



Bridge Deck Waterproofing

Eliminator® Product in Action

Charles Bridge, Prague, Czech Republic



Client: PRAGUE MUNICIPALITY
Consultant Engineer: MOTT MACDONALD
Main Contractor: SMP CZ
Authorised Contractor: HELIFIX CZ



The iconic Charles Bridge in the Czech Republic is a 650 year old structure which runs through the heart of Prague linking the Lesser Quarter (Mala Strana) and the Old Town (Staromestka). Originally forming the only route across the River Vltava the bridge has been instrumental in Prague's growth and now plays a major role in the city's tourism industry. The bridge has also provided a backdrop for numerous films, music videos and computer games.

However, wear and damage from the weather, flooding and thousands of tourists has caused significant damage to the structure and led to the requirement for major renovation works. Costing €8.7 Million (Kč 220 million); the refurbishment included repair of the upper bridge section, replacement of the old concrete deck, installation of a new waterproofing system, replacing stones in sills, new drainage and repair to the structure's pillars. Like their predecessors in the 14th century who utilised then pioneering methods and materials, aiming to increase the life of the bridge (particularly famous is the legend that egg yolks were used in the original mortar to give extra strength) the engineers on the project were keen to utilise innovative and long lasting solutions for this work.

One of which was Stirling Lloyds market leading **Eliminator** system to replace the existing, leaking waterproofing system.

The Selection Criteria

Essential to the success of the refurbishment was the chosen waterproofing solution's ability to achieve a strong bond to the deck of the bridge. Consequently a minimum bond strength of 1.6 MPa to both the new concrete deck and the existing bohemian sandstone of the main structure was required. Of the five systems being considered Stirling Lloyd's **Eliminator** waterproofing membrane achieved the highest adhesion results after laboratory UV and freeze cycling tests had been carried out, averaging over 2MPa.

The **Eliminator** system would also provide a tough, durable membrane that would be tolerant of site conditions, while offering an extended service life. Being based on advanced methyl methacrylate (MMA) technology enables the system to be applied in a wide range of temperatures and climatic conditions which meant that installation of the waterproofing could be carried out throughout the year, a feature which the competing systems were unable to offer.

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For such an important tourist attraction it was imperative that any disruption to the use of the bridge and any visual impact was kept to an absolute minimum. Consequently the programme would only allow work to be carried out to just one 150m² area at any one time. Eliminator's ability to bond to itself, irrespective of the time between applications, and maintain an effective, seamless membrane even when applied in small sections would overcome this particular issue. With its unparalleled track record of success, its ability to achieve a high bond strength, its all year round application and by demonstrating its ability to successfully deal with the issues particular to this refurbishment, **Eliminator** was chosen to protect this historic structure by the projects engineers, Mott MacDonald and the client, Prague Municipality.

Proving the System

Despite these impressive credentials such was the importance to the City that the refurbishment went smoothly that a full scale model was built, with a ratio of 1:1, of a section of the bridge which included the detailing and the various joints to be encountered on the bridge deck itself for trialling the processes to be used. Prior to the application of the full **Eliminator** system random spot tensile adhesion tests were taken to confirm the high bond strength that **Eliminator** would achieve to the actual bridge. The application to the replica section also illustrated the product's ease of use and ability to cope with the various substrate types and complex detailing on the structure itself.

A Respectful, Efficient Method

Due to the need to keep the vast majority of the bridge open at all times and to maintain its splendour for the visitors from all over the world, the refurbishment of the 4,500m², 516m long deck was programmed to take two years. Each 150m² section of the refurbishment followed the same respectful, but efficient, methodology. Once the area was tented off and prior to the application of the new waterproofing, the granite paving was removed and each piece numbered to ensure that each could be returned to its original position or replaced with a replica. The whole of the old concrete deck and previous waterproofing system, which had failed allowing water to penetrate into the structure of the bridge, was then removed. Once the new concrete deck was in place and had been left

to cure and gain strength for seven days Stirling Lloyd's MMA based primer - PAR1 primer, was applied to seal the concrete, preventing any outgassing, as well as enhancing the adhesion of the subsequent membrane to the substrate and sandstone upstands.



The **Eliminator** waterproofing membrane was then spray applied in two separate coats, each in a different, contrasting colour to provide a visual check to confirm the required thickness was achieved. This quality control procedure is backed up by wet film thickness tests that were carried out throughout the application. These on-site controls ensured that the minimum specified thickness of 1.2mm for each coat was applied. As **Eliminator** cures rapidly (in less than one hour, even in the depth of a Prague winter) speedy progression on each section was achieved. Once the 1st coat had cured, the 2nd coat could be applied immediately, with no preparation required. Once the second coat had cured, again in under an hour, Stirling Lloyd's fully compatible **Metaset** Structural Adhesive was applied in spots, and while still tacky the drainage geotextile that was being used on the contract was put into place. This was then covered with 100mm of concrete, on top of which the original numbered paving was replaced in a layer of sand, returning the bridge's exposed surface to its highly aesthetic appearance exactly as it was before the refurbishment.

