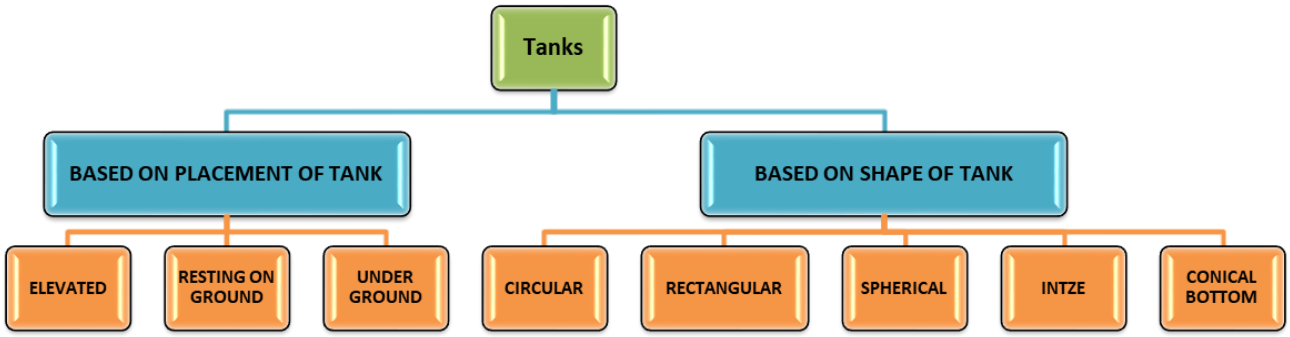
Reinforced Concrete Design of Hydraulic Structures

(Concrete Tanks)

Introduction:

Storage reservoirs and overhead tank are used to store water, liquid petroleum, petroleum products and similar liquids. The force analysis of the reservoirs or tanks is about the same irrespective of the chemical nature of the product. All tanks are designed as crack free structures to eliminate any leakage. Water or raw petroleum retaining slab and walls can be of reinforced concrete with adequate cover to the reinforcement. Water and petroleum and react with concrete and, therefore, no special treatment to the surface is required. Industrial wastes can also be collected and processed in concrete tanks with few exceptions. The petroleum product such as petrol, diesel oil, etc. are likely to leak through the concrete walls, therefore such tanks need special membranes to prevent leakage. Reservoir is a common term applied to liquid storage structure and it can be below or above the ground level. Reservoirs below the ground level are normally built to store large quantities of water whereas those of overhead type are built for direct distribution by gravity flow and are usually of smaller capacity.

Classified of Tanks:



ELIVATED TANK

CIRCULAR RESTING ON GROUND TANK

INTZE TANK

SPHERICAL TANK

CONICAL BOTTOM TANK

RECTANGULAR UNDERGROUND TANK

Loading Conditions:

The tank must be designed to withstand the loads that it will be subjected to during many years of use. Additionally, the loads during construction must also be considered. Loading conditions for partially buried tank. · The tank must be designed and detailed to withstand the forces from each of these loading conditions. The tank may also be subjected to uplift forces from hydrostatic pressure at the bottom when empty.

It is important to consider all possible loading conditions on the structure. Full effects of the soil loads and water pressure must be designed for without using them to minimize the effects of each other. The effects of water table must be considered for the design loading conditions.

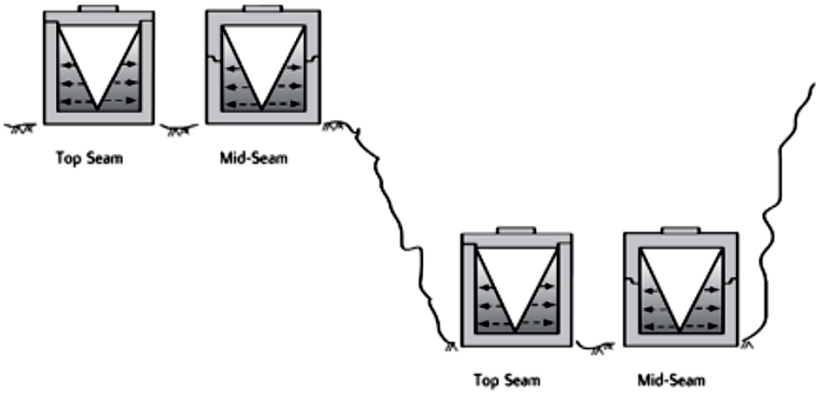
Thickness of Walls

The walls of circular tanks are subjected to ring or hoop tension due to the internal pressure and restraint to concrete shrinkage.

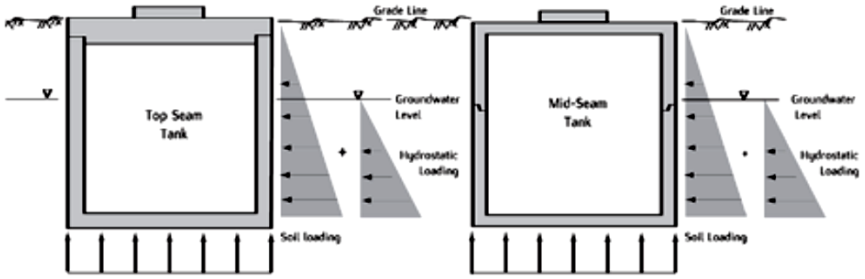
- Any significant cracking in the tank is unacceptable.
- The tensile stress in the concrete (due to ring tension from pressure and shrinkage) has to keep at a minimum to prevent excessive cracking.

1- Internal Hydrostatic Loading

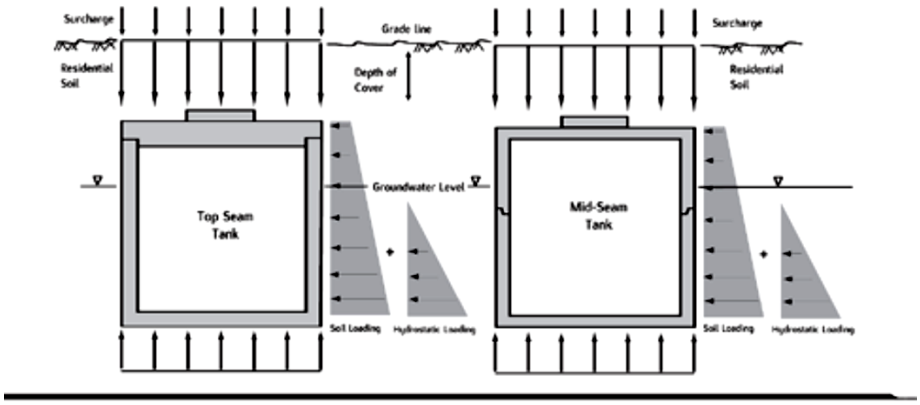
Tank Full (on grade or without backfill).



2- External Soil and Water Loading (Tank Empty).



3- Optional Loading Where Appropriate (Manufacturer to specify the maximum depth of cover).



Reinforcement:

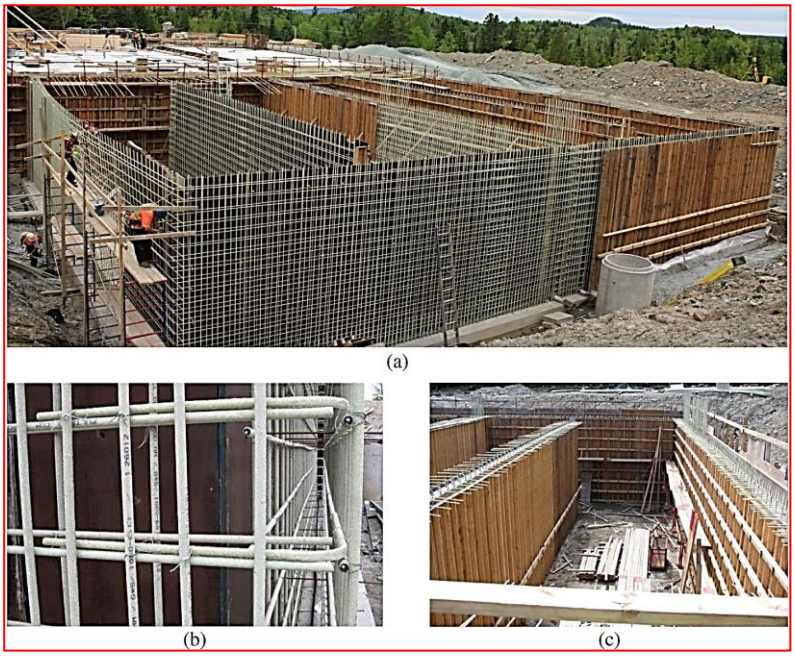
1- The amount size and spacing of reinforcement has a great effect on the extent of cracking.

- The amount must be sufficient for strength and serviceability including temperature and shrinkage effects.
- The amount of temperature and shrinkage reinforcement is dependent on the length between construction joints

2- The size of re-bars should be chosen recognizing that cracking can be better controlled by using larger number of small diameter bars rather than fewer large diameter bars.

3- The size of reinforcing bars should not exceed 32 mm bar. Spacing of re-bars should be limited to a maximum of 300 mm. Concrete cover should be at least 50 mm.

4- In circular tanks the locations of horizontal splices should be staggered by not less than one lap length or 1 m.


(a)

(b)

(c)

water treatment tank lining

A water treatment tank lining is a special coating that is designed to act as a cure in low temperatures and is applied outside and inside a tank to ensure ultimate protection from chemical attacks. Water treatment tank lining maintains toughness and offers corrosion resistance in plastic, metallic and concrete tanks that provide storage for chemicals, reactive solvents, and petroleum products.

Epoxy Water Tank Liners

This unique water treatment tank lining has become the main product when it comes to water treatment sine being invented. Technological advancements have improved these linings, and as such, they are adaptable in high temperature and aggressive environments than they were capable of before.

Cementitious Linings

Cementitious Linings have been widely used in the water treatment industry and especially when lining concrete tanks. One significant benefit of this water treatment tank lining is that it can be used to act as waterproof below your ground structures. Generally,

they are vapor permeable, which means they can be a good choice when working below the ground structures.

Polyurethane Linings

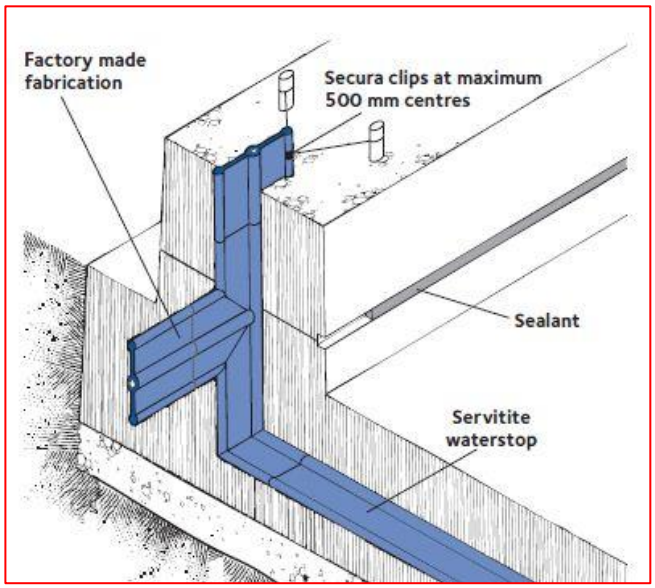
These linings are quite similar to expose polyurethanes as they are a versatile technology and has many uses and varieties. You should note that not all polyurethanes are suitable for use as tank linings not unless they are designed for that purpose specifically. However, you can make Polyurethane flexible using some formulations.

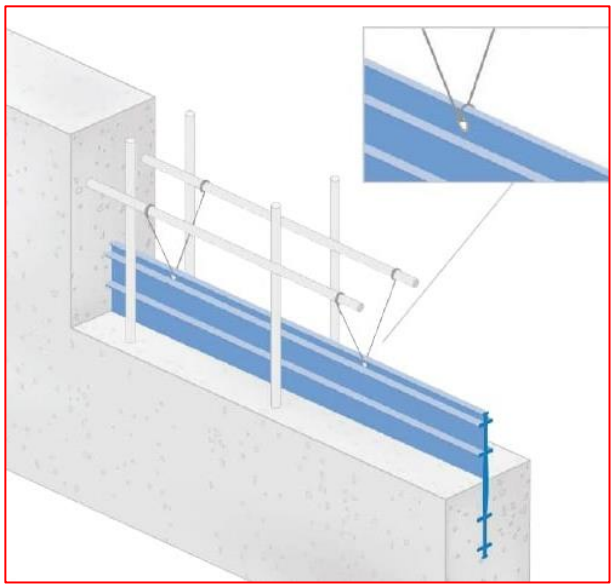
Polyurea Linings

They are a new phenomenon compared to other linings. Polyurea listings started being used in the 1990s for commercial purposes. Generally, you can apply the material using a specialist spray because the elements in it come out extremely fast. The stuff that they are made of is unique, and it offers flexibility and strength with its elongation properties going up to 100%. Like other types of water tank linings, Polyurea linings also have different available versions.

Water-Stop Rubber (WSR):

Rubber water-stop is made from natural rubber, adding various additives and filler. The water-stop has high tensile strength, good waterproof performance, good elasticity, can resistant to rust, wear, corrosion, can arise compression deformation under various loads. It is suitable for dams, reservoirs, subway, culverts, tunnels, sewage treatment plants, dams …. etc.





Construction of Concrete Tanks

1- Precast Concrete Tanks:

2- Cast the Concrete Tank:

excavation of underground tank

Compact the base by small compactor

Supporting the sides of the underground tank

Cast the blinding concrete

Reinfroced the wall and base

Fixed the WSR

Cast of concrete

Lainding by using the suitable materials