

CASE STUDY - 01

Challenge

The new Elizabeth Line, currently being built by Crossrail, will stop at 41 stations and will serve over 200 million people each year, making it one of the UK's biggest and most important national infrastructure projects.

Ensuring that maintenance workers are protected both during the construction and operation of the new line is of vital importance, so when the provision of a large bulkhead with double leaf stainless steel fire door for the protection of a sub-surface track-facing maintenance POD was required, Rhino Doors was chosen.

Given the environment and installation requirements, this would not be a simple task. The complex nature of the bespoke, high-performance stainless-steel bulkhead that would house the door in the tunnel wall rendered it a job for Rhino's special projects team. The tunnel in which the door would sit featured a curved aperture with irregular contours in the tunnel wall; this required the Rhino team to design the bulkhead so that gaps at the structural opening-to-bulkhead interfaces were kept to a maximum tolerance of 5mm.

The client specified that the complete bulkhead and door construction would need to have a design life of 50 years in a C5 environment; with the combined door and bulkhead providing fire integrity resistance of E60 to BS476: Part 22, coupled with the capability of withstanding fatigue loading from train induced pressure fluctuations of up to 2kPa throughout the requisite period.



Solution

To meet the complex requirements and stringent specification, Rhino's special projects team first undertook a digital 3D survey in order to catalogue the irregular contours of the curved tunnel aperture. This was followed by a series of structural and fatigue loading calculations (produced in-house). These calculations were used to design a 200mm thick bulkhead measuring 4.65m wide x 4.78m high, built from structural steel lattice members and clad with composite stainless-steel cover plates. These plates were designed in small sections to facilitate both on-site handling and fitting of the door around existing service utilities routed through the tunnel.

In order to maintain the critical fire rating for the structure as a whole, Rhino applied a 1825-micron dft intumescent paint system to the bulkhead structure; the access door design itself already had an appropriate fire rating.

In the centre of the bulkhead Rhino added a 62mm thick, 316L stainless steel fire door, nominally 2.8m wide x 2.6m high and kitted-out with pull handle entry combined with lever handle escape to the active leaf and a pull handle and auto locking flush bolts at the top and bottom of the passive leaf. A door selector was also fitted at the head of the door to sequence the closing of the leaves.

To meet the 50-year design life requirement of the specification, Rhino hot dipped galvanised the carbon steel structural members and all external surfaces were treated with a 250-micron dft full paint system in order to achieve the required life span in a C5 environment.

Results

Despite the challenging brief and complex installation location, the design of the complete bulkhead and door assembly (with the supporting calculations) was deemed by the main contractor to be fully compliant with the prescribed functionality and the JL20 product specification produced for the installation.

Additionally, over the course of the pre-site attendance, planning and engineering phase, Rhino fully conformed with all the main contractor's attendant requirements, which culminated in all of Rhino's works being manufactured, site installed and commissioned in accordance with the agreed programme and to the satisfaction of all parties.



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