



Case study Water Tower

Project: Bengo Water Tower
Contractor: Stonbury Limited
Consulting Engineers: Bureau Veritas
Products Specified: Sika® CarboDur®

Structural Strengthening

Sika® CarboDur® carbon fibre structural strengthening system was chosen as the ideal solution to re-establish an ailing roof slab on Bengo Water Tower, which is owned by Three Valleys Water and is located on the outskirts of Hertford. The 30 metre high tower, which has a capacity of 900 cubic metres, dates back to the early 1930's and was built with a 75mm thick reinforced concrete roof slab with minimum steel reinforcement.

Penetration of the concrete by the elements had lead to corrosion of the reinforcing steel and consequently the slab had become structurally unsound. Because of the nature of the project, it was important that any repair materials used on this project met all criteria required for contact with potable water.

Veritas, carried out a structural analysis of the structure and decided upon a solution to reinstate and in fact improve upon the original strength of the slab by using the Sika® CarboDur® structural strengthening system. After removing and reinstalling the failing concrete, specialist contractors Stonbury Limited bonded 500 metres of Sika® CarboDur® pultruded carbon fibre plates in a radial pattern to the underside of the roof slab using Sikadur® 31 Rapid, a specially formulated, cold cure epoxy adhesive.

This is a fast and efficient system, with a tried and tested track record, offering high performance with good technical support. In addition Carbon Fibre will have no problems with corrosion caused by the moist atmosphere. From a practical point of view, carbon fibre is much lighter than steel and can be hoisted and placed in a water tower with no need for specialist hoisting and clamping equipment, so saving considerably on return to service times.

Other works undertaken was the removal of original asphalt liner & replacement with DWI approved polyurethane membrane also sealing of roof slab against rainwater ingress. Formation of new access openings and security upgrades to current codes. Replacement of access ladders and valves. Coating of pipework and installation of new handrailing to the access shaft. Sika believe that this is the first project of its kind where carbon fibre strengthening has been utilised within a potable water tank. Its benefits could change the way structures are refurbished for years to come.

Sika® CarboDur®



Reasons for Strengthening

- Corrosion of the reinforcement
- Corrosion of prestressing cables
- Increased traffic loads
- Inadequate design
- Modified standards/codes
- Excessive cracking of concrete
- Seismic retrofitting

Externally bonded reinforcement increases the load carrying capacity of structural members and will also reduce deflection. The tensile stress induced by imposed loads must be shared by the member and the external reinforcement. Steel plates have been used for this purpose for some decades and research started on composite materials in the early 1980's. The stress is transferred from the structural member to the bonded reinforcement by a structural adhesive. The requirements for this method of strengthening have been proven by extensive testing. This included large scale beam tests under dynamic loading conditions and extensive freeze-thaw cycling. Sika® CarboDur® Systems are fully proven under the most extreme conditions.



Durability is a prerequisite for a strengthening system. The Sika® CarboDur® Systems, plates, fabrics, and adhesives, all have excellent resistance to corrosive and aggressive chemical influences. Specifically: There is no risk of under-rusting.

Advantages of Sika® CarboDur® Pultruded Plates

- Precise performance properties (defined)
- Range of dimensions – optimum design
- Choice of modulus
- Factory prepared for use
- Low temperature application with heated plates
- Elevated temperature in service grade
- Can be post tensioned
- Very high strength
- Corrosion resistant
- Minimal thickness

Advantages of Sika® CarboDur® Composites

- High strength to weight ratio
- Lightweight –easy to apply

Advantages of SikaWrap® Fabrics

- Shear resistance
- Impact and blast resistance
- Very flexible for details
- Easy on circular and square members
- High strength
- Carbon fibre and glass fabrics available

