Case Studies of Remedial Treatment of Water Retaining Structures

1.0 Ferrocement Lining for Leak Proofing of a Swimming Pool

Anchored ferrocement lining provides an excellent effective leak-proof surface inside leaking masonry and concrete tanks as a cost effective rehabilitation. The present case study discusses the treatment for an old swimming pool with leakage through walls, base, joint between wall and floor which was carried out in the following steps.

- Removing the inner finishes from affected areas – tiles / mortar rendering with paint application etc.
- Cleaning, roughing and washing of surface and applying bond coat slurry over the wet surface.
- Application of sealing base coat using polymer-modified mortar and fixing of anchors at a suitable grid.
- Fixing of hot dip galvanized mesh of specified quality, diameter and spacing with specified gaps at joint.
- Application of a coat of polymer cement bond slurry and application of polymer-modified mortar into the mesh layer using angular push technique and finish rough – wait for 24 hours.
- Fixing of one more layer of mesh reinforcement and applying one more layer of polymer mortar in the same manner as given in Fig. 1. Then repeat to provide specified no. of layers of mesh and mortar layers to build up the designed thickness for lining.
- Application of finishing surface such as tiling or epoxy / PU paint etc.
- Fig. 1 provides a view of FC lining over swimming pools – for new swimming pools, the continuous lining is provided in between the retaining structure and finishing surface.

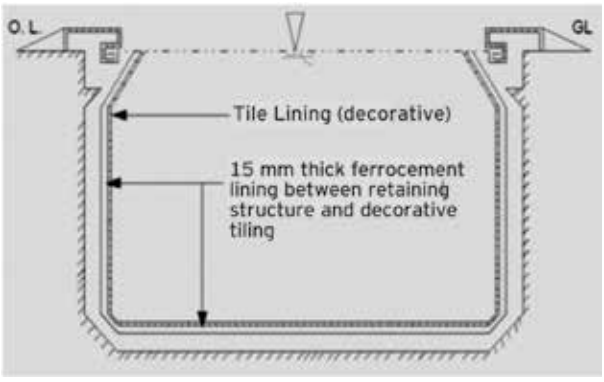

Fig. 1: Ferrocement treatment of the swimming pool

(Source: NBM & CW, April 2003, Vo.8, Issue 10, pp.-42)

2.0 Treatment of Overhead RCC Water Tank with Ferrocement Lining

A study was taken up on 12 randomly selected leaking over head tanks in the districts of Saharanpur and Muzaffarnagar in the past which showed that:

- The supporting structure in eight cases was intact and leakage was from the wall and the dome wall joint.
- In six out of eight cases, there was porosity due to honey combing at locations of leakage or the shuttering lift ring position where a horizontal crack developed separating the bottom concrete ring from the ring above.
- In four cases, the outlet pipe and inlet pipe junction with concrete was not properly packed and there was seepage through these positions.

A 50,000-galllon overhead water tank was rehabilitated using the following steps:

- Removal of internal finishes – 25 mm thick cement mortar plaster.
- Opening of the shuttering lift ring from inside and outside, fixing of grout nozzles and packing the same with non-shrink polymer micro concrete after applying a coat of cement slurry added with bond improvers.
- Pressure grouting of dome wall joint and shuttering of lift joint.
- Fixing of anchors in concrete over inner surface of wall and base.
- Fixing of meshes over the wall and base dome on inside surface and application of high-strength polymer-modified cement mortar in layers. Each layer is properly reinforced. A special type of bond coat is used between layers of ferrocement and old concrete.
- Application of thin, high-strength, non-shrink mortar as inner finishing layer.

(Source: NBM & CW, April 2003, Vo.8, Issue 10, pp.-42)

3.0 Rehabilitation of a Large Leaking Below Ground RCC Water Tank

The water tank under this case study is of basic size 17 x 4.9 m having a top dome roof. The crown of the dome is about 2 m. About 1.5 m of the tank is below the ground level and the rest is projected above.

3.1 Condition Assessment

3.1.1 Horizontal Construction Joints

The foundation of the water tank is of PCC (1:4:8), 75 mm thick over which RCC was laid, with M-20 concrete with minimum 330 kg/m^3 over for which an inclined PCC filling (1:5:10) was provided and finally the surface was finished with a PCC (1:2:4) to a smooth surface. The diameter of the 450 mm base slab was about 170 m whereas the internal diameter of the tank was 15.2 m with a 0.25 m

vertical wall. The total height of the vertical wall was 4.9 m having a ring beam of 0.3 m depth over it. The vertical lift of the circular vertical wall was 1 m. Thus, there were four horizontal construction joints in the body of the circular vertical wall. Water stoppers were provided in each lift with a PVC water bar of about 150 to 200 mm. The water bars have been provided inside a groove of 90 mm x 90 mm in the circular vertical wall. Thus, a possible zone of weakness was around the PVC water bar, which is prone to leakage.

3.1.2 Vertical Construction Joints

The outside perimeter of the circular wall was about 49.5 m. It was unlikely that a formwork of this length had been used for the construction. It was most likely that there were about 3 to 4 vertical construction joints in every vertical lift. The length of formwork for three such construction joints was about 16 to 17 m whereas if there were five construction joints, then the length of formwork would have been about 10 m.

3.1.3 Quality of Concrete

The concrete was not properly compacted. The water was leaking over an area of 10 x 10 cm where water was coming out profusely. In different parts of the tank, reddish stains could be seen. Horizontal bands of wetness of varying degrees on the external surface of the tank indicated the rusting of reinforcement.

3.2 Remedial Measures

Based on the observation, the following remedial measures were recommended:

- Removal of the protective plaster and the surrounding soil up to a distance of 3 m from the face of the tank. Injection grouting at 0.5 m vertical spacing and 1 m horizontal spacing.
- The total height of the tank from the base slab level up to the bottom of the ring beam was 4.9 m; thus about 11 holes were required for covering the vertical height in one line. Thus, along the circumference for 50 such vertical lines a total of 550 holes were drilled.
- The grouting was done using polygrout / cement grout.
- Weak plaster was removed and redone after application of bond coat of acrylic-based polymer-modified cementitious composite coating system.
- Application of one coat of acrylic-based polymer-modified cementitious slurry followed by one coat of brush topping from inside.
- Acrylic-based polymer-modified cementitious slurry treatment could extend to the internal surface of the dome.

(Source: CE& CR, May 2008, pp.-76-77)