



3.1 Material Requirements for Construction of a 3,200-litre Rainwater Tank

Table 3-1: Material requirements for making a 3,200-litre rainwater tank

MATERIALS REQUIRED	QUANTITY
Cement	7 bags
Sand	4 cubic metres
Aggregate	0.4 cubic metre
PVC elbow, 3 inch (or 7.6 centimetres) inner diameter	1 piece
PVC pipe, 3 inch (or 7.6 centimetres) inner diameter	0.2 metre
Wire, 0.04 inch (or 0.1 centimetre) diameter	5 kilograms
GS pipe, 3/4 inch (or 1.9 centimetres) inner diameter	0.8 metre
GS socket, 3/4 inch (or 1.9 centimetres) inner diameter	2 pieces
Tap, 3/4 inch (or 1.9 centimetres) inner diameter	1 piece
GS plug, 3/4 inch (or 1.9 centimetres) inner diameter	1 piece
Iron bar, 0.24 inch (or 0.6 centimetre) diameter	0.8 metre
Aluminium or iron wire, 0.12 inch (or 0.3 centimetre) diameter	2 kilograms
Nylon net	0.04 square metre
Skilled mason	3 days
Unskilled labourer	3 days

Note: Cost of the tank can be estimated using local prices of the materials.



3.2 Techniques for Construction of Cement Rainwater Tank

Step-by-step procedures for construction of cement rainwater tank are illustrated in the following figures.

a. Iron moulds for construction of tank

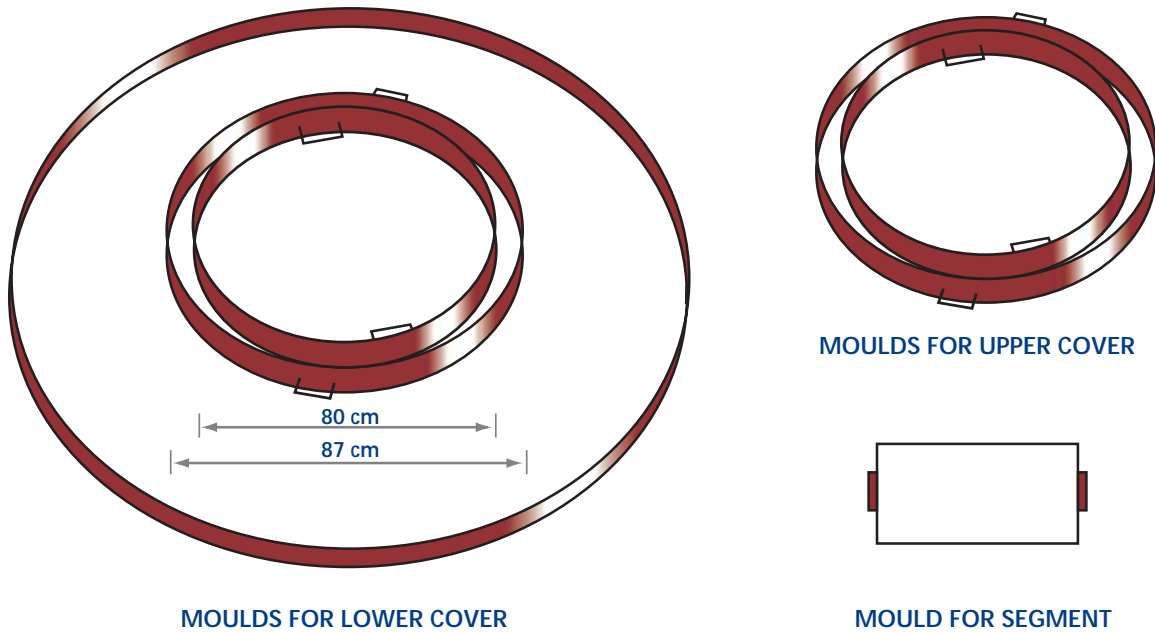


Figure 3-1: Set of iron moulds for construction of tank.

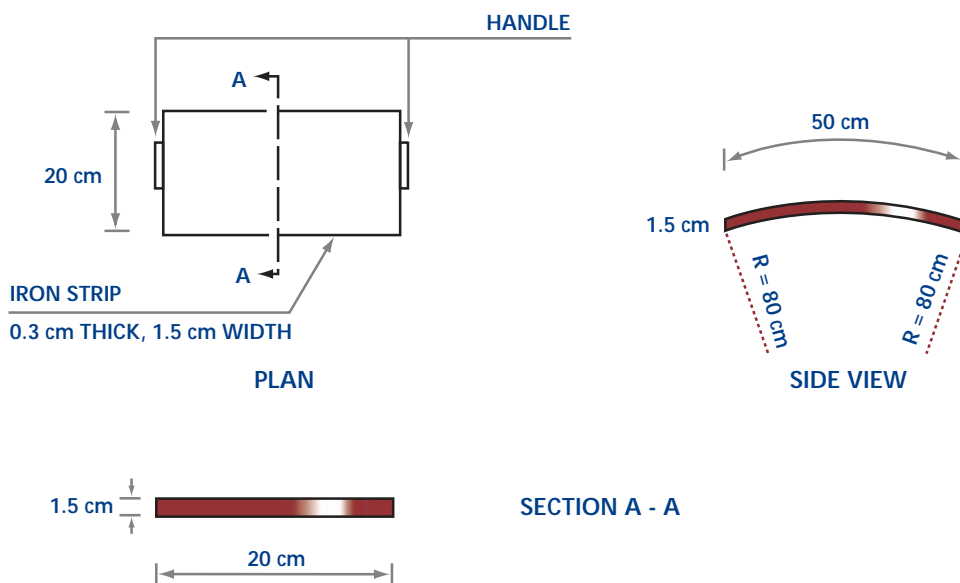


Figure 3-2: Measurements of iron segment mould. Iron strips of 1.5 centimetres wide and 0.4 centimetre thick is used for making the segment mould. The segment mould has a curved shape that is 20 centimetres wide and 50 centimetres long. Details of dimensions are shown in the drawing.



Figure 3-3: Iron segment moulds for casting tank segments.

MOULDS FOR UPPER COVER

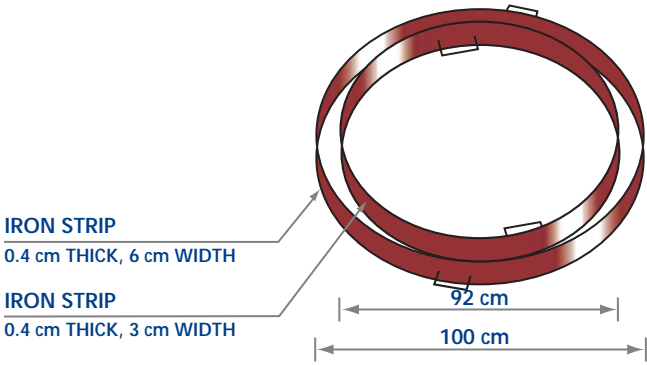


Figure 3-4: Measurements of moulds (set of 2) for the UPPER COVER of the tank. Iron strips 0.4 centimetre thick and width of 6 centimetres and 3 centimetres are used to make the moulds. Diameters of the outer and inner moulds are 100 centimetres and 92 centimetres, respectively. Details of dimensions are shown in the drawing.

MOULDS FOR LOWER COVER

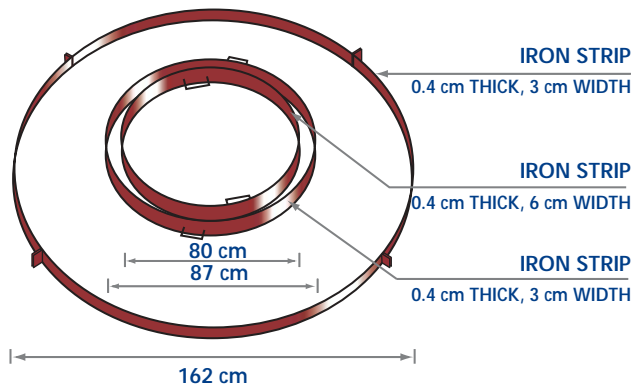


Figure 3-5: Measurements of moulds (set of 3) for the LOWER COVER of tank. Iron strips of 0.4 centimetre thick and width of 6 centimetres and 3 centimetres are used to make the moulds. Diameters of the outer and inner moulds are 162 centimetres, 87 centimetres and 80 centimetres, respectively. Detail dimensions are shown in the drawing.

b. Casting cement segments for rainwater tank

Cement segments are required for making the rainwater tank and the foundations for both the jar and tank. It is necessary to cast sufficient cement segments. For making one rainwater tank, 100 segment pieces are needed (80 pieces for the tank body, 12 pieces for the foundation and 8 extra pieces in case of breakage).

Figure 3-6: Prepare a sand base in a straight line on smooth ground that is approximate 60-70 centimetres wide and 15 centimetres high. The length of the sand base depends on the availability of the space. It should be long enough to cast as many segments as possible.

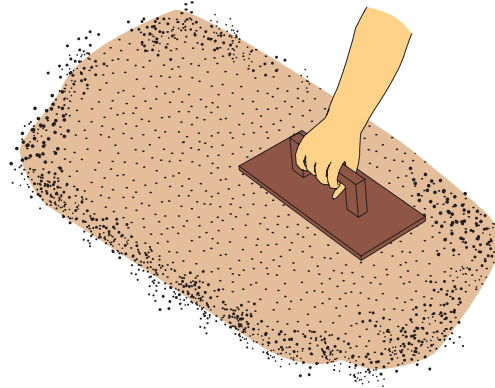
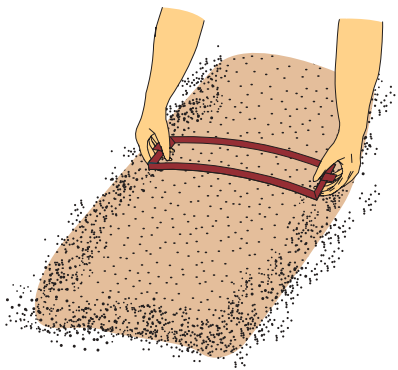
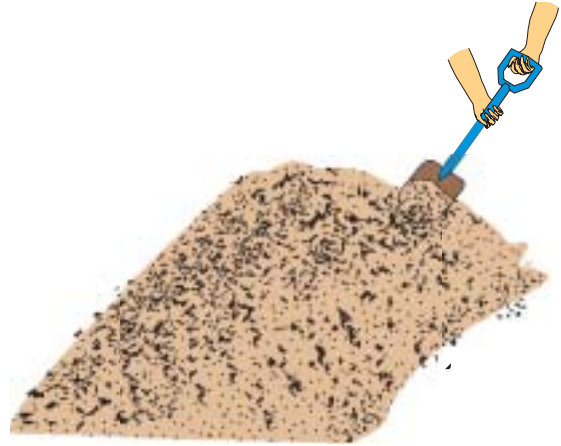


Figure 3-7: Shape the surface of sand base by using the segment mould to get proper curvature and then smooth and slightly pack the curved sand surface with a wooden trowel.

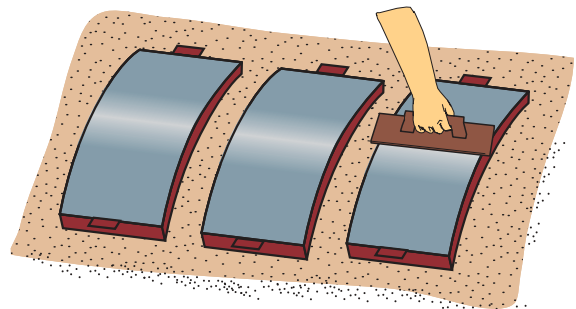
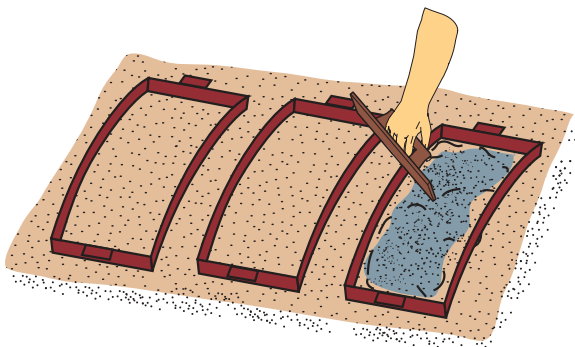


Figure 3-8: Place the segment moulds on top of the sand base. Then fill with cement mortar prepared in a 1:3 proportion. Pack thoroughly and smooth the surface with a wooden trowel.

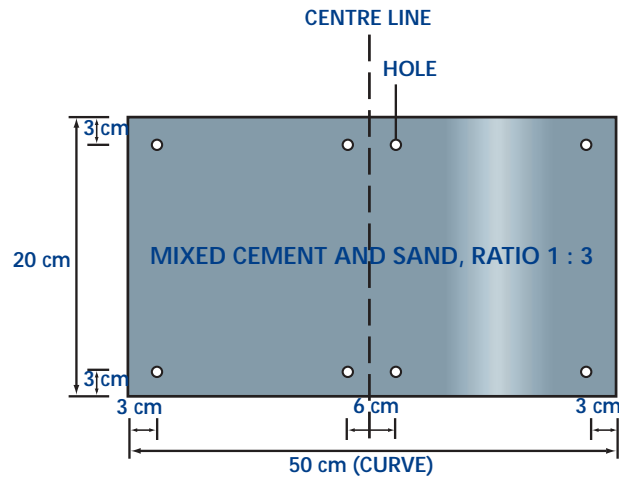


Figure 3-9: Wait about 15 minutes, then make holes in the cement segments with a 7centimetres long nail, as shown in the drawing.

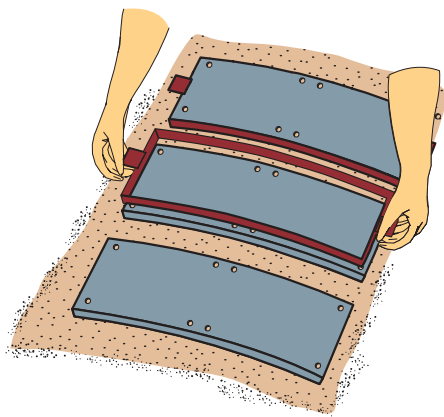


Figure 3-10: Wait about 20 minutes more. Then remove the segment mould one by one carefully. And then wash the moulds to clean them properly for reuse.

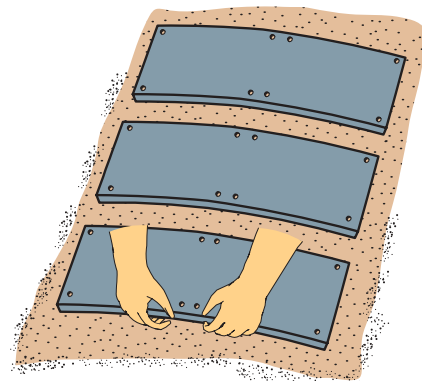


Figure 3-11: Remove the cement segments from the sand base the next day or after at least 12 hours. While removing the cement segments, it is very important to handle them carefully by holding at the middle of the segment, as shown, to avoid breakage.

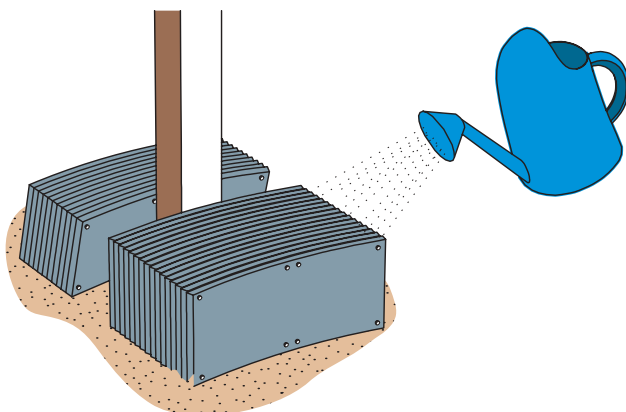


Figure 3-12: Keep the cement segments in shade and cure with water for a minimum of 3 days but, ideally, cure for 7 days if possible.



Figure 3-13: Cast cement segments for tank construction in action.

c. Casting the upper cover of tank

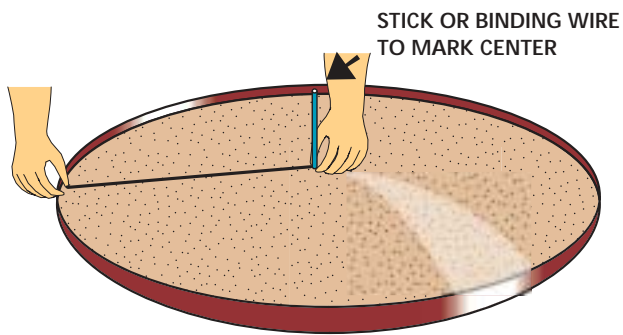


Figure 3-14: Prepare a conical sand base inside the 92 centimetres diameter inner mould with 18 centimetres height at the centre. Insert a piece of wire into the sand to mark the centre.



Figure 3-15: Make the upper cover wire reinforcement and two handles on top of the conical sand base. The 0.3 centimetre diameter binding wire is used to make the reinforcement and 0.9 centimetre diameter iron bar is used for the handles. The arrangement of wire reinforcement and handles is shown in the picture.

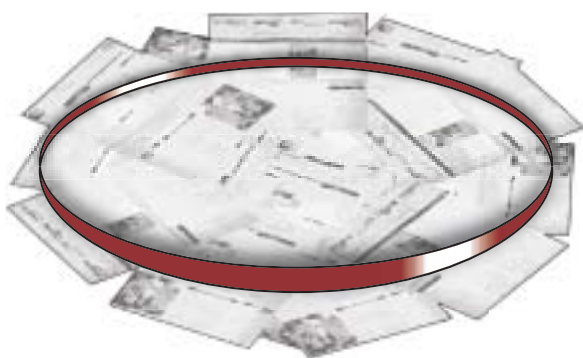


Figure 3-16: Set aside the wire reinforcement for use later on. Cover the top of sand base with paper, and place the outer mould on top of the paper ready for casting.

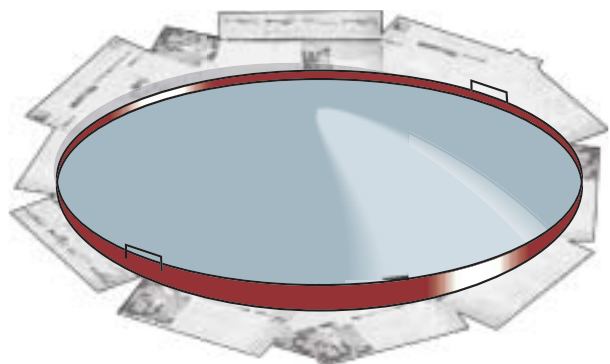


Figure 3-17: Fill with the mixture of cement mortar that has been prepared in a proportion of 1:2 and make it about 2.5 centimetres thick on top of the paper. Smooth the mixture uniformly on top of the paper.

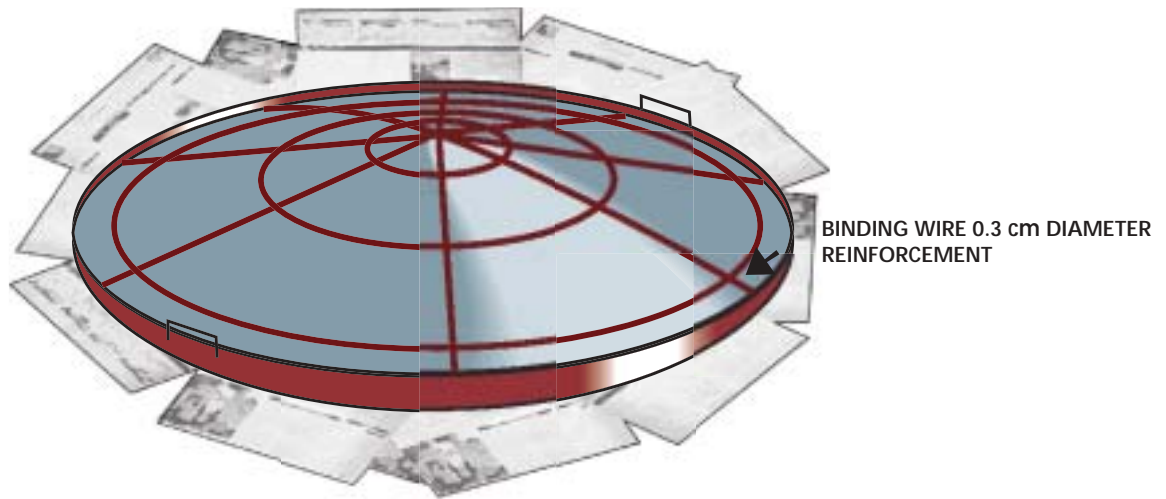


Figure 3-18: Place the wire reinforcement with handles on top of the cement mortar.



Figure 3-19: Add another layer of the 1:2 cement mortar mixture on top of the wire reinforcement; fill up to the top level of mould. Remove the outer mould after one hour, before the concrete mortar is set. Cure the cast upper cover with water for at least 3 days, though, again, curing for 7 days is better.



Figure 3-20: A finished upper cover with handles.

d. Casting the lower cover of tank

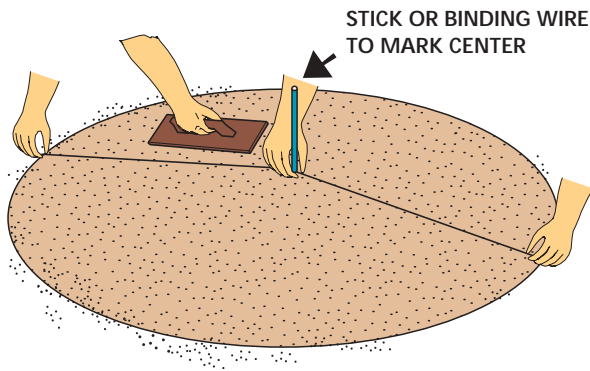


Figure 3-21: Prepare a conical sand base inside the lower cover outer mould (diameter 162 centimetres) with a height of 18 centimetres at the centre. Insert a piece of wire to mark the centre.



Figure 3-22: Make the lower cover wire reinforcement and two handles on top of the conical sand base. Use 0.3 centimetre diameter binding wire for reinforcement and 0.9 centimetre diameter iron bar for handles. The arrangement of handles and binding wire reinforcement is shown in the photo.

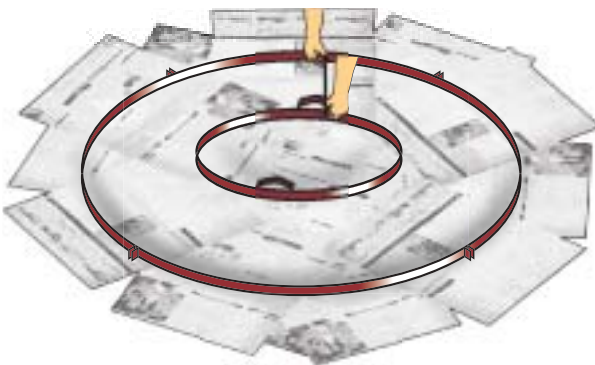


Figure 3-23: Set aside the wire reinforcement for use later on. Cover the top of sand base with paper and place the outer mould (162 centimetres) and inner mould (87 centimetres) on top of the paper.



Figure 3-24: Fill the space between the two moulds with a mixture of 1:2 cement mortar and make it 2.5 centimetres thick and spread it uniformly.

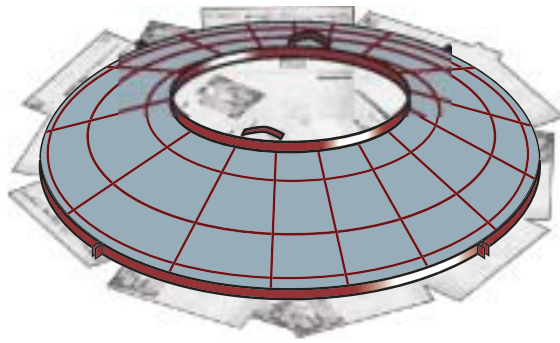


Figure 3-25: Place the wire reinforcement on top of the cement mortar.

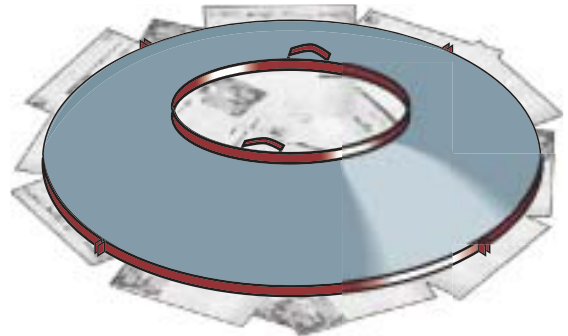


Figure 3-26: Fill the space between two moulds with more of the 1:2 cement mortar up to the top level of the moulds and then smooth the surface.



Figure 3-27: Place the 80 centimetres diameter inner mould on top of the paper-covered sand base to cast the tank mouth. Fill the space between the two moulds with the 1:2 cement mortar and fill up to the top level of the moulds.

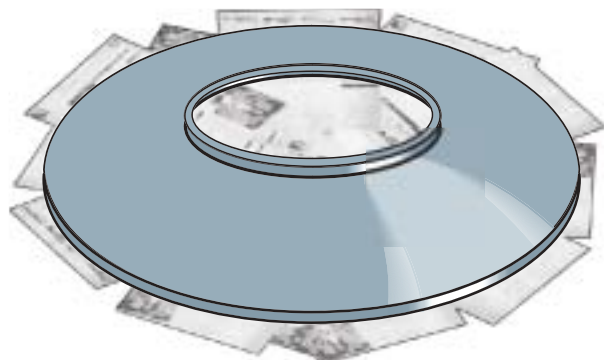


Figure 3-28: Remove the moulds after one hour. Water the cast cover for curing for at least 3 days, though again, curing for 7 days would be better.

Figure 3-29: Finished segments and covers for tank.



e. Construction of foundation for tank

For the tank foundation, 12 pre-cast cement segments are used. The steps of making the tank foundation are the same as for the jar, which is illustrated in Sector 2, Figures 2-5 to 2-11.

f. Construction of the tank body

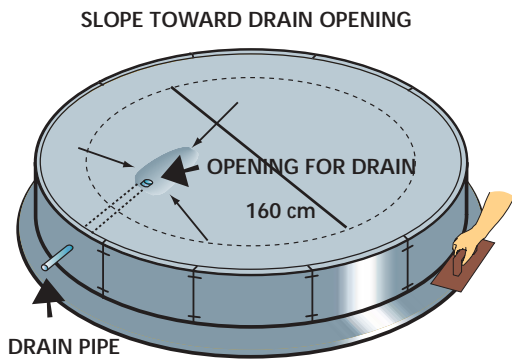


Figure 3-30: A finished tank foundation using 12 pre-cast cement segments.

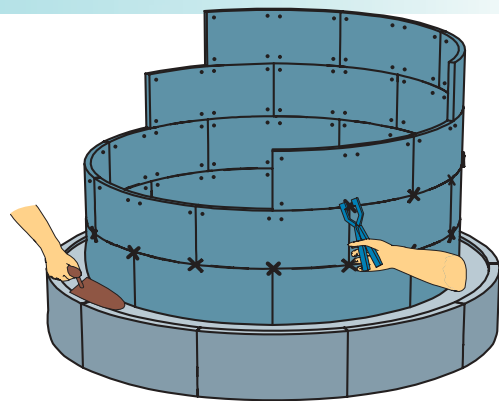


Figure 3-31: Join 10 pieces of pre-cast cement segments with binding wire along the inner circle that is 160 centimetres in diameter to form one layer. 8 layers are needed for the tank body. It is important to check and adjust the diameter of each layer as and when it is completed. Details of joining segments with binding wire are shown in Figures 3-32 and 3-33.

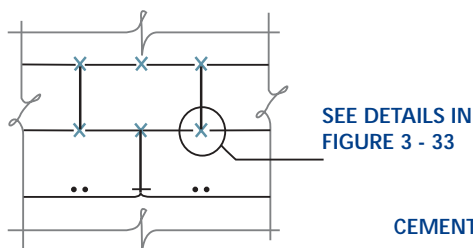


Figure 3-32: Fix pre-cast cement segments with 0.1 centimetre diameter binding wire. (see details in Figure 3-33)

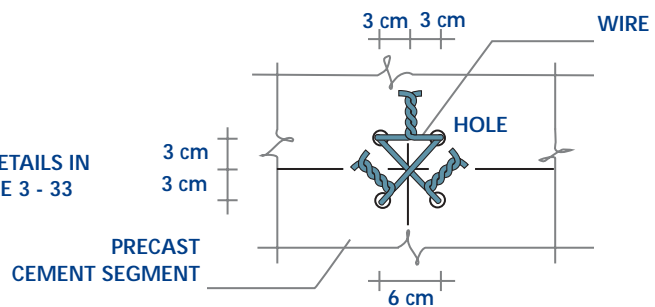


Figure 3-33: Proper way of joining the pre-cast segments with binding wire.



Figure 3-34: Assemble the pre-cast segments to form a tank body.

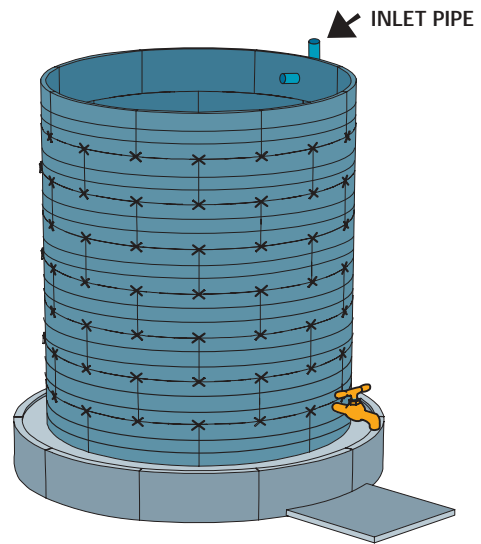


Figure 3-35: Reinforce the 8 layer-segment tank body with 0.1 centimetre diameter binding wire as shown. Insert a tap about 10 centimetres above the foundation floor. An inlet pipe is fixed onto the last layer of segment.

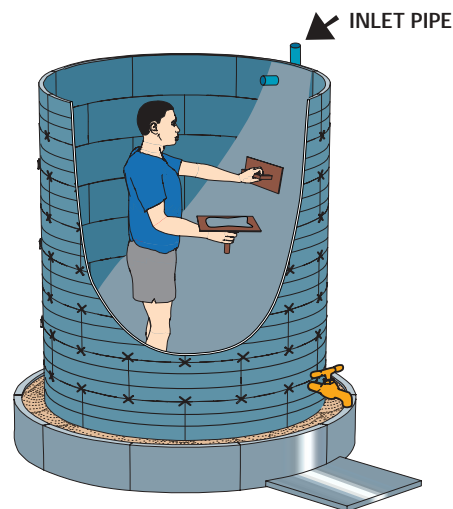


Figure 3-36: Plaster the inside wall of tank with two coatings of 1:2 cement mortar that are each 1.5 centimetres thick. It is necessary to wait a half an hour before plastering the second coating. Care should be taken to avoid making the mortar plastering too thick, as it may fall off of the wall.

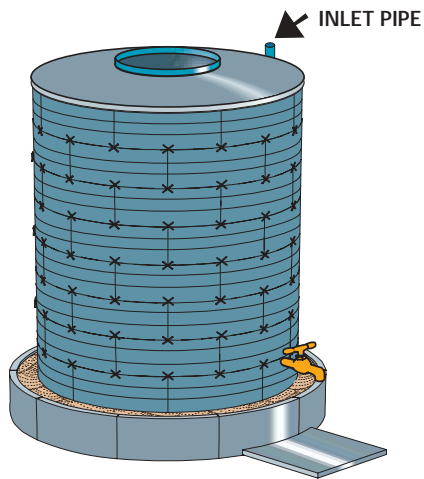


Figure 3-37: Put the cover on top of the tank after plastering the inside tank wall.

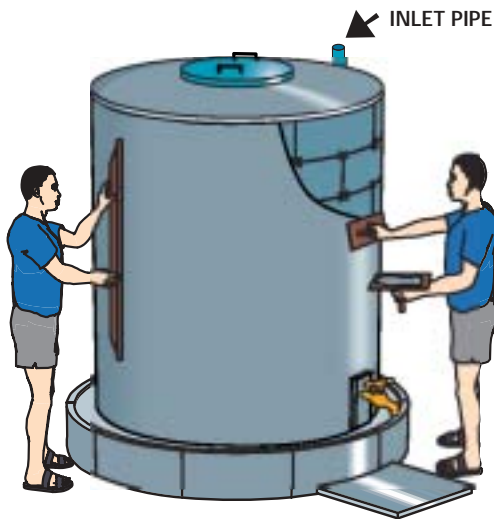


Figure 3-38: Plaster the outside wall of tank with two coatings of 1:2 cement mortar that are each 1.5 centimetres thick. Again, it is necessary to wait for a half an hour before plastering the second coating. And again, care must be taken to avoid making the mortar plastering too thick.

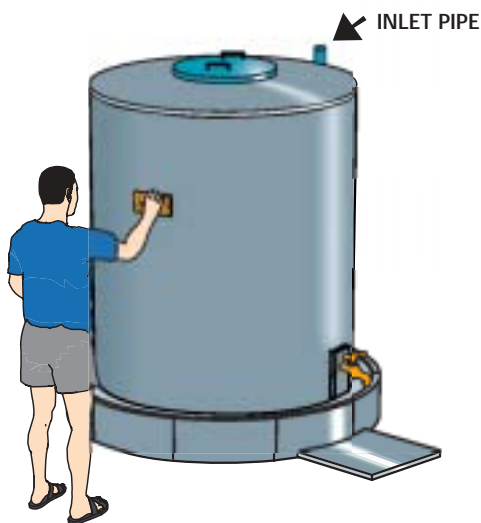


Figure 3-39: Use a sponge to smooth the tank surface.



Figure 3-40: Fix the rain gutter and connecting pipe to the tank.



Figure 3-41: A completed 3,200-litre tank.

