

**SPECIFICATIONS FOR
TRENCH EXCAVATION, BACKFILLING
& ROAD REINSTATEMENT**

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Specification for Trench Excavation, Backfilling and Road Reinstatement for Pipe Laying

1. Pipe Trench Excavation - General

Trench excavation means excavation in all materials of whatever nature encountered for trenches into which pipes are to be laid or pipe appurtenances constructed. Pipe shall mean pipe of all kinds and for whatever purposes.

The contractor would be required to provide shoring for the trenches in order to minimize damage to the roads and also other utilities. If the Contractor is required to excavate a trench, wider than the maximum trenches width, prior approval of the Engineer should be obtained. However, the contractor shall bear the total responsibility for damages to utilities, backfilling and compaction of the trench as per specifications and reinstatement of roads occurred as a results of collapse of side of the trench. Road reinstatement both temporary and permanent shall be measured in linear meters along the top surface of trenches for different diameters of pipes.

Disruption to traffic should be minimized. The Contractor should provide necessary measures for the safety of pedestrians, vehicles etc. All open trenches and backfilled areas should be protected by providing proper barricading, night lighting and also steel plates etc. when necessary. Road signs at either ends of the road warning motorists and pedestrians should be erected. Any damage to vehicles or injured to public and the damage to third party property due to the above excavation work or during movement of machinery should be the responsibility of the Contractor. It may be necessary to transport the excavated material temporarily to other locations. Required traffic control arrangements in concurrence with the traffic police and Local Authority should also be provided by the Contractor.

Contractor shall take every precautions to minimize damages to third party property due to excavation and backfilling of pipe trenches. Any damages to third party property shall be rectified and made to the good condition at the contractor's cost.

Trenches shall be carried out manually if excavation using machinery poses a potential danger to the roads and third party property including other utilities. The trench shall be excavated to required depth and trimmed the bottom to specified gradient as shown in the drawings. Any excessive excavation shall be filled and compacted by the contractor at his own cost as directed by the Engineer.

Asphalt cutters should be used when damaging asphalt concrete and concrete paved roads.

Prior to the commencement of pipe laying as far as practicable, Engineer shall nominate a soil testing laboratory and inspected the pipeline trace jointly with the Contractor to decide on the suitability of the materials to be excavated for backfilling of the trenches.

Engineer along with the soil laboratory personnel will decide on the locations where the soil tests are to be carried out to determine the soil parameters setout in Clause 2(v) and details given in the drawing Nos. WT 403/BT/01A & WT 403/BT/02A and

decide on the suitability of the excavated material for backfilling based on the test results and recommendations of the soil laboratory personnel.

If the excavated soil is found to be unsuitable, Engineer shall inform the Contractor of the sections of the pipeline trace to be backfilled with imported soil from the approved borrow pits.

2. Trench Alignment and Grade

Before starting excavation in any road the Contractor shall have obtained the approval of the Engineer and Engineer shall obtain the approval of the relevant Road Authority for Contractor's detailed work programme for the trench excavation in roads ahead of the particular work. This programme shall contain the names of the roads and chainages to be excavated, date of commencement and planned completion date of backfilling, planned dates of completion of temporary and permanent road reinstatement, and the dates of handing over to the relevant Road Authority. No excavation shall be permitted unless the Contractor shall have obtained approval of the said programme as aforesaid and can demonstrate that all necessary pipes fittings materials and plant are available on site for the speedy completion of all the work.

i Construction Alignment and Grade

The line and level of trenches shall be as shown on the Drawings or as determined from the Drawings or as may be directed by the Engineer. Before commencing trench excavations, the route of the trench shall be pegged out accurately and the natural ground levels shall be agreed with the Engineer. Strong sight rails shall then be fixed and maintained at each change of gradient, and at as many intermediate points as may be necessary. On these rails shall be marked the centre line and the level to which the excavation is to be carried out, such rails being not more than 50 m. apart and at changes of direction and grade.

ii. Changes in Line and Grade

In the event obstructions not shown on the plans are encountered during the progress of the work which will require alternations to the plans, the Engineer shall have the authority to change the plans and order the necessary deviation from the line and/or grade. The Contractor shall not make any deviation from the specified line and/or grade without approval by the Engineer. Should any deviations in line and/or grade be permitted by the Engineer in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, any additional costs for thrust blocks, valves, air and vacuum assemblies, blow-off assemblies, extra pipe footage, manholes or other appurtenances shall be borne by the Contractor. The Contractor shall include in his unit rates in the contract provision to cover any deviation from the invert grade shown on the plans to facilitate extra depth required to eliminate possible conflicts between culverts and other utilities.

iii. Trench widths

Trench excavation shall be carried out by such methods and to such lines, dimensions and depths as shall allow for the proper construction of the works, provided always that, unless the Engineer permits otherwise, for trench excavation, the Table 1, shall be referred for nominal trench widths and depths. Any changes to Table 1, if necessary depending on the special conditions shall be authorized by the Engineer.

Trenches shall have vertical sides or battered trench as specified herein unless otherwise authorized by the Engineer.

Notwithstanding the foregoing, any rock in trench excavation shall be so excavated that the clearance between the pipe when laid and the rock sides and bottom of the trench is kept to the minimum limits necessary to provide for the specified thickness of bedding and concrete protection of the pipe. Bell holes and holes and depressions for couplings, valves and the like shall be excavated the same distance below these installations.

iv. Working Space

Excavation for structures such as valve chambers etc. shall be allowed 30 cm working space for purposes of establishing Contractor's liability for permanent reinstatement costs.

v. Backfill Material

Soils used as backfilling material shall be naturally occurring soils and shall not be highly plastic clays, silts, peat or other organic soils or any soil that is mixed or contaminated with the top soil, vegetation and other deleterious matter. Material used for backfilling shall conform to the requirement of Type 1 materials as given below.

Type 1 material shall be soil having the maximum dry density under standard conditions of proctor compaction not less than 1600 Kg/m³ with the properties plastic limit <15, liquid limit (LL) < 40, CBR >20.

Materials excavated from the trenches may be used as backfill provided it meets the requirements specified for backfill material. Surplus materials from excavations shall be removed and disposed of by the Contractor as required by the Engineer and as specified on contractors cost. The trench shall be dug only so far in advance of pipe laying as the Engineer shall permit.

Where in the opinion of the Engineer sufficient supplies of the aforesaid material for trench refilling cannot reasonably be obtained from excavations, the Engineer may order the Contractor to carryout following.

a) Remove Stones

To carry out such work as may be necessary to sieve out stones, from the excavated material at contractors cost.

b) Borrow

If the excavated soil from trench is not satisfy the requirements, imported soil to be used for backfilling of trench. The Contractor shall take every steps to excavate suitable material from borrow areas and transport it to the length of trench to be backfilled, and the Contractor shall do any or all of these things as directed and as specified in the drawings and the specifications with own cost.

TABLE 1. DETAILS OF TRENCH WIDTH AND DEPTH UPTO THE INVERT FOR THE PIPE LAYING (Minimum Recommended)

PE Pipes

Dia. (mm)	Trench	
	Width (m)	depth (m)
63	0.40	0.90
90	0.40	1.00
110	0.40	1.12
125	0.40	1.14
140	0.40	1.15
160	0.45	1.17
180	0.45	1.19
200	0.45	1.21
225	0.50	1.24
250	0.50	1.26
280	0.60	1.29
315	0.60	1.33
355	0.70	1.37
400	0.70	1.41
450	0.70	1.46
500	0.75	1.51
560	0.90	1.64
630	0.90	1.64

DI Pipes

Dia. (mm)	Trench	
	Width (m)	depth (m)
80	0.60	0.95
100	0.60	0.95
150	0.60	1.00
200	0.60	1.20
250	0.60	1.25
300	0.60	1.30
350	0.75	1.35
400	0.90	1.40
450	0.90	1.45
500	0.90	1.50
600	1.10	1.60
700	1.20	1.70
800	1.30	1.90
900	1.50	2.00
1000	1.60	2.10
1100	1.70	2.25
1200	1.80	2.40
1400	2.00	2.60

PVC Pipes

Dia. (mm)	Trench	
	Width (m)	depth (m)
63	0.40	0.90
90	0.45	1.10
110	0.45	1.20
160	0.60	1.20
225	0.60	1.30
280	0.60	1.30
315	0.75	1.35

Note :- Thickness of beddings are excluded.

3. Trial Holes

Trial holes shall be excavated well ahead of the trench excavation to such depths as necessary to determine and confirm the alignment for the trench. Trial holes may also be required by the Contractor to determine the position of underground services, sub-soil drains or rock profile for any other reason. The Contractor shall obtain all necessary permissions from the Road Authorities for the excavation of trial holes. Trial holes shall be excavated at a distance of 50 m or as directed by the Engineer.

3.1 Reinstatement of Trial Holes

The Contractor shall arrange the refilling and reinstatement of trial holes to be carried out immediately after the required information is obtained. The reinstatement of the surfaces of trial holes shall be carried out to the approval of the Engineer and the relevant Roads Authority at the contractor's cost.

4. Trench Excavation in Roads

When excavating trenches along public roads, the Contractor shall comply with the requirements and conditions of the relevant road maintenance authority having jurisdiction over the particular road, viz, the Road Development Authority (for major roads) the Provincial Road Development Authority (for secondary roads) for the Local Government Authorities (for minor roads).

The information provided regarding jurisdictions in the drawings titled 'Key Plan – Miscellaneous Information' is only a guide and not to be taken as the final status. The Contractor shall obtain the information regarding the final status from the relevant authorities.

All trench excavation and other work carried out within the limits of any public road shall be completed as rapidly as possible and the Contractor shall make every effort to ensure that no more than half of the width of the carriageway shall be obstructed at one time. Road drains and kurbs shall be kept free from obstruction. The Engineer may direct that trench excavation in highways shall be located in footpaths or in verges rather than in the carriageway. If that is the case, trench excavation shall

wherever practicable be carried out in such a way that every part of the excavation is at least 1m clear of the existing edge of the carriageway. In any event the Contractor shall take special precautions, which shall include the continuous support of the sides of the excavation, from the time when excavation is begun until the refilling of the trench is completed, to ensure that there is no disturbance of the adjacent road or road foundation. Where excavated material has temporarily been deposited on an adjacent surface, the surface shall on completion of refilling be restored entirely to its original condition and left free of loose stones.

4.1 Excavation in carriageway

The excavation of trenches in RDA roads shall be in the shoulders as far as possible. However, when excavations are needed within the carriageway, the Contractor shall take all the necessary care to minimize the area of damage to the road surface. Before starting excavation, the Contractor shall use asphalt cutting apparatus comprising a diamond disc or similar, to cut the surface of the carriageway along the intended line of excavation. Necessary shoring and road barricades, traffic diversion etc shall be provided by the Contractor.

4.2 Security requirements

The Contractor shall inform the relevant local police station regarding the excavation in public road at least one week prior to commencement.

4.3 Safety precautions

The Contractor shall erect and continuously maintain road signs and adequate lighting through out the night ahead of each end of excavation of trenches, warning about the excavation, until the temporary and Permanent reinstatement are completed. The road signs should be written in red luminous paint on white background so that they are visible at night to the vehicle drivers.

Safety precautions of workers and public shall always be taken during day time and also in night if night works are done.

Contractor shall take all precautions to protect workers, public and third party property during or in the process of rock excavation. In case of rock blasting, all precautions specified in the safety guidelines or Manuals or any other acceptable Manuals to the Employer by the Department of Labour, Sri Lanka shall be strictly followed. Suitable blasting technique shall be selected. Any damages to workers, public, third party property shall be compensated by the contractor at his cost.

Adequate protection shall be provided along the trench excavation to the approval of the Engineer. The excavated material shall not be deposited or dumped along the trench so that it will obstruct the movement of vehicles or pedestrians. If the Engineer or the Road Maintenance Authority directs so, Contractor shall remove the excavated material and store it elsewhere, until it is used for backfilling, at his own cost.

The Contractor shall maintain warning lights and barricades throughout the night at the road crossings until it is temporarily reinstated, or at the trench excavations if it has to be kept open overnight, or at any road excavation as directed by the Engineer.

The Contractor shall supply any reasonable materials and/or manpower necessary to maintain a smooth traffic flow as required and as directed by the Engineer.

4.4 Road Closure

The Contractor shall make every effort to avoid complete closure of the roads for traffic due to the Construction activities.

In any event that this is unavoidable, the Contractor shall obtain the approval of the Engineer to that effect, furnishing all the details of the work. Contractor shall also obtain the permission from the Road Maintenance Authority, Local Government Authorities (MC, UC, PS) the Local Police Station and any other relevant authority, and shall abide by their requirements. The Contractor shall allow in his work programme for any delays which may arise in obtaining such permissions.

Contractor shall obtain necessary Insurance coverage or any other means to compensate the loss of Revenue of the Third Party Business Men, Transport Agencies, Bus Services etc. contractor shall relieve the Employer from any claims what so ever arising out of the closure of road.

5. Trench Excavation in Surfaces Other than Roads

Trench excavation in surfaces other than roads shall include all surfaces except those asphalt surfaces which require road reinstatement. These surfaces include but are not limited to fields, paddy fields, pasture land and the like, footpaths, verges, non-asphalted roads, lanes, alleys, bund embankment and all public and private lands.

Trench excavation located in fields shall, if the Engineer so requires, have temporary fencing erected around that length. Temporary fencing shall not normally be removed until the trench excavation has been refilled and reinstated. The Contractor is hereby notified that generally pipe alignments not in streets are covered with a vegetation growth which must be removed and disposed off the site of work. The Contractor shall have particular regard to the safety of livestock which may be in the area, and shall ensure that all open excavations, access routes and steep or loose slopes arising from the Contractor's operations are adequately fenced and protected. After the erection of temporary fencing where required, the Contractor shall remove top soil to such depth and over such area as may be necessary to provide sufficient material to ensure adequate surface reinstatement of the working areas occupied by the Contractor for construction of the pipeline.

Excavation in Asphalt roads and concrete paved roads shall be done using Asphalt cutter and concrete cutter to avoid damages to other parts of the road. Contractor shall remove re-concrete and Asphalt parts of the excavated soil as directed by the Engineer at this own cost.

6. Temporary Buildings

Temporary buildings sites (squatters) may also occupy pipeline rights-of-way. The Employer will remove the occupants and the Contractor may demolish the buildings

as directed by the Engineer. The Employer, under the laws of Sri Lanka, is not required to obtain easements or be liable for loss of business for construction of water pipelines and appurtenances. However, the Contractor is required to limit the damage to any existing improvement and to make full compensation for any damage done as a result of the construction activities.

7. Bedding Types and Special Protection

It should be ensured that the trench bed is leveled in conformity with the levels as indicated in the drawing. The pipe bedding material shall be well graded and free from organic matter. Excavated material also could be used if it satisfies the requirements laid down in the drawing and with the approval of the Engineer.

The Contractor shall adopt the special bedding type A,B, C and D specified in the relevant type drawing where appropriate. When ground conditions requiring the use of special bedding types are encountered, the Contractor shall inform the Engineer, and with his approval, adopt the proper bedding type. The chainages indicate in the LS drawings for special bedding types, are only for guidance. Decision of the Engineer in this regard shall be final.

The filling material shall be the soil having the maximum dry density under standard conditions of compaction not less than 1600 Kg/m³ with the properties PL<15, LL<40, CBR >20 and the particle sizes not greater than 25mm.

The bedding material shall be Quarry dust, Mined sand or Crushed stone as specified in the relevant type drawing. When sand is used as bedding material, 100mm wide RCC grade 20 barriers at 50m intervals across the trench to cover full widths of the trench and full depth of the bedding shall be provided.

The trench shall have special protection when the soil condition is unfavorable in such a way the bearing capacity is less than 75 KN/m². The Geotextiles shall be used to bear the soil load above where it is specified in the type drawing Nos. WT 403/BT/01A & WT 403/BT/02A (attached) or directed by the Engineer. The Table 2 given below shall be referred for the properties of Geotextiles.

The Geotextiles shall be wholly synthetic and is tropic fibrous material. It shall have properties not inferior to those listed in Table 2.

When the minimum specified cover to the pipe line from the surface cannot be maintained due to some special reason, the Contractor shall adopt the special protection type using concrete pre-cast slabs as specified in the relevant type drawing and as instructed by the Engineer.

TABLE 2

Property	Test Method	Value	Unit
Tensile strength (wet and dry) under uniform applied stress		7500	N/m ²
Grab tensile strength	ASTM 1682 100m	660	N
Trapezoidal tear strength	ASTM 117	300	N
CBR Puncture resistance	DIN 54307E	1600	N
Burst Strength	ASTM 3786	1400	KPA
Pore Size		> 0.03 < 0.10	mm mm
Permeability to water under 100mm head		50	l/m ² /sec

8. Supporting Trench Excavation

The Contractor shall effectively support the sides of all trench excavations which shall include the use of steel sheet piles where necessary to prevent any fall or sliding of the embankments or run from any portion of the ground outside the excavation into the trench and to prevent settlement of or damage to structures adjacent to the excavation. The Contractor shall be deemed to have made his own allowance for shoring up the sides of trenches, any extra excavation necessary to provide space for such support and for any other working space. If for any reason any portion of trench excavation shall give away, the Contractor shall at his own expense take all necessary remedial measures including the excavation and removal of all the ground thereby disturbed.

8.1 Battered Trench Sides

Where the Contractor elects and is permitted by the Engineer to execute trench excavations with battered sides instead of providing support as aforesaid they shall be excavated to stable slopes and heights as a slope of not steeper than one to one from a point of 30 cm above the top of the pipe. The toe shall be set back not less than 30 cm from the vertical face of the trench.

9. Trimming Trench Excavation

When excavating to specified levels for trench excavation or to specified limits for the face of any structure therein required to about undisturbed ground, the Contractor shall not excavate the last 15 cm until the Engineer permits otherwise. Should the Contractor have excavated to within 15 cm above these specified levels or to within 15 cm of these specified limits before he is ready or able to commence the constructional work he shall where required by the Engineer excavate further so as to remove not less than 15 cm and any such further excavation and additional foundation material ordered by the Engineer shall be at the cost of the Contractor. The bottom of trench excavations shall be carefully boned in and trimmed true to grade with the aid of a straight edge at least 6 m long as to ensure a continuous support for the pipes. Any stones or flints either likely to cause the pipe to bed unevenly or to damage the pipe and its coating of greater than 15 mm in size shall be picked out of the trench bottom and any holes so formed shall be filled in with soft material and trimmed to the correct level. All shattered and loose material shall be removed from the bottom of the trench excavations so that the bedding material rests on a solid and clean foundation.

10. Inspection by Engineer

When the specified levels of trench excavation are reached the Engineer will inspect the ground exposed and if he considers that any part of the ground is by its nature unsuitable, he may direct the Contractor to excavate further and to refill the further excavation with such materials as he may direct. Should the bottom of any trench excavation while acceptable to the Engineer at the time of the inspection subsequently become unacceptable due to exposure to weather conditions or due to flooding or have become puddled, soft or loose during the progress of the works, the Contractor shall remove such damaged, softened or loosened material and excavate further by hand. In this case the cost of the extra excavation and of the additional foundation materials required will be the Contractor's responsibility.

11. Disposing Material from Trench Excavation

Subject to any specific requirements of the Contract, the Contractor shall make his own arrangements for the temporary storage of any excavated material which is required for use in refilling trench excavations, including any necessary double handling. In this connection the Contractor shall have regard to the working areas available to him for the construction of the pipeline particularly where this is located in roads or in other places to which the public has free access. Any temporary tips alongside the trench excavations shall be to stable slopes and heights. Where the nature of the excavated material is suitable, the Contractor's temporary storage as aforesaid shall include for separate storage as the Engineer may direct of any of the various grades of material hereinafter specified for the refilling and surface reinstatement of trench excavation, namely, soft material, coarse material, hard material and topsoil. Any excavated material not required for or not suitable for use as refilling as aforesaid or use elsewhere in the Works shall become the property of the Contractor and he shall be entirely responsible for its removal from the Site and for its ultimate disposal. Contractors are reminded that when working along the carriageways it is often not possible to stack or place excavated materials along the

trench and they may be required to remove such materials required for backfill to temporary sites to be provided by the Contractor and to return these materials on completion of pipe laying.

12. Trenches not to be Left Open

Trench excavation shall be carried out expeditiously and; subject to any specific requirements of the Contract, the refilling and surface reinstatement of trench excavations shall be commenced and completed as soon as reasonably practicable after the pipes have been laid and jointed. Pipe laying shall follow closely upon the progress of trench excavation, and the Contractor shall not permit more than 20 m of trench excavation ahead of pipe laying to remain open. The Contractor shall take precautions to prevent floatation of pipes in locations where open trench excavations may become flooded, and these precautions may include the partial refilling of the trench. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trench excavation. The Contractor shall not excavate trenches in more than one location in any one road at a given time without the Engineer's permission.

13. Control of Water

All excavation and placement of backfill and fill shall be carried out in the dry. The Contractor shall furnish, install and operate all necessary machinery, appliances and equipment to keep excavations free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property, or to cause a nuisance or a menace to the public. He shall at all times have on hand sufficient pumping equipment, potable Generators and other machinery in good working condition for all ordinary emergencies, including power outage, and shall have available at all times competent workmen for the operation of the pumping equipment. During excavation, construction of pits, etc. installation of pipelines and fittings, placing of structure and trench backfill and the placing and setting of concrete, excavations shall be kept free of water. The Contractor shall control surface runoff so as to prevent entry or collection of water in excavations. The static water level shall be drawn down a minimum of one of foot below the bottom of the excavation so as to maintain the undisturbed state of the foundations soils and allow the placement of any fill or backfill. The dewatering system shall be installed and operated so that the ground water level outside the excavation is not reduced to the extent that would damage or endanger adjacent structure or property.

i Submittals

Before dewatering is started the Contractor shall file for record purposes only with the Engineer the method, installation and details of the dewatering systems he proposes to use.

ii Release of Groundwater

The release of ground water to its static level shall be performed so as to maintain the undisturbed state of the natural foundation soils, prevent

disturbance of compacted fill or backfill and prevent flotation or movement of structures, pipelines and sewers.

14. Backfilling Trench Excavations and Compaction

The backfilling material to be used shall be as specified above and indicated in drawings for type of pipes at different level in trench. Accordingly the backfill material which shall be used upto 300mm from the top of the pipe, or as indicating shall be a sandy material or quarry dust free of stones, hard objects etc. Excavated earth may be used for this purpose provided it meets the requirements and approved by the Engineer. For the remaining backfill excavated earth could be used if suitable. However the backfill material shall be free of particle size as specified in different level of layers in trench. If excavated material is not suitable the Contractor should bring specified material from outside.

During wet condition, if the excavated material from the trench cannot be compacted to the required degree, the Contractor may be required to use imported materials as backfilling. However if the excavated material have been spoiled by the Contractor due to his negligence, the Contractor shall be required to use imported material as directed by the Engineer at his own cost.

The standard compaction test shall be carried out as per test 12 of BS 1377 – 75 or ASTM D 698 – 98.

The backfill material shall be placed in layers of 150mm thick and well compacted. Where necessary the Contractor shall adjust the moisture content of the fill material either by drying out or by adding water to assist the compaction of the materials. During the compaction the backfill shall have a uniform moisture content equal to or a little above the optimum moisture content recorded in the compaction test. Backfill shall be compacted to a dry density of not less than 98% [or as indicated in the relevant drawing at different layers in the trench] of the maximum dry density. Suitable approved mechanical rammers shall be used for compaction.

The remainder of the refilling may consist of coarse material including broken rock from excavation not greater than 25mm, free and clods of earth larger than 15 cm in size and boulders of any size and shall satisfy the soil properties given in Clause 2(v) hereof provided that the compacted backfill is, in the opinion of the Engineer, sufficiently dense to prevent material from the superimposed layers being washed into the voids in such backfill. This coarse material shall be spread in layers of not greater depth than 20 cm and be thoroughly rammed by an approved mechanical rammer.

The coarse filling is to be carried up to the surface level existed before the commencement of the Works (in roads and footpaths) or (elsewhere) to such level as with the surface reinstatement. Hard material such as broken rock and original road metalling shall not be used for the reinstatement of road.

i. Compaction

Where necessary, the Contractor shall adjust the moisture content of the refill material either by drying out or by adding water to assist the compaction of

the materials. During the compaction, the backfill shall have a uniform moisture content equal to or a little above the optimum moisture content recorded in the Compaction Test. Backfill shall be compacted to a dry density of not less than 98% of the Laboratory Proctor Density when tested in accordance with these specifications. The Contractor shall carry out a minimum of one compaction test each working day that back filling is taking place. The Contractor is advised to use clean sand or other clean granular material approved by the Engineer to obtain the required compaction in the presence of wet conditions, if the excavated materials or selected backfill materials cannot be compacted and the compaction work is held up.

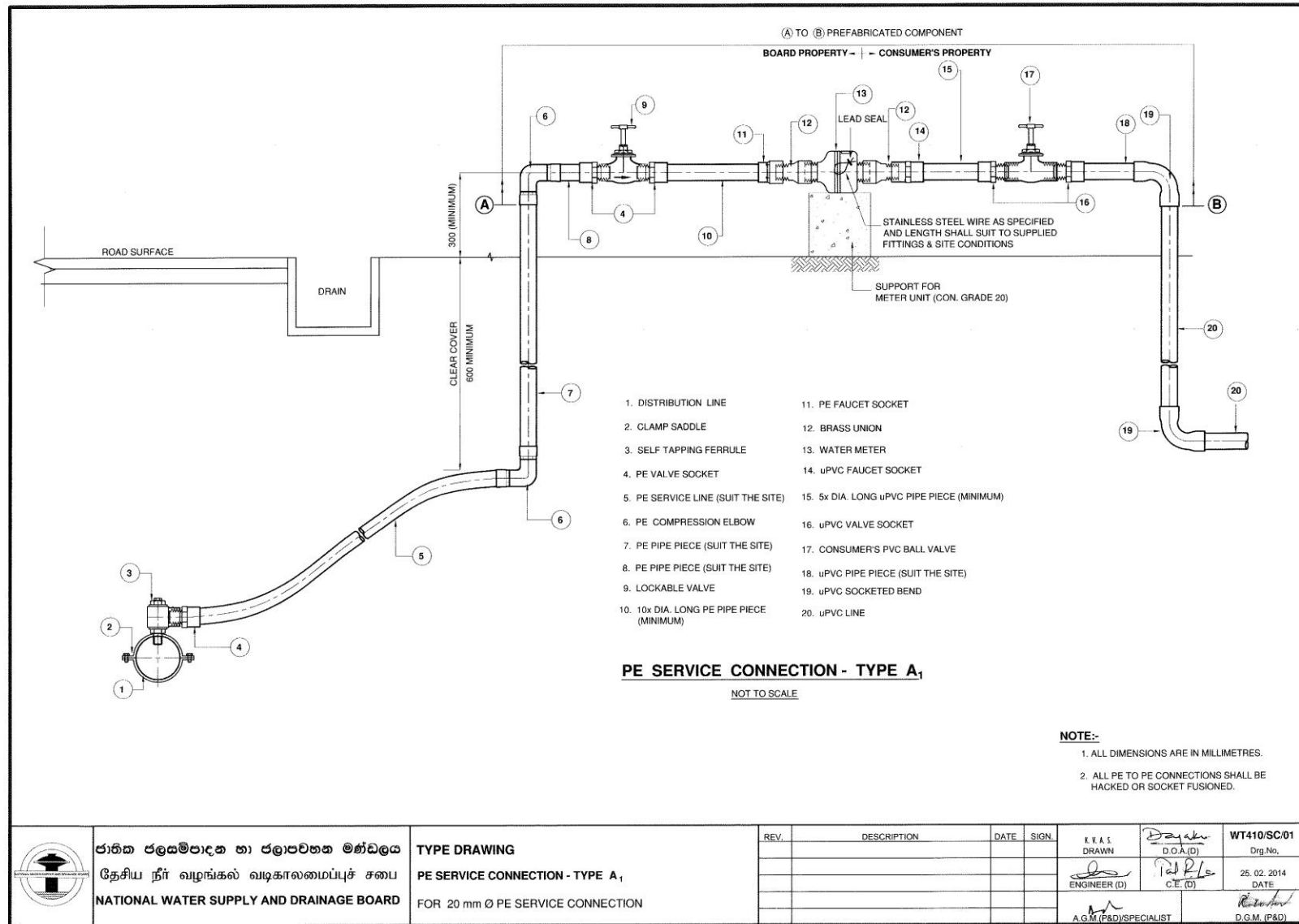
The Contractor is advised to consider the cost of such materials in his rates. Sand backfilling shall only be laid on level areas and the sand water jetted to consolidate completely. When sand or clean granular materials are used, they shall be protected from washing away by capping with 150 mm of lateritic soil with proper moisture content compacted to 98%.

ii Miscellaneous

Should the material being placed as backfill, while acceptable at the time when approved, become unacceptable to the Engineer due to exposure to weather conditions or due to flooding or have become puddled, soft or segregated during the progress of works, the Contractor shall at his own expense remove such damaged, softened or segregated material and replace it with fresh approved material. To permit the proper consolidation of backfill into the voids behind trench sheeting and supports, trench sheeting shall be withdrawn gradually as backfill progresses in depth and along the trench. On no account shall any excavated material be dozed back when refilling trenches in roads and no backfilling shall be carried out unless in the opinion of the Engineer, sufficient mechanical rammers are in operation on that portion of the work. Where directed by the Engineer, trench excavations shall be refilled with concrete.

15. Road Reinstatement

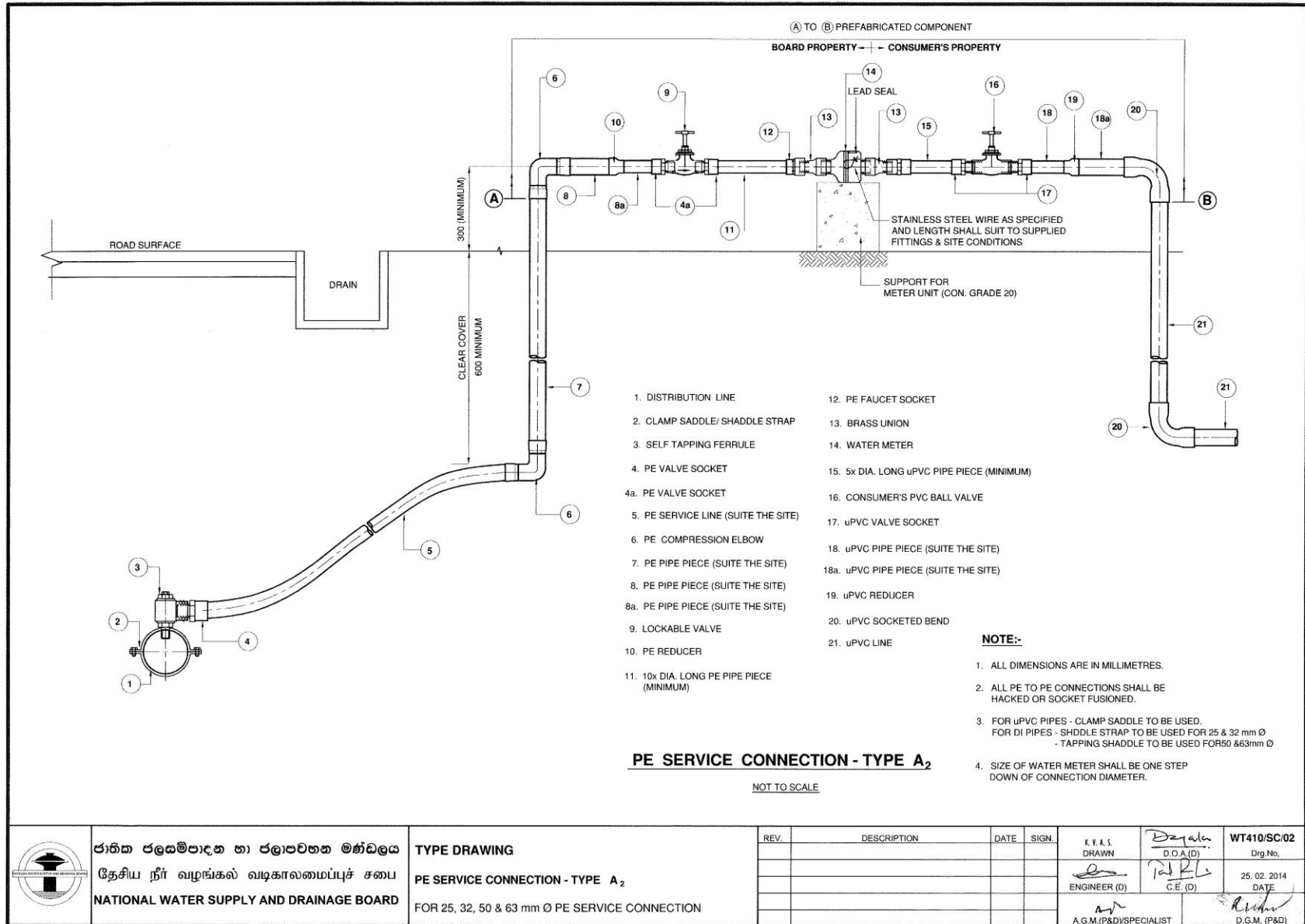
Road reinstatement shall be done as stated in the drawing Nos. WT 403/BT/01A & WT 403/BT/02A and as specified in the ICTAD Specification No. SCA/5, Second Edition June 2009 for Construction and Maintenance of Roads and Bridges.



ජාතික ජලයම්පාදන හා ජලාපවිතන මණ්ඩලය
 தேசிய நீர் வழங்கல் வடிகாலமைப்புச் சபை
NATIONAL WATER SUPPLY AND DRAINAGE BOARD

TYPE DRAWING
PE SERVICE CONNECTION - TYPE A₁
 FOR 20 mm Ø PE SERVICE CONNECTION

REV.	DESCRIPTION	DATE	SIGN.	I.V.A.S DRAWN	DATE	WT410/SC/01 Org.No.
				<i>Dayakar</i> D.O.A.(D)		
				<i>Pat R/S</i> ENGINEER (D) C.E. (D)	25.02.2014 DATE	
				<i>Rohan</i> A.G.M. (P&D)/SPECIALIST		<i>Rohan</i> D.G.M. (P&D)

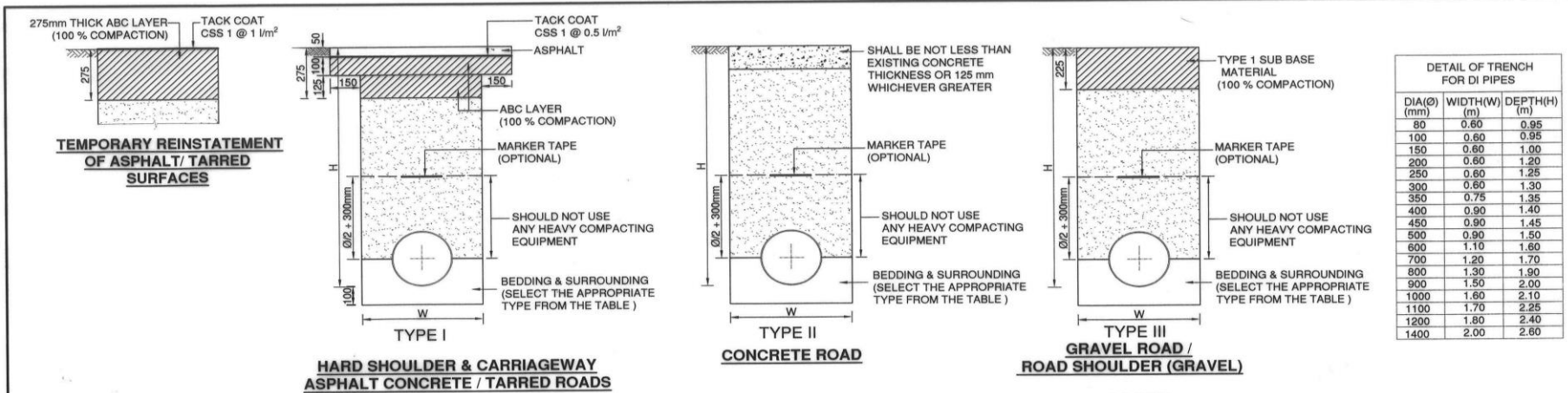


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 தேசிய நீர் வழங்கல் வடிகாலமைப்புச் சபை
 NATIONAL WATER SUPPLY AND DRAINAGE BOARD

TYPE DRAWING
PE SERVICE CONNECTION - TYPE A₂
 FOR 25, 32, 50 & 63 mm Ø PE SERVICE CONNECTION

REV.	DESCRIPTION	DATE	SIGN.

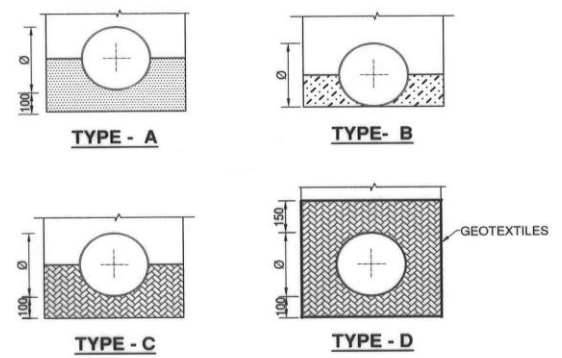
K.V.A.S. DRAWN	Dayala D.O.A.(D)	WT410/SC/02 Dirg.No.
ENGINEER (D)	Pal RL C.E. (D)	25.02.2014 DATE
A.G.M.(P&D)/SPECIALIST		Rishu D.G.M. (P&D)



DIA(Ø) (mm)	WIDTH(W) (m)	DEPTH(H) (m)
80	0.60	0.95
100	0.60	0.95
150	0.60	1.00
200	0.60	1.20
250	0.60	1.25
300	0.60	1.30
350	0.75	1.35
400	0.90	1.40
450	0.90	1.45
500	0.90	1.50
600	1.10	1.60
700	1.20	1.70
800	1.30	1.90
900	1.50	2.00
1000	1.60	2.10
1100	1.70	2.25
1200	1.80	2.40
1400	2.00	2.60

BACK FILLING AND PERMANENT REINSTATEMENT

EXISTING SOIL CONDITION	APPROXIMATE BEARING CAPACITY KN/m ²	TYPE
HARD SOIL/ROCK	>200	A
NORMAL SOIL	100-200	B
LOOSE SOIL	<200	C
CLAY	>75	C
	<75	D
PEAT/MASHY AREAS	<75	D



BEDDING AND SURROUNDING TYPES

LEGEND

- IMPORTED OR EXCAVATED SELECTED BACK FILL MATERIAL TO BE COMPACTED TO A DRY DENSITY NOT LESS THAN 98% OF MAXIMUM DRY DENSITY OF THE MATERIAL, HAVING MAX. PLASTIC LIMIT OF 15% AND LIQUID LIMIT OF 40% AND FREE FROM STONES GREATER THAN 25mm
- QUARRY DUST / MINED SAND COMPACTED.
- EXCAVATED / IMPORTED SOIL FILL COMPACTED OF PARTICLE SIZES NOT GREATER THAN 25 mm WITH THE PROPERTIES PL<15, LL<40, CBR>20
- CRUSHED STONE (<6 mm) COMPACTED

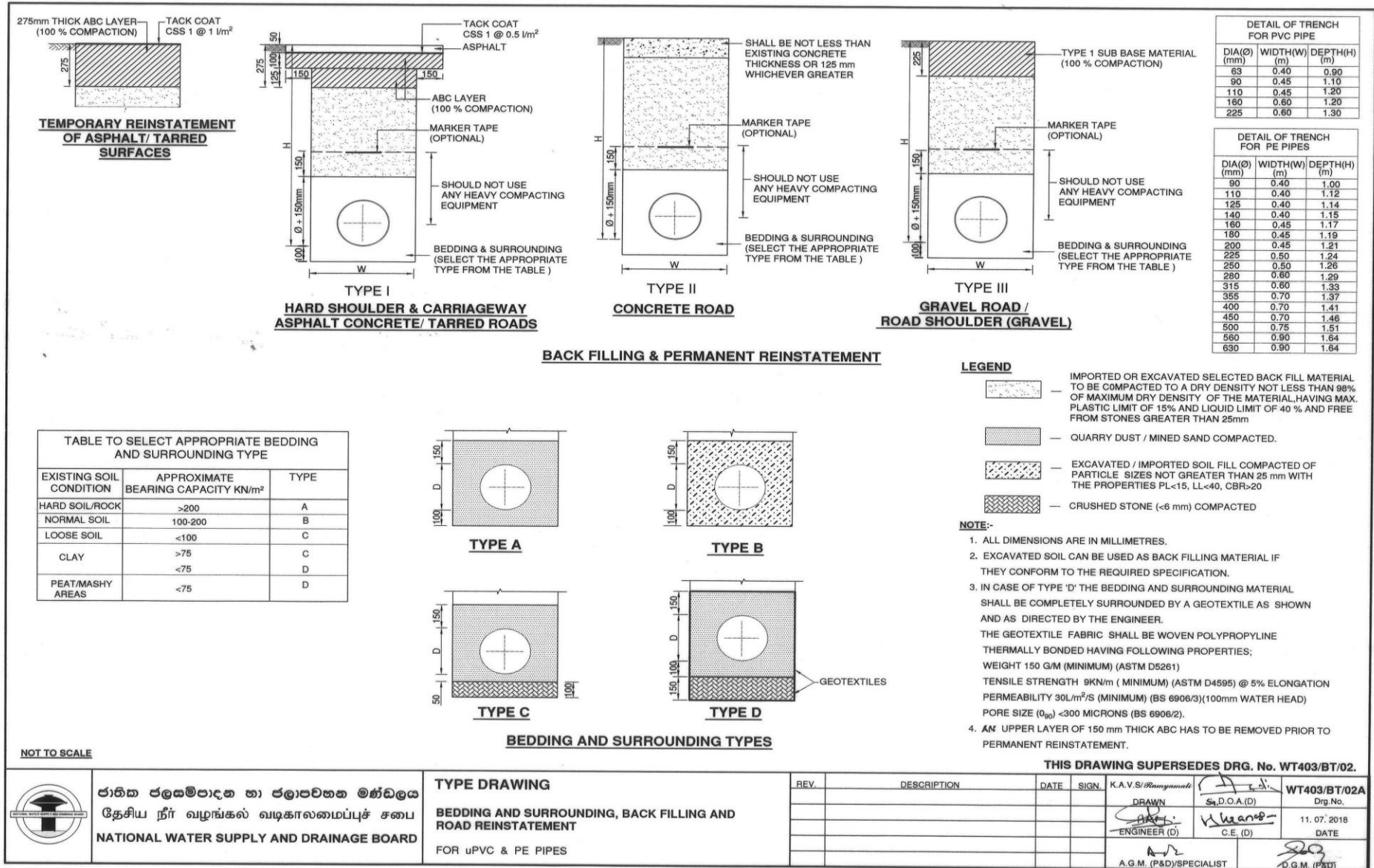
- NOTE:-**
- ALL DIMENSIONS ARE IN MILLIMETRES.
 - EXCAVATED SOIL CAN BE USED AS BACK FILLING MATERIAL IF THEY CONFORM TO THE REQUIRED SPECIFICATION.
 - IN CASE OF TYPE 'D' BEDDING AND SURROUNDING, CRUSHED STONE SHALL BE COMPLETELY SURROUNDED BY A GEOTEXTILE AS SHOWN AND AS DIRECTED BY THE ENGINEER. THE GEOTEXTILE FABRIC SHALL BE WOVEN POLYPROPYLENE THERMALLY BONDED HAVING FOLLOWING PROPERTIES:
WEIGHT 150 G/M (MINIMUM) (ASTM D5261)
TENSILE STRENGTH 9KN/m (MINIMUM) (ASTM D4595) @ 5% ELONGATION
PERMEABILITY 30L/m²/S (MINIMUM) (BS 6906/3)/(100mm WATER HEAD)
PORE SIZE (Ø₉₀) <300 MICRONS (BS 6906/2).
 - UPPER LAYER OF 150 mm THICK ABC HAS TO BE REMOVED PRIOR TO PERMANENT REINSTATEMENT.

NOT TO SCALE

THIS DRAWING SUPERSEDES DRG. No. WT403/BT/01.

<p>ජාතික ජලයම්පාදන හා ජලාපවහන මණ්ඩලය தேசிய நீர் வழங்கல் வடிகாலமைப்புச் சபை NATIONAL WATER SUPPLY AND DRAINAGE BOARD</p>	<p>TYPE DRAWING</p> <p>BEDDING, SURROUNDING, BACK FILLING AND ROAD REINSTATEMENT FOR DI PIPES</p>	REV.	DESCRIPTION	DATE	SIGN.	K.A.V.S./Ranganath	 S.D.O.A.(D) 11.07.2018 DATE A.G.M. (P&D)/SPECIALIST D.G.M. (P&D)	WT403/BT/01A
						DRAWN		
						ENGINEER (D)		DATE

Drawing No. WT 403/BT/01A



Drawing No. WT 403/BT/02A