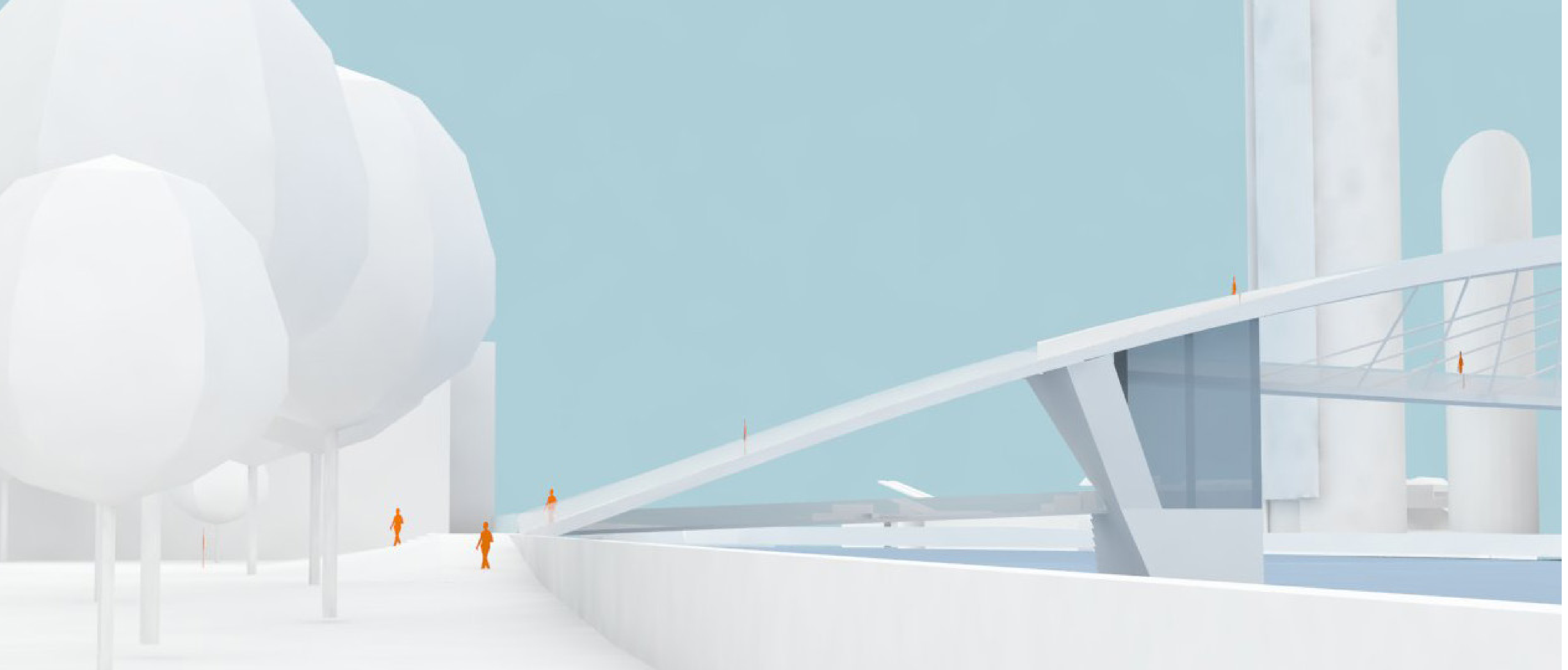
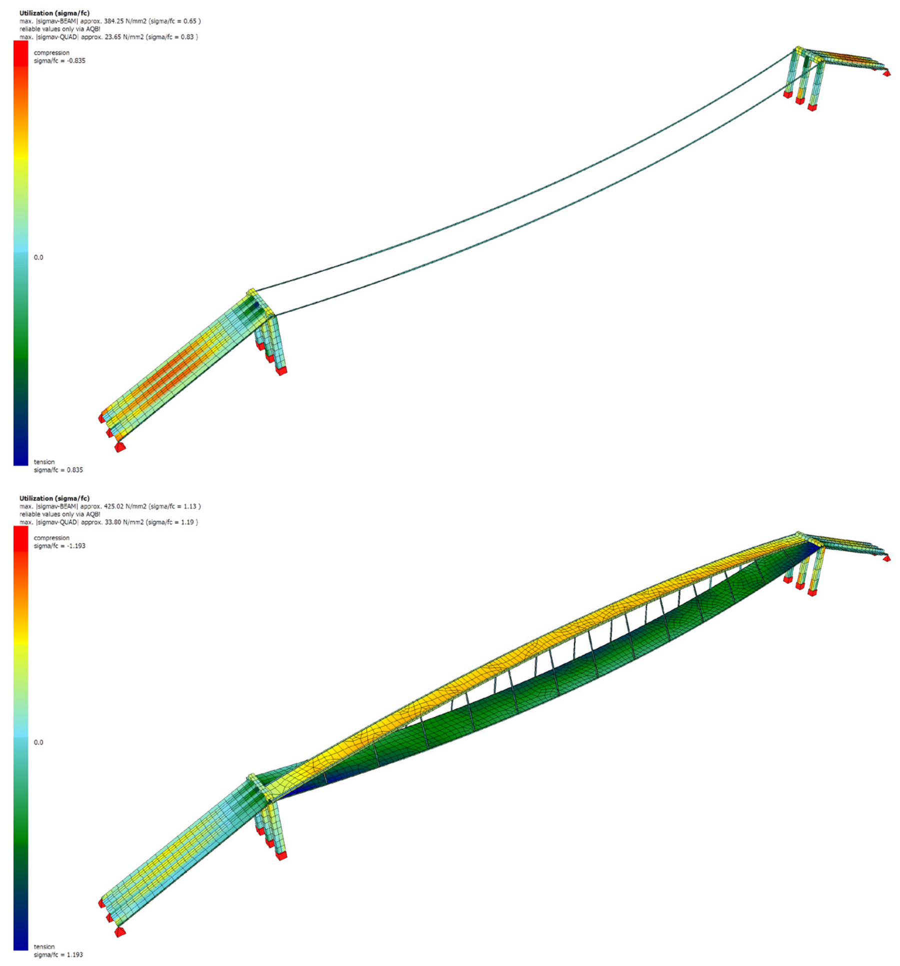


Promenade

Bridge crossing - enclosed within cables on the tension ribbon



Landscape integration and Abutments

Open space is limited on both sides of the Thames, and the bridge must enhance the riverwalk rather then blighting it would extensive ramp and lift structures. The riverwalk has been gently lifted to a height of 6.5m AOD where it meets the bridge, forming a landscaped launching point for the staircase and lower bridge to the pier and lift. This raised landing point keeps fully open views of the river and Nine Elms/ Pimlico, and preserves all existing routes and connections.

The groups of supporting cables are anchored at each bank underneath this landing point. Each abutment is founded on a 3m reinforced concrete pile cap anchored by a group of 1.5m to 2.1m diameter reinforced concrete piles. At this stage is it estimated that 12 piles to 18 piles will be requires at each embankment. The large predominantly horizontal forces from the cables are transfer via a reinforced concrete beams and shear walls on top of the pile caps. These beams and shear walls provide also the jacking pit for the suspension cables.

Integrating Cycle and Pedestrian Traffic

The Bridge is designed to delight users during morning rush-hour users as well as out of hours. The bridge is designed to offer two differing exeriences at all times:

- a lower flat route (incline 1:20 or less) supported by two lifts on each side
- an arched route with steps as widely spaces steps as needed.

Both routes are clearly ledgible and will requ ire no wayfinding or signposting, they depart at the same point level with the riverbank and converge again on the other side. Rush-hour cyclists eager to avid waiting for lifts are encouraged to push their cycle up the arched/ stepped route with integrated sloped tracks for cycles.

The main lower span of the bridge is designed as a 5m deck with painted separation for cyclists and pedestrians, ensuring that the cycling users can travers the bridge speedily while giving the pedestrians users two differing experiences, the lower shared route or the more elevated arched walk on top of the world.

The PLA River Clearance requirements of 10.96m AOD for 150m lenghts will be maintained.

Two bridge elements are designed to work in combination to achieve the required clearances, a shallow Ductal Fibrecement arch and a tension ribbon structure, with two concrete supports in the water outside the clearance zone. The arch and ribbon are tied and work in

Superstructure

The structural typology of the bridge is that of a partial suspension bridge, where the cables are used to support an elevated bridge deck. The lengths of the three spans are 35m for the North span, 150m for the main span between the piers and 35m for the south span. Two groups of locked coil cables either side of the deck span from bank to bank over two river piers. The sag of the cable profile is 3.5m in the main span.

The predominant geometrical constraints of the bridge are clear width of 150m between piers, minimum clear height above the water level and the existing levels and flood defences at either side of the river banks.

The architectural concepts allows pedestrians and cyclists to cross the bridge at two levels, the lower level is supported directly by the suspension cables and upper deck arches between the internal piers. The upper bridge deck is connected via props to the suspension cable system. The suspension cables, upper arch and props form a bow fish like truss system, where the cables are in tension and the uppers arch is in compression. The props stabilize the compression arch to resist global buckling. The spacing of the props is 4.0m.

Upper deck

The upper bridge deck is formed from prefabricated and site-joined Ductal Fibrecement sections spanning between the props. The 4m wide deck structure comprises two longitudinalDuctal beams either side of the upper arch and transverse ductal deck. Other finishes, such as the lighting and handrail, will be integrated into the deck structure.

Lower deck

The lower deck is directly connected to the suspension cables using a customized steel clamp. The deck is formed of pre-cast concrete planks resting on the steel clamps. The spacing of the cable groups determines the spans of the concrete plans and ranges from 6.0m to 8.0m. The width of the planks is approximately 2.0m. This fixing typology for the deck allow for thermal expansion and contraction of the suspension cables without imposing significant stresses onto the deck. Other finishes, such as the lighting and handrail, will be applied or fixed the deck structure.

Suspensions system

The cables form the primary structure of the bridge and have a shallow cable profile, as described above. The cables system has therefore similar characteristics to ribbon bridges which have similar shallow profiles. Substantially stiff abutments are required to help limit the live load deflections.

Props

Vertical steel props are located either side of the deck. The props are connected to the suspension cables via clamp brackets and provide support to the arch and upper deck. Horizontal ties running within the decks connect the props in order to provide additional later stability to the cable system since the prop arrangement is asymmetric across the bridge.

Piers

The river piers themselves comprise fabricated steel box sections/ concrete columns connected to a reinforced concrete foundation which is founded on 2 No. concrete caissons. The piers have to withstand a ship impact without significant permanent displacements as well as providing adequate stiffness to the cable system along the length of the bridge. Cable saddles are fitted atop the piers below the bridge deck.

Pier foundations

The bridge is supported by two piers in the River Thames. The foundations for the piers comprise a pair of concrete caissons, dug into the river bed level within a sheet pile cofferdam. When a 3m deep pile cap will be placed onto the caisson. The pier foundations have to withstand a ship impact without significant permanent displacements as well as providing adequate stiffness to the cable system along the length of the bridge.

Stairs, walkways and lifts

Stairs and walkways are design as simply supported structures spanning from the embankment onto the piers. The structure of these elements will be Ductal Fibrecement planks. The lift will require a lift shaft and is clad as lightweight open glass and steel structure.

Dynamic behaviour of the bridge

Wind

The influence of the wind on the bridge will need to be examined in in more details in terms, aerodynamic stability, buffet movements and environment for bridge users. These studies will be carried out during the next stage.

Pedestrian excitation

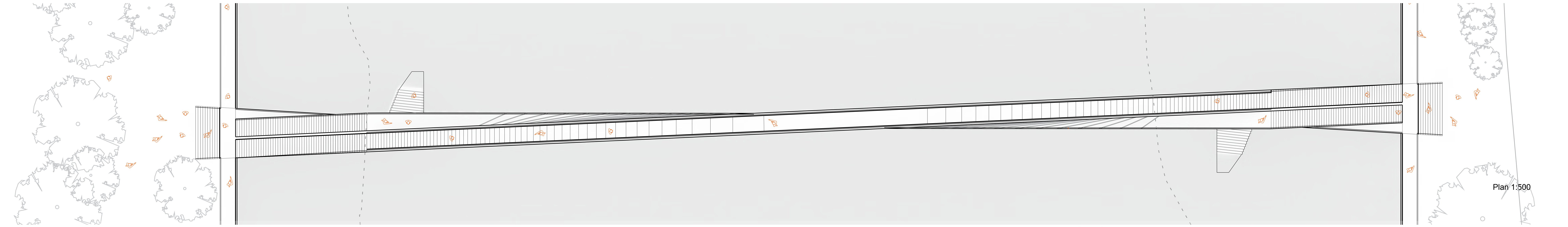
Suspension bridges with a low dip of the suspension cables prone to dynamic excitation by pedestrian users both in vertical and lateral directions due to the "soft" nature of the cables. A details study of the dynamic behaviour will be carried out during the next stage of the design. Considering the spans and typology of the bridge construction mass tuned dampers will very likely be required. At this stage it is assumed that dampers will be distributed across the bridge, e.g. at third and quarter points and integrated within the bridge deck.

Phased Construction

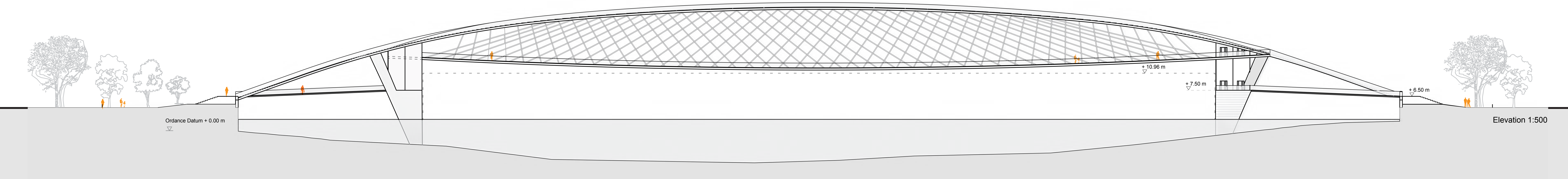
The bridge is designed to limit impact onto river traffic to an absolute minimum. Only the installation of the first cable will lead to short-term disruptions. A wide range of construction methods and sequences are available for suspension bridges. Offsite prefabrication of steel and pre-cast concrete elements offers flexibility in terms of erection sequence and certainty in terms of the programme; and once installed the planks and girders provide platforms for subsequent construction operations.

The principle stages for the erection of the bridge are as follows

Stage 1: Install abutments either side of the bridge, concrete caissons and internal piers
Stage 2: Run pilot cables across the rivers and install the suspension cables. Anchor cables into abutments.
Stage 3: Pre-cast bridge deck erection on suspension cables starting from midspan
Stage 4: Install props and upper arch and deck
Stage 5: Install stairs cases, walkways and lift structure



Plan - Integration of pedestrians & cyclists



Long Section

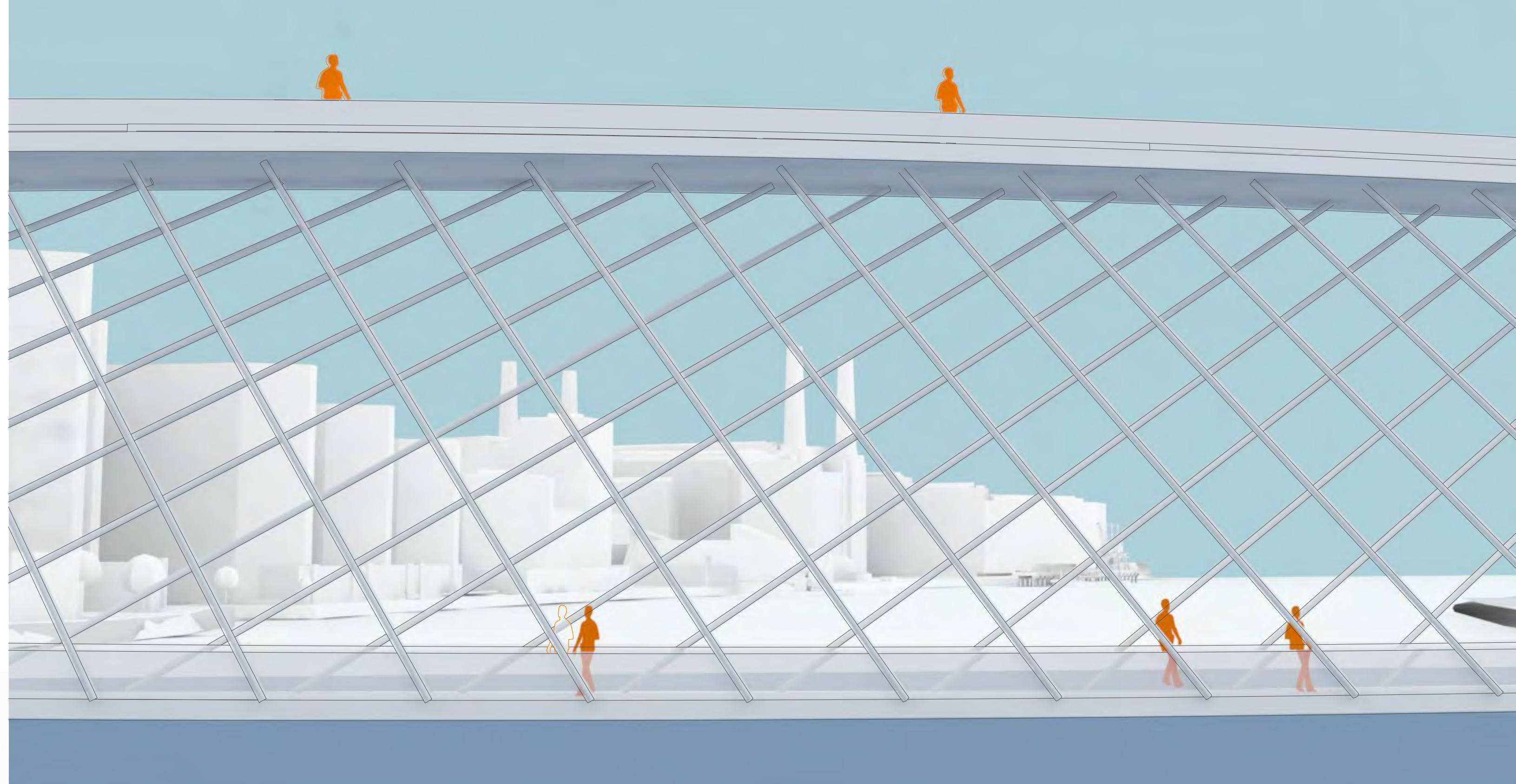
Identity

The Bridge is designed as a landmark for Nine Elms and Pimlico, combining an expression of its function with a sculptural articulation of its elements that creates a recognizable silhouete from afar, and a memorable crossing experience up close.
The bridge is routed in the context, using as departure points the existing riverwall and avoiding any further build form in the adjancent green open space. The bridge is not impossing itself onto its two constituent shorelines, instead limiting its expression of form to the central 150m clear span. Its formal language and use of materials is at once using the latest advances of the 21st century, but expresses them in a form reminiscent of the beauty of earlier industrial structures.

Inside view

Crossing the bridge, and inhabiting the bridge, is encouraged via two separate yet intertwined routes.
The lower route via the suspension bridge deck is a direct route across the river, catering to the traveller in a hurry as well as those on wheels. The steel props either side of the bridge create a sense of enclosure, a structural space that is inhabitable, twisting as it follows the shifting alignment of the arch over the suspension bridge.
The journey across the arch is a very different experience, unconstrained by cables, ties and props, the user rises further and further above the water, with a magnificent view over the thames from its crown. Both crossing experiences depart and arrive at exactly the same location, allowing the user to decide which route to take every day anew.

Place making across the bridge & its landing points



Tension ribbon and arch structure