

## THE FALKIRK WHEEL

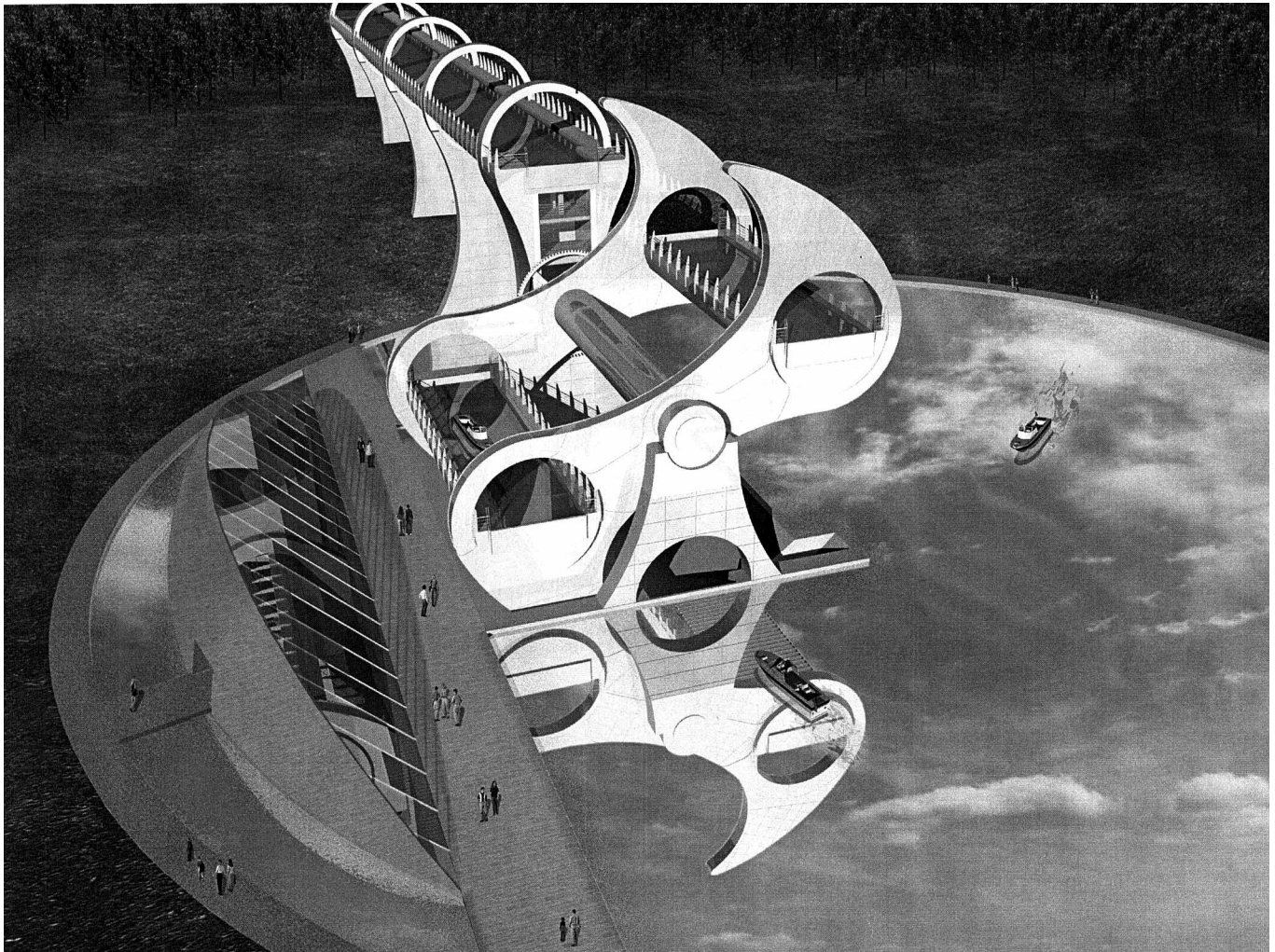
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The Falkirk Interchange is part of the Millennium Link, the joining of the two lowland canals, the Forth and Clyde (1790) and the Edinburgh Grand Union (1822). The original join, from Port Maxwell at the western end of the Union to Lock 16 close to the Union Inn (Auntie Kate's) at the old Port Downie on the Forth and Clyde, was by way of a flight of 11 locks. In the mid 1990's an investigation of this, closed in the 1930's, showed it to be difficult to re-establish due to many obstructions and physical changes over these seventy years. The new routed interchange was planned but with many physical obstacles still to be overcome. Thus an exemplar design was undertaken on behalf of British Waterways by Binnie Black and Veatch of Glasgow to consider what still needed to be done in design and financial terms.

Earlier feasibility research had been done and costs apportioned to the numerous structures, infilled sections of canal, bridges, and utility services along the whole Link. The exemplar design allowed tenderers to be instructed under European rules that ultimately led to the selection of Morrison Bachy Soletanche Joint Venture as the design and build contractor. From early feasibility to exemplar and construction designs, the underlying solution has remained remarkably true over some six years, and includes constructing an aqueduct over a road, 1.3 kilometres of new canal, bypassing a 1930's coal mine, and a Roman construction camp, and infilling a section of 1960's coal mine. The largest obstacles to be seen above ground along the route are a main railway, a B class road and the archaeologically important Antonine wall dating from circa AD142, all of which could not be disturbed in any manner. This prompted the solution to tunnel under all three obstructions. To accommodate the change in level and to pass under the railway, two locks each with a drop of 3.7 m were necessary before the tunnel, some 147 m long and 8 m diameter, could be reached.

The interchange site to the north of the tunnel, with a level difference of 24 m between the canals required many engineering and design ideas to be considered. The innovative solution by way of a wheel boatlift outshone all others. Much design, technical, safety, and cost research followed before the final design was chosen. Competitive tendering did not come up with the polished design hoped for, and as a result a partnership of contractors, designers, manufacturers and the British Waterways team, prepared the final design. From the tunnel, an earth embankment 150 m long and a concrete aqueduct 120 m long reach out to the wheel boatlift or transfer mechanism sitting high above a basin. The basin then enables boats to discharge from the mechanism via a lock down into the Forth and Clyde canal.

The Wheel is the centrepiece of the whole Millennium Link which is anticipated to effect a regeneration of Falkirk and the central lowlands from



**The Falkirk Wheel – an impression.**

Edinburgh to Glasgow, the Forth to the Clyde Estuary. The Wheel as a boatlift and design form is seen as an icon of 2000 comparable to the Forth Bridge, Eiffel Tower and other international feats of engineering. The structure is 27 m long and 35 m in diameter and manufactured in steel ranging in thickness from 6 mm to 50 mm. It is designed to turn every 15 minutes, carry a mix of boat sizes in caissons 27 m long and 6.6 m wide, and by hydraulic motors acting on a 3.6 m gear attached to its aqueduct end. While the wheel rotates the caissons are kept horizontal by a planetary gear system which includes 9.5 m diameter main gears and 2.3 m diameter idler gears. Each of the two caissons holds 260,000 litres of water (260 tonnes) and is equipped with bottom hinged flap gates at either end which can only be operated in the docked station, with the land positioned gates being chosen to house the hydraulic mechanisms. Manufactured in Ripley, Nottinghamshire, Spring 2001 will see the first sections being transported by road to Falkirk where they will be assembled, an interesting exercise using heavy lifting equipment and structural support trestles.

Much thought has gone into the setting of water seals on the gates which are both caisson and land based. During loading and unloading the caissons have to be sealed against the land docks, accomplished by the use of slide sections which effectively bring the canal out to meet the caisson thereby taking up the working clearance between the lift and the gates. The hydraulic equipment for the gates is land based for ease of maintenance and repair. The main drive motors are all fitted inboard of the wheel where associated equipment, spares and supplies, stand-by electric generator and control systems are all located. Whilst the wheel is designed with a life of 120 years, certain major mechanical equipments may need replacing. For this to be done with the least difficulty the main drive gears are formed in steel sections allowing their future replacement with a relative ease comparable with the 1880's Victorian canal engineers who planned for maintenance work to be carried out in the year 2000.

As construction work progresses thoughts are turning to other aspirations and aims of the Link. Regeneration of areas close to the canals and the creation of employment have already begun. Several building developments have started and water based business interests are formulating plans for the opening of the Link, city to city, coast to coast.

Improving environments and encouraging wild life are major commitments with the extensive dredging and return of boat traffic. Close to the Falkirk Interchange the removal of mercury contamination is progressing using new lime treatment techniques for dealing with the waste. The little known Bennett's pondweed is endemic to the Forth and Clyde. Fish are being safeguarded during construction and the counting and recording of species carried out. The Lowland canals are Scheduled Ancient Monuments and as such are protected through legislation. British Waterways and its partners are committed to effectively restoring locks, bridges and all that is associated with canals.

Prior to plans to use the wheel area as a park-like facility, the site was a deep opencast pit left by mining ending in the early 1980's. Until the early 1970's the site was the home of Scottish Tar producing various tar-related products. Little remains of that huge facility, partially destroyed by fire in the 1970's, when fire fighters lost their lives controlling the blaze. Although some tar remains on the site it is safely contained in deep encapsulated pits, and the land over these pits will be used as an area for car and bus parking. All these works have left a high water table, heavy with iron deposits, and the need for 30 m deep concrete pile foundations.

The Romans while building the Antonine Wall may have been the first to change the landscape in Scotland. Other major earth works were undertaken more recently by railway and road builders constructing viaducts and embankments. In present times we can make every effort to design and create something of beauty that is pleasing to the eye, yet functional, using newer materials in different ways. British Waterways have set out to restore navigation, build something which could not have been built in the 1900's, an achievement of its time in this new canal age. All this comes about due to the commitment and enthusiasm of many people in the voluntary sector and Local authorities, to Scottish Enterprise, the European Regional Development fund, the Millennium Commission, and British Waterways.