The base material, if used, should be thoroughly tamped on top of the replaced earth and the pavement, if of the asphalt type, replaced in sections as removed and compacted to provide a smooth, firm surface. An alternative is to employ one of the commercial cold patch materials for the surfacing, either by itself or to bind the salvaged material.

13.04 Replaced paving brick and other brick should be set on sand where practicable and the spaces between the brick packed with sand.

13.05 In temporarily repaving a concrete road, replace the broken concrete on top of the backfill, tamp thoroughly and finish off the surface with earth.

13.06 Before repaving permanently, it is desirable to permit traffic to run over the temporarily repaved trench for a short period of time in order to pack the subsurface materials and eliminate the possibility of future settlement.

13.07 Where permanent concrete pavement or base is to be placed over a refilled trench, the following method should be followed:

- (1) Remove the temporary pavement and base material.
- (2) Cut back the edges of the concrete on each side 6 inches beyond the original cut.
- (3) Tamp the backfilled earth to obtain a packed level surface.
- (4) Clean the edges of the concrete and paint them with a grout of cement and water in order to obtain a good bond with the new concrete.

(5) Using the proper class of concrete as specified in G45.140 for pavement repairs, follow the instructions for mixing and placing concrete as outlined in G45.150. Place the concrete to the depth of the original surface or base course.

13.08 In restoring the asphaltic surfacing of a two-course pavement follow the instructions of 13.07 for the base and finish the repair with an approved cold patch material.

13.09 On private property and public parks where sod or top soil has been removed, finish off the surface of the trench with top soil or sod as removed. This work shall be done to the satisfaction of the property owner or authorities.

14. REMOVING SURPLUS MATERIALS

14.01 In general, it is desirable to remove all surplus excavated material in conjunction with the backfilling operation so as not to obstruct traffic.

14.02 Where space is restricted, it may be desirable to estimate the amount of surplus earth and remove this material from the job at the time it is excavated.

14.03 Where practicable, small amounts of excavated material should be left on the job to be used later for filling in the temporarily repaved trench where settlement has taken place.

14.04 When the job is finished, clean up all surplus material and debris.