Segmental Mechanism

The Helix Bridge relies on the segments at each end of the deck being able to wind around the quayside hub to retract the spans. Each segment comprises a large steel torsion box offset to the edge of the steel deck. Between segments, the boxes are connected by a pair of large steel hinges along the outer vertical edge. These hinges comprise a series of interlinking flat plates with low friction bearing surfaces and steel pins. Structural continuity of the torsion box between adjacent units is provided by the torsional stiffness of the hinges when acting as a pair. At the free edge of the deck, continuity is provided by interlocking finger plates which transfer shear between units providing a loadpath to the offset torsion box and to the hub support. At midpier, the closing joint comprises finger plates and a pair of pin locks to secure the bridge in its closed position.

Construction Sequence

1. Construct sheet pile caisson in the river channel, install bored concrete piles to bedrock at pier and quayside base, construct concrete pier and quayside base.
2. Form approaches to structure at 1:20 gradient, install end support internal frame.
3. Rotate hub frame to the ‘bridge open’ position and erect steel bridge hub onto support frame.
4. Individually hang 2.2m long steel bridge segments onto hub, making the hinged connection between adjacent segments, commence with segment 1 and proceed to segment 9.
5. Install guided roller bearings to pier top and erect central deck section 10, secure onto guided roller bearings at pier and make connection to segment 9 (erected in stage 4).
6. Install steel ballast plates into section 10, complete deck and parapet finishes, install lighting and rotate hub into bridge closed position. (Only 1 half shown here for clarity).

Geometry

The bridge is part inspired by Thomas Heatherwick’s Rolling Bridge at Paddington Basin, London. Unlike the Rolling Bridge, this structure retracts by winding around a vertical axis on both banks. The segmented steel box units, the first of which is permanently fixed to the cylindrical steel hub, are drawn away from the span as the hub and its walking surface rotate anticlockwise. As each segment separates from the adjacent unit and contacts with the hub, a large pin on the rear face of the unit locks into the hub making a secure connection. The winding of the segmental units forms a helix around the hub and withdraws the central span over the pier providing the required navigation clearance. The parapet comprises a series of vertical 1.4m high, 50mm wide posts, positioned with a 100mm clear gap. Units 1 to 9 and the quayside hub are constructed from painted steel, to minimise weight in the cantilever tip, unit 10 is constructed using a fibre reinforced polymer with additional steel ballast plates positioned in unit 10 to balance the cantilever. Across the structure, key moving components are manufactured using stainless steel, painted steel, or reinforced concrete.