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Indian Standard
CODE OF PRACTICE FOR
LAYING OF GLAZED STONEWARE PIPES
(*First Revision*)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

CODE OF PRACTICE FOR LAYING OF GLAZED STONEWARE PIPES

(*First Revision*)

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Indian Standard

CODE OF PRACTICE FOR
LAYING OF GLAZED STONEWARE PIPES
(*First Revision*)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 November 1983, after the draft finalized by the Water Supply and Sanitation Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 For all sewers and drains in ordinary ground, glazed stoneware pipes are recommended in preference to other types of pipes. They are particularly suitable where acid effluents or acid subsoil conditions are likely to be encountered. Laying of glazed stoneware pipes for drainage purposes has been generally governed by the regulations laid down by the various municipalities and municipal corporations. These regulations are intended to ensure proper laying of pipes, giving due consideration to economy and safety of workers engaged in pipe laying. However, there is no uniformity in these regulations regarding minimum standards of laying which should be fulfilled for proper and safe laying of stoneware pipes and this code is intended to give the necessary guidance on sound practices of laying stoneware pipes. It is being revised to incorporate improvements found necessary in the light of usage of the standard. In this revision, the quantity of spun yarn to be used in the joints have been omitted and the guidance for the depth of yarn to be inserted in the joints have been given (*see 6.1.2.1*).

0.3 This code represents a standard of good practice and, therefore, takes the form of recommendations.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the methods of laying glazed stoneware pipes below ground level for drainage purposes. It also includes handling and jointing of pipes, tests, backfilling, and restoration of surfaces.

1.2 For the purpose of this code, stoneware pipes shall be those conforming to IS : 651-1980* and IS : 3006-1979†.

1.3 This standard is only applicable to public sewers and pipes laid down for building drainage in accordance with IS : 1742-1983‡.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions of terms as given in 2 of IS : 1742-1983‡ shall apply.

3. EXCAVATION AND PREPARATION OF TRENCH

3.1 General — The trench shall be so dug that the pipe can be laid to the required alignment and at the required depth. When the pipeline is under a roadway, a minimum cover of 90 cm is recommended for adoption, but it may be modified to suit local conditions. The trench shall be excavated only so far in advance of pipe laying as specified by the authority. The trench shall be so shored and drained that the workmen may work therein safely and efficiently. The discharge of the trench dewatering pumps shall be conveyed either to drainage channels or to natural drains.

3.1.1 Trenching — The excavation should be carried out with manual labour or with suitable mechanical equipment as approved by the authority.

3.2 Width of Trenches — Unless otherwise specified by the Authority, the width at bottom of trenches for different diameters of pipes laid at different depths shall be as given below:

- For all diameters, up to an average depth of 1.20 m, width of trench in mm = diameter of pipe + 300 mm.
- For all diameters for depths above 1.20 m, width of trench in mm = diameter of pipe + 400 mm.
- Notwithstanding (a) and (b) the total width of trench should not be less than 0.75 m for depths exceeding 0.9 m.

3.3 Limits of Excavation Relative to Gradients — Except where special foundations are to be provided for the reasons given in 3.5, the

*Specification for salt-glazed stoneware pipes and fittings (*fourth revision*).

†Specification for chemically resistant glazed stoneware pipes and fittings (*first revision*).

‡Code of practice for building drainage (*second revision*).

trench shall be excavated in accordance with one of the following alternatives as may be considered appropriate by the Authority:

- a) The trench shall be excavated to the exact gradient specified so that no making of the subgrade by backfilling is required and the concrete bed, where required, may be prepared with greatest ease giving a uniform and continuous bearing and support for the pipe.
- b) When the bottom of the trench at the specified gradient is found to be unstable or includes ashes and cinders, all types of refuse, vegetable or other organic material, or large pieces of fragments of inorganic material, they shall be removed to the satisfaction of the Authority. Before laying the concrete bed, where necessary, the specific gradient shall be attained by backfilling with an approved material in uncompacted layers of 80 mm. The layers shall then be tamped as directed by the Authority.

3.4 Trimming of Trench Bottoms — The bottom of the trench shall be properly trimmed off to present a plain surface and all irregularities shall be levelled. Where rock and large stone or boulders are encountered the trench shall be trimmed to a depth of at least 80 mm below the level at which the bottom of the barrel of the pipe is to be laid, and filled to a like depth with stones broken to pass through a sieve of 12.5 mm aperture size (*see* IS : 2405 (Part 1)-1980*) and well rammed to form a firm bed for pipes. Excavation shall be at joints to such dimensions as will allow the joints to be conveniently and thoroughly filled.

3.5 Special Foundation in Poor Soil — Where the bottom of the trench at sub-grade is found to consist of material which is unstable to such a degree that, in the opinion of the Authority, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe, consisting of piling, timbers and other materials, in accordance with plans prepared by the Authority shall be constructed.

3.6 Rock Excavation — The term 'Rock' wherever used in this standard shall have the same meaning as given in 3.1 of IS : 1200 (Part 1)-1974†.

3.7 Blasting — Blasting for excavation in rock shall be permitted only after securing the approval of the Authority and only when proper precautions are taken for the protection of persons and property. The hours of blasting shall be fixed by the Authority. The procedure of blasting shall conform to the requirements of local controlling Authority.

*Specification for industrial sieves: Part I Wire cloth sieves and square aperture series (*first revision*).

†Method of measurement of building and civil engineering work: Part 1 Earth work (*third revision*).

3.8 Braced and Sheeted Trenches — Open-cut trenches shall be sheeted and braced as required by any governing state laws and municipal regulations and as may be necessary to protect life, property and the work. When close sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting.

3.8.1 The Authority shall have the right to order the sheeting to be driven to the full depth of the trench or to such additional depths as may be required for the protection of the work. Where the soil in the lower limits of a trench has the necessary stability, the Authority at his discretion, may permit stopping of the driving of sheeting at some designated elevation above the trench bottom.

3.8.2 Sheetting and bracing which have been ordered left in place should be removed for a distance of 0.9 m below the established street level or the existing surface of the street, whichever is lower. Trench bracing, except that which has been left in place, may be removed when the backfilling has reached the respective level of such bracing. Sheetting, except that which has been left in place, may be removed after the backfilling has been completed or has been brought up to such an elevation as to permit its safe removal. Sheetting and bracing may be removed before filling the trench, but only in such a manner as will ensure the adequate protection of the completed work and adjacent structures.

3.9 Care of Surface Material for Re-use — All surface materials which, in the opinion of the Authority, are suitable for re-use in restoring the surface shall be kept separate from the general excavation material as directed by the Authority.

3.10 Stacking Excavated Material — All excavated material shall be stacked in such a manner that it will not endanger the work and it will avoid obstructing foot-paths and roads. Hydrants under pressure, surface boxes, fire or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural water-courses shall not be obstructed.

3.11 Barricades, Guards and Safety Provisions — To protect person from injury and to avoid damage to property, adequate barricades, construction signs, torches, red lanterns and guards, as required, shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the roadway. All materials, piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences for barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities regarding safety provisions shall be observed.

3.12 Maintenance of Traffic and Closing of Streets — The work shall be carried in such a manner which will cause the least interruption to traffic, and the road or street may be closed in such a manner that it causes the least interruption to the traffic. Where it is necessary for traffic to cross open trenches, suitable bridges shall be provided.

3.12.1 Suitable signs indicating that a street is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.

3.13 Structure Protection — Temporary support, adequate protection and maintenance of all underground and surface structure, drains, sewers and other obstructions encountered in the progress of the work shall be provided under the direction of the Authority. The structures which may have been disturbed shall be restored upon completion of the work.

3.14 Protection of Property and Surface Structures — Trees, shrubbery fences, poles and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorised by the Authority. When it is necessary to cut roots and tree branches, such cutting shall be done under the supervision and direction of the Authority.

3.15 Interruption of Service — No valve or other control of the existing services shall be operated without the permission of the Authority.

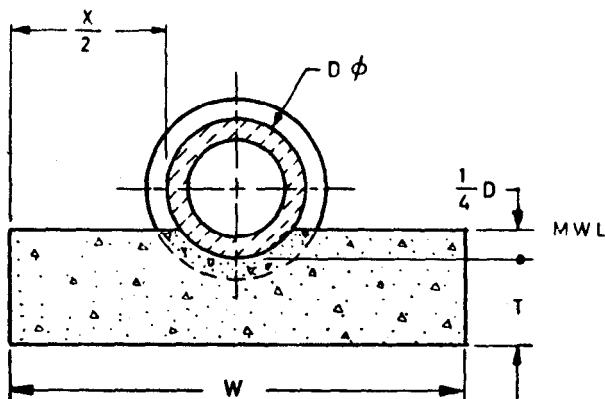
4. BED CONCRETE

4.1 Bedding — Where the pipes are laid on a soft soil with the maximum water table level, lying at the invert level of the pipe, the pipe shall be bedded in concrete (*see Fig. 1*). Alternatively, precast concrete sleepers at suitable intervals with 90° contact may be used if approved by the Authority when the pipes are to be laid over swelling soil; sand filling cushion of suitable thickness may be provided.

4.2 Haunching — Where the pipes have to be laid in a soft soil with the maximum water table level rising above the invert level of the pipe, but below the top of the barrel, the pipe sewers shall be haunched (*see Fig. 2*).

4.3 Surrounding or Encasing of Pipes — In the following cases the pipes shall be completely encased or surrounded with concrete (*see Fig. 3*):

- a) Where the maximum water table level is likely to rise above the top of the barrel;
- b) Where the sewers are to be laid adjacent to growing trees, to avoid damage to the pipe likely to be caused by the roots of the trees;
- c) Where the depth of the pipe is less than 1.2 m under the road surface; and
- d) Whenever the intensity of loading on pipes exceeds the limits given in Appendix A.



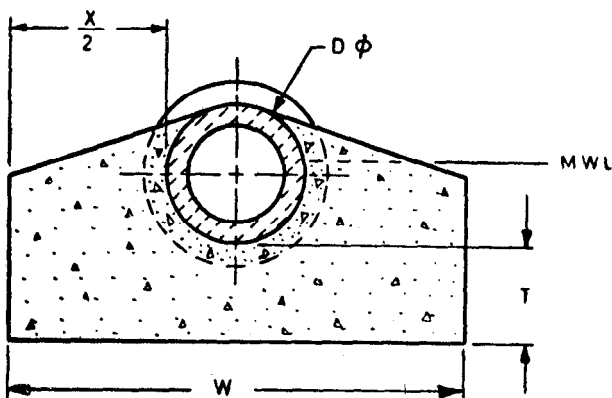
$W = D + X$, where D is the external diameter of the pipe

$X = \begin{cases} 300 \text{ mm, up to trench depth of } 1.20 \text{ m} \\ 400 \text{ mm, trench depth more than } 1.20 \text{ m} \end{cases}$

$T = 100 \text{ mm}$ for pipes under 150 mm nominal diameter; one fourth of internal diameter subject to a minimum of 150 mm and maximum of 300 mm for pipes of more than 150 mm diameter

MWL = Maximum water level.

FIG. 1 BEDDING



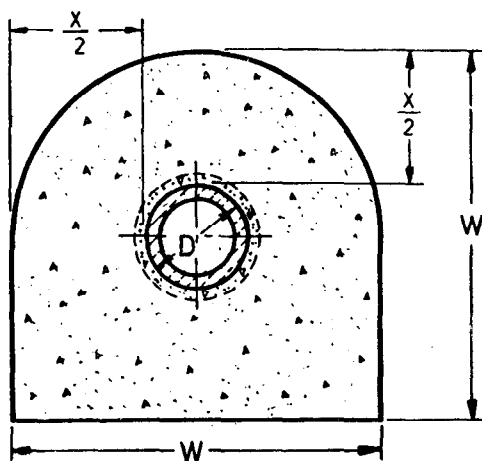
$W = D + X$, where D is the external diameter of the pipe

$X = \begin{cases} 300 \text{ mm up to trench depth of } 1.20 \text{ m} \\ 400 \text{ mm trench depth more than } 1.20 \text{ m} \end{cases}$

$T = 100 \text{ mm}$ for pipes under 150 mm nominal diameter; one-fourth of internal diameter subject to a minimum of 150 mm and maximum of 300 mm for pipes of more than 150 mm diameter

MWL = Maximum water level.

FIG. 2 HAUNCHING



$W = D + X$, where D is the external diameter of the pipe

$X = \begin{cases} 300 \text{ mm up to trench depth of } 1.20 \text{ m} \\ 400 \text{ mm trench depth more than } 1.20 \text{ m} \end{cases}$

$T = 100 \text{ mm}$ for pipes under 150 under nominal diameter; one fourth of internal diameter subject to a minimum of 150 mm and maximum of 300 mm for pipes of more than 150 mm diameter.

FIG. 3 SURROUND OR ENCASING

4.4 Materials — The concreting whenever necessary shall be done with 1 : 4 : 8 mass cement concrete or lime concrete (when the sub-soil conditions permit the same). The dimension of concreting shall be as shown in Fig. 1, 2 and 3.

5. LAYING

5.1 Unloading of Pipes — While unloading, pipes shall not be thrown down from the trucks on hard ground. Unloading them on timber skids without a steadying rope and thus allowing the pipes to bump hard against one another should not be allowed. In order to avoid damage to the pipes and especially to the spigot end, pipes should not be dragged along concrete and similar pavements with hard surfaces.

5.2 Handling of Stoneware Pipes into Trench — In shallow trenches manual handling is enough, but in deep trenches they should be lowered into the trench by means of ropes. Under no circumstances shall pipes be dropped or dumped into the trench.

5.3 Detection of Cracks in Pipes and Fittings — The pipe and fittings shall be inspected for defects, and be rung with a light hammer preferably while suspended to detect cracks.

5.4 Cleaning Pipes and Fittings — All lumps, blisters and excess coating materials shall be removed gently from the socket and spigot end of each pipe and the outside of the spigot and the inside of the socket shall be wiped clean and dry before the pipe is laid.

5.5 Placing the Pipes in Trench — Every precaution shall be taken to prevent foreign materials from entering the pipes when it is being placed in the line. Normally the socket ends should face the up-stream. When the line runs uphill the socket ends should face the up-grade.

5.5.1 After placing a length of pipe in the trench on concrete bedding where that is specified, the spigot end shall be centered in the socket and the pipe forced home and aligned to gradient. The pipe shall be secured in place with approved backfill material or concrete tamped under it except at the socket. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.

5.5.2 At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or canvas or other means approved by the Authority.

5.5.3 Sight rails shall be provided at all changes of directions or gradients at distances of about 30 m along straight lengths. The centre line shall be marked on each horizontal rail which is fixed at true level. All inverts shall be laid therefrom with the help of proper boning rods.

5.6 Cutting of Pipes — The cutting of pipe for inserting, fitting or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining so as to leave a smooth end at right angles to the axis of the pipe.

5.7 Pipelines Crossing Railway Lines, Irrigation Channels or Similar Works — The Authority should consult the appropriate authorities before preparing plans and specifications for this part of work.

5.8 Connection to an Existing Sewer — The connection to an existing sewer shall be done through manholes.

5.9 Connections to Manholes — Before connecting a pipe to a manhole, a relieving arch or any other similar protection device should be made in the manhole for the safety of the pipe.

5.10 Strength and Loading of Stoneware Pipes — The pipes, when laid, should not be subjected to superimposed load beyond their safe crushing strength and some guidance in this regard is given in Appendix A.

6. JOINTING OF PIPE

6.1 Types of Joints — The stoneware pipes shall be cement jointed or provided with bituminous joints as approved by the Authority.

6.1.1 Materials for Cement Joints — The materials shall consist of the following:

- a) Spun yarn or tarred gaskets,
- b) Cement (*see* IS : 269-1976*, IS : 455-1976† or IS : 1489-1976‡), and
- c) Sand (*see* IS : 1542-1977§).

6.1.2 Jointing Procedure for Cement Joints — The procedure as laid in 6.1.2.1 to 6.1.2.4 shall be followed.

6.1.2.1 Caulking of yarn or gasket — In each joint, spun yarn soaked in neat cement slurry or tarred gasket shall be passed round the joint and inserted in it by means of a caulking tool. More skeins of yarn or gasket shall be added if necessary and shall be well caulked. Yarn or gasket so rammed shall not occupy more than one-fourth of the depth of socket.

6.1.2.2 Caulking of cement mortar — Cement mortar (1 : 1) (one part of cement to one part of sand) shall be slightly moistened and carefully inserted by hand into the remaining space of the joint after caulking of yarn or gasket. The mortar shall then be caulked into the joint with a caulking tool. More cement mortar shall be added until the space of joint has been completely filled with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45 degrees as shown in Fig. 4.

6.1.2.3 Curing — The cement mortar joints shall be cured at least for seven days before testing.

6.1.2.4 The approximate quantity of cement required for each joint for certain common sizes of pipes are given below for guidance:

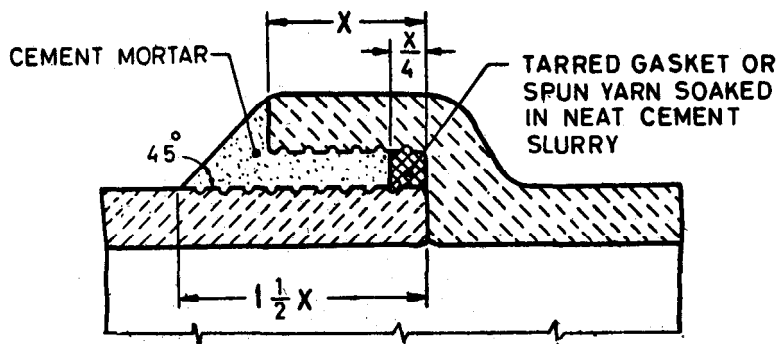
<i>Nominal Diameter of Pipe</i>	<i>Cement</i>
mm	kg
100	1.0
150	1.5
200	2.0
250	2.5
300	3.25
350	4.5
400	5.5

*Specification for ordinary and low heat Portland cement (*third revision*).

†Specification for Portland slag cement (*third revision*).

‡Specification for Portland pozzolana cement (*second revision*).

§Specification for sand for plaster (*first revision*).



$X = \text{Socket Length}$

FIG. 4 TYPICAL DETAIL OF CEMENT JOINTS FOR GLAZED STONEWARE PIPES

6.1.3 Materials and Jointing Procedure for Bituminous Joints — The materials shall consist of a composition of asphalt and sand in the ratio of 1 : 7. Asphalt and sand shall be boiled together and filled into the socket in a molten state with the aid of special moulds.

6.2 Jointing with Cast Iron Pipes — Where any cast iron soil pipe, waste pipe, ventilating pipe or trap is connected with a stoneware pipe or drain connecting with a sewer, the joint shall be made with cement joints (see 6.1).

6.3 Jointing with Concrete Pipes — The procedure shall be the same as described for cement joints (see 6.1) but the socket or the spigot shall be thoroughly wetted before the joints are made.

7. HYDRAULIC TEST

7.1 Test Pressure — All pipelines shall be subjected to a test pressure of at least 2.5 m head of water at the highest point of the section under test. The tolerance of two litres per centimetre of diameter per kilometre may be allowed during a period of 10 minutes.

7.2 Before commencing the hydraulic test, the pipelines shall be filled with water and maintained full for 24 hours by adding water, if necessary, under a head of 0.6 m of water. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections, if any, and filling the system with water. A knuckle bend shall be temporarily jointed-in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head; or the top-end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered

till the required head is obtained and fixed suitably for observation. A typical arrangement for hydraulic test is given in Appendix B.

Subsidence of the water may be due to one or more of the following causes:

- a) Absorption by pipes and joints,
- b) Sweating of pipes or joints,
- c) Leakage at joints or from defective pipes, and
- d) Trapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the proper test should commence.

Any leakage will be visible and the defective part of the work should be cut out and made good. A slight amount of sweating which is uniform may be overlooked; but excessive sweating from a particular pipe or joint shall be watched for and taken as indicating a defect to be made good.

7.3 Rectification of Faulty Joints — Any joint found leaking or sweating, shall be rectified or embedded into 150 mm layer of cement concrete (1 : 2 : 4) 300 mm in length and the section retested.

8. BACKFILLING

8.1 Starting of Backfilling — Filling of the trench shall not be commenced until the length of pipes herein has been tested and passed.

8.2 Trench Zoning — For the purpose of backfilling, the depth of the trench shall be considered as divided into the following three zones from the bottom of the trench to its top:

- Zone A — From the bottom of the trench or top of the concrete, when concrete bedding is provided, to the level of the centre line of the pipe.
- Zone B — From the level of the centre line of the pipe to a level 300 mm above the top of the pipe.
- Zone C — From a level 300 mm above the top of the pipe to the top of the trench.

8.3 Backfill Material — All backfill material shall be free from cinders, ashes, slag, refuse, rubbish, vegetable or organic material, lumpy or frozen material, boulders, rocks or stone or other material which in the opinion of the Authority, is unsuitable or deleterious. However, material containing stones up to 200 mm as their greatest dimension may be used in Zone C unless otherwise specified herein.

8.3.1 Backfill Sand — Sand used for backfill shall be a natural sand complying with 8.3, graded from fine to coarse. The total mass of loam

and clay in it shall not exceed 10 percent. All material shall pass through a sieve of 20 mm aperture size [see IS : 2405 (Part 1)-1980*] and not more than 5 percent shall remain on an IS sieve of aperture size 6.30 mm.

8.4 Backfilling in Freezing Weather — Backfilling shall not be done in freezing weather except by permission of the Authority, and it shall not be made with frozen material. No fill shall be made where the material already in the trench is frozen.

8.5 Procedure

8.5.1 Backfilling in Zone A shall be done by hand with sand, fine gravel or other approved material placed in layers of 80 mm and compacted by tamping. The backfilling material shall be deposited in the trench for its full width of each side of the pipe, fittings and appurtenance simultaneously.

8.5.2 Backfilling in Zone B shall be done by hand or approved mechanical methods special care being taken to avoid injuring or moving the pipe. The type of backfill material to be used and the method of placing and consolidating shall be prescribed by the Authority to suit individual locations.

8.5.3 Backfilling in Zone C shall be done by hand or approved mechanically methods. The type of backfill material and method of filling shall be as prescribed by the Authority. Unless otherwise specified, backfilling by hand shall be done in layers of 300 mm each layer well compacted before laying the next layer.

8.6 Backfill Under Permanent Pavement — Where the excavation is made through permanent pavements, curbs, paved footpaths or where such structures are under-cut by the excavation, the entire backfill to the sub-grade of the structures shall be made with materials recommended and in accordance with **8.5.3**. Paved footpaths and pavements consisting of water bound macadam, gravel, slag or cinders shall not be considered as being of a permanent construction.

8.7 Backfill with Excavated Material — The excavated material may be used for backfill in the following cases, provided it complies with **8.3**.

- a) In Zone C, in cases where settlement is unimportant.
- b) In any zone when the type of backfill material is not indicated or specified provided that such material consists of loam, clay, sand, fine gravel or other materials which are suitable for backfilling in the opinion of the Authority.

*Specification for industrial sieves: Part 1 Wire cloth sieves and square aperture series (first revision).

8.8 Concrete Slabs Over Pipes — When pipes are laid under roads and pavements subjected to heavy traffic loads, the trenches may be covered with reinforced concrete slabs of suitable dimensions.

8.9 Surface Finish — In refilling, the fill shall be made 25 mm higher per 300 mm depth of trench subject to a maximum of 75 mm than the adjacent ground surface as the refill will settle with time, and it is most undesirable that this settlement should form a depression above the pipe.

9. REMOVAL AND RESTORATION OF PAVED FOOTPATHS, ETC., AFTER LAYING OF PIPE

9.1 Allowable Removal of Pavement — Pavement and road surfaces may be removed as a part of the trench excavation, and the amount removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of the pavement area required to be removed for laying of stoneware pipes. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 150 mm on each side of the trench. Wherever, in the opinion of the Authority, existing conditions make it necessary or advisable to remove additional pavement, it shall be removed as directed by the Authority.

9.2 Restoration of Damaged Surfaces and Property — Where any pavement, shrubbery, fences, poles or other property and surface structures have been damaged, removed or disturbed during the course of work, such property and surface structures shall be replaced or repaired after completion of work.

9.3 Replacement of Pavement and Structures — All pavements, paved footpaths, curbing, gutters, shrubbery, fences, poles rod or other property and surface structures removed or disturbed as a part of the work shall be restored to a condition equal to that before the work began, furnishing all labour and material incidental thereto. In restoring the pavement sound materials may be re-used. No permanent pavement shall be restored unless and until, in the opinion of the Authority the condition of the backfill is such as to properly support the pavement.

9.4 Cleaning Up — All construction materials, and all tools and temporary structures shall be removed from the site as directed by the Authority. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump and the construction site left clean to the satisfaction of the Authority.

APPENDIX A

(Clause 5.10)

STRENGTH AND LOADING OF PIPES

A-1. LOAD CALCULATIONS

A-1.1 The superimposed load should not normally exceed 1 600 kg per metre length, which is the minimum crushing strength specified in IS : 651-1980*. The superimposed load on a laid pipe may be calculated by Marston's formula, given below:

$$W = C w B^2$$

where

W = load on pipe in kilogram/linear metre,

C = coefficient which depends upon the ratio of depth of trench to the trench width and the filling materials (see Table 1),

w = weight of filling materials in kg/m^3 (see Table 2), and

B = width of trench in metres.

TABLE 1 VALUE OF 'C'

RATIO OF DEPTH TO TRENCH WIDTH (1)	SAND AND DAMP TOP- SOIL (2)	SATURATED TOPSOIL (3)	DAMP CLAY (4)	SATURATED CLAY (5)
0.5	0.46	0.46	0.47	0.47
1.0	0.85	0.86	0.88	0.90
1.5	1.18	1.21	1.24	1.28
2.0	1.46	1.53	1.56	1.62
2.5	1.70	1.76	1.84	1.92
3.0	1.90	1.98	2.08	2.20
3.5	2.08	2.17	2.30	2.44
4.0	2.22	2.33	2.49	2.66
4.5	2.34	2.47	2.65	2.87
5.0	2.45	2.59	2.80	3.03
5.5	2.54	2.69	2.93	3.19
6.0	2.61	2.78	3.04	3.33
6.5	2.68	2.86	3.14	3.46
7.0	2.73	2.93	3.22	3.57
7.5	2.78	2.98	3.30	3.67
8.0	2.81	3.03	3.37	3.76
8.5	2.85	3.07	3.42	3.85
9.0	2.88	3.11	3.48	3.92
9.5	2.90	3.14	3.52	3.98
10.0	2.92	3.17	3.56	4.04
11.0	2.95	3.21	3.63	4.14
12.0	2.97	3.24	3.68	4.22
13.0	2.99	3.27	3.72	4.29
14.0	3.00	3.28	3.75	4.34
15.0	3.01	3.30	3.77	4.38
Very great	3.03	3.33	3.85	4.55

*Specification for salt glazed stoneware pipes and fittings (fourth revision).

TABLE 2 MASSES OF COMMON FILLING MATERIALS

(Clause A-1.1)

MATERIAL	WEIGHT kg/m ³
Dry sand	1 600
Ordinary (damp) sand	1 840
Wet sand	1 920
Damp clay	1 920
Saturated clay	2 080
Saturated topsoil	1 840
Sand and damp soil	1 600

A-1.2 The load imposed on the pipe due to surface (traffic) loads may be found in accordance with the procedure given in 5.4 of IS : 783-1959*.

A-2. MEASURES TO ACHIEVE HIGHER LOADING

A-2.1 Wherever the pipes have to be laid at such depths that the super-imposed load on the pipe exceeds the safe crushing strength of 1 600 kg/m, protection may be provided by use of the methods given below:

- Bedding, haunching, surround or encasing the pipe as described in 4.1, 4.2 and 4.3.
- Wooden struts may be fixed horizontally near the mid-depth of the trench at suitable intervals to distribute a portion of the load to the two side walls of the trench as shown in Fig. 5.
- Any other methods as recommended by the Authority.

A-2.2 Whenever protection to pipes is provided by use of any of the methods described under **A-2.1** (a), the minimum crushing strength of pipes is also increased.

In case of ' bedding type ', the actual crushing strength may be computed by multiplying the minimum crushing strengths by a load factor ranging from 2.25 to 3.37 as felt suitable by the Authority. In the case of encasing, the arch action of the concrete is the deciding factor for the strength of pipe.

*Code of practice for laying of concrete pipes.

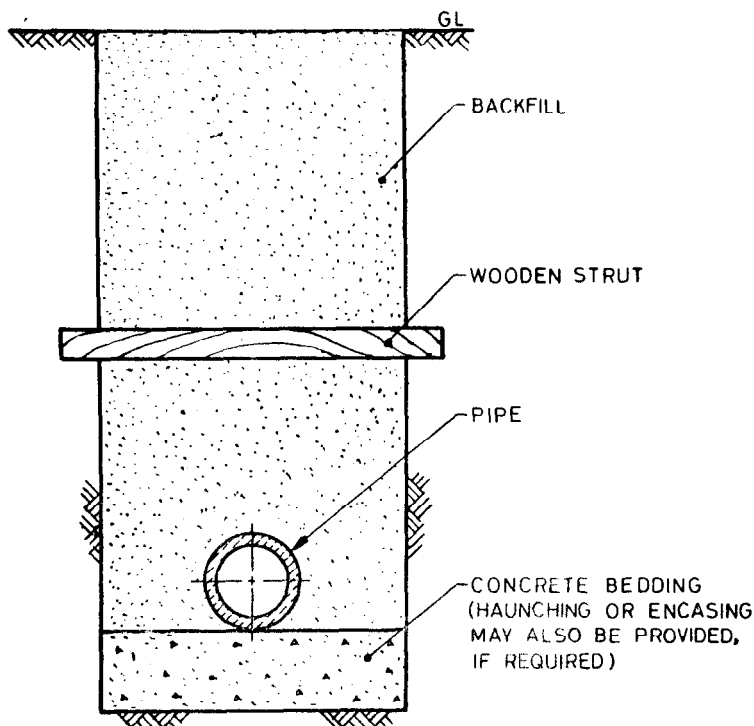


FIG. 5 FIXING OF WOODEN STRUTS IN DEEP TRENCHES

APPENDIX B

(Clause 7.2)

HYDRAULIC TESTING OF STONEWARE PIPE SEWER LINES

B-1. METHODS OF TEST

B-1.1 The sewer testing plug is inserted at the upstream and downstream end and also in the various house service tappings and plugged. The testing plug comprises of two flanges, one rubber ring, wing nut, etc, as shown in Fig. 6.

B-1.2 The plug is inserted at the upstream end and the lock is obtained by expanding the ring against the pipe wall by tightening the wing nut. To build up necessary compressive force to cause expansion of the rubber ring a roller washer is used.

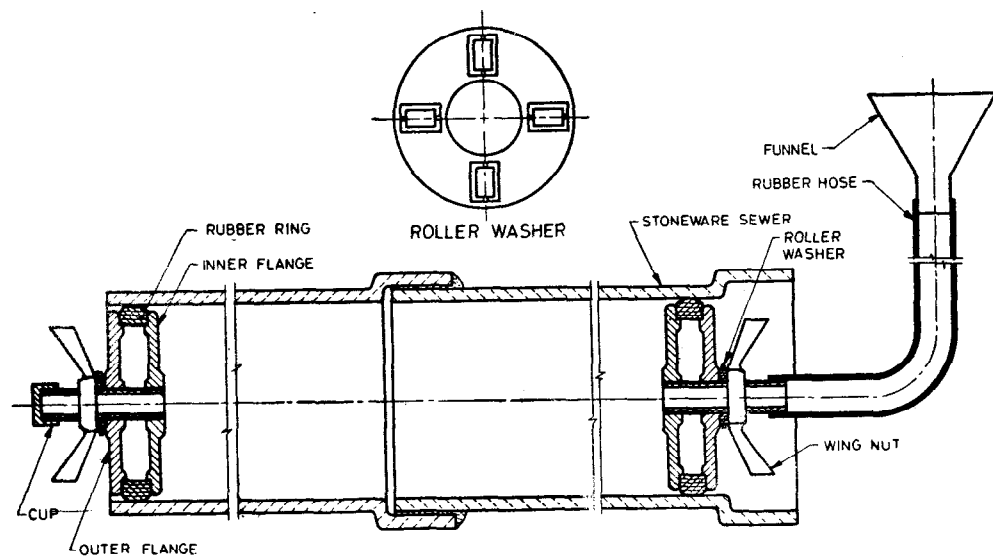


FIG. 6 TYPICAL ARRANGEMENT FOR HYDRAULIC TEST OF SEWERS

B-1.3 Water for filling in is let through the funnel connected to the plug provided at the upstream end. To allow the air to escape a small hole is made on the pipe wall at the upstream end and after filling the pipe completely the hole is plugged with a wooden plug wound with hemp.

B-1.4 The down stream end of the sewer and all slants in the sewer line (provided for house service) are plugged with the sewer testing plug and capped.

B-1.5 The funnel is kept at a height of 25 mm from the invert of the sewer and filled with water.

B-1.6 The pipe line is considered sound if the water in the funnel does not empty within 30 minutes.

(Continued from page 2)

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