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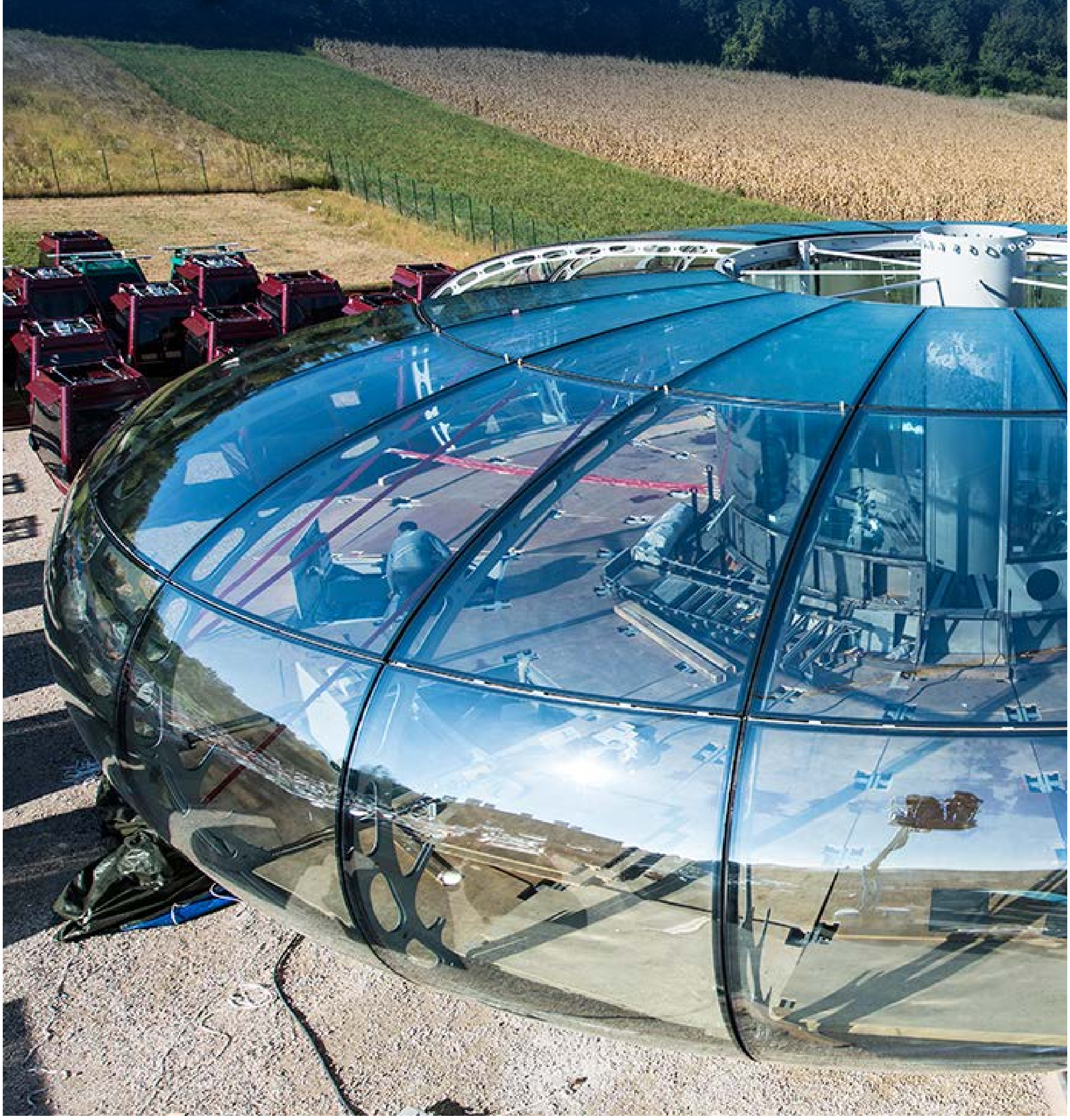
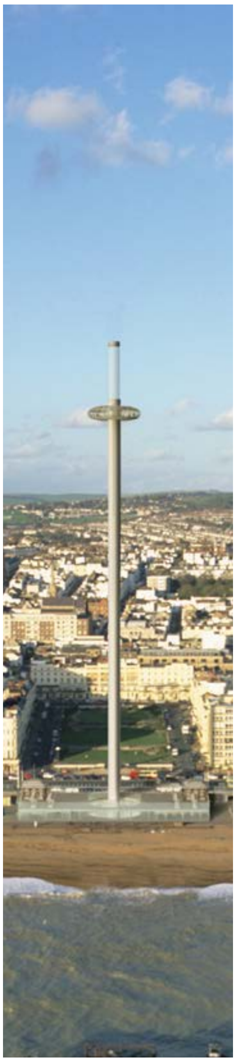
Key words
engineering
construction
materials
glass

A clear view from the top

Building the pod for the British Airways i360



The i360 pod under preliminary construction at its manufacturer's base.



The i360 tower rises high above Brighton and the surrounding countryside.

Currently under construction in Brighton is the British Airways i360, the world's tallest moving observation tower. Created by the team behind the London Eye, the i360 has a large glass pod that glides up the 162 m tower. It is a testament to the design skills of our architects, engineers, and contractors that the pod appears so simple and delicate, and that each pod sector fits together perfectly. To achieve this degree of sophisticated simplicity is in truth hugely complex.

The pod design

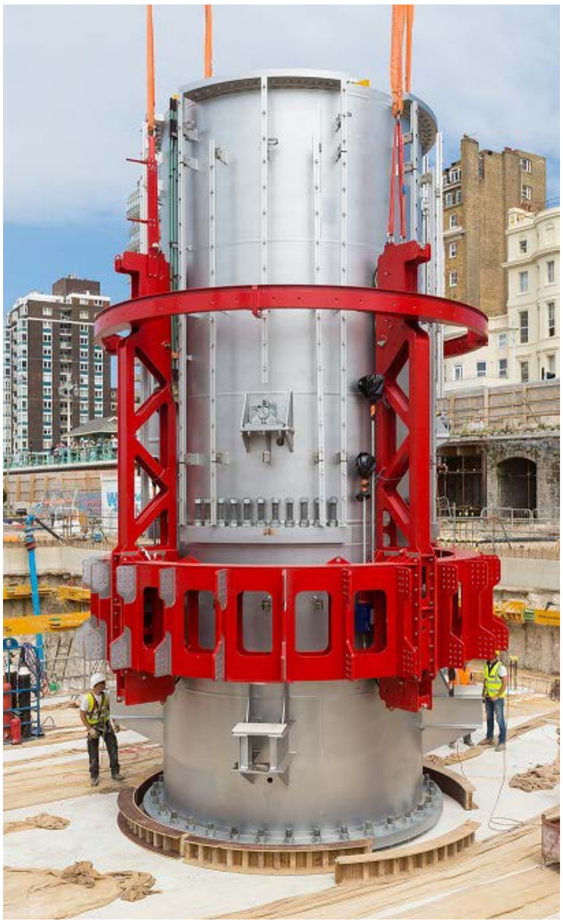
From the outset, we wanted the pod to have a clear, open space so that up to 200 people would have the freedom to move around and enjoy unimpeded 360 degree views in all directions. Having successfully worked with Poma to create the 32 London Eye capsules, it made complete sense to bring them in to realise the pod design.

Ten times bigger than a single London Eye capsule, and 18 metres in diameter, the design of the i360 pod is based on an 'oblate ellipsoid'. In geometrical terms this means a 3-dimensional shape created by revolving an ellipse 360 degrees about its minor axis (with a cylindrical core removed to allow the tower to pass through). In layman's terms this means a shape a bit like a Smartie, but with a vertical hole through the centre.

With up to 200 people free to move around inside the pod on each ride or 'flight', this meant the team had to consider not only how to manage the weight to keep the pod stable as it runs up the 162 m tower, but also how to manage humidity and temperature, bring electricity into a moving structure and integrate the communications, sound and lighting systems into the design of the pod, whilst keeping the design as visually light and free from clutter as possible.

The chassis

The pod is supported on a red-painted chassis which will be hauled up and down the tower on 4 pairs of steel ropes. These ropes run up the outside of the tower in the 4 vertical slots in the tower cladding, and then run over bull wheels near the top of the tower and are attached to a counterweight inside the tower. To lift the pod, a winch in the basement pulls the counterweight down. To lower the pod, the winch slowly releases the counterweight back up inside the tower.



The i360 pod is attached to the two ring beams of this red chassis as it travels up and down the tower.

If you have been able to watch the progress of the build you will have seen that the red-painted chassis actually came over with the tower sections back in June 2015 and was placed over cans 1 and 2 as the tower went up.

A close up look at the chassis reveals 4 masts with a small ring beam at the top and a large ring beam at the bottom. The bottom ring beam supports 24 cantilevered pie-shaped floor sectors of the pod, and the upper ring beam supports 24 glazed superstructure pie-shaped sectors of the pod. The cables connecting to the counterweight inside the tower are attached to the 4 mast sections of the counterweight which also integrates spring-loaded guiding wheels running on the tower, so the pod and chassis travels up and down smoothly on the surface of the tower.

Two electrical 'bus-bar' tracks run up two of the tower slots and transfer mains electricity, via pick-ups on the chassis, into the pod to power air conditioning, heating, and other equipment housed within the pod. Because the pod and chassis are always heavier than the counterweight, we are able to harvest 50% of the power required to lift them through regenerative motors, making a return ride equivalent in energy-usage to a passenger sitting on a bus for a 1.5 mile journey.

Delivering the pod to Brighton

To ease prefabrication and transport, Poma constructed the pod in 24 floor sectors, 24 glazed superstructure sectors and 12 inner wall arc sections. The superstructure sectors consist of double-curved, double-glazed laminated glass assemblies mounted onto a light-weight painted mild steel frame. The floor sectors support a solid floor and house the air conditioning units, communication and safety systems. These systems are concealed from view by mirrored glass on the underside of the pod, which will create convex reflections of the city and its surroundings for people on the boarding platform to see as the pod rises or descends.

Working on the interior of the pod

Constructing the pod

The floor sectors were installed first, supported on temporary rods or hangars. The floor sectors of the pod are supported by 48 trusses, one either side of each sector, which are bolted together and cantilevered from the chassis to support the floor. The temporary hangars were removed once all of the sectors were adjusted to be perfectly level and then bolted together.

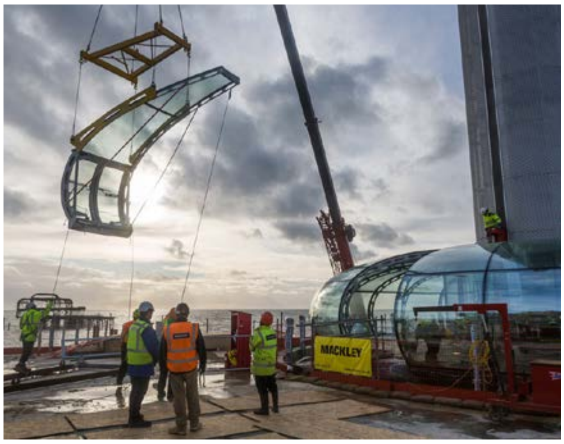
Creating the glazed superstructure sectors

Despite the delicate appearance, the superstructure sectors are incredibly robust, weighing slightly less than the weight of the floor sectors. This is because the double-glazed glass assemblies are constructed from two laminated double-curved sheets glued together with an interlayer and separated by a sealed air gap between the two separate glass layers, creating a window assembly that is four layers of glass thick.

Specialist glass maker Sunglass in Italy, who also provided the double-curved glass assemblies for the London Eye capsules (although they are only single glazed), curved the glass at high temperature using their own patented bespoke moulds. The process of heating glass puts the outer surface into compression and the inner surface into tension, effectively creating a stronger 'toughened glass' material. As this form of toughened glass cannot be cut to size, each piece had to be precisely cut to size at the start of the process in order for them to fit together accurately in layers and then be attached to the steel ribs forming the frame for each superstructure sector. Each sector has a rib on each side which matches perfectly with its neighbour so that two adjoining sectors can be bolted together.

Perfect viewing conditions

The external glass surface incorporates a permanent self-cleaning treatment, which means rain water will not stick, but rather it will run off in sheets preserving clear views for visitors even in rainy conditions.

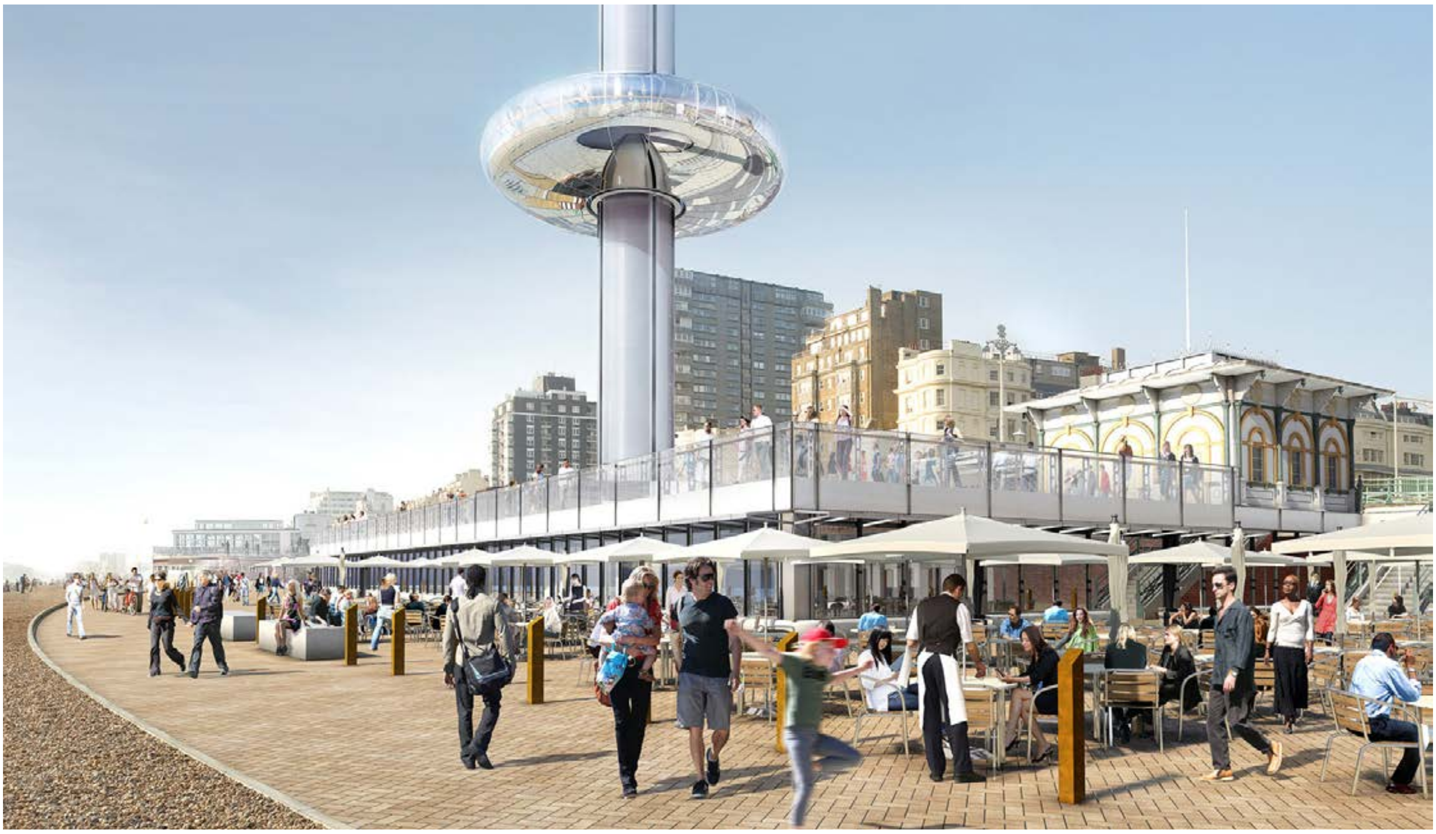


The last segment of the pod is lifted into place.

Look here!

Keep up-to-date with this exciting engineering project:
http://britishairwaysi360.com/latest-news/

David Marks of Marks Barfield Architects is the i360's chairman and architect; Dr John Roberts is chief engineer.



A CGI impression of the pod as it lifts off to rise up the tower.