

21149 **FMC Safer bitumen tank repair****FM Conway** **5****DESCRIPTION**

At FM Conway's Imperial Bitumen Terminal on the River Thames, Gravesend, bitumen is delivered into a series of tanks for storage and blending. The two largest tanks are 18m in diameter and 18m high and have a capacity of 3,000 tons of bitumen. These tanks are over 75 years old. As a result of corrosion, large portions of the base and sides up to 1m from the ground needed to be replaced with new steel plates 12mm thick.

**Corrosion at base of tank**

Careful and accurate planning was required for this task. Any failure had the potential to be catastrophic, resulting in the risk of explosion/fire or total collapse. FM Conway set up a team to plan and complete the repairs during the period from middle of December 2020 to March 2021. FM Conway used the principles set out in its 'Big Ten in 10' to analyse and mitigate the significant risks associated with this project.

The initial challenge was to clean the tank of bitumen to a standard where it was safe to carry out hot works for flame cutting and welding. The second was to work out how to support an 18m high tank weighing 75 tons while the base and sides up to 1m from the ground were cut out.

The project was conducted under Temporary Works BS 5975:2019 Code of Practice and within the requirements of Construction Design Management Regulations 2015. FM Conway acted as the client, principal contractor and designer. All design calculations were cross checked with their structural engineers and approved. Guidance documents were written based on HSE Guidance,

Eurobitume and The Model Code of Safe Practice Part 11: Bitumen safety code.

It was decided that the tank would be supported on specially designed stools whilst the bottom section was cut from it. The tank was free standing whilst the floor was replaced and then the sides were removed in 4m sections and new sections welded into place.

Rather than use a manhole hatch as the means of entry to the tank, a full height doorway was cut into the side of the tank to de-risk the confined space work required and to facilitate the easy removal of materials.

As the risk of fire or explosion was high before the inside was cleaned, it was necessary to cold cut the doorway. An accurate cold cut was made using high pressure water with a fine crushed garnet added into the flow.

Prior to commencing the work, as much residual bitumen as possible had been extracted by modifying the withdrawal points and using an uplift tanker. What remained in the tank following this was allowed to cool, to assist the cooling cold air was blown into the tank with fans, hardening the bitumen beyond its normal state. This made it easier to remove and separate the bitumen from the tank bottom and sides.

FM Conway used its own highly trained, confined space teams to clean the inside of the tank and remove the heater coil, to make it safe for hot works to be carried out. This was completed by hand breaking out using a jack hammer into an IBC pallet truck to an extraction point by crane. All the hardened bitumen was recycled.

Confined space entry protocols RAMS had previously been written and the teams trained for the task, lift plans were also written. Care was taken to ensure there was adequate ventilation and extraction in place during plasma arc cutting and welding, powered respirators were worn to alleviate any residual risk.

All the new steel sections had been cut and shaped off-site to minimise work required inside the tank. The sides were cut using plasma arc all the way around the tank leaving the tank independently supported on its temporary structure. The floor was cut out and plates removed using pallet trucks. The bedding was relayed, and new plates installed, all welds were then checked using a vacuum box.

The new tank sides were installed in 4m sections shaped for the circumference of the tank and custom fitted to 1m high. All the plates were lifted into position by crane and final location to fit on rollers.

The welds on each installed plate were vacuum checked. In addition, on completion the tank welds were tested using



an industrial radiographer to x-ray them. Finally, the tank was hydrostatically tested with over 2,800,000 litres of water. The tank was then opened again cleaned out, connected to external pipework, partially filled with bitumen and recommissioned 7 days ahead of schedule.

The team at FM Conway developed an innovative approach to solving unusual problems whilst minimising and controlling risk. For example, the method of supporting the tank which had to withstand the additional stresses caused by three major storms that occurred over the construction period.

The project was successfully completed in 35 days without incident. During the project 34 tons of steel had been removed and replaced and over 1,000m of weld completed. FM Conway had applied the principles of 'The Big Ten in 10' and its philosophy of controls was evident in the way this project was planned and executed to minimise risk at all stages.

### BENEFITS

- Project was delivered without incident
- Minimised risks associated with confined space work
- Minimised risks associated with being struck by falling objects
- Raised the levels of competence of the team
- Demonstrated management of a project in a high-risk environment
- Reinforces application of 'The Big Ten in 10' principles

- Demonstrated the value of the industry codes of practice
- Innovative and cost-effective project to extend life of tank age.

### TRANSFERABILITY AND DEVELOPMENT

- Should the task need to be repeated on other tanks, FM Conway has learnt from the experience and can see how the process could be improved using automated machinery.
- The technique could be applied by other companies if they have similar tanks, this is more likely to be on bitumen farms than modern asphalt plants. The abrasive water jetting could be used on plant and structures where intrinsically safe, cold cutting of fuel storage facilities may be required.



Cold cutting doorway in tank



Specially constructed stalls to support the tank