CHAPTER NO. 29

SEWERAGE AND DRAINAGE

SPECIFICATION NO. 29.1—General

(1) **Possession of Site.**—The Engineer-in-charge shall as soon as practicable after the execution of the contract/agreement, give to the contractor the use of the site of the respective works covered by his contract, so as to enable him to commence and continue the execution of the works included in his contract, but non-delivery of the use of such site or sites, or any part thereof, shall not affect the contract or this specification, and it shall not entitle the Contractor to any increased allowance in respect of money, time or otherwise, unless (and then only to the extent to which) the Engineer-in-charge may grant him anys extension of time.

(2) **Local Taxes.**—All octroi, terminal tax or other municipal taxes shall be paid by the Contractor on all tools, plant and material imported to take delivery of by him, including all goods and materials delivered to him free on rail and those transported by him into the town from outside and he shall be entitled to no reimbursement for any payments made on account of such octroi or terminal tax charge. Provided, however, that in respect of fittings such as manhole covers, pen stocks, step irons, etc., for which only a rate covering carriage and fixing is payable to the Contractor, the octroi or terminal tax, if any, leviable on such fittings shall not be paid by the Contractor.

If any fresh octroi, terminal tax or other tax shall be levied, or any existing octroi, terminal tax or other tax shall be enhanced after the date of the Contractor's tender the same shall be paid by the contractor and no extra allowance shall be given to him by reason of such fresh or enhanced octroi, terminal tax or other tax having been levied.

(3) **Rejected Materials :**—Any materials or articles delivered on to the works by or under the orders of the Contractor which the Engineer-in-charge shall find to be unsuitable, or of a specification or description inferior in his opinion to that required for the purpose of the work shall not be used on the works and shall be removed by the Contractor at his own expense and charges from the site of work within 24 hours of notice to that effect in writing by the Engineer-in-charge to the contractor.

(4) **Removal of Employees, Workmen and Foremen :**—The Engineer-in-charge shall have full power at all times to object to the

employment of any workman, foreman or any other employee on the works by the Contractor, and if the Contractor shall receive notice in writing from the Engineer-in-charge requesting the removal of any such man or men from the works, the Contractor shall comply with the request forth-with, within 24 hours after receiving the said notice.

No such workman, foreman or other employee after his removal from the works by request of the Engineer-in-charge, shall be re-employed or reinstated on the works by the Contractor at any time, except with the previous approval in writing of the Engineer-in-charge.

The Contractor shall not be entitled to demand the reason from he Engineer-in-charge for requiring the removal of any such workman, foreman or other employee.

(5) **Services of Notices on the Contractor.**—Any notice, order, requirement or instruction which the Engineer-in-charge may wish or require to give in relation to the works shall be deemed to be duly served to the Contractor if recorded in the Order Book kept on the work, or if it shall be delivered personally to the Contractor or any of his Agents or sent by post to his office : and notice of such office and of the Contractor's address shall be given by the Contractor to the Engineer-in-charge.

(6) **Service of Legal and other Notices by Contractor.**—The Contractor shall give or cause to be given all requisite notices to the Executive Engineers, P.W.D., Punjab (B. & R. Branch), in charge of Government roads along with the sewers will be laid, before proceeding to break up their respective roads, as also all other persons likely to be affected by the works. He shall not proceed with any works until the notices so given in respect thereof shall have expired and he shall be held responsible for any errors of notice or want of notice.

(7) **Portable Office for use of Engineer-in-charge** —The Contractor shall supply at his own sole costs and charges a moveable wooden office for the use of the Engineer-in-charge of the works. This office shall not be less than 9 feet by 7 feet inside and 8 feet high. It shall have a boarded floor, be properly lighted, ventilated and painted and provided with drawing table fitted with 2 drawers having lock and key and two chairs or stool. The Contractor shall move the said office from place to place, keep it clean and in good condition. At the Completion of the works such office and fittings shall remain

the property of the Contractor and the full costs thereof are included in the rates for various items of completed work laid down in the schedule and no other payment therefor shall be made to the contractor.

(8) **Works executed out of Working Hours.**— If the Contractor shall execute any works, not in ordinary working hours, during the absence of the Engineer-in-charge and without having previously given him sufficient notice in writing that such work was about to be executed, he will be required to take up and reconstruct any work so executed, if ordered to do so by the Engineer-in-charge in writing under his hand.

(9) **Engineer and his Assistants to have access to works and Stores, etc.**—The Engineer-in-charge with his Assistant Engineers, Overseers, inspection Mistris, Munshies, Inspectors and all other persons authorised by him shall at all times have full access to the works and the Contractor's workshops and factories, stores, brickfields, godowns and all other places where work is being prepared or materials collected or stored for the works and shall have full power to send workmen upon the works to execute any other works not included in the Contract and for whose operations the Contractor shall afford every reasonable facility during working hours ; provided that such operation shall be carried on in such manner as not to impede the progress of the works included in the Contract ; but the Contractor shall not be held responsible for any damage which may happen or be occasioned by any such other works.

(10) **Storing Materials in Public Thoroughfares.**—The Contractor shall not store or keep any materials or plant in public thoroughfares except such as are required for immediate use on the works. The Engineer-in-charge shall have power to decide as to the sufficiency of the area of ground in possession of the Contractor from time to time and no claim for extra payment in respect of non-possession of ground or insufficient area in possession of the Contractor shall be allowed. Should the Contractor require any further area than that allowed him by the Engineer-in-charge it shall be obtained and occupied at his own cost and charges.

(11) **Contractor to carry out work to Engineer's instructions.**—The Contractor shall carry on the works at whatever point or points and in such sections or portion as the Engineer-in-charge shall direct. The contractor shall be bound by all instructions and by the working and detailed drawings which the Engineer-in-charge may give from time to time as to the mode of construction of the works.

(12) **Contractor to maintain Works for the Protection of the Public.**—The contractor shall at his own expense and charges provide and maintain all fencing, boarding, strutting, lighting and watchmen necessary for, or in consequence of any works and all enclosures for material or machinery on works for the protection of the public and shall be responsible for any damage resulting from neglect of the proper precautions.

(13) **Contractor not to interfere with existing Surface or Underground Works.**—The Contractor shall not at any time cut off or otherwise interfere with the supply of water, electricity or irrigation water or with the flow of any channel, conduit, drain, pipeline or sewer, or stormwater channel or with any telegraph or telephone line, without the written authority of the Engineer-in-charge. Should any such interruption or interference take place in consequence of any of his operations, he shall be liable for all inconvenience or damage occasioned thereby.

(14) **Contractor to be responsible for Accidents or Damages.**—The Contractor shall be responsible and answerable for all accidents and damages of any kind arising and anything to the detriment of any person or persons whatsoever which may occur during the performance of the contract which in the opinion of the Engineer-in-charge are consequent upon or in any way attributable to the execution of the works and he is forthwith to reimburse and compensate at his own costs and charges the Government or other injured or aggrieved parties as the case may require for all expenses, losses or injuries which they in consequence of any such accident or damage may have sustained or become liable for; and in the event of the Contractor failing to meet, reimburse or defray any claims, costs and charges in respect of such accidents, the Engineer-in-charge or some other person appointed by the Government may settle all claims and restore any damage done and the cost shall be deducted from any moneys due to the Contractor or shall be recovered from him.

(15) **Roads to be kept Open and in Repair :**—The Contractor shall keep open and maintain in a proper, safe and effectual manner all public, private or occupation roads, streets, bridges or footpaths which he may use or interfere with until the works have been completed and shall leave them in as good condition as they were before he had occasion to use or interfere with the site. Any works done by the Contractor in this connection shall be regarded as a work for temporary purposes. The full costs thereof are included in the rates for various items of completed work laid down in the schedule and the Contractor, shall

receive no payment in respect thereof other than the contract rates for the items included in the schedule; provided however, that the Contractor shall be entitled to receive payment for restoration of soling and metalling of roads, and for surfacing the same with tar, where required over the sewer trenches in order to restore the road surface into its original condition as laid down in the relevent items of the Schedule.

(16) **Traffic and Drainage Diversions.**—The Contractor shall arrange to carry out all work with the least interference practicable with public foot and vehicular traffic and with existing waste water or storm water drainage arrangements and shall provide all necessary road barriers, fences, notices, lights, gangways, access crossings, diversions for traffic, temporary drains, dewatering channels, chutes pumping or water lifting arrangements and all other facilities for the proper execution of the works to the approval and satisfaction in all respects of the Engineer-in-charge. The length of excavation work to be left open at any one time in any street or place shall be subject to the approval of the Engineer-in-charge of the works who shall have power to require the Contractor to reduce the length of open work at any time. Any works carried out by the Contractor in these connections shall be deemed as temporary works incidental to the construction work. The full costs thereof are included in the rates for various items of completed work laid down inthe Schedule and no other payment therefore shall be made to the Contractor, who shall carry out the same at his sole costs and charges.

(17) **Extraordinary Traffic and Trespass.**—The Contractor shall not, except with the consent of the occupiers thereof, from temporary roads nor cart any earth or material, nor place any excavated or other material upon private lands, except such lands as are the property of or in occupation by the Government, and for the use of which he shall have been given permission in writing by the Enginer-in-charge of the works, and any damage done to any property whether contiguous to the work or otherwise shall be at the sole risk and cost of the Contractor.

The contractor shall also pay for all trespass or damage caused by or incidental to the works in whatever manner occasioned and shall indemnify the Government from any liability in respect thereof, and the amount of any claim made upon them in consequence of such trespass or damage by the Contractor, which they may have to pay may be deducted by the Engineer-in-charge from any money in

hand due to the Contractor or may be recovered from the Contractor in any manner admissible according to the law of the land.

(18) **Dismantlement of Existing Works.**—In all cases where dismantlement of any existing structure shall be necessary for the execution of any works comprised in the contract, the Contractor before commencing such dismantlement shall first obtain the instructions and permission, in writing of the Engineer-in-charge. He shall leave the surroundings after such dismantlement in a neat and tidy condition to the satisfaction of the Enginer-in-charge.

(19) **Protection of Existing Works :**—The Contractor in carrying out the construction work shall take effective measures to carefully open out on all existing channels, culverts, bridges, pipelines, conduits, watercourses, sewers, drains, electric cables, transmission lines, telephone and telegraph lines and their supports and all other works buried or otherwise, where such have to be interfered with for the purpose of the construction of the works and shall provide and arrange all necessary temporary supports and diversions if necessary therefore, across, under, over, through and along side of the trenches and all other parts of the construction works and shall leave all such existing channels, culverts, bridges, pipelines, conduits, watercourses, sewers, drains, electric cables, transmission lines, telephones and telegraph lines and all other works in their original condition to the satisfaction of their owners and of the Engineer-in-charge.

The full costs of all works which shall be carried out in the above connection shall be at the Contractor's own costs and charges and are included in the rates for various items of completed work laid down in the schedule and no other payment shall be made to him in respect thereof, except that if any dismantling or reconstruction of any brickwork, concrete or masonary structure is necessary in the opinion of the Engineer-in-charge for the purpose of the work, the Contractor shall be paid for the same in accordance with the requirements of the Engineer-in-charge at the relevant rates laid down in the Schedule.

(20) **Contractor to pay Fees of Electric Supply Company, etc :**—The Contractor shall pay all fees and charges of the owners of any water supply main, drain, conduit, sewer, irrigation channel, electric cable or telephone or telegraph line for any damage done in crossing any of their works or for work necessary to be performed in consequence of the interference with their works, except compensation or rights of easement for constructing the sewer or other works on their property.

Such works will be treated as temporary works incidental to the construction work. The full costs thereof are included in the rates for various items of completed works laid down in the Schedule and no other payment therefor shall be allowed to the Contractor.

21. **Footways to be kept clear of Rubbish, etc.**—The contractor shall not deposit any earth, rubbish or material upon any footway to the obstruction of passengers except where unavoidable, in which case he shall provide free access by means of gangways or bridges in all cases where considered necessary by the Engineer-in-charge. Where an entrance for traffic is required adjacent to the site or works, the Contractor shall make at his own costs and charges such arrangement as will avoid any interference with such entrance and he shall also provide at his own costs and charges such bridges and gangways for street crossings to meet the convenience of the general public as may be required by the Engineer-in-charge.

All such works as above described shall be deemed to be a work for temporary purposes and shall be carried out at the sole cost and charge of the Contractor. The full costs thereof are included in the rates for various items of completed work laid down in the Schedule and no other payment therefor shall be allowed to the Contractor.

22. **Dangerous Places.**—In the case of any work or dangerous place being left by the contractor the Engineer-in-charge shall have full power to enter on the work for the restoration and completion of the same without notice and the cost shall be borne by the Contractor, and shall be recoverable from him.

23. **Pumping and Dewatering.**—The Contractor shall, at his own costs and charges at all times during the period of the contract provide and maintain in good working order and repair, and shall operate by day and by night an adequate number of pumping plants and equipment with all accessories of suitable capacity and design, to the full satisfaction of the Engineer-in-charge and shall keep the trenches and other excavation clear of all water to the extent, necessary in the opinion of the Engineer-in-charge for the proper construction of the works. He shall also keep the surface of the sub-soil water level in the trenches lowered to a sufficient extent at all times, and shall provide and construct all drains and channels required, to enable the works to be completed in a proper and sound manner to the satisfaction of the Engineer-in-charge. The provision, maintenance, repair and operation of all pumping arrangements and all other works for keeping down sub-soil water level, for dewatering and draining water from the

works and for the disposal of such water in a manner to be approved by the Engineer-in-charge shall be deemed to be temporary works incidental to the construction work. The full costs thereof are included in the rates for various items of completed work laid down in the schedule and no other payment shall be made to the Contractor in respect of any works he may carry out or any expenditure he may incur in compliance with the terms and conditions of this para.

24. **Moulds, Centering, Shuttering, etc.**—All moulds, centering and shuttering for arches, sewers, concrete and reinforced concrete, and for all other works shall be constructed of sound, seasoned wrought wood work of ample strength and good quality suitable in all respects for the purpose for which it is intended to be used, and to the entire approval, as to strength, quality, design, mode of construction and workmanship of the Engineer-in-charge.

All moulds and centering for moulded cement concrete and reinforced cement concrete work shall be accurately made and all surfaces in contact with the concrete shall be smooth planned and treated with soft soap and other suitable composition before erection. All moulds and centering shall be cleaned down after use and all surfaces in contact made smooth and soft soaped before re-erection. All moulds shall be designed arranged in sections so as to be easily erected, dismantled and withdrawn in the confined spaces in which they are intended for use.

25. **Templates, Profiles, Sight Rails, posts and other Setting out Apparatus.**—The Contractor shall manufacture, prepare, erect and preserve all pegs, posts, templates, planking, profiles, sight rails and posts, boning rods and all other setting out timber, clamps, nails and other iron work and materials for the proper and accurate setting out of the works as shall be required by the Engineer-in-charge and shall plane to accurate levels all sight rails, templates, profiles and other setting out apparatus or equipment and all shall paint, number and otherwise mark the same to the approval of the Engineer-in-charge.

All setting out materials shall be provided in ample quantity and of first class quality and description. All such supply of setting out materials, together with the labour required for levelling, erecting, fixing, testing and preserving free from damage, all setting out apparatus and appliances as above described shall be regarded as work incidental to the construction works. The full costs thereof are included in the rates for the various items of completed work laid down in the Schedule and no other payment shall be made therefor to the Contractor.

SPECIFICATION NO. 29.1—General

26. Fire Hydrants, Sluice Valves, Road Water Filling Standpipes, Public Standposts and Letter Boxes.—All streets hydrants, sluice valves, roadwater filling standpipes, public standposts and letter boxes shall be kept accessible for use at all times.

27. No Work to be covered until approved by the Engineer-in-charge.—No work shall be covered up until after it has been examined by the Engineer-in-charge and his consent thereto first obtained. If the Contractor covers up any work without such consent he shall uncover the same immediately he is requested to do so by the Engineer-in-charge. If at any time the Enginere-in-charge doubts that any portion of the work is not properly executed, he shall have full power to examine the same in any manner and at any time he may deem fit and if on examination he shall find any defect, whether of workmanship or of material, the whole cost of such examination and of making good such defect and of preparation shall be borne by the Contractor, but if no defect be found to exist, then the cost of such examination and of the reinstatement of such portion of the work as may have been disturbed by such examination shall be paid to the Contractor according to the assessment of the Engineer-in-charge.

SPECIFICATION NO. 29.2—Excavation, etc., for Sewers

TRENCHES AND OTHER EXCAVATION WORK FOR DRAINS, SEWERS, MANHOLES, JUNCTION CHAMBERS, FLUSHING TANKS, ETC.

1. **Alignment and Grade.**—The drains/sewers are to be laid to the alignment and gradients shown on the drawings but subject to such modifications, as shall be ordered by the Engineer-in-charge from time to time to meet the requirements of the works. No deviations from the lines, depths of cuttings or gradients of the sewers shown on the plans and sections shall be permitted except by the express direction in writing of the Engineer-in-charge.

2. **Setting out Sight Rails, Boning Rods, etc.**—The drains/sewers shall be constructed and laid with a true grade and in straight lines between curves as shown on the plan. These shall be laid and constructed to their proper levels by the aid of suitable boning rods and sight rails which shall be fixed according to the requirements of the Engineer-in-charge at intervals not exceeding 50 feet, and also by levelling along the invert line of the sewer by means of accurate 'Dumpy' levelling instruments. The sight rails and boning rods shall be provided, fixed and maintained by the Contractor who shall also provide and maintain suitable levelling instruments and equipment and shall set out the positions and levels of the drains/sewers and others works, according to the drawings and with any instructions he may receive from the Engineer-in-charge from time to time during the progress of the work ; and he shall be responsible for the correctness of the same throughout. He shall, also provide at his own costs and charges all labour and materials necessary to enable the Engineer-in-charge and his staff to check the levels and dimensions of the works whenever the Engineer-in-charge or his staff require him to do so. All sight rails and posts shall be of well seasoned, deodar timber of ample size and strength. The rails and boning rods shall be suitably planed accurately and no wraped or otherwise defective or damaged sight rails or boning rods shall be allowed. The sight rails shall be secured to the posts by heavy wrought steel clamps to the approval of the Engineer-in-charge and in such manner that they shall be fixed immovably to the correct line and level. All boning rods and sight rails shall have the centre line accurately marked thereon by a thin saw cut and shall be painted black and white to the requirements of the Engineer-in-charge. All boning rods shall be suitably shod and with iron. At least four separate sight rails shall always be maintained in correct levels and alignment along the line of sewer at every place where construction work is proceeding and the alignment and levels of the sight rails shall be checked by level and line at least twice every day

to ensure that no disturbance or interference of the alignment and levels has taken place. Whenever required, the Contractor shall erect and maintain such additional sight rails as the Engineer-in-charge shall direct. The Contractor shall, at all times, see that his workmen or other unauthorized persons are not allowed, accidentaly or otherwise, to tamper or interfere with sight rails or other alignment or level marks.

All bends and curves shall be set out mathematically in a manner to be approved by the Engineer-in-charge and the contractor shall provide, and maintain for the purpose such additional sight rails, posts, rails and other wrought and rough timber work also lines, steel wire and other articles as the Engineer-in -charge shall require from time to time.

(3) **Excavation for Drains /Sewers.**—The excavation for sewers and works shall be in open cutting unless the permission of the Superintending Engineer, for the ground to be tunnelled is given in writing. Where sewers have to be constructed along narrow passages, or due to other obstructions or reasons, the Superintending Engineer, may order the excavation to be made partly in open cut and partly in tunnel and in such case, the excavated spoil shall be removed at once so as not to block the passage, and shall be brought back later on for refilling the trench or tunnel.

(4) **Length of Trenches.**—The excavations shall be made in such lengths and of such widths as shall in the opinion of the Engineer in-charge, enable the sewers to be properly constructed. Unless otherwise permitted by the Engineer-in-charge not more than 6" (20 mm) of any trench in advance of the end of the built sewers shall be open at any time and unless written permission to the contrary is given by him, the trench shall be excavated to its full depth for a distance of at least (5 mm) more than the minimum length of sewer permitted to be laid in it.

(5) **Opening out Trenches.**—In excavating the trenches, etc., the soling, road-metalling pavement, kerbing, etc., and turf is to be placed on one side and preserved for instatement when the trench or other excavation shall be filled up.

Before any road metal is replaced, it shall be carefully shifted. The surfaces of all trenches and holes shall be restored and maintained to the satisfaction of the Engineer-in -charge and of the owners of the roads or other property traversed and the Contractor shall not cut or

break down any live fence or trees in the line of the proposed works but shall tunnel under them, unless the Engineer-in-charge shall order to the contrary.

The Contractor shall grub up and clear the surface over the trenches and other excavations or all trees, stumps, roots and all other incumbrances affecting the prosecution of the work and shall remove them from the site to the approval of the Engineer-in-charge. The contractor shall keep all excavated spoil sprinkled with water during the execution of the work so as to prevent any dust nuisance.

(6) Obstruction of Roads and Removal of Materials.—The Contractor shall not occupy or obstruct by his operations more than one half of the width of any road or street. However in special conditions the Contractor shall obtain the consent of the Engineer-in-charge in writing before closing any road to vehicular traffic, and the foot walks must be kept clear at all times.

During the progerss of the work, the Contractor, at his own costs and charge shall maintain all crossings, side walks, and road-ways open in satisfactory condition and the work shall at all times be conducted to cause a minimum of inconvenience to public travel and to permit of safe and convenient access to private and public property along the line of the work.

If all the excavated material cannot be stored in the street in such manner as to maintain the traffic conditions laid down in this specification, the surplus shall be removed by the Contractor from the site of the work and stored and after the construction of the sewer so much of this material as is of satisfactory quality shall be brought back and used for backfilling the trench.

If the quantity of such material is not enough to fill back the trench completely the Contractor shall make arrangements at his own costs and charges for more material required to fill the trench completely and nothing extra will be payable to the contractor for such additional filling material.

Where directed by the Engineer-in-charge, in built up districts and other places where traffic conditions render it necessary in his opinion, the material excavated from the upper part of the trenches immediately beneath the soling of the road to such depth as the Engineer-in-charge shall direct in writing to the Contractor, from time to time, shall be removed by the Contractor as soon as

excavated and the material subsequently excavated, if suitable for the purpose, shall be used to backfill the trenches in which the sewer has been built and neither the excavated material nor materials of construction shall be stored on the roadways and side walks.

(7) **Removal of Filth.**—All night soil, filth or other offensive matter met with during the execution of the works immediately it is taken out of any trench, sewer or cesspool, shall not be deposited upon the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be at once put into carts and removed to a suitable place to be provided by the Contractor.

(8) **Excavation to be taken to Proper Depth.**—The trenches shall be excavated to such depth that the drains/sewers shall rest on concrete as described in the several para's relating thereto and so that the inverts may be at the levels, given on the sections. In bad ground the Engineer-in-charge may order the contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewer with concrete, broken stone, gravel or other materials. For such extra excavation and concrete, broken stone, gravel or other materials, the Contractor shall be paid extra at the rates laid down for such work in the schedule if the extra work was ordered by the Engineer-in-charge in writing, but if the contractor should excavate the trench to a greater depth than is required without a specific order to that effect in writing of the Engineer-in-charge, the extra depth shall have to be filled up with concrete at the Contractor's own costs and charges to the requirements and satisfaction of the Engineer-in-charge.

(9) **Refilling.**—After the Sewer or other work has been constructed and proved to be watertight the trench or other excavation, shall be refilled. The utmost care shall be taken in doing this so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and up to two and a half feet (75 centimetre above the crownof the sewer manhole, junction chamber and other work shall consist of the finest selected material placed carefully in 6" layer and flooded and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in 6" (15cm) layers with material taken from the excavation, each layer being watered to assist in the consolidation, unless the Engineer-in-charge shall otherwise direct.

The refilling 6" (15cm) layer should be carried on up to 6" (15cm) below G.L./R.L. It should then be flooded and consoildated. After

this having been done, the trenches or the excavation should be restored to its original condition and opened to use.

(10) Contractor to supply New Surfacing Materials, if required.—In the event of the surfacing materials excavated from the trenches and other excavations being insufficient to restore the surfaces to the satisfaction of the Engineer-in-charge, the Contractor shall make up the deficiency with materials equal in quality to that which was removed and if the old materials are unsuitable or worn out or damaged, the Contractor shall supply new materials in their place.

(11) Contractor to restore Settlements and Damage.—The Contractor shall, at his own costs and charges, make good promptly during the whole period the works are in hand, any settlements that may occur in the surfaces of roads, berms, footpaths, gardens, open spaces, etc., whether public or private, caused by his trenches, or by his other excavations and he shall be liable for any accidents caused thereby. He shall also, at his own expense and charges repair and make good any damage done to buildings and other property. If in the opinion of the Engineer-in-charge, he fails to make good or to pay and satisfy the expenses of making such works with all practicable despatch, the Engineer-in-charge shall be at liberty to get the work done by other means and the expense thereof shall be paid by the Contractor or deducted from any money that may be or become due to him or recovered from him in any other manner according to the law of the land.

12 Disposal of Surplus Spoil.—The Contractor shall dispose of all the surplus material into the depressions or other suitable sites, inside or outside the town as approved by the Engineer-in-charge. In case suitable sites are not indicated by the Engineer-in-charge then the place for disposal shall be provided by the Contractor, which shall be to the approval of the Engineer-in-charge. The surplus spoil shall be immediately removed, as each trench is refilled, the surface properly restored and the roadway with sides left clear. The spoil at the disposal point shall be dressed and trimmed to the approval of the Engineer-in-charge. The Contractor may store surplus material required for restoring the settlements at convenient points subject to the approval of the Engineer-in-charge. These surplus materials should be stacked and protected properly so that it may neither cause any obstruction to the traffic nor any nuisance such as dust, etc. The surplus materials not used for restoration shall be removed by the Contractor before the final payment.

(13) **Timber of Sewer Trenches, etc.**—The Contractor shall at all times support effectively the sides of the sewer trenches and other excavations by suitable timbering, piling and sheeting. In all classes of soil the poling board frame system type of timbering, as per details attached shall be provided. In loose and sandy strata, a close timbering may be provided if necessary and in case of loose, flowing sand, or soft and waterlogged ground driven/piled type, timbering may have to be used according to site condition which will be determined by the Engineer-in-charge in writing. The timbering sheeting or piling with tongue and grooved or other joints of the approved type in case of latter 2 type of timbering shall have to be provided, if necessary, and nothing extra shall be payable over and above the rates already mentioned. It is intended that all timbering shall be removed as the work proceeds, except timber sheeting against which concrete is placed, which shall not be removed unless specially permitted by the Engineer-in-charge. Such sheeting will, however, not be paid for when left in position unless the same was specifically ordered in writing to be left in by the Engineer-in-charge to protect the sides of the trenches and other excavations as provided for below. The Engineer-in-charge may require any portion of the timbering, piling or sheeting to be left in the ground in order to protect the sides of the trenches or other excavation by an order in writing to the Contractor, detailing the quantity of timber to be left in and the place thereof. Such timber will be paid for at the rate specified in the schedule.

All timbering, sheeting and piling with their whalings and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place. In normal cases the dimensions and thickness shall conform to the Plans attached. When timbering or sheeting is withdrawn, it shall be done gradually and carefully to avoid falls and subsidences and all cavities shall be solidly filled in. In case of timbering or sheeting left in place all cavities behind such sheeting shall also be solidly filled in as directed by the Engineer-in-charge.

The Contractor shall be held accountable and responsible for the sufficiency of all timbering, bracing sheeting and piling used and for all damage to persons or property resulting from the improper quality, strength pacing maintaining or removing of the same.

(14) **Shoring of Buildings**—The Contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible

for all damage to persons or property resulting from any accident to any of such buildings.

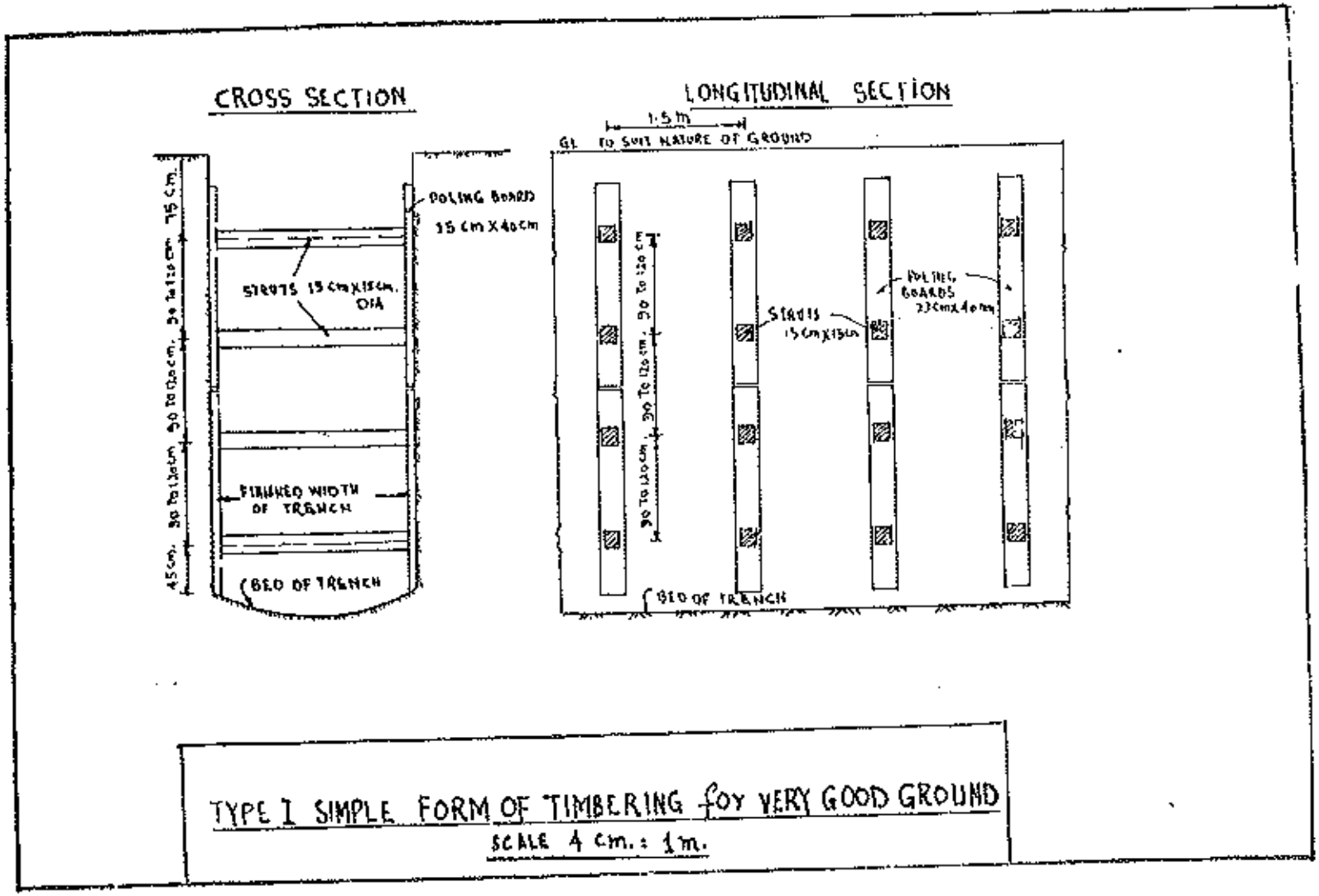
(15) Timbering," Shoring and Supports.—The Contractor shall provide and maintain on the works at all times, at his own costs and charges, an ample supply of planks, struts, whalings, wedges, and scantlings of timber of first class quality, suitable for timbering shoring and supporting the sides of trenches and other excavations and for underpinning, shoring and supporting walls, buildings and other structures which may be interfered within course of the work to the full requirements of the Engineer-in-charge.

All timbering, shoring, supporting and underpinning work shall be carried out and maintained by the Contractor at all times at his own costs and charges in a manner so as to effectually prevent subsidence, slipping or collapse of sides of trenches and all other excavations and also of buildings, walls and other structures, to the full satisfaction and the detailed requirements of the Engineer-in-charge and the Contractor shall immediately comply with all orders issued by the Engineer-in-charge as to augmentation of the stock of timber of each kind to be kept available on the works, the maintenance of proper quality thereof; and in regard to the strengthening of all timbering and shoring of the work and the adoption of improved or sounder methods for carrying out the work.

The Contractor shall also employ a sufficient number of skilled carpenters and timber men for the setting and removal of all timbering, shoring and supports to the full satisfaction of the Engineer-in-charge at all times and shall comply immediately with all instructions of the Engineer-in-charge in regard to the employment of more workmen possessing the requisite skill and experience for such work.

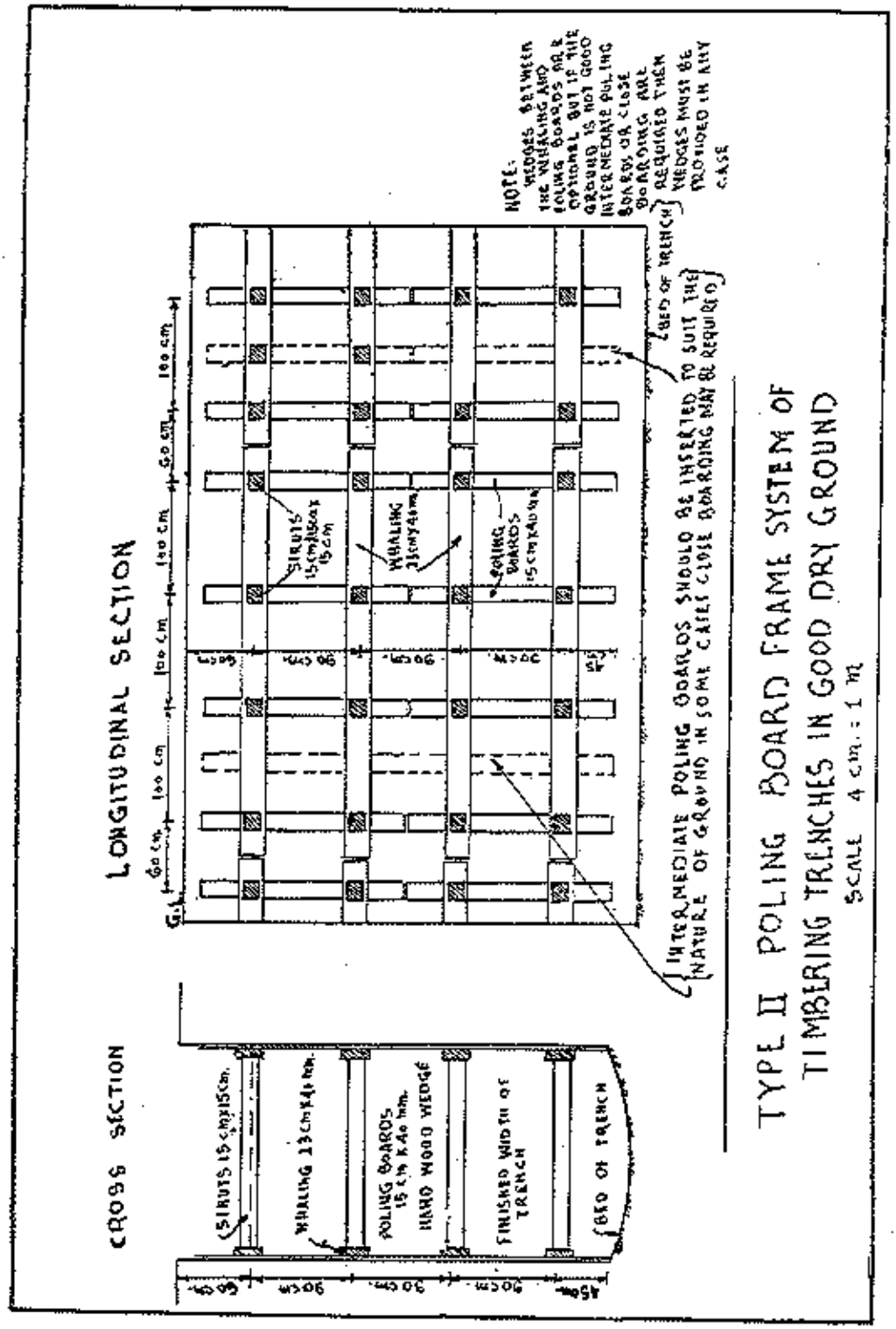
All work, materials and labour provided or used for carrying out timbering, shoring and supports to trenches, excavations, buildings, walls and all other structures shall be deemed as temporary works incidental to the construction work and the full costs thereof are included in the rates for various items of completed work laid down in the Schedule and no other payment therefor shall be made to the Contractor.

(16) Removal of Water from Sewer Trenches, etc.—The Contractor shall at all times during the progress of the works keep the trenches and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to the public health nor to public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use at the same by the public.



TYPE I SIMPLE FORM OF TIMBERING FOR VERY GOOD GROUND

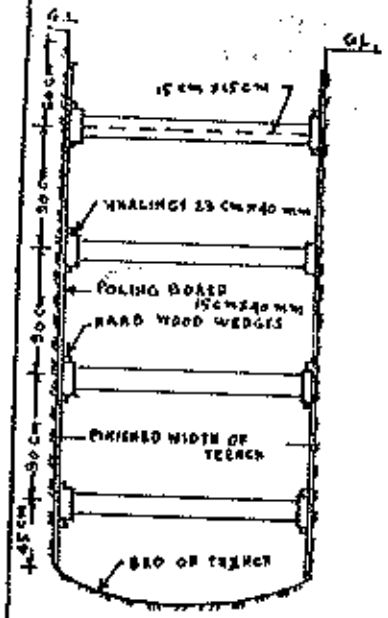
SCALE 4 cm. : 1 m.



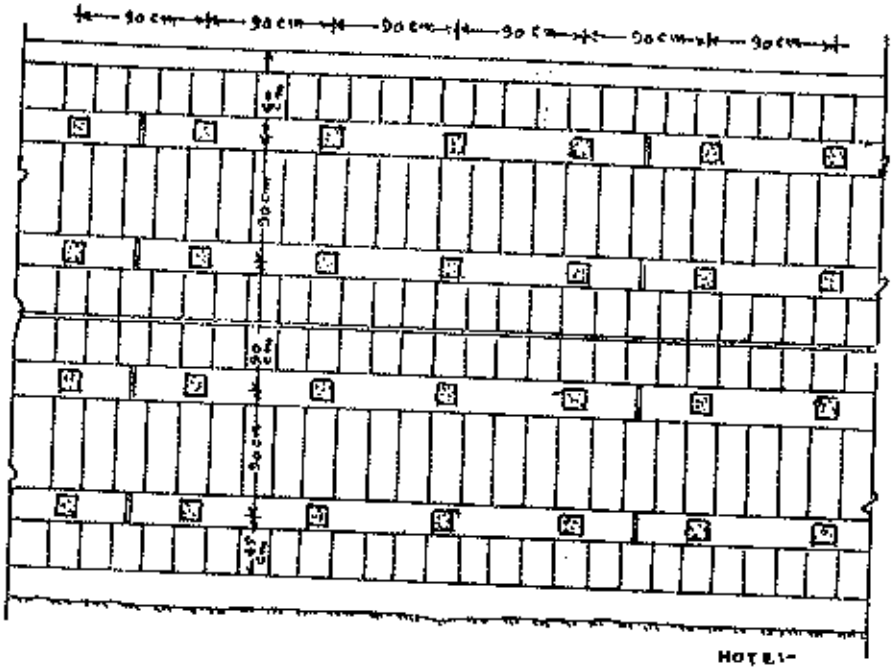
TYPE II POLING BOARD FRAME SYSTEM OF TIMBERING TRENCHES IN GOOD DRY GROUND

SCALE 4 cm = 1 m

CROSS SECTION



LONGITUDINAL SECTION

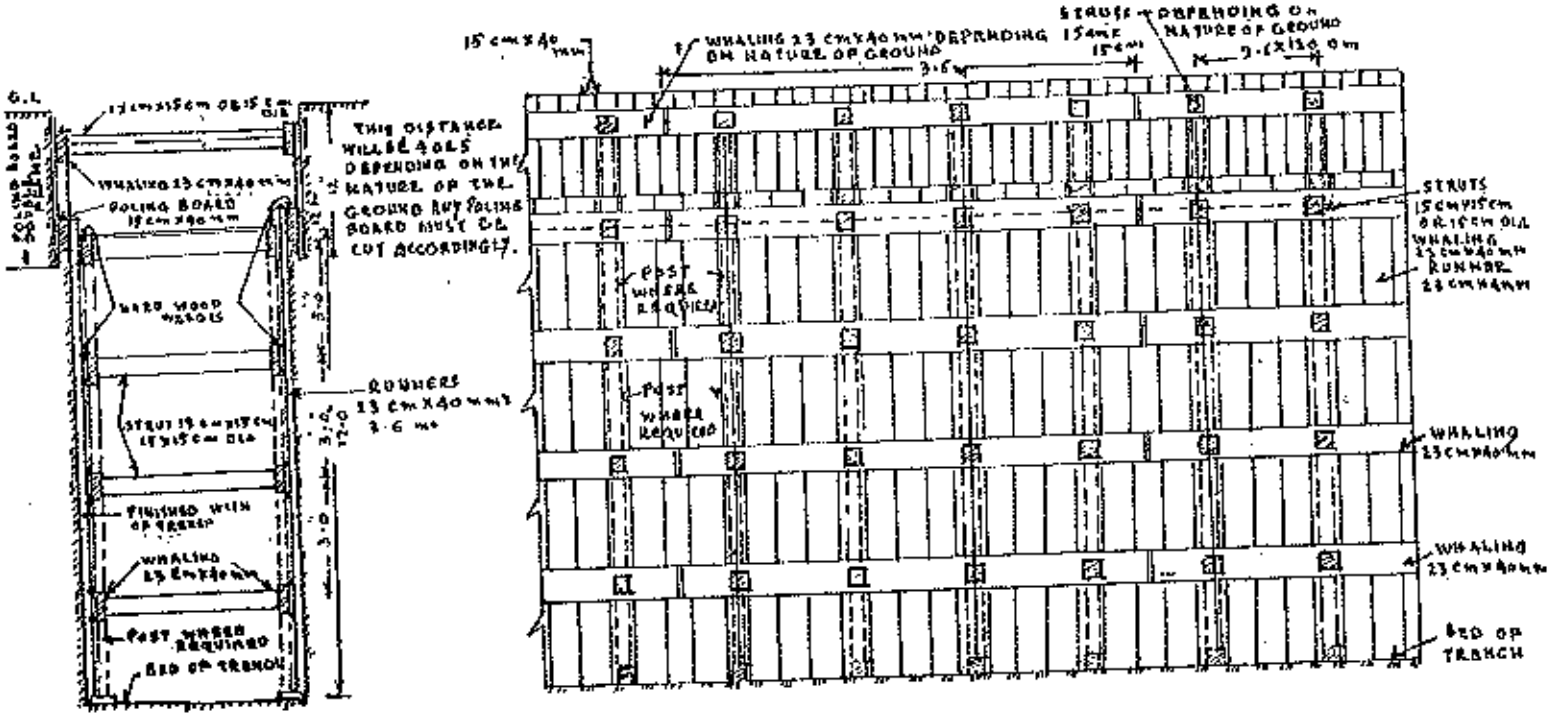


NOTE:-

WEDGES BETWEEN THE WHALINGS AND POLING BOARDS ARE OPTIONAL BUT IF THE GROUND IS NOT GOOD AND INTERMEDIATE POLING BOARDS OR CLOSE BOARDING ARE REQUIRED THEN WEDGES MUST BE PROVIDED IN ANY CASE.

POLING BOARD FRAME SYSTEM OF CLOSE BOARD TIMBERING IN TRENCHES

SCALE:- 4 cms = 1 m



TYPE IV PILED OR DRIVEN TIMBERING FOR TRENCHES UP TO ABOUT 15 FEET DEEP IN RUNNING SANDY STRATA SCALE:- 4 cm = 1 m

He shall from time to time forward in writing in advance to the Engineer-in-charge, particulars of his arrangements for dealing with storm water and sub-soil water in order to push forward the progress of the work but the approval of the Engineer-in-charge to any such proposals shall not relieve the Contractor of any of the full responsibilities imposed upon him in regard to the work. The Contractor shall at all times provide adequate plant and materials, labour, fuel, lubricants, spare parts and all other contingent items, stores and accessories, for keeping all trenches and works dewatered in a safe, proper and effectual manner necesary for the prosecution and completetion of the work without incurring any risks of damage to neighbouring buildings property and structures.

The Contractor in carrying out the dewatering of the trenches and excavations shall take adequate precautions to ensure that under no circumstances shall the sandy bottom of trenches below sub-soil water level be allowed to "blow" thereby endangering building and other structures in the vicinity of the works; and the Contractor shall be held fully and wholly responsible for all damage done to buildings and other property resulting from his dewatering and pumping operations. If he fails to make good or to pay and satisfy the expenses of making good such damages, or works with all practicable despatch, the Engineer-in-charge shall be at liberty to get the work done by other means or to pay the cost of the said damages, deducting the amount expended from any money that may be or become due to the Contractor or the Government may recover the same from him in any manner according to the law of the land.

(17) **Width and Depths of Trenches and Sizes of Excavations for Sewers, Manholes and other Works.**—The maximum width of trenches in respect of which payment will be allowed for excavation will be as follows:—

(*a*) trenches not exceeding 7′ (2m) in depth-20″ (5.00mm) plus external diameter of barrel for pipe sewers; and six inches plus maximum external overall diameter or width of sewer for brick or concrete sewers constructed *in situ*.

(*b*) trenches exceeding 7 feet (2m) not exceeding 15 feet-24 inches (4.5m-600mm) plus external diameter of barrel for pipe sewers; and 12″ (300mm) plus maximum external over-all diameter or width of sewer for brick or concrete sewers constructed *in situ*.

(*c*) trenches exceeding 15' (4.5m) depth 27" (300 mm) plus external diameter or barrel for pipe sewers and 18" (450 mm) plus maximum external over-all diameter or width of sewer for brick or concrete sewers constructed *in situ*.

The cross-sections of trenches to be excavated below the level of the crown of the barrels, in the case of circular sewers of a ll classes and below the intrados of the covering arches of egg shaped sewers be trimmed accurately to the exact cross-sections of the sewers to be laid or constructed therein and no earth filling shall be permitted between the sides of cradle of envelope and the trench sides below the horizontal diameters or springing of the covering arches of the sewers as the case may be.

If any excavation is carried out at any point or points to a greater width than the specified cross-section of the sewer with its envelope, the same shall be filled with concrete by the Contractor at his own expense and charges to the requirements of the Engineer-in-charge.

The minimum widths of trenches down to the crowns of the barrels, for pipe sewers and drains not over 18" (450 mm) in dameter shall be such as to give a clearance of 8" (200 mm) on each side of the barrell of the pipe and for those of larger diameter of 9" (230 mm) on each side of the barrel of the pipe and all such trenches shall have a clear width at the bottom equal to the width of the cradles of the sewers to be laid in them. The minimum clear width of trenches for other sewers shall be the greatest external width of the structures to be built therein.

Where a manhole or the foundation thereof extends beyond the exterior lines of the sewer or its foundation the minimum excavation in earth reqired for the same shall be that contained ina prism with vertical sides and a horzontal section equal to the smallest rectangle which will enclose such manhole and its foundation.

The minimum dimensions of the excavation in earth for brick work and for concrete flushing tanks, junctions with junction chambers, storm water overflows and similar works shall be such as to give a clearance inside the sheeting or timbering of 1' (30 cm) on all sides above the foundation, but in all such cases the excavation shall be large enough to include the foundation for the structures as shown on the drawings.

SPECIFICATION NO. 29.2—Escavation etc. for Sewers

The Engineer-in-charge shall have power by giving an order in writing to the Contractor to increase the maximum width in respect of which payment will be allowed for excavation in trenches for various classes of sewers, manholes and other works in certain lengths to be specifically laid down by him, where, on account of bad ground for other unusual conditions, he considers that such increased widths are necessary in the interests of the work.

(18) The Measurement of excavation shall be taken by multiplying, the length, and width of trenches as permissible,—*vide* para 17 above with the depth of the trenches. Measurement.

(19) The rate for excavation up to various depth of drains/sewers shall cover:— Rate.

(*i*) Excavation up to the desired depth, according to proper alignment grade, including lead and lift as specified in the schedule of rates.

(*ii*) Providing and setting out sight rails, boning rods, bench walls aligning the sewers, etc.

(*iii*) Dressing the sides and bottom of the trenches to correct sections, dimensions levels, aligunments and templates.

(*iv*) Providing maintenance and removal of timbering to trenches according to poling board frame type system, including shoring to protect existing structures, etc.

(*v*) Diversion of traffic including fixing and maintenance of sign and caution boards. Providing and maintenance of night signals.

(*vi*) Providing and maintaining access to houses.

(*vii*) Providing and watching fencing to trenches to avoid accidents.

(*viii*) Refilling of trenches in 6" (15 cm) layers, and watering restoration of settlement and restoring the unpaved surfaces to original condition.

(*ix*) Removal of surplus spoils upto a lead of one mile (1 kilometre) and dressing the same.

(*x*) Removal of stumps, roots and all other incumbrances and hard materials such as Kankar, excluding full grown trees, etc.

(*xi*) Pumping out, the rain, strom or water from any other sources, collected in the trenches except the sub-soil water.

(*xii*) Cost of all temporary works as given in the specification no. **29.1 General.**

Extra rates Payable.

(20) Extra over and above the rates shall be payable according to the rates in the Schedule of rates for the following:—

(*i*) For cutting metalled or cement concrete roads.

(*ii*) For restoration of road surfaces. This rate includes the cost of deficient materials also.

(*iii*) For excavation under sub-soil water level.

(*a*) This extra rate also includes the extra cost involved in providing steel sheet, shuttering, removal and lowering of sub-soil water.

(*iv*) For disposal of surplus spoil beyond one mile.

(*v*) For providing close board, timbering instead of poling board frame type system.

(*a*) The rate shall be payable for every 10ft. (3 metre) depth or part thereof and shall be measured in Rft. (R/metre) of the trench length.

(*vi*) For providing driven/piled type timbering instead of close board timbering.

(*a*) The method of measurement, etc. is the same as in case of item (*v*) above.

SPECIFICATION NO. 29.3—Earth Work

EXCAVATION FOR OPEN SULLAGE DRAINS AND OUTFALL DRAINS ETC.

Specification.

(1) Excavation for the open sullage, outfall and other drains shall be according to the specification under item No. 29.2 except the following:—

(*i*) No timbering shall be provided.

(*ii*) The disposal of the surplus spoil shall be up to 2 chains (60 metres).

Measurement.

(2) The measurement shall be done in the same way as specified in the specification no. 29.2.

Rate.

(3) The rate for the excavation shall cover all items given in specification no. 29.2 except : —

(*i*) Only 6 ft. (2 m) lift and 200 ft. (60 m) lead is covered.

(*ii*) Beyond that lead and lift shall be payable.

(*iii*) No provision for timbering of trenches.

(*iv*) Cost of all temporary works as given in the specification no. 29.1 General.

Extra payable.

(4) Extra over and above the rate shall be payable according to the rates in the schedule of rates for the following:—

(*i*) For cutting roads.

(*ii*) For restoration of roads.

(*iii*) For timbering if required.

SPECIFICATION NO. 29.4—Earth Work

EXCAVATION FOR STORAGE TANKS, PUMP HOUSES, SUMPS, ETC.

Specification.

(1) The excavation shall be carried according to the specifications detailed in specification no. 29.2 except the following:—

(*i*) No timbering shall be normally necessary.

(*ii*) The disposal of the surplus spoil shall be up to one chain (30 metres).

(*iii*) The sides and beds of the storage tanks, etc., shall be dressed to correct levels and grade in such a manner that there exists neither any concavity nor any convexity.

Measurement.

(2) The measurement shall be done as in case of specification no. 29.2 In case of big storage tanks, and row of filter beds, etc., where the existing surface of the ground is not in level, spot levels may be taken at short intervals, say 5-10 ft. (1.5-3 m) apart to fix the depth of excavation.

Rates.

(3) The rates of excavation cover all items given in specification no. 29.2 except the following:—

(*i*) Only lift up to 5 ft. (1.5m) and 100 ft. (30 m) lead is covered.

(*ii*) Beyond that lead and lift is payable.

(*iii*) No provision for timbering.

(*iv*) Cost of all temporary works as given in the specification no. 29.1 General.

Extra payable.

(4) Extra over and above the rate shall be payable according to the rates in the schedule of rates for the following:—

(*i*) For cutting roads.

(*ii*) For restoration of roads.

(*iii*) For timbering if required.

SPECIFICATION NO. 29.5—Clay Puddle

(1) The clay puddle shall conform to the specifications no. 3.3 with the exception that only weathered and tempered caly of quality should be used. **Material.**

(2) Clay puddle should be measured in cft. (cum) **Measurement.**

(3) The rate includes the cost of all forms and shuttering required for placing and supporting of puddle. **Rate and Extras.**

SPECIFICATION NO. 29.6—Reimbursement to Drains And Flooring in Strips

Material.

(1) **Bricks.**—Unless otherwise specified the bricks used for drains should be first class conforming to specification no. 3.5.

Cement—It shall be conforming to the specification no. 3.12.
Sand—It shall conform to specification no. 3.11. The source shall be to the approval of the Engineer-in-charge.

Specification.

(2) The reimbursement/pitching shall be laid in brick on edge or flat according to the details shown in the plan. It shall be laid over the concrete bed and a layer of mortar not less than ½" thick (6mm) shall be laid over the concrete before laying the reimbursement or pitching. All joints should not be more than ¼" thick (6 mm) and shall be completely filled with mortar. In case of re-imbursement it shall slope towards the drain at a gradient of 1/60. The imperfections in the bricks shall be made smooth by rubbing with bricks mortar.

The external of the exposed joints shall be struck flush as the work proceeds and left perfectly smooth.

In smaller strips along the house walls, Tega shall be used instead of re-imbursement. It shall project not more than 6 inch (15 cm) above the top of the drain.

Measurement.

(3) (*a*) **Re-imbursement and Flooring in Strips.**—The measurement of re-imbursement to drains and flooring in strips shall be measured in Sq. ft. (Square metres).

(*b*) **Tega.**—The measurement shall be done in Rft. (R/metres).

Rates.

(4) The rate of re-imbursement and Tega shall cover the following —

(*i*) Dressing of Sub-grade, laying of re-imbursement, Tega, strip flooring in and on the mortar, to the required strength.

(*ii*) Cutting and wastage of bricks.

(*iii*) Nothing extra shall be payable for laying in narrow strips along the drains, for curves, bends, slope and benching of slopes and for all irregular areas.

(*iv*) Cost of all temporary works as given in the specification no. **29.1 General.**

SPECIFICATION NO. 29.7—Flooring and Paving

Material.

(1) The work shall conform to the specification given in **14.4** except that the flooring shall be laid in herring bone or other special bonding as approved by the Engineer-in-charge.

Measurement.

(2) The measurement shall be done in sq. ft. (sq. metres).

Rates.

(3) The rate shall cover the following items:—

(*i*) Dressing of the Sub-grade to exact template, curbs, level and grade.

(*ii*) Laying flooring in herring bone or other special bonding.

(*iii*) Cutting Bricks including the wastage.

(*iv*) Nothing shall be payable for all smallness of work or laying in strips or in restricted places including laying in curves, bends, slopes, etc.

(*v*) Cost of all temporary works as given in specification no. **29.1 General.**

SPECIFICATION NO. 29.8—Clay and Dry Concrete

Material. (1) Clay.—It shall conform to specification no. 3.3

Brick Ballast.—It shall conform to specification no. 3.7.

Measurement. (2) These should be measured in sq. ft. (sq. metres).

Rates and Extras. (3) The rate includes consolidation and ramming to a finished thickness according to templates, levels and slopes, etc.

SPECIFICATION NO. 29.9—Manhole, Ventilating Shafts and other Accessories

Material.

(1) **Manhole and Flushing Tank Covers.**—The mahlole and flushing tank covers andframes shall be 22 inches(560 mm)diameter clear opening double/single seated 'Conical' pattern 3 to 5 inch (100th—150 mm) depth, conforming to Public Health Standard pattern weighing 3 and 5 cwt. (128 @ 265 kg) each. In caase of 1 cwt. (52 kg) manhole covers, the clear opening shall be 18 inches (455 mm). They shall be of the best foundry grey metal, tough and close grained. The covers and frames are to be coated with bitumastic composition applied by heating them when now and before any rust has appeared on them and dipping them while hot into the heated composition. The covers and frames shall be clean moulded, accurately made and fitted in a workman-like manner, the surface being smooth and even 'Rocking' covers will not be accepted.

(2) **Step irons.**—These shall be either of galvanized mellable iron or of Cast iron conforming to Public Health Standard design. The Cast iron steps shall be of the best foundry grey metal, tough and closed grained casting free from any blow holes. It should be painted with 2 coats of superior quality of Black bitumastic paint of approved manufacture.

(3) **Ventilating Shafts/Flushing Syphons.**—These shall be of Cast iron conforming to P.W.D. Public Health Standard drawings. These shall be of the best quality foundry grey metal, tough and closed grained casting free from any blow holes and imperfections. The machined surfaces shall be properly finished and all parts properly assembled in workman-like manner. The surface being smooth and even. These should be preferably, quoted with bitumastic solution as described in the case of manholes covers above.

Fixing.

(4) While fixing these in positon they shall be set in perfect level and aligument embedded in the mortar. The ventilating columns shall be erected absolutely true, concentric and vertical. These not conforming to above shall have to be re-errected without any additional payment.

Measurement.

(5) The measurement shall done in numbers.

Rate.

(6) The rate covers the cost of:—

(i) Carriage from Stores.

(ii) Labour rate for fixing in position.

(iii) Cost of cement mortar required for setting in position.

SPECIFICATION NO. 29.9— Manhole, Ventilating Shafts and other Accessories

It does not include the cost of lead, bolts, nuts, etc., in case of ventilating shafts.

(iv) Cost of special scaffolding, Derricks, Jibs, poles, tools and plants ropes, guys, etc.

(v) Fixing and grouting hold-fast, holding down bolts in 1 : 2 cement mortar and subsequently making goods of the brick-work, concrete masonry or stone work to original condition.

(vi) Cost of all temporary works as given in the specification no. 29.1 General.

SPECIFICATION NO. 29.10—Painting of Ventilating Shafts

The work of painting of the ventilating shafts shall conform to the relative specifications of painting.

Measurement.

(1) The measurement shall be done per cft. (2 metres) of the column.

Rate.

(2) The rates shall cover :—

(i) Cleaning of the surfaces.

(ii) Painting with the required No. of coats.

(iii) Special scaffolding required for such works.

(iv) Cost of all temporary works as given in the specification no. **29.1. General.**

SPECIFICATION NO. 29.11 Brick Sewers

Material.

(I) (i) **Bricks.**—Unless otherwise specified the bricks used for sewers/drains should befirstclass conforming to specification no. 3.5 except that for the arches and barrels and sides of sewers, it shall be specially moulded, radiated bricks accurately moulded to shape and size so as not to require cutting of any bricks. The sizes of bricks for usual sizes of sewers constructed are given in the attched table.

SIZE AND BRICKS REQUIRED PER 90 METRES

SIZE OF SEWER IN mm				610×915	660×990	710×1065	760×1140	810×1215	860×1290	910×1365	970×1455	1020×1530
DATA OF RADIATED BRICKS TO BE USED IN 1ST CLASS HAND MOULDED RADIATED BRICKS	SIDE OF INNER TOP ARCH RING SEWER.	g IN mm		54·8	54·2	53·8	57·9	54·35	56·60	56·05	56·20	59·40
		h IN mm		62·4	61·2	60·2	64·3	63·15	62·10	61·25	61·10	64·25
		BRICKS		8,800	9,600	10,400	10,400	11,200	12,000	12,800	13,600	13,600
	OUTER OR UPPER ARCH RING SEWER.	g IN mm		46·5	47·8	49·00	50·05	48·65	49·65	50·50	51·90	52·65
		h IN mm		63·5	63·9	64·35	64·70	62·10	62·50	62·90	63·85	64·15
		BRICKS		7,600	8,000	8,400	8,800	9,600	10,000	10,400	10,800	11,200
		g IN mm		50·65	51·5	52·3	53·05	51·70	52·40	53·05	54·15	54·70
		h IN mm		64·05	64·4	64·7	65·00	62·80	63·15	63·45	64·22	64·76
		BRICKS		9,600	10,000	10,400	10,800	11,600	12,000	12,400	12,800	13,200

(ii) **Brick Ballas** :—It shall conform to specification no. 3.7 but of 1½ inch (30 mm) and ⅜ (20 mm) inch gauge.

(iii) **Surkhi** :—It shall conform to specification no. 3.9.

(iv) **Lime** :—It shall be class A lime conforming to specification no. 3.8.

(v) **Cement** :—It shal be conforming to the specification no. 3.12

(vi) **Sand** :—It shall conform to specification no. 3.11. The source shall be to the approval of the Engineer-in-charge.

(vii) **Other Building Material** :—Unless otherwise specified it shall conform to the relevant specification given in Chapter no. 3.

Workmanship.

(2) **Workmanship** :—The foundation layer of the lime/cement concrete shall be laid in the properly finished trench. The Cement Concrete invert of 1 : 1½ : 3 ratio shall be *cast in situ*, to correct position,

level and grade, with the help of the site rails, boning rods, etc. The lime/cement concrete envelope shall be cast with the help of form work placed in positon to correct position, alignment, level and grade. Further operation of lining the concrete envelope with collar joints, bricks, plaster and laying arches over it, shall then be carried out according to the details as provided in the standard section and the section completed with good and smooth finish. The various items involved in sewers shall be according to the relative specifications for workmanship.

(3) All bricks for the internal rings shall be sound, well picked, specifically hand moulded as laid down previously in this specification. They shall be radiated for all arches and other curved work. The courses shall be kept parallel to the gradient and all bricks must be fully embedded in the mortar, no grouting is being permitted. The joints on the face of the work are not to exceed 3/16ths of an inch (5 mm) in thickness and are to be carefully and neatly pointed flush unless intended to be rendered in which case the joints shall be raked out ready to receive the plaster. All curved work shall be built to template and centres as shall be required by the Engineer-in-Charge. The brick work shall break joints properly and shall be laid evenly and uniform to the correct curvature. All cavities behind the side walls shall be filled in and rammed and consolidated very carefully before the covering arch is constructed. All arched work shall be formed upon properly and accurately constructed centres, great care being taken in keying in the arch.

(4) **Collar Joint.**—In single brickwork the internal surface of the concrete envelope shall be neatly and accurately rendered in 1:2, or 1:3 cement sand mortar not less than ½ inch (12.5 mm) thick. In other work, a cement sand 1:2 or 1:3 coller joint not less than ½ inch (12.5 mm) in thickness shall be formed round the inner layer of brick work. The end of each section of brick work shall be properly raked back to form a key for the succeeding work.

(5) **Invert Blocks.**—Invert blocks shall be specially moulded and lipped at the joints. They shall be laid true to line at proper inclinations and shall be joined in 1:1 cement sand mortar, no joints being greater than ¼ of an inch (6 mm) in thickness, or they may be constructed *in situ.*

(6) **Removal of Centering.**—After the covering arch has been turned, and before the centering is removed the trench shall be filled into a height of at least 2½ feet (75 cm) above crown and properly consoli-

dated as specified. No centering shall ber emoved without the sanction in writing of the Engineering-in-charge or his representative. On the removal of the centering the inside of the brick work shall be thoroughly cleaned and pointed, if not intended to be plastered, so that the work may be left with an even surface.

(7) Junction Blocks.—Connections with house drains shall be made by means of 4" to 6"(100 mm to 150 mm) diameter stoneware, fireclay or moulded cement concrete (1:2:4) junction blocks as shall be required by the Engineer-in-charge. For very large buildings, 9" (250 mm) diameter and still large blocks shall be provided if required by the Engineer-in-charge and the detailed design of all junction blocks shall be subject to his previous approval. The sockets of the junction blocks shall be stopped by means of light concrete (1:2:4) or stoneware stopper fastened in place by a fillet of weak cement mortar or by a bituminous composition joint so that no land water can leak into the sewer and also that no sewage can escape into the ground. This must be done at all junctions left, whether the connections are expected to be made at once or not.

(8) Sewers to be Watertight.—All sewers shall be absolutely watertight when submitted to a head of water of the height of the road or ground level above the sewer, or such other head not exceeding the height of the road or ground level above the sewer, as shall be given in writing by the Engineer-in-charge to the Contractor from time to time.

(9) Rendering :—In case of sewers intended to be provided with a coat of cement rendering, such rendering shall consist of one part of cement to 1½ or two parts of sand by volume as shall be laid down in the schedule or shown in the drawings, not less than half an inch (12.5 mm) in thickness and worked to a polished face to the requirments of the Engineer-in-charge.

(10) Dewatering of Trenches.—The provision of para 5 of specification no. 29.15 shall also apply to all trench work for brick work. Sewers if any sub-soil drains are constructed by the Contractor for dewatering purposes, they shall be sealed off and pluged by the Contractor at his own expense and charges, to the approval of the Engineer-in-charge.

No sump or shaft for dewatering or pumping purposes shall be built by the Contractor within the line of any trench but should be made entirely separate from and outside the same.

SPECIFICATION NO. 29.11—Brick Sewers

(11) **Interior of Sewers to be kept clean.**—The interior of the sewer shall be cleared of all dirt, cement mortar and superfluous materials of every description as the work proceeds.

Measurement.

(12) The measurement shall be made in running ft. (R/metres) of the complete section.

Rate.

(13) The rate covers—

(i) Cost of all concrete, masonary plaster and collar joints as shown in the Standard Section irrespective of small quantity or difficult nature of work.

(ii) Covering of the sewer.

(iii) Testing for watertightness.

(iv) Cleaning of the sewer.

(v) Labour for providing, wash of sodium silicate or other water-proofing compound.

(vi) Cost of temporary bulk heads to keep the sewer clean or to eliminate entry of surface or rain water.

(vii) Rectifying any defects observed in the sewer.

(viii) Protection of the existing works from damage and cost incurred to repair the damage carried to the existing structures poles, sewers, pipe-lines, etc., belonging to Government or private individuals.

(ix) Cost of all temporary works as given in the specification no. 29.1 General.

Extra payable.

(14) (i) Extra as per schedule of rates shall be payable if sewers are constructed at a depth lower than 13 feet (4 metres).

(ii) Only composite rate per rft. (2 metres) of sewer shall be paid. In case any specification of any item is changed, the corresponding rate of that item shall be changed suitably.

SPECIFICATION NO. 29.12—Laying and Jointing Glazed Stoneware Pipe Sewers

Materials.

(1) (i) The stoneware pipes and specials shall be of the best description and of the highest quality, to be manufactured by a maker of repute. They shall comply fully and in all respect with the Indian Standard Specification no. I S : 651-1955 for salt glazed stone ware pipes and specials.

(ii) **Cement.**—It shall be conforming to the specification no. 3.12.

Sand.—It shall conform to specification no. 3.11 The source shall be to the approval of the Engineer-in-charge.

Lime.—It shall be class A lime conforming to specification no. 3.8

Surkhi.—It shall conform to specification no. 3.9.

Brick Ballast.—It shall conform to specification no. 3.7 but of $1\frac{1}{2}$ inch (30 mm) and $\frac{3}{4}$ (20 mm) inch gauge.

(iii) **Hemp yarn.**—2nd quality hemp yarn. It shall be free from imperfections and broken fibres.

(iv) **Hard Wood.**—Local available hard wood such as sheesham, Sal, Kikar, etc.

(2) **Laying of Glazzed Stoneware Spigot and Socket Pipe Sewer :**—A layer of cement concrete or lime concrete of such thickness and description as shall be laid down in the Schedule or shown in the drawings or as may be directed in writing by the Engineer-in-Charge, shall be laid along the bottom of the trench, the surface being formed evenly to the required gradient. Bricks shall be laid on the bed, one behind each socket to raise the pipes so that the outside of the sockets shall be about an inch (25 mm) above the bed. The pipes shall be laid with sockets forward beginning cement at the lower end and they shall be kept in alignment with small props of mortar.

(3) **Laying of Patent Glazed Stoneware Pipes.**—In cases where patent stoneware, pipes are to be used for which no clearance is needed on the underside, the lime concrete or cement concrete bed shall be from 4" to 6" (10 cm to 15 cm) thick as shall be laid down in the schedule or directed in writing by the Engineer-in-charge and the pipes shall be laid direct upon it, socket holes of sufficient depth being cut into it so that the pipes shall be supported throughout their full length.

(4) **Concrete to be Placed Around Pipes.**—After the joints and pipes have been proved to be water tight they shall be bedded in cement or lime concrete as shall be laid down in the schedule or shown on the

SPECIFICATION NO. 29.12—Laying and Jointing Glazed Stoneware Pipe Sewers

drawings or as shall be directed by the Engineer-in-charge, to the extent of one half of the external diameter the concrete being made to slope towards the sides of the foundation already laid, as shown on the detailed drawings.

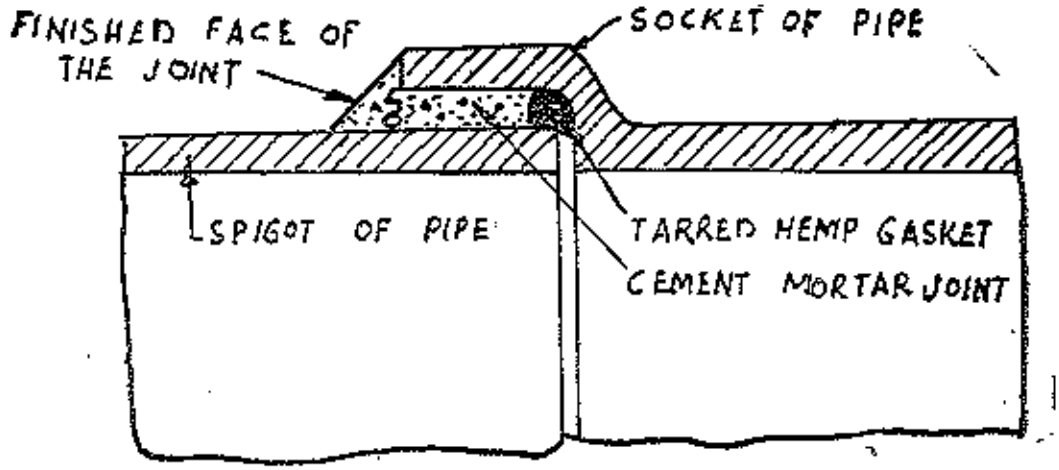
In all places where the sewers have less than four feet (120 cm) or more than twelve feet (360 cm) of cover and in other cases where the contractor shall be given instructions in writing by the Engineer-in-charge to that effect, they shall be surrounded with six inches (.5 cm) of lime concrete or cement concrete as shall be directed and the cost of such concrete shall be included in the rates of the Schedule.

(5) **Engineer-in-charge may Order Concrete to be Increased or Diminished.**—The Engineer-in-charge may increase or diminish the concrete around the sewers both as to quantity and quality or to omit the same entirely, according to the nature of the ground that may be revealed when the sewer trenches are opened out, and the Contractor shall be entitled to be paid only for the actual quantity and description of such concrete as he actually places in the work, in consonance with the Engineer-in-charge's written orders.

(6) **Jointing of Glazed Stoneware Spigot and Socketted Pipes**—The pipes shall be laid with sockets facing against direction of the flow. No pipes which are cracked or defective shall be used in the work and before the spigot end of a pipe is laid into the preceding socket, the socket and spigot ends shall be made perfectly clean inside and outside after which a ring of tarred hemp gasket of quality and description to be approved by the Engineer-in-charge shall be placed over the spigot. The spigot end of the pipe shall be placed concentrically into the preceding socket, care being taken that the inverts of the pipes form a continuous line to the correct alignment and grade and that spigot end is in contact with the back of the socket all round. The tarred hemp gasketshall be gently forced to the back end of the socket, and caulked with a hard wood tool keeping the spigot concentric with the socket with an equal annular space left for the joint all round. The joint shall then be formed by carefully packing a stiff mortar composed of one part of Portland cement to one part of coarse, clean, washed, sharp, siliceous, sand into the joint. For this purpose, the jointer shall be equipped with suitable wooden jointing tools and a pair of rubber gloves on his hands and he shall force the mortar into the joint all round therewith, taking great care to ensure that the joint is completely filled with the mortar in such a manner that it shall be absolutely watertight against an internal hydraulic pressure of 8 feet (2.44 m) head of water, after the joint has thoroughly set.

SPECIFICATION NO. 29.12—Laying and Jointing Glazed Stoneware Pipe Sewers

Each joint shall be completely filled with mortar packed homogeneously and solidly, extending from the tarred hemp gasket at the back of the socket up to the external face of the socket and the face of the joint shall be finished off smooth projecting at an angle of 45 degree with the longitudinal axis of the sewer as shown in the sketch as soon as possible.



If the Engineer-in-charge shall direct the omission of the tarred hemp gasket, the joint shall be well filled thoroughly with a stiff cement mortar paste consisting of one part cement mixed with one part of clean washed sand and finished off as above described, care being taken that the inside of the pipe shall be thoroughly wiped out with a mop or scraper. There must be no proud edge of pipe projecting inside or any fin or lump or cement, but the inside shall be left perfectly smooth and clean.

The cement must be spread out in a layer 6 inches (15 cm) thick on a dry floor for nine days to be air slaked before use in the joints so that there may be no risk of cracking the pipe sockets.

As soon as the joint has set sufficiently hard, it shall be covered with a sack which shall be kept wet continuously until the concrete envelope of the sewer has been laid and set and the filling is over the sewer is taken in hand.

All joints shall be exposed and space left all round for inspection by the Engineer-in-charge and testing and the necessary staging for the protection of the exposed sewer and for handling of excavated material shall be provided; also a suitable ladder affording easy access for inspection at every place where work is being carried out. The inside of the sewer must be left absolutely clear in the bore and free from cement mortar or other obstruction, throughout its entire length.

SPECIFICATION NO. 29.12—Laying and Jointing Glazed Stoneware Pipe Sewers

(7) **Jointing of Patent Glazed Stoneware Pipes.**—The joints of all patent pipes shall be made strictly according to the instructions of their manufacture and to the approval of the Superintending Engineer. A sample of any patent pipe which the Contractor may propose to use, shall be submitted to the Engineer-in-charge and his approval thereto shall be obtained previous to its use.

(8) **Testing of Glazed Stoneware Pipe Sewers.**—After a sufficient interval has been allowed for joints to set, the pipes will be tested under a head of at least 2½ feet (25 cm) of water and in no case under a greater head than 8 feet (244 cm) of water above the top of the pipes. Any defective or leaking spigot and socket joints shall be cut out and made good and in the case of any patent joints that may be defective and cannot be remade, they shall be entirely surrounded with cement, sand grout consisting of one part cement to one of sand and this shall be allowed to set before the sewer is filled in. A strong colouring shall be added to the water used for testing of patent pipes in order that any leakages may be more easily detected.

(9) **Junctions for House Connections.**—Junctions for house drains shall be 4" (100 mm) and 6" (150 mm) and for other larger buildings may also be 9" (250 mm). They shall be inserted when the sewers are laid wherever directed by the Engineer-in-charge and shall be formed with oblique angled, curved junction pipes inserted in the sides in the direction of the flow and tangenitial with the main pipes. The ends of the curved pipes are to radiate to the centre whence they are struck. They are to be laid at a sharp inclination with the sewers, as shall be directed from time to time by the Engineer-in-charge.

The sockets of the junction pipes are to be stopped off by means of solid caps or light stoppers of stoneware or moulded concrete 1:2:4 fastened in place by a fillet of weak cement mortar or by a bituminous composition joint so that no land water can leak into the sewer and also so that no sewage can escape into the ground. This must be done at all junctions left, whether the connections are expected to be made at once or not.

(10) **Sewers to be Kept Clean, etc.**—The interior of each sewer shall be kept clear of all dirt, cement and superfluous materials of every description as the work proceeds.

(11) **Back Filling.**—The trenches for the sewers shall be back filled as already described. No walking on or working upon the completed sewer shall be allowed until the trench has been back filled to a height of at least 2 feet. (60 centimetres).

SPECIFICATION NO. 29.12—Laying and Jointing Glazed Stoneware Pipe Sewers

(12) **Dewatering of Trenches.**—The provisions of 29.16 (5) of this specification shall also apply to all trench work for stoneware pipe sewer. If any sub-soil drains are constructed by the Contractor for dewatering purposes they shall be sealed off and plugged by the Contractor at his own expense and charges to the approval of the Engineer-in-charge. No sump or shaft for dewatering or pumping purposes shall be built by the Contractor within the line of any trench but should be made entirely separate from and outside the same.

Measurement.

(13) **Lowering Pipes in Trenches—**

(*a*) **Measurement.**—Measurement shall be recorded in rft. (r/metres) along the centre line of the pipe sewer.

(*b*) **Jointing, Cutting, Providing Wooden Plugs, etc..**—The measurements for these items shall be recorded in numbers.

Rates.

(14) The rate covers —

(*a*) **Lowering Pipes in Trenches:**

(*i*) Carriage from store to site and stacking including protection.

(*ii*) Breakage of pipes if any.

(*iii*) Lower of the pipes in trenches and laying these in proper position, alignments, level and

grade, with the help of sight rails boning rods, etc.

(*iv*) Cost of sight rails, tee, threads, and other tools required for laying pipes.

(*v*) Cleaning, pipes from inside.

(*vi*) Cutting socket holes in the bed concrete.

(*vii*) Cutting and removing caps or plugs from existing pipes or sockets of the branches (oblique junctions) for making connections.

(*viii*) Providing necessary brick or other supports to pipe to keep them in position.

(*ix*) Protection of existing works from damage and cost incurred to repair the damage carried to the existing structures poles, sewers, pipe-lines, etc., belonging to Government or private individuals.

SPECIFICATION NO. 29.12—Laying and Jointing Glazed Stoneware Pipe Sewers

(*x*) Cost of all temporary works as given in the specification no. 29.1 General.

(*b*) **Jointing:**

(*i*) Cost of material used in joints, i.e., cement, tarred, hemp yarn, sand, sacks for curing.

(*ii*) Labour for making joints including all tools, etc.

(*iii*) Curing of joints.

(*iv*) Testing water tightness of pipes sewers against water pressure.

(*v*) Repairing and relaying leaking joints, including providing collar joints.

(*vi*) Cleaning of the pipes and keeping the sewer length clean.

(*vii*) Providing temporary bulk heads to keep sewer clean from rain water or otherwise.

(*c*) **Cutting:**

(*i*) Cutting of pipe to uniform smooth surface.

(*ii*) Making the outer surface rough for jointing.

(*iii*) Cleaning of pipe.

(*d*) **Hard Wood Plugs:**

(*i*) Cost of wood and labour for making the plug.

(*ii*) Labour for fixing the same in position.

(15) (*i*) Extra as per schedule of rate shall be payable for fixing and lowering chutes. **Extra payable.**

(*ii*) Extra as per schedule of rates shall be payable for fixing oblique junction. The cost of providing stopper with weak cement mortar of bitumastic composition joint shall be covered in the extra rate payable.

SPECIFICATION NO. 29.13—Laying and Jointing, Plain and Reinforced Concrete Pipe Sewers

Materials.

(1) (*i*) The reinforced cement concrete pipes shall conform to Indian Standard Specifications No. I.S. : 458-1956 for concrete pipes with or without reinforcement.

(*ii*) **Cement.**—It shall be conforming to the specification no. 3.12.

(*iii*) **Sand.**—It shall conform to specification No. 3.11. The source shall be to the approval of the Engineer-in-charge.

(*iv*) **Brick Ballast :**—It shall conform to Specification No. 3.7 but of 1½ inch (30 mm) and ⅜ (20 mm) inch gauge.

(*v*) **Hemp yarn.**—2nd quality hemp yarn. It shall be free from imperfections and broken fibres.

(*vi*) **Hard Wood.**—Local available hard wood such as sheesam, sal, kikar, etc.

(*vii*) **Lime.**—It shall be class A lime conforming to Specification No. 3.8.

(2) **Cradle of sewers.**—Plain and reinforced cement pipe sewers shall be laid on a lime concrete or cement concrete or reinforced cement concrete cradle as shown on the drawings or as shall be otherwise directed in writing by the Engineering-in-charge from time to time. The lime concrete or cement concrete shall be laid generally in accordance with the specifications laid down in paras 2 and 4 of specification 29.12. In the case of reinforced concrete cradle, the concrete width of the cradle shall be deposited continuously to the height of the reinforcement and then the reinforcement shall be immediately placed in position, after which the remainder of the concrete shall be laid to complete the cradle accurately to template and in conformity with the contract drawings. Alternatively the reinforcement may be placed in position before the concrete is laid.

The work of constructing the cradle shall be carried out in a continuous operation so as to ensure proper bond between the concrete and the reinforcement and between the concrete above and below the reinforcement.

When any new concrete is jointed to old concrete the old concrete must be properly racked back and roughened and the joint made

in a manner to be approved by the Engineer-in-charge in all respects.

The inverts of the reinforced cradle shall be left about ½" (12.5 mm) lower than the finished level throughout and after the reinforced concerte pipe sewer has been laid and levelled thereon, the space between the underside of the pipes and the invert of the cradle shall be carefully grouted, solid with a thin grout consisting of one part portland cement and one and a half part of the sand, in such a manner, that no void shall be left and that the pipes shall rest throughout their length and breadth on the cradle and so that the load of the pipes and the superimposed load of earth filling shall be evenly distributed on the cradle. The Contractor shall take great care to see that no dirt, earth or other foreign material is allowed on the surface of the cradle or of the pipe resting thereon and shall provide the necessary grout holes and channels in the work to ensure positively that the grout fills all cavities and spaces between the pipes and their cradles and shall do all other acts and carry out all other work and operations required to satisfy the Engineer-in-charge in all respects that the pipes are fully supported on their cradles in the manner described above. Should the Engineer-in-charge find that the grouting is not being carried out to give the above requirements, the Contractors shall without any extra charge whatsoever comply with all further directions and instructions of the Engineer-in-charge to ensure that the pipes are properly supported by the cradles even though such directions or instructions of the Engineer-in-charge shall entail a different method of carrying out the work.

The reinforced cradle shall be allowed to set for at least 3 days before any pipe is placed on it and the contractor shall take due care in setting the pipe on the cradle that no damage to the cradle shall occur. If any damage shall occur, the cradle shall be rectified to the satisfaction of the Engineer-in-charge and in any particular case where the damage has affected, in the opinion of the Engineer-in-charge the structural strength of the cradle, the Contractor shall cut out the damaged section of the cradle and replace it at his own costs and charges to the satisfaction of the Engineer-in-charge. In case the Engineer-in-charge shall require a layer of gravel, broken stone or broken brick ballast to be laid beneath the foundation of the Sewer, the Contractor shall supply and deposit the gravel, broken stone or broken brick ballast as required by the Engineer-in-charge, in layers not exceeding six inches (15 cm) thickness, each of which shall be well rammed and consolidated to the required levels and grades before the cradle is constructed.

SPECIFICATION NO. 29.13.—Laying and Jointing, Plain and Reinforced Concrete Pipe Sewers

No pipe or the cradle therefor shall be laid or placed till the alignment of the sewer and its levels and gradients have been carefully checked and tested with the trench excavation and found correct.

(3) **Joints.**—The jointing for the pipes shall be made by a loose collar and shall give a minimum caulking space to the satisfaction of the Engineer-in-charge. The collars shall be specially roughened inside for a better grip.

The two adjacent pipe ends will be so designed and manufactured that when butted together concentrically a dowel will be left between the two ends. Into this dowel cement mortar 1½ (one part cement, one and a half parts fine aggregate) shall be filled and then between the ends, paste of cement mortar of the same proportion will be placed, the space remaining between the pipe ends and the collar being then caulked with cement compound of one part of cement mixed with one and a half part of fine aggregate and so that an even space appears all round the external diameter of the pipes. Every joint shall be finished off smooth inside and shall be perfectly tight against and internal pressure of water equal to 20 feet (6 metres) head and also against all leakage of ground water into the sewer.

(4) **Interior of Sewer to be kept clean.**—The interior of the sewer shall be cleared of all dirt, cement mortar and superfluous materials of every description as the work proceeds.

(5) **Engineer-in-charge may order concrete to be increased or Diminished.**—The Engineer-in-charge shall have power to vary the concrete in the cradle or surrounded under or round the sewer both as to quantity and quality or to omit the same completely according to the nature of the ground that may be revealed when the sewer trenches are opened out and the Contractor in such case shall be entitled to be paid only for the actual quantity and description of such concrete as he actually places in the work with the Engineer-in-charge's written orders.

(6) **Testing of Plain and Reinforced Concrete Pipe Sewers.**—After a sufficient interval has been allowed for the joints to set, the sewers will be tested under a head of at least 4 ft. (1.2 m) and in no case under a greater head than 20 feet (6 metres) of water above the top of the pipes. In addition the sewers shall be examined for leaks of land water making its way through the walls and joints. The Contractor shall make the sewers watertight against the ingress of land water from outside and also against the leakage of water from the inside of the sewers at the

SPECIFICATION NO. 29.13.—Laying and Jointing, Plain and Reinforced Concrete Pipe Sewers

test heads above specified, to the full satisfaction of the Engineer-in-charge. All defective or leaking pipes or joints shall be cut out and replaced and made good by the Contractor at his own costs and charges or in the case of any joints that may be defective and cannot be made, they shall be entirely surrounded externally with cement concrete and cement sand grout (1 : 1) to render the joints watertight and this should be allowed to set before the sewer is filled in. A strong clouring should be added to the water used for testing of pipes in order that any leakage may be more easily detected.

Junctions for house drains and also for branch sewers of smaller size ranging from 4" (100 mm) to 6" (150 mm) diameter upwards shall be inserted when the sewers are laid wherever directed by the Engineer-in-charge. For large sewers, these shall be fitted at angles ranging from 30 degrees to 45 degrees with the centre line of the main sewers as shall be ordered by the Engineer-in-charge while for smaller pipe sewers they shall be formed with oblique angled, junction branches inserted in the sides, in the direction of the flow, and tangential with the main pipes. The ends of the curved pipes shall radiate to the centre whence they are struck, and they shall be laid at a sharp inclination with the sewer.

The sockets of the branches on the junction pipes shall be stopped off by means of a light stopper of stoneware or moulded concrete (1 : 2 : 4) fastened in place by a fillet of weak cement mortar or by a bituminous composition joint so that no land water can leak into the sewer and also so that no sewage can escape into the ground. This must be done at all junctions left whether the connections are expected to be made at once or not.

(7) **Dewatering of Trenches.**—The provisions of para 5 of specification No. 29.16 shall also apply to all trench work for concrete pipe sewers. If any sub-soil drains are constructed by the Contractor for dewatering purposes they shall be sealed off and plugged by the Contractor at his own expense and charges, to the approval of the Engineer-in-charge. No sump or shaft for dewatering or pumping purposes shall be built by the Contractor within the line of any trench but should be made entirely separate from and outside the same.

8. (*a*) Lowering pipes in trenches in cft. (21 metres) along the centre line of the sewer. **Measurement**

(*b*) Jointing, cutting, provide wooden plugs in numbers.

SPECIFICATION NO. 29.13—Laying and Jointing, Plain and Reinforced Concrete Pipe Sewers

Rates.

9. (*a*) **Lowering of Pipes :**

(*i*) Carriage from store to site and stacking including protection.

(*ii*) Breakage of pipes if any.

(*iii*) Lowering of the pipes in trenches and laying these in proper, position, alignment, level and grade, with the help of sight rails boning rods, etc.

(*iv*) Cost of sight rails, tee, threads, and other tools required for laying pipes.

(*v*) Cleaning, pipes from inside.

(*vi*) Cutting socket holes in the bed concrete.

(*vii*) Cutting and removing caps or plugs from existing pipes or sockets of the branches (Oblique Junctions) for making connections.

(*viii*) Providing necessary brick or other supports to pipe to keep them in position.

(*ix*) Protection of existing works from damage and cost incurred to repair the damage carried to the existing structures poles, sewer, pipe-lines, etc., belonging to Government or private individuals.

(*x*) Cost of all temporary works as given in the specification no. **29.1 General.**

(*b*) **Jointing :**

(*i*) Cost of materials used in Joints, i.e., cement, yarn, sand, sacks for curing.

(*ii*) Labour for making joints including all tools, etc.

(*iii*) Curing of joints.

(*iv*) Testing water tightness of pipes sewer against water pressure.

(*v*) Repairing and relaying leaking joints, including providing collar joints.

(*vi*) Cleaning of the pipes and keeping the sewer length clean.

SPECIFICATION NO. 29.13.—Laying and Jointing, Plain and Reinforced Concrete Pipe Sewers

(*vii*) Providing temporary bulk heads to keep sewer clean from rain water or otherwise.

(*c*) **Cutting :**

(*i*) Cutting of pipe to uniforms smooth surface.

(*ii*) Making the outer surface rough for jointing.

(*iii*) Cleaning of pipe.

(*d*) **Hard Wood Plugs :**

(*i*) Cost of wood and labour for making the plug.

(*ii*) Labour for fixing the same in position.

Extra Payable.

Extra as per schedule of rates shall be payable for fixing oblique junction. The cost of providing stopper with weak cement mortar or birumastic composition joint shall be covered in the extra rate payable.

SPECIFICATION NO. 29·14—Cast Iron Sewers and Rising Main

Material.

(1) According to the specification no. 3·54.

(2) **Laying of Cast Iron Pipes.**—In trenches where cast iron sewers are to be laid, the ground shall be excavated exactly to the required alignment, depth and grade, and holes are to be taken out where the joints occur so that the barrels of the pipes may be on a solid bed throughout. In laying spigot and socket pipes, the socket shall be kept up hill and a socket must always terminate the line of drain in such a position as to exactly receive the invert channel in each manhole. To produce this result, a pipe must, if necessary be cut.

(3) **Jointing :**—All spigot and socket pipes and specials shall be jointed by forcing the home into the socket which must be centered so that the joint is an even thickness and all round. The joint shall be be filled with lead wool forced and caulked into the socket by ring, till it is half full, after which the joint shall be run with molten lead in sufficient quantity so that after being caulked solid, the face of the lead shall be receased about 1/16th of an inch (1.5 metre) inside the face of the socket, which shall be painted with a coat of hot melted bituman to protect all tool marks. Flanged cast iron pipes and specials shall be properly faced and the joint shall be made by inserting a washer of soft lead or other approved material between them.

(4) **Testing.**—All cast iron pipe sewers shall be subjected to a hydraulic test of not less than 30 feet (9 metres) head and all cast iron rising mains shall be tested to a hydraulic test of 100 feet (30 metres) They shall be head. absolutely tight under these test heads.

(5) **Dewatering of Trenches.**—The provision of para 5 of specification no. 29·16 shall also apply to all trench work for cast iron sewers and pipe-lines. If any sub-soil drains are constructed by the Contractor for dewatering purposes, they shall be sealed off and plugged by the Contractor at his own expense and charges to the approval of the Engineer-in-charge. No sump or shaft for dewatering or pumping purposes shall be built by the Contractor within the line of any trench, but should be made entirely separate from and outside the same.

(6) In General the work shall conform to the relative specification given in Chapter no. 28.

Measurement.

(7) According to units Provided in chapter no. 228 of the Schedule of Rates.

Rates and extra payable.

(8) As provided in the relative specification of chapter no. 28.

SPECIFICATION NO. 29·15—Cotruction ot Reinforced Concrete Sewers, Junctions, Storm Overflows and other Works Constructed *in situ*

Materials.

(1) **Cement.**—It shall be conforming to the specification no. 3·12.

Sand:—It shall conform to specifiction no. 3·11. The source shall be to the approval of the Engineer-in-charge.

Steel.—It shall conform to specification no. 3·20.

(2) **Inverts.**—Inverts of reinforced concrete sewers, junction chambers and other works constructed *in situ* shall be formed between transverse templates and shall be screeded. These templates shall be accurately made and placed at such close intervals as the Engineer-in-charge shall approve, Unless otherwise shown on the drawings a layer of cement mortar not less than ½ inch (12.5 mm) thick shall be spread evenly and to a smoothy finished surface upon the concrete of the inverts as soon as concrete is in place. Where radii of inverts are too short for screeding between templates, the inverts shall be shaped by means suitable forms which shall be removed as soon as the concrete has sufficiently set and if required by the Engineer-in-charge the surfaces of the inverts shall be floated or trowelled to a smooth finish. The concrete for inverts shall be deposited contionously for their full cross-section and for such longitudianl distance as the Engineer-in-charge shall approve. Where inverts are required to be lined with brick masonry, or other materials, such works shall be laid at such times and in such manner as shall be directed by the Engineer-in-charge. Inverts shall be carefully protected against injury during the progress of the works.

(3) **Side Walls.**—Concrete in the side walls of sewers, junction chambers and other works shall be deposited continuously to the height directed by the Eingineer-in-charge and for such longitudinal distance as may be convenient and approved by him. If the side walls are required to be lined with brick work or other material such work shall be carried out in a manner to be approved by the Engineer-in-charge.

(4) **Roof and Arch Work.**—Concrete in the roofs or arched work of sewers, junction chambers, manholes and other works shall be deposited continuously for the full depths and widths of the roofs and arches and for such longitudinal distances as may be convenient and approved by the Engineer-in-charge. The outer surfaces of roofs and arched work shall be left with an excess of mortar and finished true and smooth. If the roofs are required to be lined with brick work or other material such work shall be carried out in a manner to the approval of the Engineer-in-charge.

SPECIFICATION NO. 29·15—Construction of Reinforced Concrete Sewers, Junctions, Storm Overflows and other Works Constructed *in Situ*

(5) **Filling in.**—The refilling in of trenches and other excavations shall be carried out in the manner directed in para (9) of this specification no. 29·2.

(6) **Bulk Heads.**—Temporary wooden bulk heads shall be used while depositing concrete for sewers and other works at such intervals as may be required for convenient working. These bulk heads shall be of a design and shape and shall be so fixed and secured as well be approved by the Engineer-in-charge and shall not be removed till the concrete has set sufficiently to hold its shape.

(7) **Reinforcements.**—Where shown on the drawings or where directed by the Engineer-in-charge, concrete sewers, junction chambers, overflow chambers and other works shall be reinforced with metal of the dimensions and shapes shown and of a quality and in the manner hereinbefore specified, to the requirements of the Engineer-in-charge.

(8) **Branches.**—Connections and branches for lateral sewers and drains shall be provided by the Contractor and built in where shown on the drawings and also where directed in writing by the Engineer-in-charge. Such connections and branches shall be closed with suitable plugs as already described herein for brick sewers.

(9) **Minimum Length of Inverts.**—Unless otherwise permitted or ordered by the Engineer-in-charge, not less than 16 feet (5 metres) of foundation or invert for a concrete or reinforced concrete sewer shall be built at one operation.

(10) **Dewatering of Trenches and Excavations.**—The provisions of para 5 of specification no. 29·16 shall also apply to all trench work for concrete and reinforced concrete sewers, junctions, chambers and other works.

If any sub-soil drains are constructed by the Contractor for dewatering purposes they shall be sealed off and plugged by the Conractor at his own expense and charges to the approval of the Engineer-in-charge.

No sump or shaft for dewatering or pumping purposes shall be built by the Contractor within the line of any trench but should be made entierly separate from and outside the same.

Measurement. (11) According to the units provided in the Schedule of Rates for the concerned items.

SPECIFICATION NO. 29·15—Construction of Reinforced Concrete Sewers, Junctions, Storm Overflows and other Works Constructed *in Situ*

(12) (i) As provided in the relative specification of the items. **Rates.**

(*ii*) No extra shall be payable for reasons of any difficulties or wastage in the work.

(*iii*) Cost of all temporary works as given in the specification no. **29·1 General.**

(13) As provided in the relative specification of the items. **Extras Payable.**

SPECIFICATION NO. 29·16—Construction of Manholes, Screening, Chamber, Section Sumps, Collecting Tanks, etc.

Material.

(1) Cement.—As per specification no. 29·15.

Sand:

Steel etc.:—Concerning these items.

(2) Construction of Manholes.—The contractor shall built and construct the various manholes or other structures in the position shown upon the drawings or where, otherwise, directed by the Engineer-in-charge and in accordance with detailed drawings to be supplied by him from time to time. The floors for manholes shall be constructed in salt glazed ware bricks and /or cement concrete and the side walls of cement concrete and brick work as laid down in the drawings and proper channels shall be formed across them to lead the sewage from one sewer to the other without interruptions to the flew while of other structures shall be as shown in plan. All pipes required for branch sewers house connections and ventilation purposes shall be built in the walls as shall be directed by the Engineer-in-charge, relieving `arches being provided to prevent any load on the pipes. All ladders, gratings, and step irons, as directed by the Engineer-in-charge, shall be provided and built into the brick work while the walls are being constructed.

(3) To be Watertight.—Where shown on the drawing or otherwise directed by the Engineer-in-charge the inside of all structures shall be rendered with cement mortar composed of one part of cement to 1½ or two parts of sand as shall be laid down in the schedule or shown on the drawing, not less than half an inch (12.5 mm) in thickness and worked to a polished face and they shall be absolutely watertight. In places where no rendering is ordered the joints shall be carefully smooth finished internally.

(4) Shaping of Manhole Inverts.—In the case of manholes on small pipe sewers of concrete or glazed stone-ware the channels shall be formed of half round pipes bedded in cement mortar and shaped to fit the ends of the sewers. Where practicable in the opinion of the Engineer-in-charge there shall be fall of not less than 1½" (40 mm) in each manhole, but in flat areas where it is not feasible to enforce this provision, the Engineer-in-charge shall amend or reduce the fall to be allowed in each manhole. In manholes on brick or concrete sewers, proper grooves shall be formed in the brick work or concerte to enable a dam for flushing or other purposes to be formed in the sewers at any time.

SPECIFICATION NO. 29·16—Construction of Manholes, Screening Chamber, Section Sumps, Collecting Tanks, etc.

(5) **Dewatering of Excavations.**—The Contractor shall keep all excavation for manholes and all other works absolutely and continuously clear of all water down to a level below the bottom of the excavation and below the lowest part of the foundations of the work to be carried out and shall construct the manholes and other works without allowing any water to rise in the excavation made for the said works. He shall, moreover, continue full pumping operations and shall keep the excavation for each manhole or other work free of water until the manhole or other work is completed and passed and if any defect or defects are found in the said work subsequently, the Contractor shall carry out all dewatering and pumping operations required to make the defect or defects good to the satisfaction of the Engineer in charge.

Measurement.

(6) (*a*) **Manholes**

(*i*) The measruement shall be recorded in feet--inches (metres-centimetres) depth, where composite rates for various depths have been given in the schedule.

(*ii*) The depths shall be measured from the top of the manhole cover (assumed as formation level of ground) to the finished invert level.

(b) Screening Chambers, Manholes for which composite rates have not been provided in the schedule, etc.:

(*i*) Measurement shall be according to the units provided in the schedule of rates for the concerned items.

Rates.

(7) (*a*) **Manholes.**—These shall be paid for per unit number depending upon the depth as given in the schedule. For depth exceeding full number of feet, (metres) proportionate payment per each inch (centimetre) depth will be payable over and above full feet (metres) depth. This proportionate rate will be worked out as the difference of rate from the next higher depth.

For example, for manhole on 7 inches (200 mm) i/d sewer, 8 feet (2 metres 49 centimetres) 2 inches deep, the rate payable shall be:—

	Rs.
(*i*) Rate for 8 feet (2.4 metres) depth ..	304·0 (292.0) per each
(*ii*) Rate for 9 feet (2.7 metres) depth ..	327·0 (317.0) per each

Increase of rate per 12 inches (30 cms.) depth = 23.0 (25.0)

Increase for every inch depth beyond 8 ft. (2.4 metres) = 23/12 (25/30)

Hence rate payable for 8 ft. 2 inches (2.49 metres) depth equal to

$304+2\times23/12$ = Rs. 307.83 nP.

$292+9\times25/30$ = Rs. 299.50

SPECIFICATION No. 29.16 Construction of Manholes, Screening Chamber, Section Sumps, Collecting Tanks, etc.

The rates include :—

(*i*) Cost of all masonry work including plastering, etc.

(*ii*) Cost of R.C.C. slab.

(*iii*) Cost of concrete in foundation of the sewer, benching, in the haunches and on the arch where depth below G.L. is 4 ft. (1.20 m) or less.

(*iv*) Making and finishing of benching and formation of complicated floor work, including formation of channels and bullnozing, etc.

(*v*) Fixing of heavy manhole cover and step iron including carriage up to site.

(*vi*) Cost of accurately planned and fitted shuttering and supports for all works and curves.

(*vii*) Cleaning of manholes.

(*viii*) Cost of testing for watertightness.

(*ix*) Cost of all temporary works as given in specification No. **29.1 General.**

(*x*) Nothing extra shall be payable for reason to any difficulty or smallness of work.

(b) Screening chambers, etc., Manholes for which Composite rates have not been provided in the Schedule :

Rates shall be payable for the various individual items as provided in the Schedule and will cover the items given in the relative specifications.

(*i*) Testing for water-tightness.

(*ii*) No extra shall be payable for reasons of any difficulties, wastage, or smallness of work.

(*iii*) Cost of all temporary works as given in the specification no. **29.1 General.**

Extras payable. (8) (*i*) As provided in the relative specification of the items.

(*ii*) Extra as provided in the schedule for finishing of benchings and complicated floor work in the manholes.

SPECIFICATION NO. 29.17—Constructing of Flushing Tanks

(1) Cement.—As per specification no. 29.15 concerning these items. Material.

Sand :—
Steel :—
etc.

(2) **General Construction.**—The Contractor shall built the various flushing tanks in the positions shown on the plans or where directed by the Engineer-in-charge, in accordance with the detailed drawings to be supplied by him.

The floors shall consist of concrete and the sides shall be of brick work in cement mortar as specified. Galvanised wrought iron or malleable iron steps irons shall be built in where necessary, while the walls are being constructed. The insides of the flushing tanks shall be rendered with cement mortar composed of one part of cement and 1½ or two parts sand as shown in the Schedule or in the drawings, not less than half an inch (12.5 mm) thick and worked to a polished face and they shall be absolutely water-tight.

Each tank shall be fitted with an automatic syphon with trapped outlet of pattern and size to be approved by the Superintending Engineer before they are placed on order.

(3) **Water-supply Connections.**—A supply of water from the Water-supply system shall be laid on the each flushing chamber by means of a connection of suitable size and a suitable disconnecting gully and meter chamber with cast iron hinged and locked lid shall be provided and constructed in connection therewith.

The covers of flushing tanks shall be similar to those laid down for manholes and they shall be set to correct levels and alignments on a layer ½" thick (12.5 mm) of cement sand mortar (1 : 2).

(4) **Dewatering of Excavations.**—The provisions of para 5 of specification no. 29.16 shall also apply to all flushing tanks and all other works contingent to the Sewerage Scheme.

(5) Measurement shall be according to the units provided in Schedule of Rates for the concerned items. Measurement.

(6) (*i*) The rates payable shall be as provided in the relative specifications of the items. Rates.

(*ii*) No extra shall be payable for reasons of any difficulties or wastage in the work.

(*iii*) Cost of all temporary works as given in the specification no. 29.1 General.

(7) As provided in the relative specifications of the items. Extra payable.

SPECIFICATION NO. 29.18—Construction of Punjab Standard Type Drains and House Outlet Connections

Materials.

(1) **Cement.**—It shall be according to specification no. 3.12.

Cement Concrete.—It shall be according to specification no. 10.4.

Other Materials.—It shall conform to the relative specification contained in other chapters.

(2) **Punjab Standard Type Drains.**—Punjab Standard type drains shall be made of cement concrete 1:2½:5 mix, House connections drains, type I drains, type II drains, and type III drains and the inverts of drains of larger sizes and of sewers shall be laid *in situ* in lengths not exceeding 4 ft. (1·20 m) separated by vertical expansion joints not less than ⅛" (3mm) wide, formed by accurately shaped metal templates.

The exposed surfaces of all inverts and drains including side slabs and bull noze shall be formed by applying a thin skin about ¼ inch (6 mm) thick of 1:1 cement sand mortar immediately after the concrete has been placed and screening the same to a clean smooth finish. The slabs for the side walls shall be moulded separately and shall be laid in 1:2 cement sand mortar on the lime concrete backing, previously prepared not less than 14 days after being made all joints being carefully struck perfectly clean and flush with the faces of the slabs.

The finished section of the drain shall in dimension and shape be truly according to the drawings and it shall be checked with the steel templates.

The preparation of the trench, aligning and grading shall be carried out in the same manner as required for sewers. No extra shall be payable for curves, bends, falls, junctions, inlets, outlets and all other special work in connection with the drains and the cost of all such special work is included in the rates as given in the Schedule.

(3) The house outlet connection shall be constructed according to standard drawing, finished and polished in best workmanship.

Measurement.

(4) (*a*) **Drains.**—In rft. (2 metres) along the centre line of the drain.
(b) **House Outlet Connections.**—In numbers.

Rates.

(5) (*a*) **Drains.**
The rate covers :—

(*i*) Construction of drain.

(*ii*) Excavation of trenches below top of cunnetes including dressing, to correct levels, templates, grades, etc.

(*iii*) Removal and disposal of surplus spoil.

(*iv*) Cost of site rails, pegs, boning rods and tools and plant.

(*v*) Curing of the drains.

(*vi*) Cleaning of the drains after curing.

(*vii*) No extra payable for curves, bends, falls, junctions, inlets, outlets, expansion joints and other special works in the drains.

(*viii*) In precast drains slabs, the cost of fixing and setting these to correct levels and templates in 1:2 mortar and finishing to smooth faces.

(*ix*) Lime concrete below the drain.

(*x*) Cost of all temporary works as given in the specification no. **29.1 General.**

(b) House Outlet Connections :—

(*i*) Constructing of house outlet connections.

(*ii*) All works from plinth to the street drains, if it is adjacent to the house wall.

(6) (*a*) **Drains.**—As provided in the Schedule. **Extras payable.**

(b) House Outlets.—Cost of drain from house wall to the street drains.