



The Subgrade Application Manual



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INTRODUCTION

1.0 THE BITUMAT WATERPROOFING AND DAMPPROOFING MANUAL is a composite of the field experience/opinions of Bitumat and prevailing industry practice. It is designed to acquaint readers with waterproofing and damp proofing materials and practices, and to offer guidelines for good waterproofing and dampproofing practices.

Waterproofing and dampproofing practices vary considerably not only in different parts of the world but also within a country due to the variety of conditions that exist and the various materials that are available for use. Many times waterproofing and dampproofing systems are essentially customized, designed for specific structures, and applied on the job site. Adherence to the practices outlined in this manual is an option to be considered in view of local practices and past experiences of the designer and applicator.

Waterproofing and dampproofing is an art as well as a science. The dimensions, quantities, and weights included in this manual reflects approximate measurements of material required for typical waterproofing or dampproofing applications. It is suggested to consult BITUMAT on the intended waterproofing or dampproofing materials or system for any recommendations specific to their products.

This manual is designed to assist and inform the design professional, contractor or owner, of BITUMAT's recommendation on Modified Bitumen systems and application methods, proven over time to provide superior performance. This manual contains the BITUMAT Subgrade Systems and application specifications. These specifications are based on the best available knowledge & technology in the waterproofing industry. It is offered to assist the designer and applicator to specify and install systems conforming to acceptable industry standards.



1.1.0. REFERENCES

This manual has been inspired from the following Codes of Practice:

- DTU 20.12, Design of concrete structure to receive roofing
- DTU 26.2, Tolerances in screening works
- UK CP 144, Part 3 - Roofing Works
- Germany Din 1833X, Roofing Works
- USA NRCA Roofing Manual
- FM Factory Mutual
- Canada CGSB
- USA ASTM
- USA UL

1.2.0. INTERNATIONAL COMPLIANCE & CODES OF PRACTICE

All the typical values of the test results must comply with international standards and codes of practices. It is worth noting that all BITUMAT waterproofing material / systems comply with the applicable requirements of the following associations or standards.

- FM Factory Mutual, USA
- SOCOTEC
- BV Bureau Veritas, France
- UL Underwriters Laboratories Inc.,
- NRCA National Roofing Contractors Association, USA
- BRANZ, New Zealand
- ASTM, USA
- NHA, Kuwait

1.3.0. BITUMAT MODIFIED BITUMEN MEMBRANES COMPLY WITH THE REQUIREMENTS OF FOLLOWING STANDARDS:

- 1.3.1* **UEAtc** (European Association for Technical Agreements)
Ref.: Special directives for the assessment of APP Modified Bitumen membranes.
- 1.3.2.** **CGSB** (Canadian General Standards Board)
Ref.: Standard 37/GP-56M, Modified Bitumen prefabricated and Re-inforced membrane for roofing.
- 1.3.3 *** **ASTM** (American Society for Testing & Materials)
- 1.3.4. **** **DIN** Germany

2.0. Scope

Scope of this manual is sub grade applications including the Underground Tanking system, Basements, Swimming Pools, etc. Only material applicable to these systems shall be used for the waterproofing system.

3.0. Limitations

BITUMAT as a manufacturer, is not involved in the design or construction of buildings or structures. BITUMAT will under no circumstances accept responsibility for the performance of its products when damage to its products results from such things as improper building design, construction faults, or defects in workmanship. BITUMAT does not manufacture sub grade decks and is not responsible for their performance. The various systems and their uses are shown within this manual are designed for a specific purpose; therefore, one system is not necessarily better than the other, and each should be utilized in its respective application according to each project's design requirements.

The design responsibility remains with the architect, engineer or owner, and construction details illustration and description herein are furnished solely for guidance purposes. These guidelines should not be construed as being all-inclusive, nor should they be considered as a substitute for good application practices.

Some construction details may require special treatment to secure water tightness. Therefore, it is recommended that these details are brought to the attention of the manufacturer prior to design. BITUMAT suggests that designers and architects refer to the BITUMAT Technical Department prior and during the design of any waterproofing system. For more information on sub-grade waterproofing and damp proofing, refer to other relevant BITUMAT Design and Installation Manual.

4.0. Physical properties

The typical properties of Bitumat products as stated in the Product data sheets are typical median values and are within normal tolerance limits as stated in the UEA tc and other relevant standards, and may vary under normal manufacturing procedures as such and subject to change without notice.

5.0. Delivery, Handling, Protection and Storage

All Bitumat products are designed for application under specific conditions. Improper handling at any stage can

alter the properties of the product. All Bitumat bitumen membranes and other products are intended to be installed on suitable, dry and smooth surfaces.

All Bitumat membranes and other products are transported on wooden pallets, shrink wrapped for best protection. Unload and handle all roofing materials with care. Examine all materials as they are received. All Bitumat products display legible labels identifying the material.



Look for any damaged or defective material and notify the carrier and manufacturer. Do not expose material to moisture in any form before, during or after delivery to site. Usage of wet or damaged material can contribute to failure of the waterproofing system.

Always store roll goods on end on a clean, raised platform to keep the ends of the rolls free from foreign matter. Rolls stored on their sides will flatten and stick together, making them very difficult to apply and then may cause problems later. Take care to prevent damage to roll ends or ridges.

Do not double stack modified bitumen products. Store all waterproofing materials in a dry, shaded and properly ventilated area.

Keep the temperature of all roll goods above 5°C (41°F) for 24 hours prior to application. Modified bitumen membranes are considerably easy to install when maintained at temperatures above 11°C (51.8° F).

When application of membrane occurs at low ambient temperatures, care should be taken that the rolls are not thrown on the deck or storage area. Sudden impact of the roll can cause cracking of the rolls.

It is suggested to use "breathable type covers, such as, canvas tarpaulins to allow venting and protection from the weather and moisture. Thus the possibility of rolls sticking is eliminated. Care should also be taken during installation when the ambient temperature is around 50 deg C or more.

6.0. Guarantees

Guarantees on BITUMAT material, are available only when the BITUMAT membranes are installed in accordance with the installation guidelines set forth in this manual, and by a BITUMAT approved contractor who is authorized from BITUMAT Co.Ltd to install the BITUMAT material.

7.0. Maintenance

BITUMAT does not use or maintain a building owner's basement/tank etc. and shall not be responsible for their routine maintenance and care. Since BITUMAT has no control over a building's contents, type, quantity, positioning or protection, BITUMAT shall not be responsible for consequential damages in case of waterproofing system failure.

8.0. The Contractor

The sub grade is a very important part of the building. The waterproofing of works in contact with the ground has to be both carefully specified and executed, bearing in mind that the life of the waterproofing has to be equal to that which it is protecting. Since in an underground construction it is extremely expensive to carry out any remedial/repair work, a lack of or a



defective waterproofing would result in the need for major reconstruction at a high cost. The money invested in buying material are worthless unless installed by a professional contractor. Therefore, BITUMAT recommends prequalification of the contractor. A professional contractor must have the following:

- A permanent place of business.
- Official registration documents.
- Knowledge of waterproofing systems.
- Good track record of application.
- Affiliated with a major waterproofing products manufacturer.

Since good workmanship in applying a waterproofing system is essential, qualified supervision of the application should be exercised. The contractor has the sole responsibility for the quality of the application of the waterproofing system.

9.0. Pre-Installation Meeting

A meeting between all parties concerned should be organized on site prior to installation so that each aspect of the application is best understood in the right perspective. BITUMAT strongly recommends that the above procedure must be followed to avoid misinterpretation and to ensure proper installation of the waterproofing system. Agreement shall be reached on all points and particularly on the following :

9.1. A.) Drawings and specifications should be reviewed in detail. If there are differences between the specifications of the architect and the specifications of the material manufacturer, these differences should be incorporated into the job record either as field orders or as change orders.

9.2. B) In the event that waterproofing contractor does not agree completely with the architect's specifications, he should notify the architect in writing before bidding when possible, or commencing any works.

9.3. C.) The clearances that will be required for areas adjacent to waterproofing areas should be established so that the handling of materials and application procedures can be performed in a safe manner. Agreements should be reached for backfilling operations and for use of scaffolding.

9.4. D.) Installation procedures for mechanical devices that will penetrate the waterproofing

membrane should be installed to prevent cutting the membrane after it is installed.

Membrane penetrations should be minimized.

9.5. E.) If the waterproofed surface will be used as a working platform after the waterproofing materials have been applied, an agreement must be reached on how and by whom the membrane will be protected during this construction period.

10.0. MATERIAL REQUIREMENTS

- Membrane
- Primer
- Separation Layer
- Screed
- Screws
- Base Flashing Strips
- Cant Strips
- Control Joints
- Expansion Joint Materials
- Protection Boards/membranes



11.0. Membrane

The ideal membrane for a workable roofing system must be either APP (Atactic Polypropylene) or SBS (Styrene Butadiene Styrene) polymer modified membranes depending on the weathering conditions and design requirements. The membrane should be resilient and suitable for the intended application.

The membrane should conform to international standards. BITUMAT offers a considerable range of waterproofing membranes supplied in various thickness and finish. Users may refer to the product data sheet for more information on the following membranes manufactured by Bitumat.

11.1. BITUMAT APP Modified Membranes
POLYFLAME etc.

11.2. BITUMAT SBS Modified Membranes
PREMIERFLEX etc.

11.3. Primer

The primer should be bituminous conforming to international standards.
BITUPRIME
CONCRETE PRIMER

11.4. Separation Layers

Polyethylene sheets, 150 microns thick OR 160-200 Gsm non woven Geo-textile.

11.5. Protection

Suitable protection boards or membranes must be used. Bitumat Bitutect I, Bitutect II or Bitutect III may be used.

11.6. Hydrostatic Pressure Relief Systems

Based on the practical results and

experience in the recent past, Bitumat strongly recommends a hydrostatic pressure relief system for any sub grade application, as it is a very effective way of minimizing the possibility of leak.



A hydrostatic pressure relief system is a system of perimeter and/or under-slab drains used to regulate the hydrostatic pressure in the earth surrounding a below-grade structure.

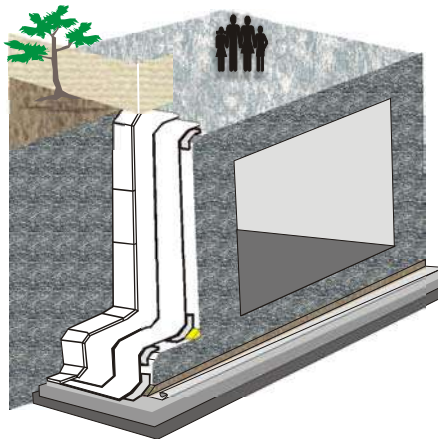
Clearly, the most effective way to waterproof walls and floors placed against earth is to remove the water from the earth prior to it reaching the wall or floor. Each of the waterproofing materials will resist hydrostatic pressure to varying degrees. However, the waterproof integrity of any building can be greatly improved if the hydrostatic pressure against the waterproofing material can be reduced or eliminated entirely. In below-grade structures, the determination of whether a hydrostatic pressure relief system can be used depends upon the quantity of water that must be handled and how it is to be handled or resisted. When gravity can be used to direct water from around the building foundation into a storm sewer, greater amounts of water can be handled than when pumping must be used to lower the water table. Operating the pumps can be costly if there is a great amount of water to handle, and there is always the threat of problems should the pumps fail.

If it is determined that a hydrostatic relief system cannot be economically employed, then the foundation floor slab must be designed with sufficient concrete mass and reinforcement to resist the uplift pressures of the anticipated water table, and the construction has to be carefully waterproofed, which can be an expensive construction process. If a hydrostatic pressure relief system can be employed, then the slab-on-grade can be designed with only surface load considerations, thereby greatly reducing construction costs. Furthermore, waterproofing of the floor slab may not be necessary.

The decision to use a hydrostatic pressure relief system depends upon a careful analysis of soil borings and water table level readings, and should be made with the input of an experienced soils or geotechnical engineer. A site with coarse, permeable soil that freely permits water percolation, combined with a water table level that is above the top of the foundation floor slab, is probably an unlikely candidate for a hydrostatic pressure relief system, particularly if the water table must be lowered by pumping. Conversely, a site with a dense clay soil resistant to water percolation could be an excellent candidate for a hydrostatic pressure relief system, even if the water table level is considerably higher than the foundation floor slab.

Hydrostatic pressure can be relieved from perimeter walls below grade by using a coarse aggregate backfill or

prefabricated drainage product known as a “geo-composite.” These systems channel ground water traveling toward the building down to a perimeter drainage system located below the bottom of the foundation floor slab. The drain system may be installed either at the exterior or interior perimeter of the foundation walls or both, depending upon the specific type of hydrostatic pressure relief system being used. When aggregate is used to relieve hydrostatic pressure against wall surfaces, a separate protection course must be placed against the waterproofing membrane to protect the membrane from damage during aggregate placement.



12.0. Substrate Preparation

Most waterproofing materials are bonded or applied to surfaces that are installed by other trades.

It is essential to the performance of the waterproofing material that these substrates be structurally sound and free from excessive cracks, holes or projections. Certain curing compounds and finishes may affect or interfere with the performance of the waterproofing material. (The use of oils, waxes, and other surface contaminants should be avoided or the contaminants must be removed prior to waterproofing). The waterproofing contractor should visually inspect the substrate surfaces before the application of waterproofing materials, and report any deficiencies so that they may be corrected by the responsible trade. Following are recommended surface preparation procedures acceptable for most waterproofing materials. Other procedures may be recommended or required by the waterproofing material manufacturer.

One of the very major factor that influences the success of the waterproofing system in a basement is the “Continuous Dewatering System”. There has to be a provision

of continuous dewatering till the adequate counter load of concrete has been successfully installed.

Inadequate dewatering, premature closing of the dewatering will adversely affect the systems capabilities to perform.

13.0. Masonry Substrates

Holes, joints, and voids in masonry substrates should be prepared flush with the surface. The masonry surface should be smooth and free from projections. Penetrations through the masonry surface should be grouted tightly.

Irregular existing masonry surfaces that will be waterproofed with a membrane should be finished to a smooth steel trowel surface. An uneven and irregular surface is undesirable as the crests and troughs will lead to irregular pressure being exerted, somewhere being so high that there could be rupturing of the membrane. Many basements have leaked due to negligence in surface preparation.

14.0. Concrete Substrates

Horizontal concrete decks must cure a minimum of 28 days, or as specified by the material manufacturer, to allow moisture to dissipate from the top surface prior to applying waterproofing materials. Total curing is very important and any possibilities of entrapped moisture should be eliminated. For proper waterproofing installation, a space of at least 2 feet (60 cm.) is needed between the exterior face of the foundation wall and the surrounding earth.

Excavation must be kept free of water (as explained before, continuous dewatering is needed) For best results, the waterproofing should be installed in lifts, typically 6 to 8 feet (1.8 to 2.4 m) high, as backfill is placed and compacted.

Not all materials can be used in this application. One has to be selective and rely on those products only which exhibit characteristics of resilience, stability, strength, elongation, rot proof and so on.

15.0. UNDERGROUND TANKING SYSTEM—UTS

Underground tanking system has sometimes been confused with Basement systems. They are two separate and distinct systems and each has its own specific application. It

may be noted that a Basement system is an integral part of the building whereas the Underground tanking is independent of the building structure. Even the way the waterproofing is handled is different. Just to stress that in an Underground tanking system, the membrane is installed from **WITHIN, that is after the vertical wall has been completed**. On the other hand, in a basement system, the horizontal is installed first and then taken to join with the membrane coming from **OUTSIDE** the vertical. Here the system is installed in two parts. First, when the horizontal has been completed and later when the vertical has been completed. In the UTS, we are ensuring that the water does NOT GO OUT of the tank whereas in the basement system, we ensure that the water does NOT COME IN. The main difference is the two is the location of the waterproofing membrane.

15.1. GENERAL

15.1.1. Scope and field of application:

- 15.1.1.1. BITUMAT 2 Layer Tanking System is designed for use as



waterproofing system for underground concrete structure.

- 15.1.1.2. The maximum hydrostatic pressure BITUMAT Tanking System can withstand is equivalent to 10m.
- 15.1.1.3. The base of the system consists of 2 Layers of BITUMAT APP or SBS Modified Bitumen membrane, to be installed as per enclosed systems chart according to the expected water pressure.
- 15.1.1.4. BITUMAT Tanking System is always protected by a suitable protection.

15.2.0. Special considerations:

- 15.2.1. For tanking where expected hydrostatic pressure is higher than 10m, contact BITUMAT Technical Department.

- 15.2.2. For dampproofing application where no hydrostatic pressure is expected, contact BITUMAT Technical Department for suggestion of a suitable and appropriate material and system.

- 15.2.3. Installation of any tanking system requires professional supervision and skilled manpower. The safest way is to insist on a professional waterproofing contractor.

15.3.0. MATERIALS

BITUMAT MATERIALS

15.3.1. Polyflame /Premierflex

Polyflame/Premierflex is a waterproofing membrane made of APP or SBS Modified Bitumen with a non-woven polyester mat reinforcement, black finish with fine talcum on one side and a very thin torch-off polyethylene foil permanently fixed to the other side. The product shows high tensile strength, dimensional stability, ultimate elongation, tear resistance and fatigue resistance.

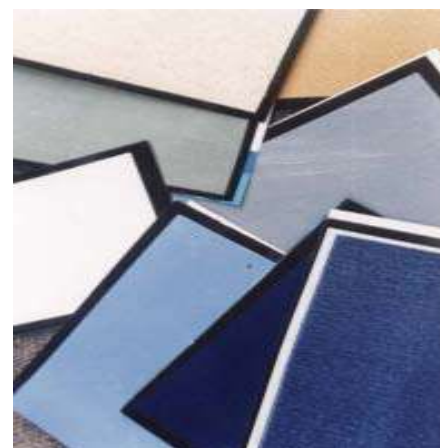
Polyflame/Premierflex

Nominal thickness : 3mm
Nominal weight : 3.5/3.7 kg/m²
Nominal roll size : 1x10 m

Nominal thickness : 4mm
Nominal weight : 4.5/4.7 kg/m²
Nominal roll size : 1x10 m

15.3.2. Glasflame

Glasflame is a waterproofing membrane made of APP Modified Bitumen a non-woven glassfibre mat reinforcement, black finish with fine talcum on one side and a very thin torch-off polyethylene foil permanently fixed to the other side. It shows high dimensional stability, total impermeability and does not rot.



Glasflame 3

Nominal thickness : 3mm
Nominal weight : 3.5 kg/m²
Nominal roll size : 1x10 m

Glasflame 4

Nominal thickness : 4mm
Nominal weight : 4.5 kg/m²
Nominal roll size : 1x10 m

15.3.3. Bitumat Bituprime

BITUMAT Concrete Primer is a solvent based, fast drying, cold applied bituminous primer designed to penetrate concrete surfaces and provide a bondable surface. Packing : 200 litres/drum

15.3.4. OTHER MATERIALS

15.3.4.1. Separation layer

- Polyethylene foil shall be at least 150 microns thick.
- Fibre boards used shall be at least 10mm thick, bitumen impregnated.
- 160-200 gsm non woven geotextile

15.3.4.2. Mortar screed

- Mortar shall be 1:4 cement / sand.
- Screed shall be at least 5cm thick, un-reinforced.

15.3.4.3. Backfilling materials

- Sand, natural soil
- Gravel or stones larger than 50mm size shall be avoided.

15.3.4.4. Expansion joints

Expansion joint covering shall be custom designed to face the specific stresses expected and be compatible with BITUMAT APP/SBS Modified Bitumen membranes.

15.3.4.5. Protection Materials

This could either be bitumen impregnated fibre boards, asphalt boards or protection membrane like Bitumat Bitutect I, II or III.

Note: For Product details, refer to the relevant Product Data Sheets.

16.0. DESIGN OF THE STRUCTURE

16.1. SCOPE

The BITUMAT Tanking System will be installed on 2 different types of substrate:

- Most of the horizontal areas will be laid over blinding concrete before pouring of the main.
- Most of the vertical areas will be installed over retaining walls and then protected before subsequent concrete casting or any other civil work.

The usual procedure is thus a 5 steps procedure:

1. Laying of blinding concrete
2. Laying of horizontal membrane + protection
3. Pouring of structural slabs and retaining walls
4. Laying of vertical membrane + protection
5. Concrete casting or other civil works execution

The responsibilities of the General Contractor and those of the Waterproofing Contractor will be inter related. Cooperation and coordination between them will be necessary.

The scope of this chapter is to summarize the usual duties of the General Contractor.

16.2. BLINDING CONCRETE

• Blinding concrete also called lean concrete, is laid on the bottom of the excavated area after proper compacting of the natural ground. Care should be taken that the compacting is sound and no air gaps/voids left.

• Blinding concrete shall be sound, solid and perfectly dry before tanking system installation. As a matter of precaution, it is highly recommended to wait for maximum curing. The idea is that maximum cracking of the surface is achieved before the primer is applied. In this way, we will avoid new cracking in the blinding.

• Design of the thickness and compressive strength of the blinding concrete shall be done by a specialist Engineer, and shall minimize the expected movement due to load over it (main slab, ...).

Structural walls and slabs :

• Structural reinforced concrete is to be cast-in-place. Pre-cast or pre-stressed concrete is generally not recommended in underground structure.

• Design of the structure shall be done by a specialist Engineer and shall minimize the expected movements due to setting of the building.

• Special attention should be paid to the design of column footing and walls / slab connections to minimize the expected shearing stress, which could affect the tanking system.

16.3. STRUCTURAL DETAILS

• All details (corners, wall / slab connections, expansion joints, pipe penetrations, ...) should be designed as per above considerations and general rules.

• All structural details should be completed before laying of any tanking membrane on such details.

• A professional Waterproofing Contractor and/or BITUMAT Technical Department should be consulted for the design.

16.4. DESIGN OF THE TANKING SYSTEM

• Special attention shall be paid at the design stage in determining the type and the thickness of BITUMAT Waterproofing membranes to be installed. Conditions and requirements varies according to specific project circumstances.

16.5. BITUMAT TANKING SYSTEM

EXPECTED HYDROSTATIC PRESSURE

- a.) 0 to 5 meters head of water
- b.) 5 to 10 meters head of water

FIRST LAYER

- a.) Glassflame/Premierflex
- b.) Polyflame/Premierflex

SECOND LAYER

- a.) Polyflame/Premierflex
- b.) Polyflame/Premierflex

• The expected hydrostatic pressure is usually determined through a soil investigation by specialized Engineers. Special attention shall be paid at the design stage in the evaluation of the possible increase of the hydrostatic pressure in the project area.

Infrastructure works (sewage network, new green areas, irrigation networks,...) may lead to high variation in the water table level.

• The vertical protective covering shall be extended horizontally to cover the concerned connection.

• It is to be noted that the protection of horizontal part of the tanking membrane to be joined later is essential and

requires special care during execution of structural works.

17.0. INSTALLATION

17.1. Surface Preparation

The condition of the surfaces to which the waterproofing materials will be applied is extremely important. Irregularities in the concrete surfaces whether they are abrupt or gradual will affect the success of the waterproofing application.

In all cases the surfaces to be waterproofed must be dry, clean, smooth and free of loose particles, grease, oil and other foreign matters. All irregularities should be removed and all voids should be filled with mortar or grout and made smooth. Wire ties or other exposed steel materials should be cut back.

The dryness of the substrate should be ensured, if necessary, by an adequate pumping system.

The system shall work permanently and shall keep the work areas dry, until such time as the waterproofing, loadings, protection and backfilling have been placed.

17.2. Application of Primer

A.) The surface must be thoroughly cleaned, and all dust, debris, loose materials, oil or greasy substances must be removed. Use an air compressor in case of too much dirt, otherwise brooms and scrapers would be appropriate.

B.) The surface must be completely cured, smooth with no depressions or protrusions and dried to receive the primer.



C.) Shake the container well prior to opening and application.

D.) Apply one coat of primer using a roller brush/ rubber brush/ airless spray etc. at the rate of 0.3 ltr / Sqm, depending upon the condition of the surface.

E.) Allow it to dry. Once the primer is installed and cured, begin the installation of the membrane.

17.3. INSTALLATION OF MEMBRANE

A suitable size (5 x 5 cms) sand cement cant strip is made in all junctions between the horizontal and vertical areas.

17.3.1. Reinforcing Strip

Bitumat recommends the use of a 30 cms wide re-inforcing strip along the cant strip, the vertical and the horizontal area. This will provide strength to the area which are subject to maximum stresses. This is applied prior to the application of the first layer.

17.3.2. First Layer – Fully bonded Horizontal Application

Clean the surface in case of dirt or dust has collected on the primed surface. The positioning of the first layer membrane roll shall be determined. Starting in one corner of the horizontal area, using the base edge of the cant strip as the starting installation. The membrane must be fully torched onto the deck by applying the butane torch flame to the whole width of the roll in order to burn off completely the polyethylene foil and melt superficially the bitumen. A small wave of melted bitumen may appear at the base of the roll in contact with the deck.

Application process starts when the butane torch flame is directed toward the exposed outer surface of the roll until the membrane surface reaches the proper application temperature (generally 200°C) and shows a slight sheen. Another indication that the torchable surface has reached the desirable welding temperatures is the observance of the film burn-off sheet melting, leaving a glossy surface of modified coating to be bonded to the substrate. If flow of modified bitumen coating is observed before contact with the substrate, the welding temperature is too high. Welding temperature is correct when flow from all seams is 3 mm (1/8 in.) to 13 mm (1/2 in.). No flow indicates too little heat and this is again undesirable as due to the low heat the adherence will be weak and suspect.

Care should be taken to avoid over heating which may result in damage of the reinforcement. Torching (the flame should be moved in the shaped of an “L”, i.e. applying about 75% of the flame to the roll and the remaining 25% to the substrate. This heat distribution ensures proper

torching which is balanced) should be done while gradually unrolling and at the same time pressing the membrane sheet towards the substrate to create a heat weld between the membrane, the perimeter of the roof and the cant strip. The flame should be moved from side to side and up the lap edge. When this section of the roll has been securely installed, the remaining part of the membrane should be re-rolled up to the point of application and heat welded in the opposite direction.

Installing additional rolls in a shingle fashion with 10 cm (4 in.) side laps and 15 cm (6 in.) end laps should be continued. Seams at overlaps must be secured for proper welding by running a heated trowel along the edge of the seam to reseal all possible voids in the laps. It is recommended to have about 10 mm flow of bitumen at the seam areas. The seam can be rolled with a hand roller, a trowel or walked in.

All edges must be sealed with the heated trowel by slightly melting the modified bitumen compound evenly creating a finally welded seam. After covering the whole area, re-check to ensure that the membrane is fully heat welded at all laps and around the perimeter of the roof and all roof protrusions. All un-adhered seams shall be lifted with a heated trowel and resealed by lightly torching the seam area. Press or roll seam to achieve a minimum 10 mm (0.4in.) compound flow-out of bitumen. **Never attempt to repair laps by heating the top surface of the membrane.**

Care should be exercised when creating the overlaps so as to ensure that the overlaps size is as per the stated dimensions. The applicator should make use of a chalk line or any other tools to ensure that the overlaps are straight. If the overlaps are not straight then in some areas the overlaps may be less than the stated specifications and this can make the joints weak. Higher overlaps means wastage of material and lesser productivity and profitability.

All end and side laps must be rechecked at the end of the work day for proper bonding. All suspect joints must be promptly resealed. All end laps must be staggered so that no adjacent end laps coincide. If for any reason the end laps do coincide, a full width of Bitumat membrane must be installed over the end laps.

17.3.3. Vertical Application

When the first layer of the horizontal area has been installed, proceed with the first layer of the vertical application. The second layer of the horizontal can commence only when the first layer of the vertical has also been duly completed. It should be noted the first layer of the vertical application will be installed so that it covers the horizontal of the cant strip and extends to about 15 cms along the horizontal i.e along the first layer already installed.

Before starting the application, ensure that the surface is smooth, dry and properly primed.

The roll is opened and aligned in such a manner that the top of the roll is having an overlap of about 15 cms along the horizontal, over the first layer of the horizontal application.

Now the roll is re-rolled, going up the surface. Slow re rolling is done so that proper torching can be done, ensuring a good bond with the vertical wall.

Torching begins from the area along the cant strip and continues upwards. Later the 15 cms horizontal area is completed. Care should be taken to ensure that adequate amount of bitumen flows out of the sides. No air bubbles should be allowed along the vertical. 10 cms side and 15 cms end laps are maintained all along. In no case should the joints be less than the stated, hence the alignment of the roll is very important.

Once the first layer has been installed along the vertical, go back to the horizontal. Now, commence the second layer of the horizontal.

17.4. Second Layer – Fully Bonded Horizontal application

The second layer shall be installed fully bonded to the first. In order to achieve a staggering of the joints, first a starter course of half a roll is installed from the end. Subsequently full rolls are installed. All laps in the sheets shall be installed so as to avoid water edges. End laps must be staggered. All side laps shall be 10 cm, (4 in.) and end laps 15cm (6 in.). Side laps of the first layer shall be in the center of the second layer, never super imposed.

The BITUMAT membrane shall be installed fully bonded onto 1st layer by applying the butane torch flame to the whole width of the roll in order to burn off completely the polyethylene foil and melt superficially the bitumen. A small wave of melted bitumen may

appear at the base of the roll in contact with the first layer. After covering the whole floor area, re-check all seams and laps.

Torching details as stated above (for the first layer) may be followed. The second layer must be terminated about 15 cms along the horizontal (over the cant strip).

17.4.1. Vertical Application

Once the second layer of the horizontal has been completed, proceed with the second layer of the vertical. Use a starter course of half a roll to achieve staggering of joints. The second layer shall be terminated with a 10 cms overlap along the horizontal, over the cant strip. The entire application is done in order to achieve staggering of joints.

18.0. PROTECTION FOR THE WATERPROOFING

Once the waterproofing has been installed, the other tradesmen takeover. There is the pouring of the concrete, the reinforcing bars etc and all have chances of damaging the application. This is the stage that needs protection as there is a very high possibility of physical damage due to physical abuse. Hence suitable protection is needed. It is strongly recommended that the applicator be present on the site during the pouring and the installation of the reinforcing bars.

Prior to pouring protective screed, a layer of 150 gsm Polyethylene or 200 gsm Geo-textile is installed over the membrane.

A bituminous protection board or Bitutect membrane should be installed before backfilling starts.

If blockwall is being erected along the vertical, (from inside, to create a sandwich) it is recommended that suitable protection must be laid in between the membrane and the blockwork.

This is to ensure that whenever, the blockwall settles or cracks, it's ragged edges do not puncture the membrane.

19.0. UNDERGROUND BASEMENT SUBSTRATE

The horizontal system shall be laid on a sound, smooth, clean and dry blinding concrete screed able to undertake the expected hydrostatic pressure without excessive movements.

19.1. Materials

The material shall be:

- A. BITUMAT APP/SBS Modified Bitumen membrane, black finish
- B. BITUMAT Bituprime
- C. Separation Layer : 150 microns thick polyethylene sheet/ 160-200 gsm Geo-textile.
- D. Protection Boards : 10mm thick asphalt impregnated fibre board, Bitutect II.
- E. Protective Screed : 1:3 fine sand / cement mortar, about 5 cm thick

19.2. Installation

Installation here will follow a different path than what was shown in the application for the Underground Tanking System.

The following process will be followed:

1. Install the 1st layer of the horizontal.
2. Install the 2nd layer over the first.
3. Install over the inside wall of the block wall (if this is required due to any reason).
4. Once the vertical wall is constructed(and cured) to install the two layers from outside, making a joint with the two horizontal layers.

19.3. On Horizontal Blinding :

- A. Apply a full coat of primer on the blinding concrete.
- B. Apply BITUMAT first layer fully torch welded onto concrete with 10cm side laps and 15cm end laps fully torched and seamed. Follow the same steps for torching as stated earlier in the Underground Tanking System.
- C. Apply the second layer, fully torch welded onto first layer, with 10cm side laps and 15cm end laps fully torched and seamed. First and second layer side laps shall be staggered. Follow the same steps as stated earlier in the Underground Tanking System.
- D. The two layers shall be extended beyond (about 20 cms) the external face of the vertical wall. This will be covered by polyethylene and light screed which shall be broken to remove the membrane when making a joint with the vertical membranes. In this way we are minimizing the possibility of weathering and physical damage to the membrane.
- E. Prior to any structural works, protect the system by laying a suitable separation layer and a mortar screed.

19.4. On Vertical Walls

Once the vertical wall has been constructed, a cant strip should be made from the outer face of the wall and then allowed to cure.

After execution of the structural works, (foundation slab and retaining walls) the same 2 layer system shall be applied onto the external face of the vertical walls. The screed laid above the installed waterproofing membrane shall be chamfered wherever necessary, so that there are no sharp edges when the external vertical waterproofing is installed.

Special care shall be paid to the execution of the horizontal / vertical connection of the system.

G. Protection boards/membrane shall be applied onto the system prior to backfilling.



Backfilling is a very vital stage and it is recommended to exercise maximum caution so as to avoid any possible damage to the membrane. The protection membrane Bitutect maybe used as this will not only add to the resistance against physical damage but will also provide an additional waterproofing layer.

H. All membrane laying and detailing shall be in accordance with BITUMAT "Underground Design and Installation Manual.

I. Note : Special attention shall be paid at the design stage in determining the type and the thickness of BITUMAT Waterproofing membranes to be installed. Conditions and requirements varies according to specific project circumstances. Contact BITUMAT for technical assistance.

20.0. UNDERGROUND WATER TANKS SUBSTRATE

The waterproofing system shall be laid on a smooth, sound, dry and clean re-inforced concrete structure able to undertake the expected dead and live load without excessive movements.

20.1. Materials

The tanking material shall be:

- A. BITUMAT APP/SBS Modified

Bitumen membrane, black

B. BITUMAT Bituprime

C. Separation Layer : 150 microns thick polyethylene sheet/ 160-200 gsm non-woven geotextile.

D. Protection Boards : 10mm thick asphalt impregnated fibre board, asphalt boards, Bitutect

E. Protective Screed : 1:3 fine sand / cement mortar, about 5 cms thick

F. Lining : The internal lining materials shall be...(Optional) as per specs.

20.2. Installation

A. Apply a full coat of primer on the concrete structure.

B. Apply BITUMAT first layer fully torch welded onto concrete with 10cm side laps and 15cm staggered end laps fully torched welded and seamed. For details of application refer to the Underground Tanking System application details.

C. Apply BITUMAT second layer fully torch welded onto first layer with 10cm side laps and 15cm staggered end laps fully torched and seamed. First and second layer side laps shall be staggered. For details of application, refer to the Underground Tanking System application details.

D. The same 2 layer shall be applied on all vertical areas.

E. Special attention shall be paid to the execution of the horizontal / vertical connection of the waterproofing system.

F. All membrane laying and detailing shall be in accordance with BITUMAT "Underground Tanking Works " Design and Installation Manual.

20.3. Protection

A. The horizontal membranes shall receive a polyethylene separation layer and about 5 cms thick mortar screed.

B. The vertical membranes shall be covered with protection boards.

C. The internal reinforced concrete structure shall then be cast.

Thickness and reinforcements shall be designed so as to provide the waterproofing system a stable mechanical backing to face the expected hydrostatic pressure. By this, the bituminous membrane shall be actually sandwiched and not come in direct contact with the water.

D. The internal lining system shall be installed as specified (Optional).
Note : Special attention shall be paid at the design stage in determining the type and the thickness of BITUMAT Waterproofing membranes to be installed. Conditions and requirements

varies according to specific project circumstances.

Contact BITUMAT for technical assistance.

21.0. SWIMMING POOLS / FOUNTAINS SUBSTRATE

The waterproofing system shall be laid on a smooth, sound, dry and clean reinforced concrete structure able to undertake the expected dead and live load without excessive movements.

21.1. Materials

The tanking material shall be:

A. BITUMAT APP/SBS Modified Bitumen membrane, black finish

B. BITUMAT Bituprime

C. Separation Layer : 150gm/m² non-woven polyester felt/ 160-200 gsm non-woven geotextile.

D. Protective Screed : Sand cement mortar or concrete, reinforced, minimum thickness 6cm or more if external hydrostatic pressure is expected.

E. Finishing : Ceramic tiles, decorative paint, ...(Optional)

21.2. Installation

A. Apply a full coat of primer on the concrete structure.

B. Apply BITUMAT first layer fully torch welded onto concrete with 10cm side.

C. laps and 15cm staggered end laps fully torched welded and seamed.

D. Apply BITUMAT Polyflame second layer fully torch welded onto first layer with 10cm side laps and 15cm staggered end laps fully torched welded and seamed. First and second layer side laps shall be staggered or crossed.

E. The same 2 layer shall be applied on all vertical areas.

F. Special attention shall be paid to the execution of the horizontal / vertical connection of the waterproofing system.

G. All membrane laying and detailing shall be in accordance with BITUMAT "Underground Tanking Works " Design and Installation Manual.

21.3. Protection

I. Apply a separation / protective layer on all the waterproofed area.

J. Lay a concrete screed, reinforced, ...cm thick (Minimum 6 cm).

K. Install the finishing materials as specified.

Note : Special attention shall be paid at the design stage in determining the type and the thickness of BITUMAT Waterproofing membranes to be installed. Conditions and requirements varies according to specific project circumstances.

Contact BITUMAT for technical assistance.

21.4. Protection

Inspection :

Unlike roofing work, flood test is not practical in most waterproofing cases. Therefore, a thorough visual inspection of all membrane installation is necessary before covering. All laps, terminations, and flashings must be carefully checked for any evidence of incomplete adhesion, physical damage or other conditions that may be detrimental to the watertight integrity of the membrane.

22.0. PROTECTIVE COVERING

Because the waterproofing operation is generally required early in the construction process, waterproofing membranes must be protected from the abuse of later construction traffic and the effects of back filling operations. Any puncture, tear or damage will render the membrane useless.

Waterproofing membranes should never be left exposed to the weather and possible abuse from other trades for any length of time after they have been properly inspected and completed.

22.1. Protection of horizontal areas :

- Immediately after execution and check-up, the waterproofing membrane shall be protected by the following built-up:

- 150 micron polyethylene sheet, loose laid, 15cm overlaps

- 3 to 4cm thick sand / cement mortar screed, un-reinforced.

- The screed shall be laid under the supervision of the waterproofing contractor. Dumpers, ready mix trucks, ...shall not have access to the waterproofed area.

- The structural works (main reinforced concrete slab) shall be executed after curing of the protective screed, and before stopping of the pumping system.

- In case of a swimming pool, the

protection will consist of a 150gm / m² non-woven polyester felt and a reinforced concrete or mortar screed of 6cm minimum thickness.

Screed thickness shall be increased if external hydrostatic pressure is expected (below ground pool structure).

22.2. Protection of vertical areas :

A protective covering, usually a pre-fabricated bitumen impregnated fibre board about 10-12mm thick, or Bitutect I, II and III should be installed immediately following installation of the waterproofing membrane.

Protection boards can be installed by the use of bituminous mastics that are compatible with the waterproofing membrane.

- Protection boards should be installed so that the joints are tightly butted to provide adequate protection for the membrane.

Whenever a blockworks wall is foreseen as protector covering, a non-woven polyester felt, 120/140gm, will be placed directly on the waterproofing membrane before blockworks erection.

- Backfilling shall be done with precaution, by avoiding complete backfilling in one go but proceeding by filling in steps of 2 meters only, with sand, natural soil not containing stones bigger than 50mm size.

22.3. Protection of horizontal / vertical connections :

- On the areas where horizontal and vertical waterproofing membrane have to be connected, the horizontal screed will be stopped at 3cm from the vertical wall. After installation of the vertical protection boards, the 2cm left have to be filled with a plastic materials (bituminous sealant). In case of a swimming pool, this joint will be continuous on all wall / floor connection.

- On the areas where such connection have to be done later (erection of horizontal slab + retaining wall after execution of the horizontal tanking), following care shall be observed :

1. The horizontal tanking membranes shall be laid fully bonded at least 30cm more than the expected retaining wall level.

2. The polyethylene + screed protection shall be kept in good condition during execution of all structural works.

2. The polyethylene + screed protection shall be kept in good condition during execution of all structural works.

3. After an execution of structural works, the Waterproofing Contractor shall remove this protection and proceed to the connection of vertical and horizontal tanking membranes.

23.0. SAFETY PRECAUTIONS Work Safely by Working Smart! When in Doubt....Do Not Use ! Prevention is better than cure!



NEVER LEAVE A TORCH UNATTENDED!

As with any construction process, safety is a key element. Therefore, **BITUMAT** recommends that all applicable safety standards and good waterproofing practices be followed. Fire ignition prevention is the applicator's responsibility.

Contact with molten asphalt and torch flames may cause burns. In case of contact with molten bitumen, apply ice or any other applicable cold liquid that is compatible with the skin and call for medical care immediately.

Torching devices should not be left unattended and should not be allowed to get in touch with flammable materials. Torch flames should be kept moving and properly monitored all the time.

Keeping the torch flame directed towards one area for any period of time may result in ignition with surface or other flammable material. Don't torch anything that cannot be seen. Don't torch near gas lines, electrical wires or flammable vents. Follow the torch manufacturer's safety precautions prior to using the torching tools. All fittings for application tools must be

thoroughly checked prior to starting the application process. Propane torch should not be used except in properly ventilated areas. Application staff must remain on site at least one hour after completion of installation to inspect for any possible flames, smoke, or smolders of any combustible material.

- Do not use trowel or other tools as a torch stand
- Do not use cigarette lighter or matches to test for leaks
- Do not keep the fire extinguisher next to LP tank
- Do not use hoses which are old and worn out
- Always check the equipments for safety before starting work
- Always wear the proper roofing dress, wearing full sleeves overalls only
- Always use soap solution to check for gas leaks before lighting
- Always keep a bucket of cold water handy in case of burns
- Conduct a safety drill on a frequent basis
- There should be a trained nurse on site who is familiar with the first aid procedures
- If working with scaffolding, ensure the sturdiness and proper placement
- Ensure safety of the side rails on the roof
- Always be alert to the site surroundings

24.0. SPECIAL CONSIDERATIONS:

Cold Weather Application

Waterproofing materials cannot be applied unless correct asphalt application temperatures can be maintained. Waterproofing membrane application shall not be continued during very cold weather conditions.

A.) When water in any form is present on the deck, application procedures must be suspended until the deck has dried. Any moisture present at the time the waterproofing is applied may result in poor adhesion and blistering of the membrane.

B.) Store membrane rolls and coatings in an area heated at a minimum temperature of (55°F) 12.6°C when the ambient temperature and wind chill factor is below (45°F) 7.1°C. This will help in the ease of application, and reduce the potential of membrane coating cracking during their handling and application.

C.) Install membrane rolls immediately after removal from storage to avoid membrane cooling to below (45°F) 7.1°C.

D.) During installation, if surface cracking appears in the membrane, discontinue installation immediately and contact Bitumat Technical Department.

E.) If temperatures at night are at or below (45°F) 7.1°C, never start applying first thing in the morning. The surface over which the membrane is to be installed must be allowed to warm to a temperature above (55°F) 12.6°C.

E.) If temperatures at night are at or below (45°F) 7.1°C, never start applying first thing in the morning. The surface over which the membrane is to be installed must be allowed to warm to a temperature above (55°F) 12.6°C.

F.) On those days when ambient temperature is greater than (55°F) 12.6°C, remove from the protected storage area only those rolls that will be installed the same day. These rolls must be unrolled, with the back side up and allowed to relax and warm. Then re-roll to apply. If the outside temperature is less than (55°F) 12.6°C, then remove only those rolls that can be applied immediately.

G.) Do not apply waterproofing materials when the ambient temperature and wind chill factor is below (45°F) 7.1°C unless the following recommendations for application during cold weather are followed:

1. Waterproofing installation at temperatures below (45°F) 7.1°C require special precautions to insure satisfactory performance of the finished deck. Remove all traces of moisture from the deck before applying waterproofing.

2. Discontinue work if proper bitumen application temperatures cannot be consistently maintained or materials cannot be securely attached to their substrate;

3. Do not overheat APP membranes to compensate for cold temperatures.

4. When torching, unroll the membrane slowly to ensure proper flow of the coating.

5. Never throw rolls of membrane on the deck or storage surface. Sudden impact of the roll can possibly cause cracking of the coating. On guarantee roof system applications, Bitumat reserves the right to stop roofing installation, when in the opinion of the Bitumat representative, weather conditions or application methods are unacceptable.

25.0. TROUBLE SHOOTING

- Never start work if the deck is not satisfactory.
- Never start work if the deck is not fully dried.
- Never use material which is wet or damaged.
- Avoid exposing materials to moisture in any form before, during or after delivery to the site.
- Always store goods on end in a clean, dry and ventilated area.

- Avoid storing materials at temperatures below (55 deg F) 12.6 deg C.

- Do not begin work when inclement weather is forecast to occur prior to the anticipated time of completion of the work item.

- Do not install materials during inclement weather, except for temporary work necessary to protect installation.

- Do not apply the membrane if the ambient temperature and the wind chill factor is below 7.1deg C (45 deg F).

- During cold weather never throw rolls of membrane on the deck or storage area.

- Always insist on a pre-roofing conference with all the concerned parties

- **Always “relax” the membrane prior to torching.**

- Special care to be exercised when torching, avoiding both under and over torching.

- Ensure staggering of laps when doing a two layer system, laps never coinciding.

- Appropriate precautions to be taken when torching on site

- Ensure proper seam integrity by rolling over the laps.

- Never install on fresh plaster. It will lead to wrinkling and buckling.

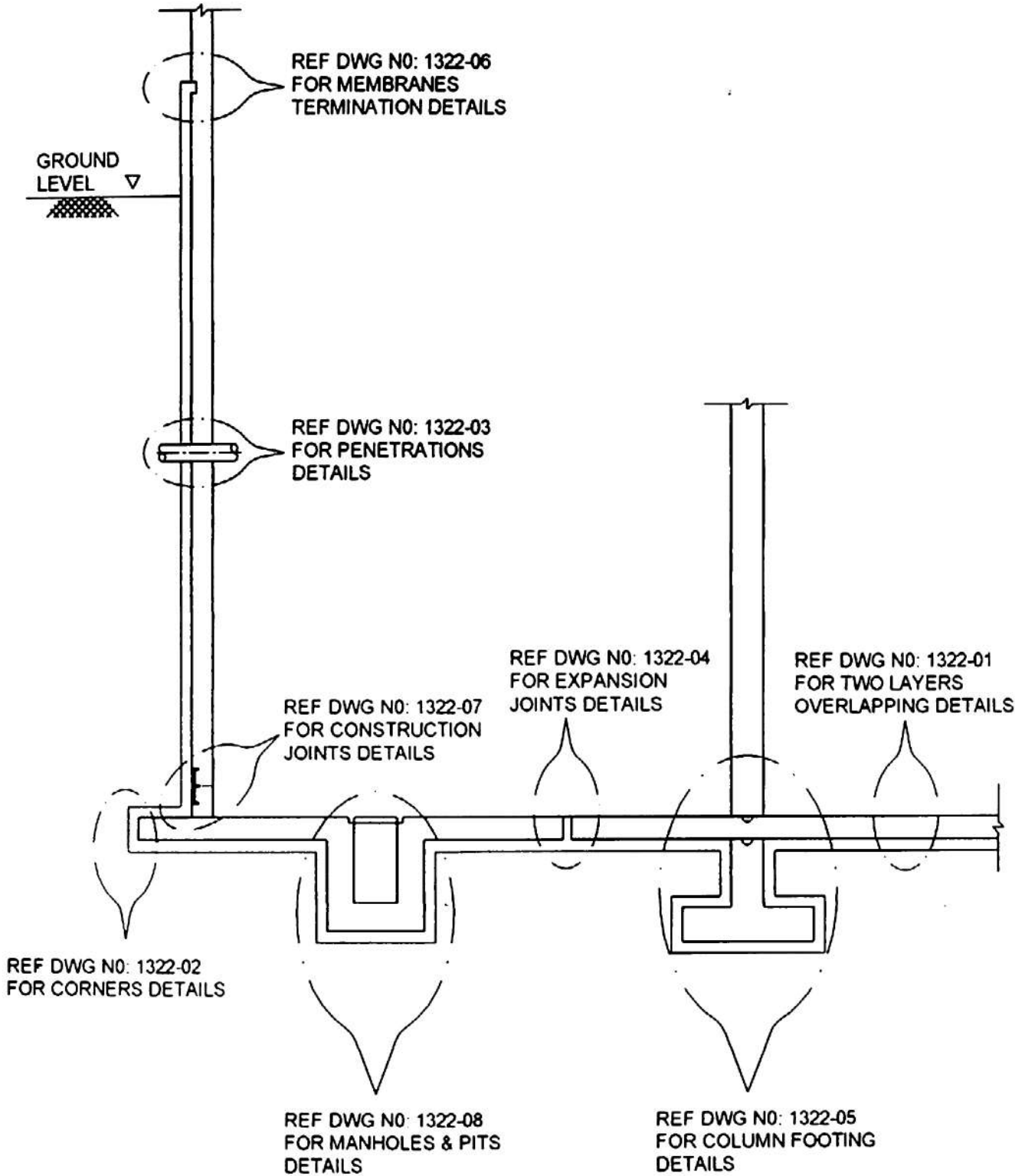
- Maintain the right size of overlaps.

- Cover immediately to avoid any damage.

- Insist on a proper safety programme on the site.



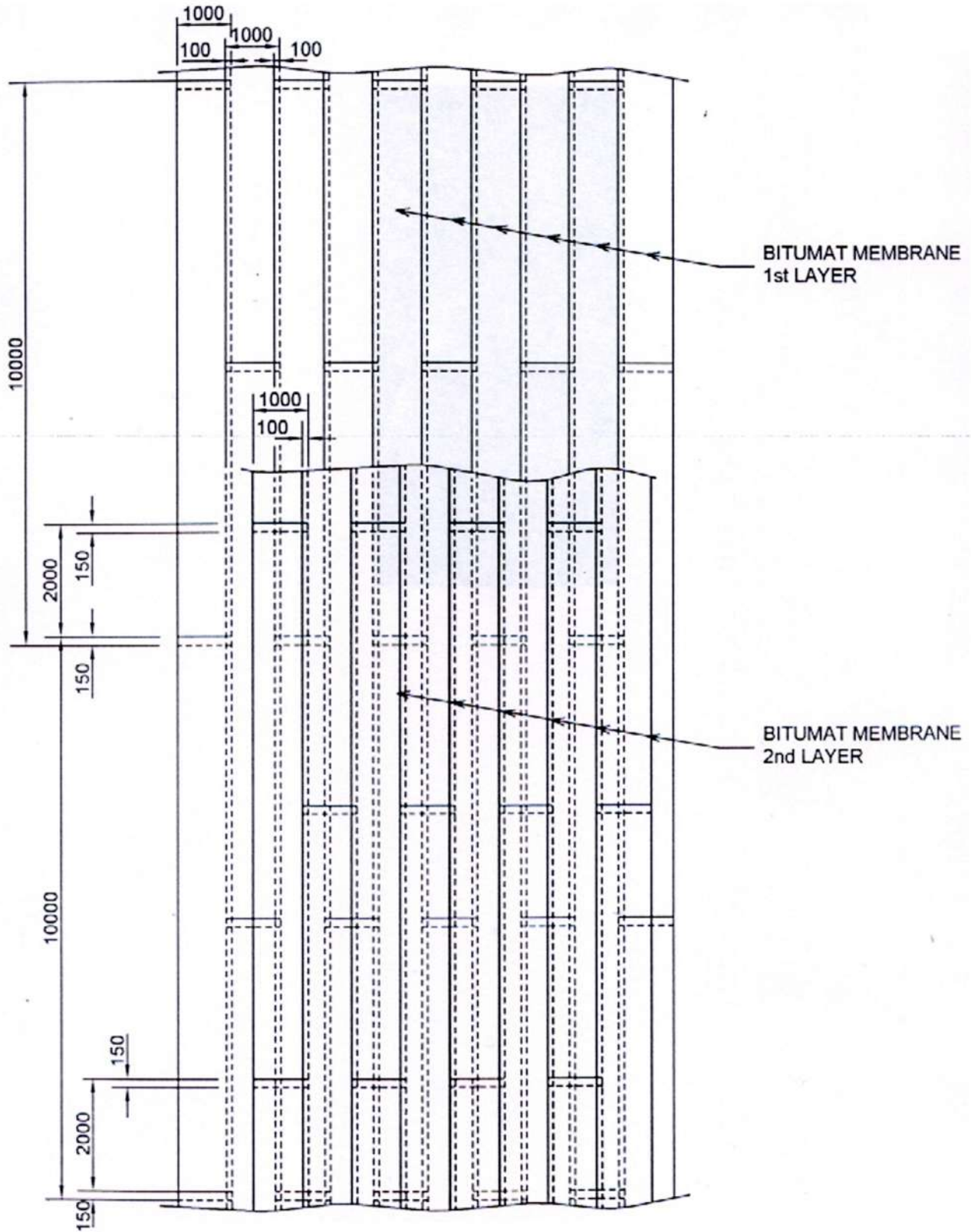
UNDERGROUND TANKING SYSTEM



KEY TO DETAILS



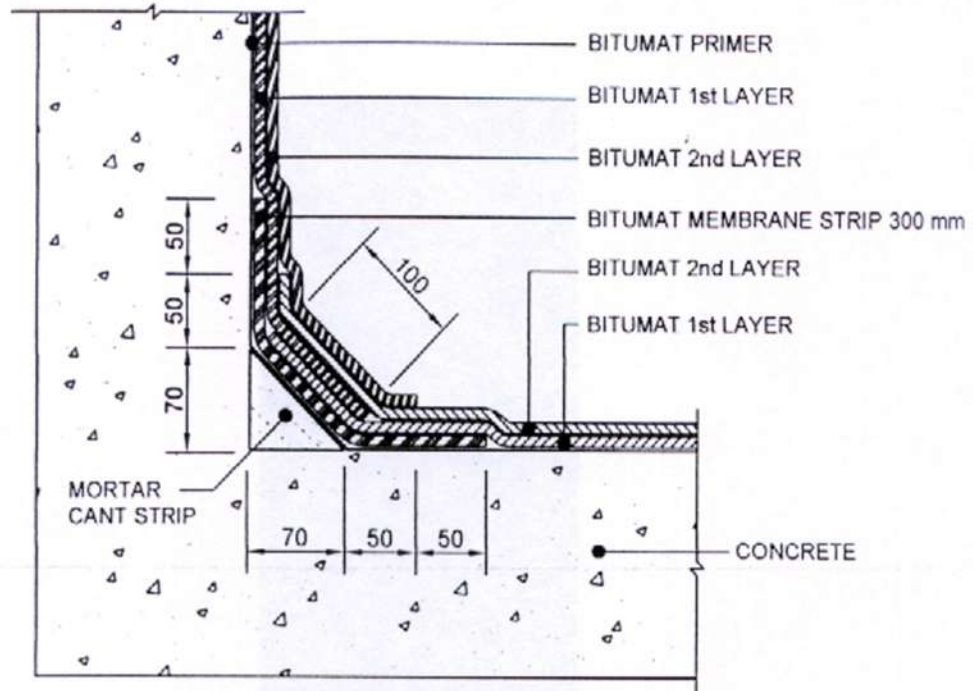
UNDERGROUND TANKING SYSTEM



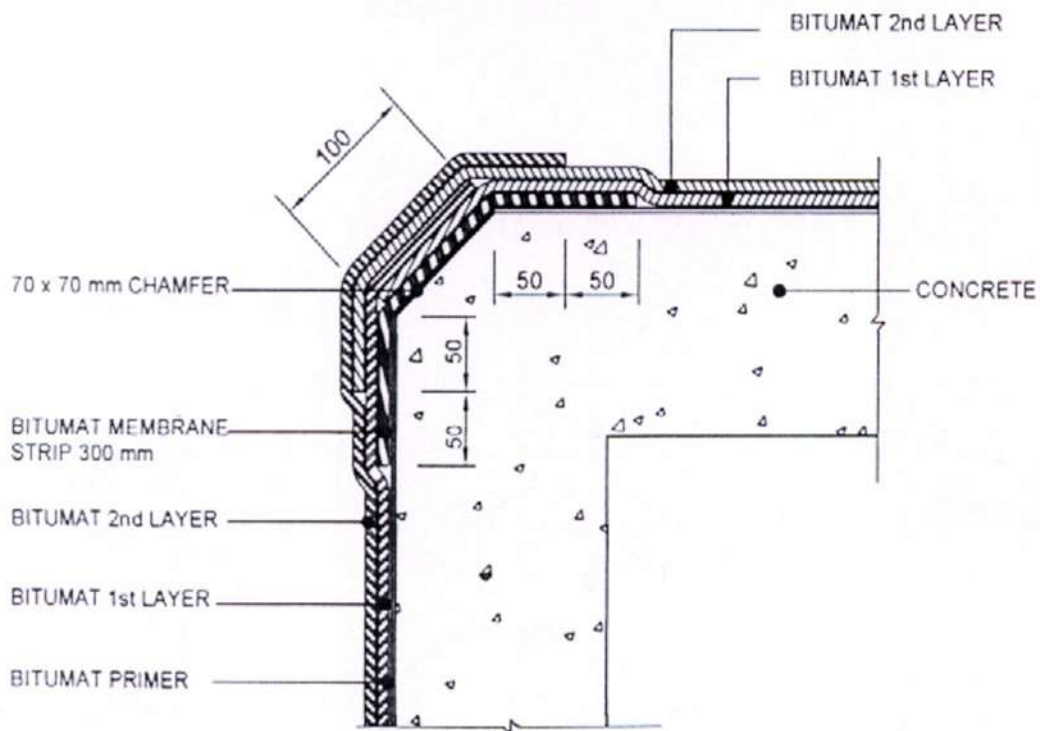
OVERLAPPING METHOD (TOP VIEW)



UNDERGROUND TANKING SYSTEM



INTERNAL CORNER

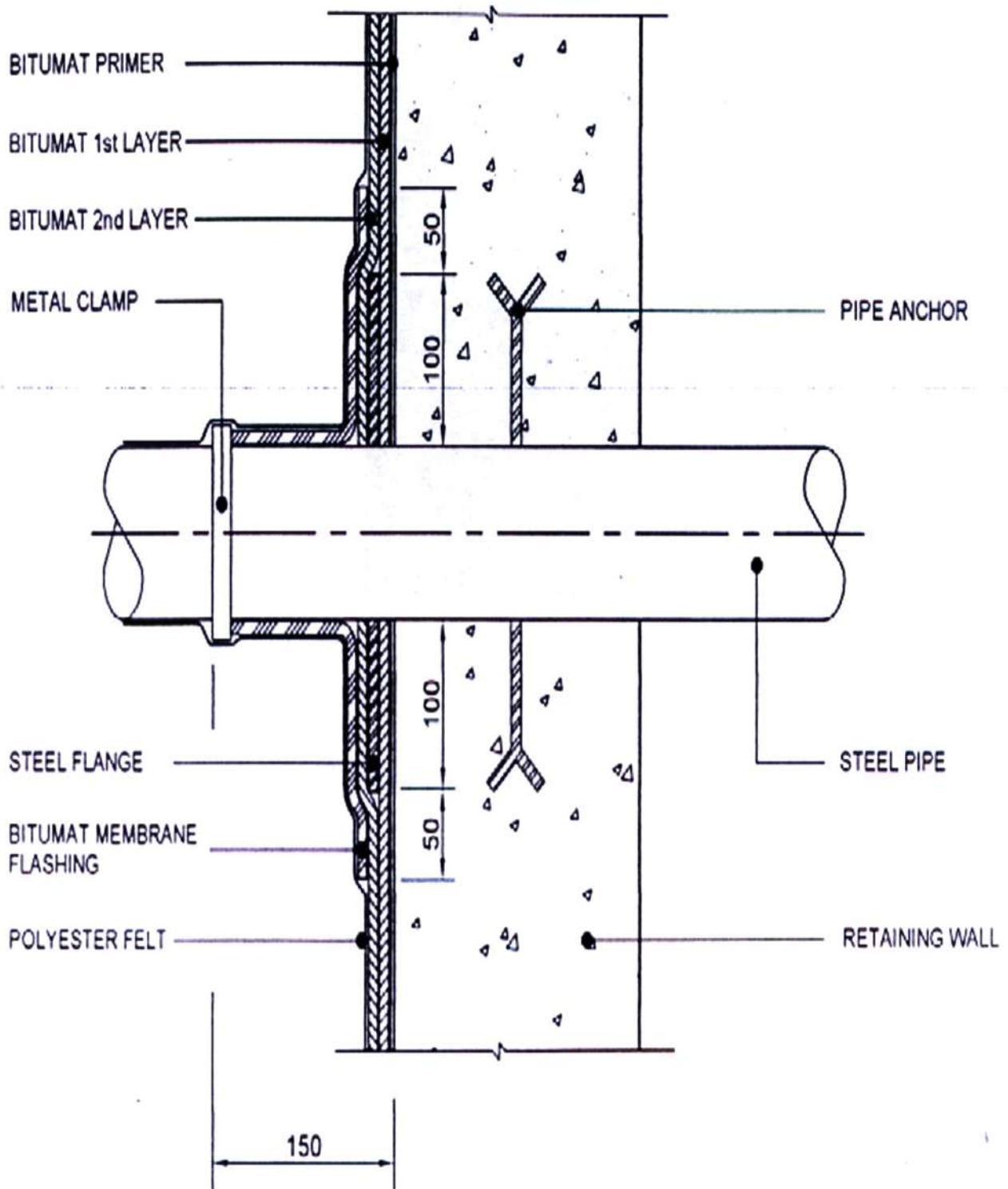


EXTERNAL CORNER

CORNER DETAILS



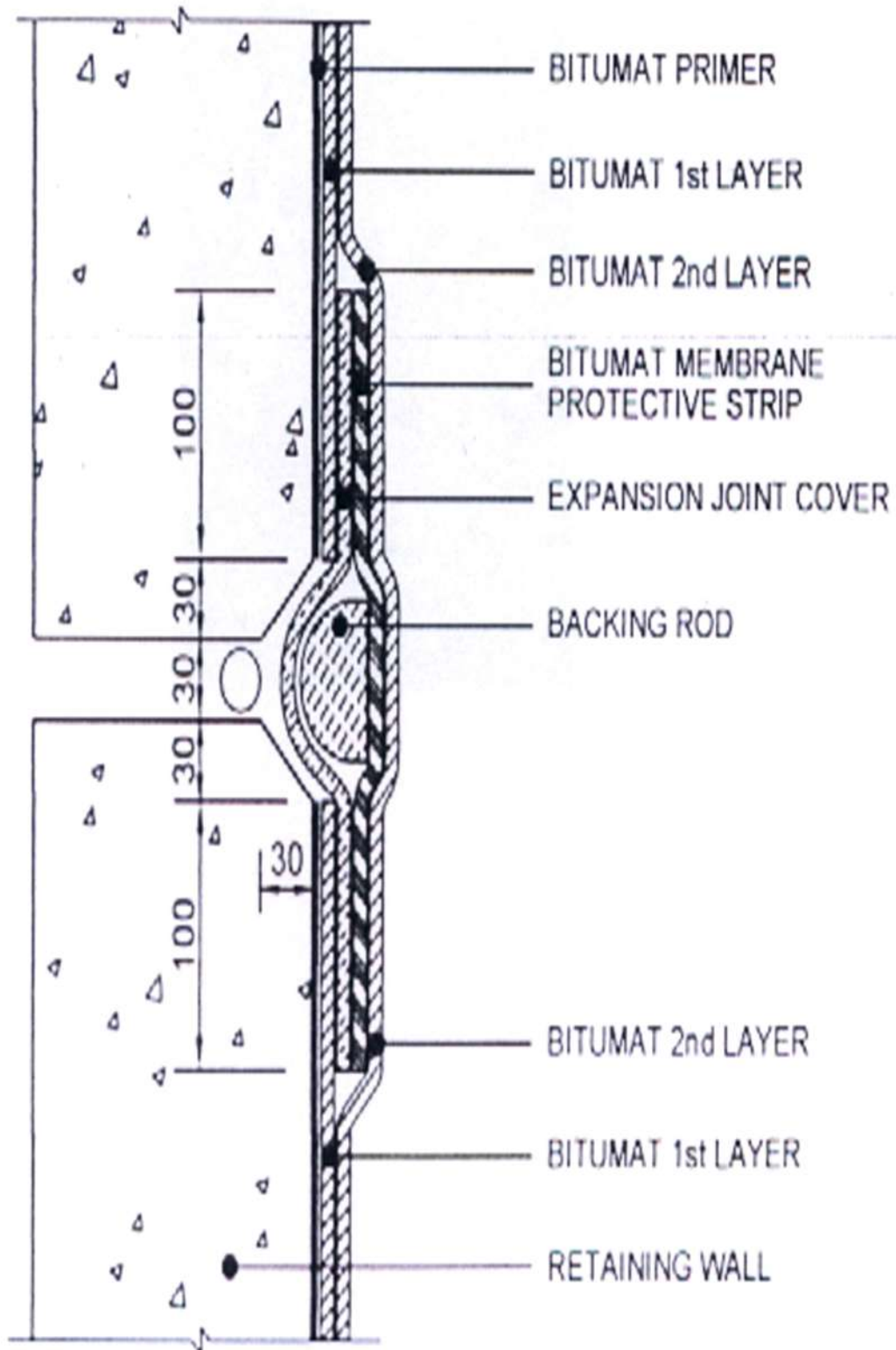
UNDERGROUND TANKING SYSTEM



PENETRATIONS



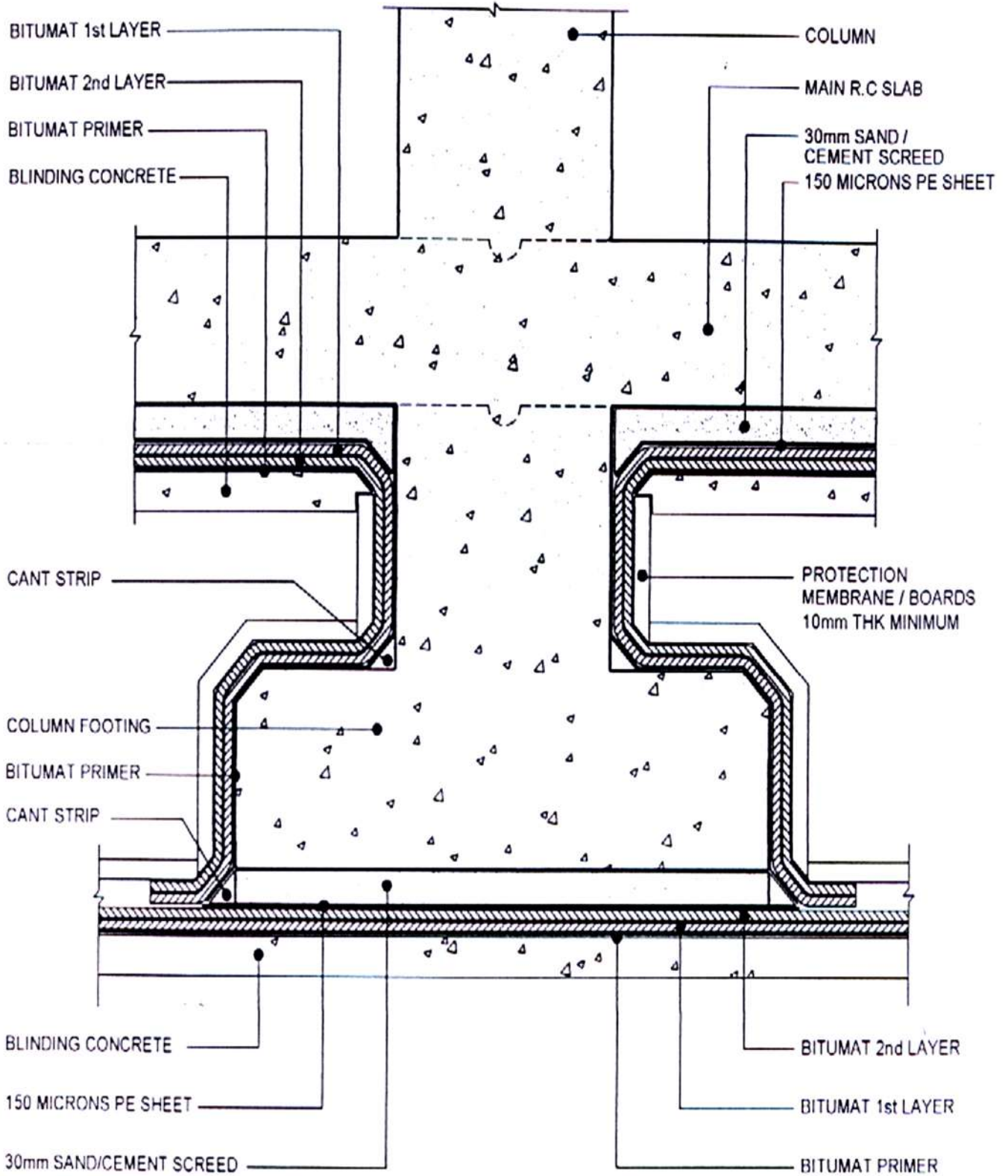
UNDERGROUND TANKING SYSTEM



EXPANSION JOINTS

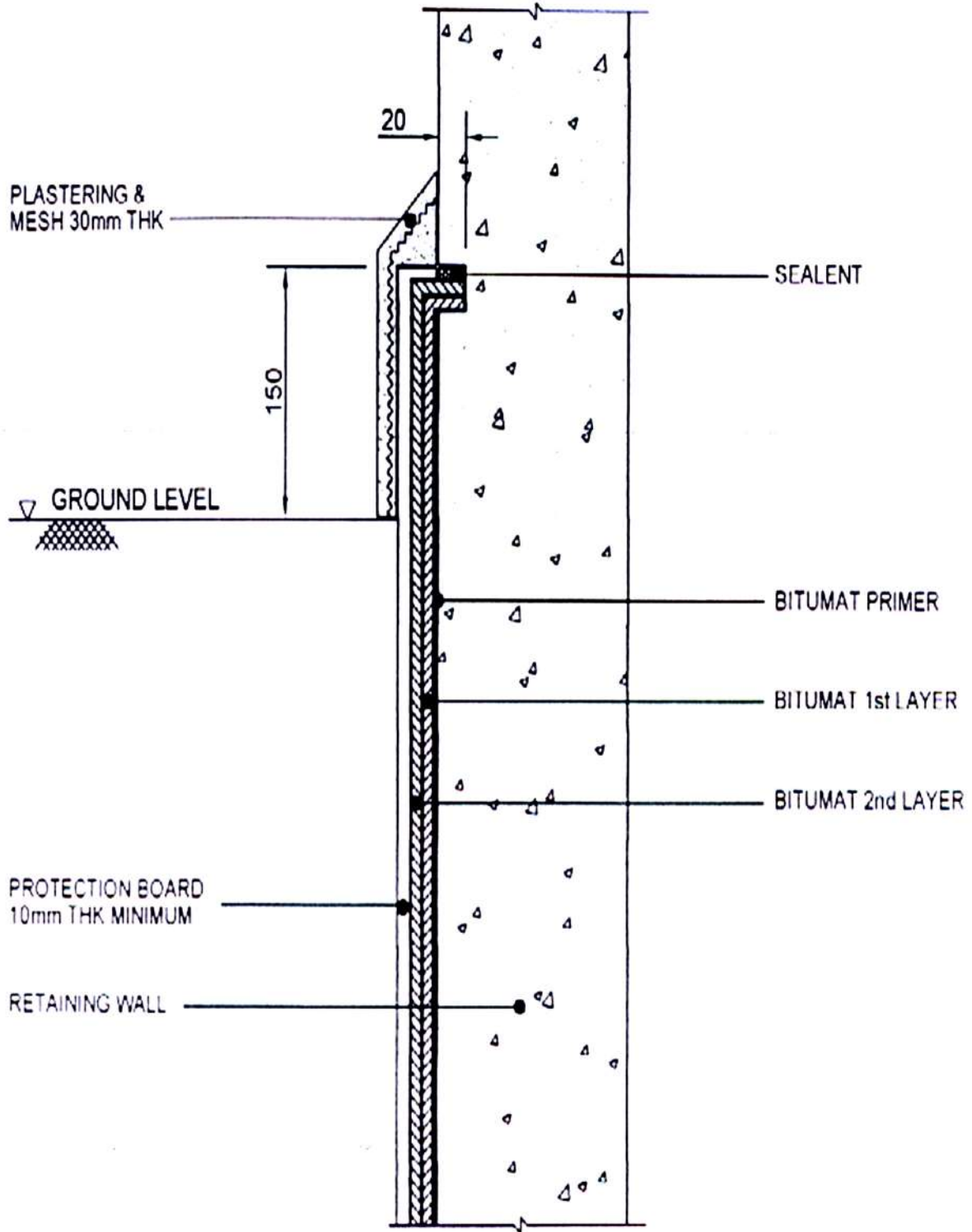


UNDERGROUND TANKING SYSTEM



UNDERGROUND BASEMENT

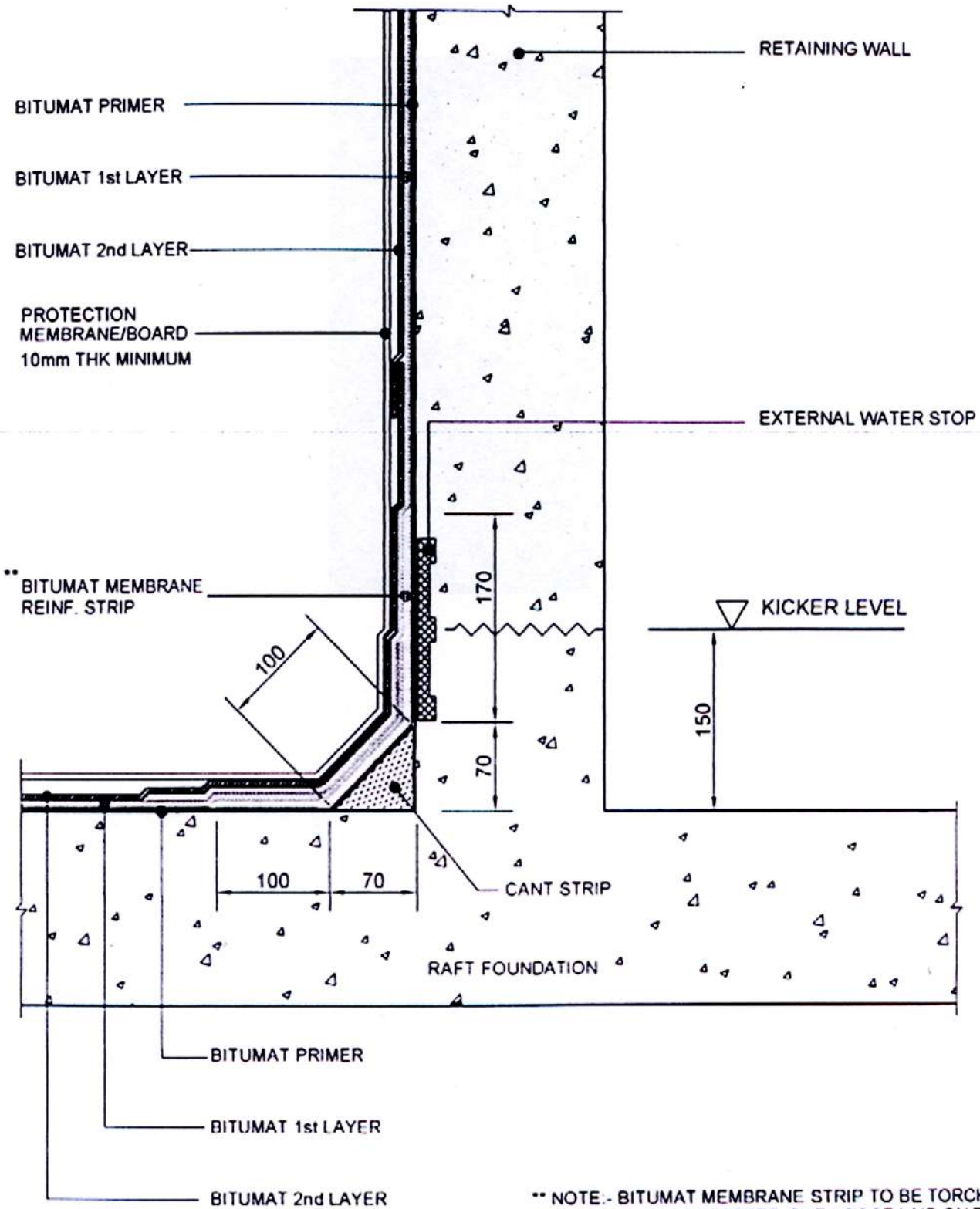
UNDERGROUND TANKING SYSTEM



MEMBRANES VERTICAL TERMINATION



UNDERGROUND TANKING SYSTEM

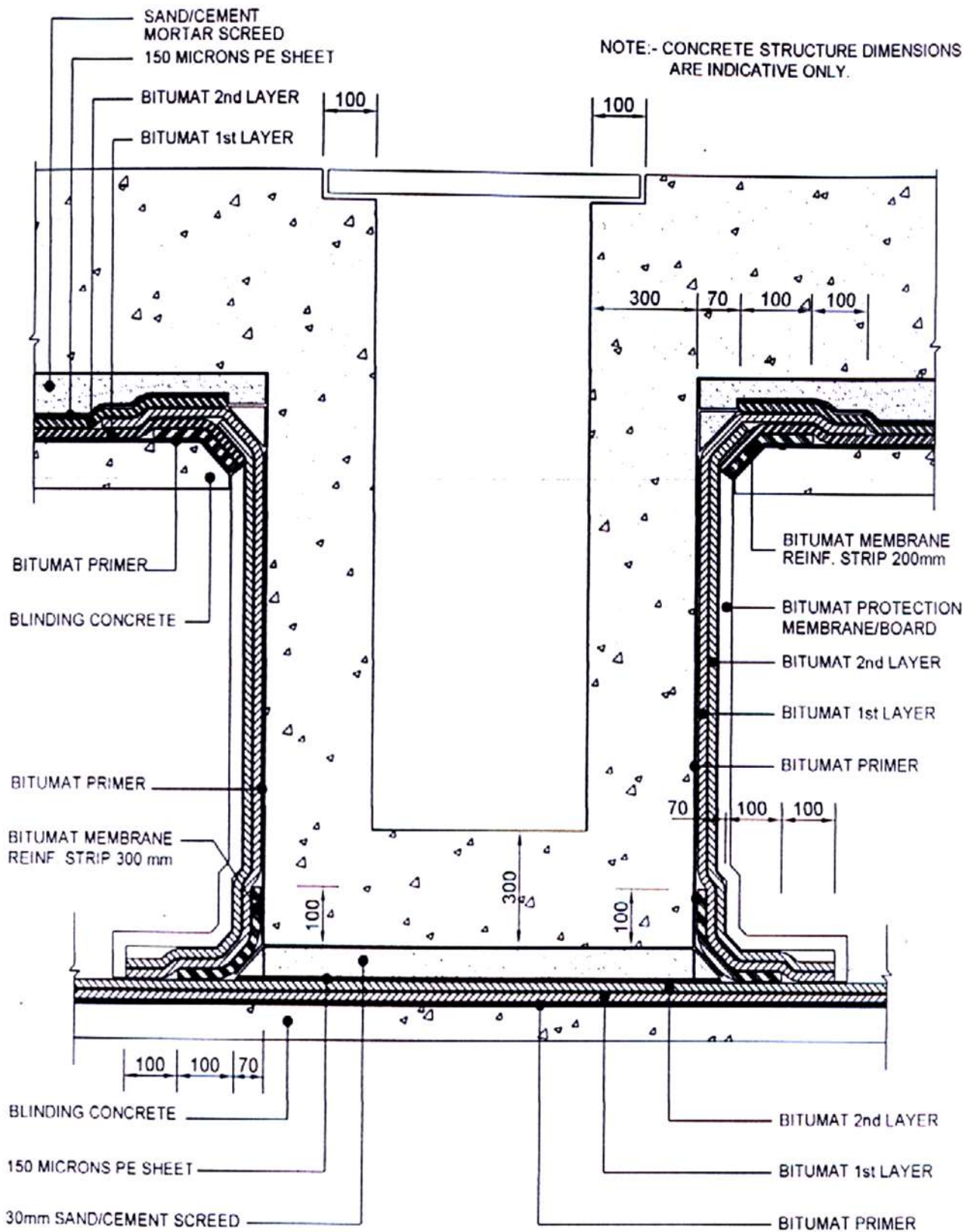


** NOTE:- BITUMAT MEMBRANE STRIP TO BE TORCHED ON TO CONCRETE, BUT LOOSE LAID ON TO KICKER WATER STOP

CONSTRUCTION JOINTS



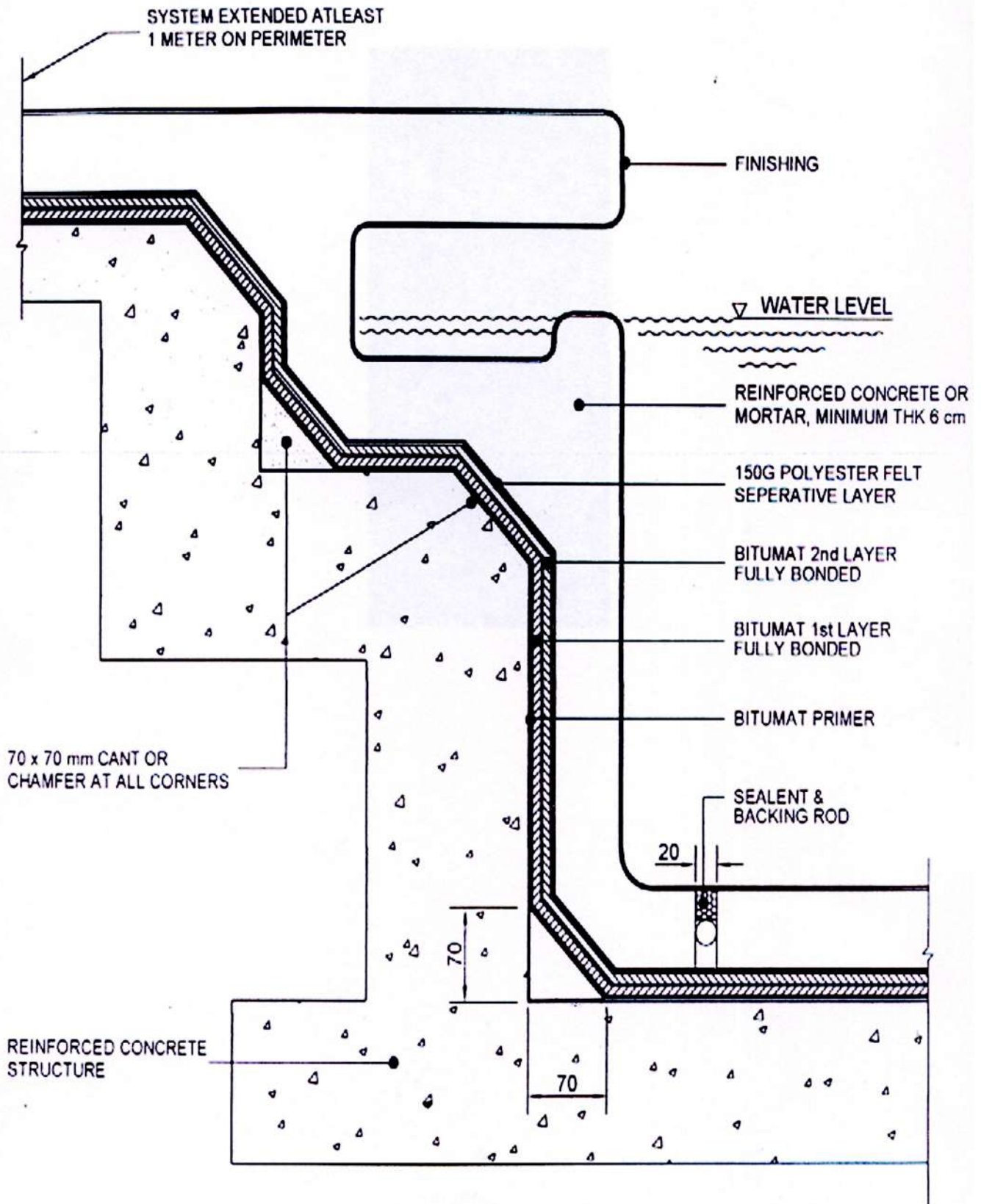
UNDERGROUND TANKING SYSTEM



TYPICAL MANHOLE SECTION



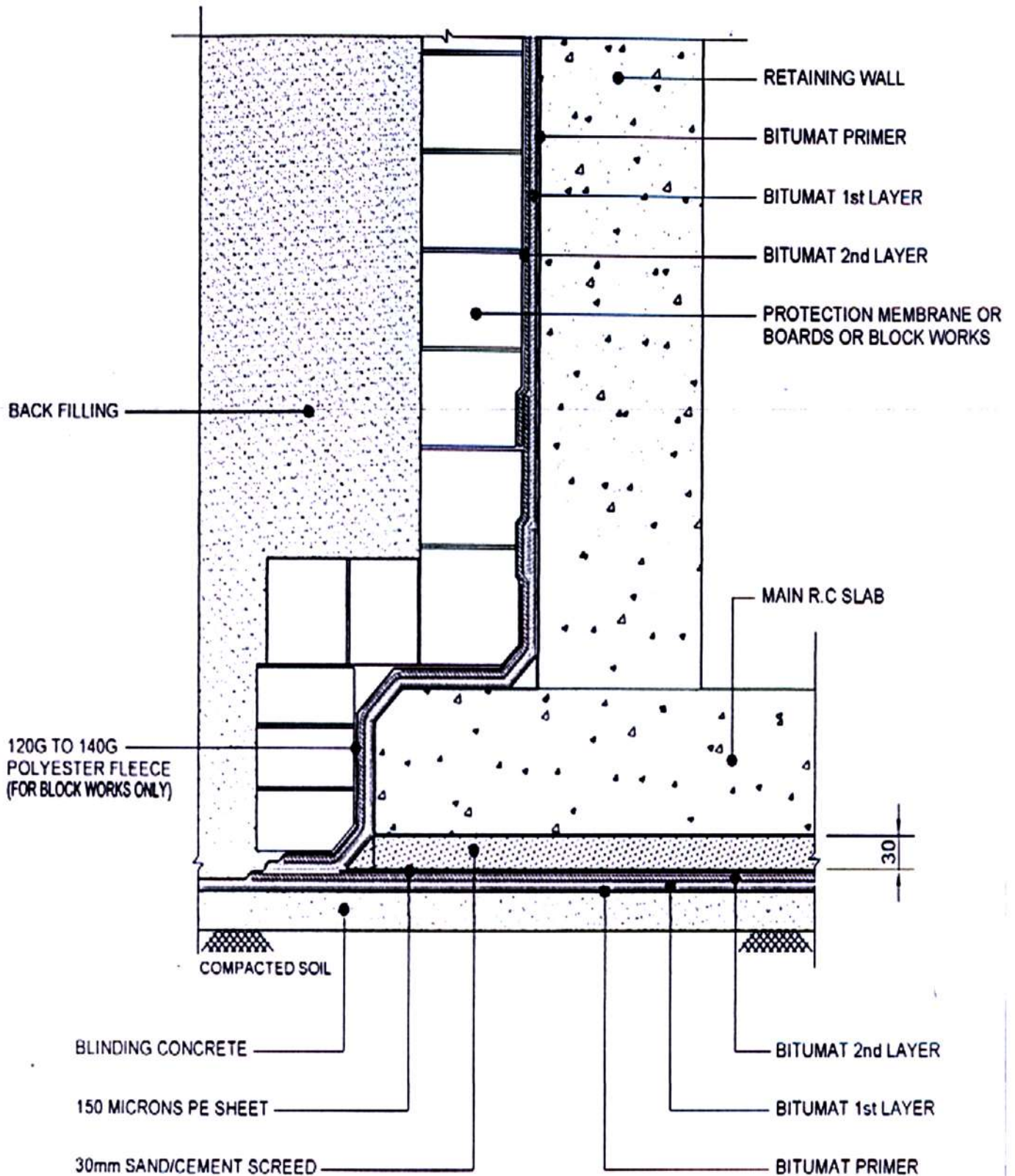
UNDERGROUND TANKING SYSTEM



SWIMMING POOLS WATERPROOFING



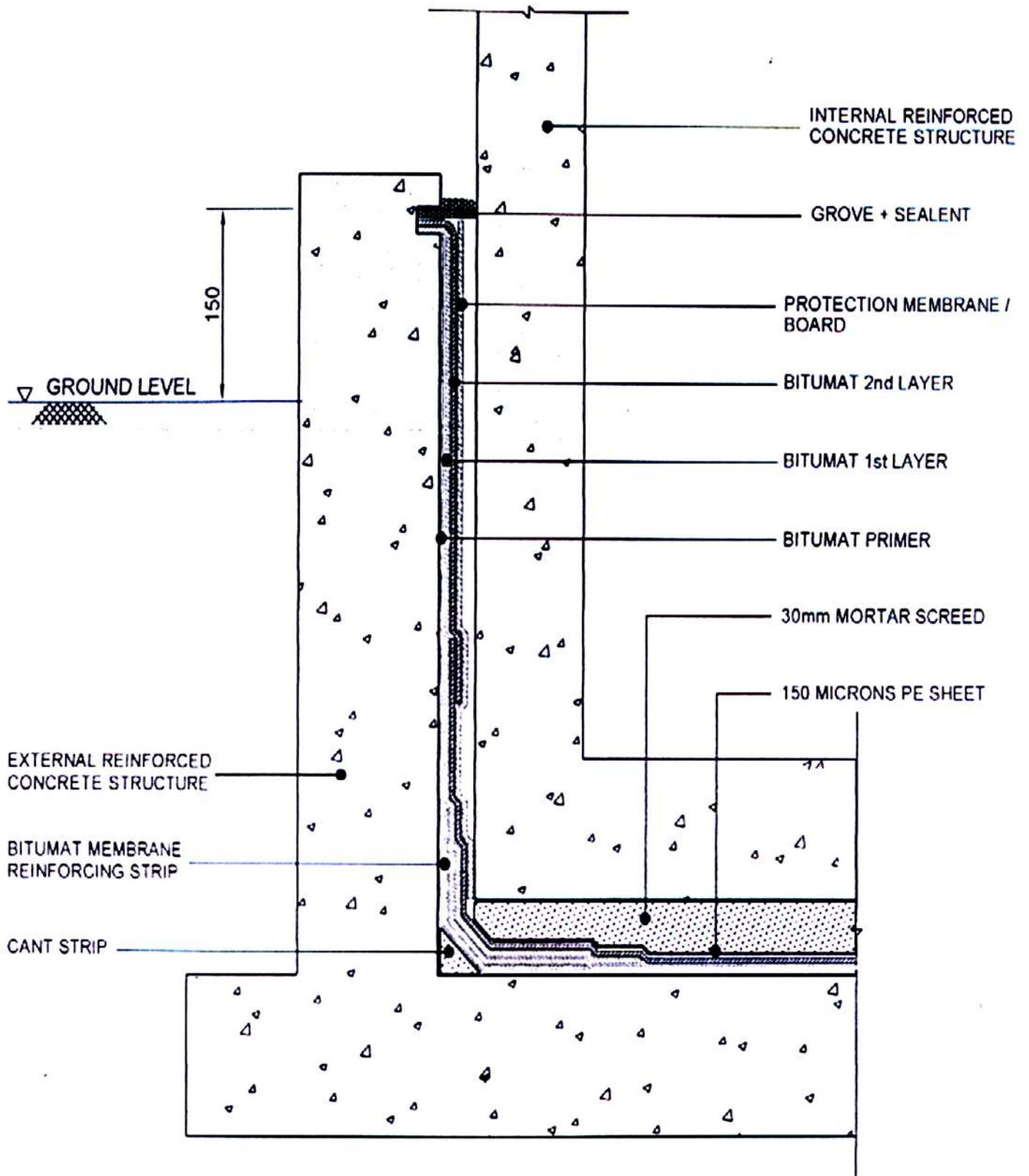
UNDERGROUND TANKING SYSTEM



UNDERGROUND BASEMENT



UNDERGROUND TANKING SYSTEM



UNDERGROUND WATER TANK TYPICAL SECTION

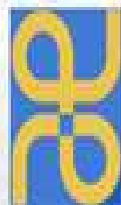
Who would not be
impressed
by our history?

20

Years

of waterproofing the world!

The Power to Perform



BITUMAT