Rail

HS2 Marston box slide

World record box slide distance of 165m

Client
HS2

Principal Contractor
Balfour Beatty VINCI

Engineer
Mott MacDonald Systra JV

Works Commenced
May 2022 (guide raft)

Works Completed
December 2022 (slide)

Freyssinet's Autoripage® box sliding technique was used on the HS2 Marston Box project and allowed the 85m long, 12,600 tonne Marston Box structure to be slid into place, across the M42, over Christmas 2022. This was a widely recognised success, acclaimed across the HS2 project and in the specialist and general press. Watch the video here.

The baseline design used a large portal frame on piles but needed two years of reduced lane widths and three months of overnight closures to construct. Main contractor Balfour Beatty VINCI searched for a better method and, with Freyssinet, developed a box slide alternative which also reduced embodied carbon by 30%. Its main advantage was that the whole structure could be constructed to one side of the motorway, improving safety and reducing disruption. During a week-long closure, the box was pushed across the motorway using jacks pulling on cables which had been anchored close to the motorway.

The standard method required a guide raft to be built beneath the box of about the same plan size as the structure. At Marston, due to several site constraints, the box had to be built 80m away from the M42, making this the longest ever box slide distance at 165m. This extra sliding distance risked losing accuracy in the left-right steering of the box. So, the first innovation was to lengthen the guide raft to contain, not just the footprint of the box, but also the long slide path up to the motorway, the raft's edge upstands providing the desired lateral confinement.

The next innovation concerned the installation of the prestressing strands from the edge of the motorway to the far end of the box. Nine 1000 tonne jacks would be attached to these cables to push the box the 165m into position across the motorway, but they needed to be threaded between the base slab of the box and the top of the raft. The solution was to cast nine cable troughs into the guide raft to allow the cables to be threaded after the box had been constructed.

Freyssinet developed a bespoke method for installing the strands beneath the box, adapting winching methodology from stay cable erection, to have a winch at each end of the trough. An innovative strand connector attached each new prestressing strand to the winch wire, allowing it to be pulled into the trench without twisting around the other strands. The system worked well and was even adapted to install two strands at a time, increasing productivity from two shifts per cable to less than one.

The extra-long guide raft worked perfectly. Normally, the box slides straight off the raft and across the prepared and levelled excavated area. On Marston the 85-metre-long box travelled the initial 80 metres whilst the south-bound carriageway was being excavated. By the time the box reached the hard shoulder the ground was ready so the slide could continue. When the box had reached the central reservation, the northbound side had been excavated. The structure took 36 hours to slide the record 165-metre distance, four hours ahead of schedule and without any health and safety incidents.

The effort was worth it. Sasan Ghavami, BBV's Construction Director said: *"We're extremely proud to have successfully delivered the world's longest box slide… using innovative construction techniques."*

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