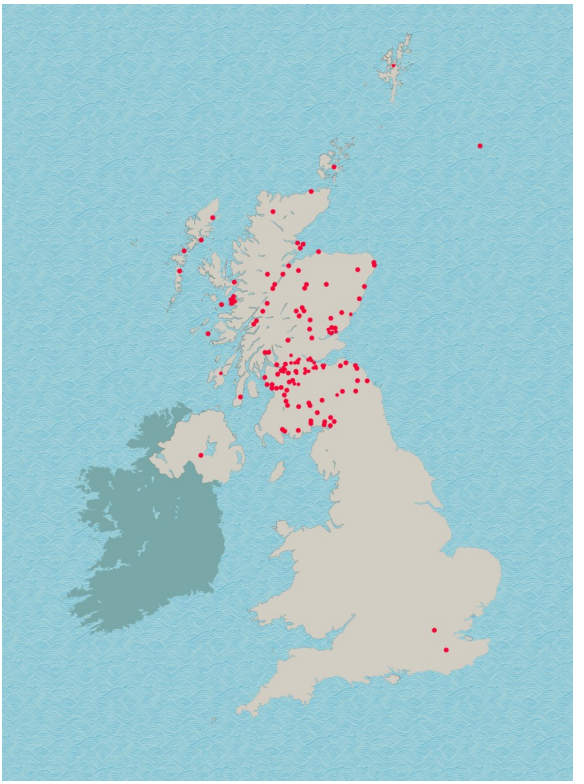
The Saltire Civil Engineering Awards Test of Time

Celebrating the Scottish Imagination



A map of all the projects awarded a Saltire Civil Engineering Award is available at:

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SALTIRE SOCIETY SCOTLAND

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Celebrating the Scottish imagination

Welcome to a celebration of 80 years of the Saltire Society and its work. Those who started the Saltire Society in 1936 feared that Scotland's cultural gas was at a peep, that the achievements of the past were unrecognised, great traditions were being lost and
contemporary arts lacked vitality. They did something about it. They formed a movement that for 80 years has promoted, presented, published, agitated and debated and in doing so helped create the conditions for today's thriving and confident creative Scotland.

In this context the Saltire Society commissioned a 'Test of Time' research project, reflecting on 34 years of the Saltire Society Civil Engineering Awards and allowing the Society, the industry and the general public to better understand the longevity and significance of Scottish engineering.

This essay is the culmination of Brunella Balzano's research.

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About Brunella Balzona

Born in a small town in the South of Italy, raised with Lego and pasta. I had my studies in Italy, achieving a First-class honours BEng in Environmental Engineering and a First-class honours MEng in Structures for Architecture at University of Federico II, Naples, Italy.

My curiosity towards things I couldn't explain made me look for a research experience as PhD student. I did my PhD at the Department of Civil and Environmental Engineering of University of Strathclyde in Glasgow and I am now completing the writing-up of the thesis.

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Civil Engineering has played an important role for society since the beginnings of human existence. The earliest practices of Civil engineering may have commenced between 4000 and 2000 BC in Ancient Egypt and Mesopotamia when the small communities, previously practicing a nomadic existence, started to establish their lives in permanent settlements. This new way of existence caused a need for the construction of shelter and then transportation became increasingly important.

In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. The first engineering school, The National School of Bridges and Highways, France, was opened in 1747. The first self-proclaimed civil engineer was John Smeaton who constructed the Eddystone Lighthouse. In 1771, Smeaton and some of his col- leagues formed the Smeatonian Society of Civil Engineers, a group of leaders of the profession who met informally over dinner. Though there was evidence of some technical meetings, it was little more than a social society.

In 1818, world's first engineering society, the Institution of Civil Engineers was founded in London, and in 1820 the eminent engineer Thomas Telford became its first president. The institution received a Royal Charter in 1828, formally recognizing civil engineering as a profession. Its charter defined civil engineering as:

Civil engineering is the application of physical and

scientific principles, and its history is intricately linked to advances in understanding of physics and mathematics throughout history. Because civil engineering is a wide ranging profession, including several separate specialised sub-disciplines, its history is linked to knowledge of structures, material science, geography, geology, soil, hydrology, environment, mechanics and other fields.

Scotland has been famous throughout the world for its engineering since the 18th century. In particular, Scottish engineers have contributed significantly to the development of transport systems. Their creativity and talent led the country to renew its appearance and to improve its ability to function as a modern nation.

With the Test of Time essay, one of a series celebrating its 80th anniversary, the Saltire Society wants to pay a homage to the professionals who have contributed to the this process of innovation. It is also an opportunity to help the wider community to better understand this legacy and how civil engineers have improved the Scotland's quality of life. The Saltire Society was founded in 1937, with the aim to celebrate all that is best in Scottish cultural life, from literature to the built environment, arts to heritage.

The Saltire Society Award is a partnership with the Institute of Civil Engineers and for 34 years has promoted a better understanding the significance of Scottish civil engineering and celebrated excellence and innovation in the profession.

Scottish engineering has found its main expression in the improvement of the communication and transport system.

An example is given by one of the first awards assigned in 1981 to the Ballieston interchange. The A8 between Baillieston and Newhouse was dualled and grade separated in a £1.5 million Scottish Office contract in the early 1960s. It was the first scheme constructed in an effort to modernise the notoriously unsafe route between Glasgow and Edinburgh. In 1963 it was announced that the entire route between the two cities was to be upgraded, and that it would be built along a new line. The Baillieston to Newhouse section was effectively at the centre of these plans. By the late 1960s it had been decided that the new route would be built to motorway standards leaving this six mile A-class road as a gap. Proposals to upgrade this "gap" to motorway status were initially developed in the mid-1970s with construction intended to follow on the completion of the M8 Monkland Motorway to Baillieston Interchange. Strathclyde Regional Council, in its 1978-82 transport plan, proposed to upgrade the route to Bargeddie junction by 1981. Changes to national budgets put the project (and many others) on hold. The scheme was resurrected in the late 1980s with an "offline" upgrade proposal which included widening the existing motorway as far as junction 5 at Shotts. This passed its statutory processes and was to be financed by PFI.

Two further examples of engineering masterpieces are represented by the two awards given respectively to Kessok Bridge in 1983 and Kylesku Bridge in 1985.

The Kylesku Bridge, in particular, is a distinctively curved concrete box girder bridge in north- west Scotland that crosses the Loch a' Chàirn Bhàin in Sutherland. It was constructed by building out the supporting legs and then lifting into place the

central span, which had been constructed on land and then moved onto a barge by rail and weighed 640 tonnes. The bridge is designed to be sympathetic to the surrounding country, and the approaches were chosen to minimise changes to the landscape.

Selkirk bridge

Another interesting example of Scottish engineering is also seen the Selkirk bridge, which received a commendation in 1984. The bridge that currently carries the A707 from the Selkirk town centre to the Bannerfield suburb, is a modern replacement to the 18th Century bridge, washed away in 1977 due to a major flood. The town had been founded on the hill, on the south side of the River Ettrick, which is prone to flooding. The he current bridge has stood since 1981 and is a twin-span concrete structure, with one span across the normal river channel and another over the south bank for floodwater. The spans are un- usual, arching up from the central pier and tapering off to the abutments.

This is presumably designed to minimise the risk of damage should another major flood occur.

Another great example is also the Stonehaven Bypass, which had a commendation in the awards of 1986. Plans for a road that would bypass Stonehaven, thereby letting vehicles heading to/from Aberdeen avoid the small town centre with its narrow streets, were put forward as early as 1927. Work did not begin however until 1982.

Congestion in the town had reached unacceptable levels. This was mainly due to the expanding oil business in Ab- erdeen. Starting at Glasslaw farm, it runs in a valley were it passes beneath the main railway line at Fetteresso. The bypass then runs in abroad sweep to the north east, crossing the deep gorge of the Cowie Water.

Machiavelli wrote: " whoever wishes to foresee the future must consult the past". One of the greatest innovation of the 16th century, was the introduction of the use of the cables in bridge design. A cable-stayed bridge has one or more towers (or pylons), from which cables support the bridge deck. A distinctive feature are the cables which run directly from the tower to the deck, normally forming a fan-like pattern or a series of parallel lines. This is in contrast to the modern suspension bridge, where the cables supporting the deck are suspended vertically from the main cable, anchored at both ends of the bridge and running between the towers.

The Cable stayed footbridge in Glasgow Road joining Dumfries

Cable stayed footbridge joining Dumfries and Lincludenca

and Lincluden is an amazing example of how the past design techniques are still alive and can provide an innovative and exciting result. In 1991 the award went to this extraordinary engineering work.

On the other hand, we also can find a pure modern design in the River garden festival bridge. We are in front of a an example of swing bridge: it's a movable bridge that has its primary structural support a vertical locating pin and supporting ring, usually at or near to its centre of gravity, about which the turning span can then pivot horizontally.

The Bell's Bridge, opened in 1988 as the world's longest pedestrian swing bridge and remains one of the enduring physical legacies of the Garden Festival.

Glasgow garden festival was the third in UK's 5 national garden festivals and the only one to take place in Scotland. It was the first event of this type to be held in the city in 50 years.

In 1994 the award went to the Faslane Naval Base at Gare Loch west of Glasgow, home to Royal Navy's four Vanguard class Trident submarines — HMS Vanguard, HMS Victorious, HMS Vigilant and HMS Vengeance. Its ship lift is one of the largest in the world, and when confirmation of the safety case for its continued operation became necessary, the engineers provided an independent peer review and a technical assessment in support of the ultimately successful case.

Facilities for submarines at Faslane consist of the huge ship lift building and three jetties to the side of it. One of the Trident submarines is always on patrol while another is in maintenance. The remaining two are on standby. Their pressurised water reactor power plants are designed to operate for seven years without overhaul.

Two years later the award went to an engineering work which really changed the communication scheme between Skye island and the rest of Scotland. We are talking about the Skye crossing, finally the bridge to connect Skye with the rest of Scotland.

In the past, the only way to go on Skye was to queue for hours waiting for the ferry from Kyle of Lochalshh to Kyleakin on the isle of Skye.

Originally the Skye bridge was a toll bridge and an expensive

one at that.

Skye Bridge

Considering the length of the structure, the cost of crossing was the highest toll per metre in Europe. The original expectation for a ticket to cross the Skye Bridge was 40p in actual fact the fare ended up being 11.40 pounds. People used to say: " The Skye bridge, the only place in the world where you get mugged and get a receipt!"

In 1998 another important masterpiece managed to obtain the award: a work which really led to a radical change in the economic and social system. It's the bridge linking the islands of Harris and Scalpay.

With the welcome assistance of a 65% grant from the European Union through the Objective One Programme, the islands' authority was able to proceed with the ambitious transport objective they had set themselves to construct the 300m bridge to Scalpay which carries road and pedestrian traffic together with the water supply for the island.

Lying in the entrance to East Loch Tarbert just off the Isle of Harris, Scalpay is a small but pop- ulous island. Despite the proximity of the island to Harris, it was only in 1997 that the Scalpay Bridge was opened, after a surprisingly long gestation period, with the first reports instigated in 1986. However, the construction was comparatively swift, running from April 96 to December 97, although advance works on the access roads started almost a year earlier.

The bridge itself is a pre-fabricated box girder structure spanning 300m in total, the central span being 170m. This span is support- ed by two inclined legs, with their footings on the shore on either side of the Kyles of Scalpay. It can be seen in the distance from the Uig-Harris Ferryas it enters/ leaves the ferry port at Tarbert. Whilst some may think it an optical illusion, the bridge really does rise up from Harris to Scalpay, although the approach roads do the opposite, dropping on Harris to meet the bridge and then dropping again once on Scalpay.

Why a Bridge rather than a more normal causeway? The simple answer is that the Kyles of Scalpay is a deep, steep sided channel, with rapid tidal flows. Constructing a causeway across would be virtually impossible.

Another very interesting case is given by the Fort Augustus Lock Repair Works. The Caledonian canal was conceived as a way of providing much-needed employment to the Highland region. The area was depressed as a result of the Highland Clearances, which had deprived many of their homes and jobs. Laws had been introduced which sought to eradicate the local culture, including bans on wearing tartan, playing the bagpipes,

and speaking Gaelic.

The canal would also provide a safer passage for wooden sailing ships from the north east of Scotland to the south west, avoiding the route around the north coast via Cape Wrath and the Pentland Firth.

The first survey for a canal was carried out by James Watt in 1773, but it was the Caledonian Canal Commission that paved the way for the actual construction. On 27 July 1803, an Act of Parliament was passed to authorise the project, and the canal engineer Thomas Telford was asked to survey, design and build the waterway. Telford worked with William Jessop on the survey, and the two men oversaw the construction until Jessop died in 1814. The canal was expected to take seven years to complete, and to cost £474,000, to be funded by the Government, but both esti- mates were inadequate. There was an upsurge in commercial traffic during the First World War when components for the construction of mines were shipped through the canal on their way to Inverness from America, and fishing boats used it to avoid the route around the north of Scotland. Ownership passed to the Ministry of Transport in 1920, and then to British Waterways in 1962. Improvements were made, with the locks being mechanised between 1964 and 1969. By 1990,the canal was in obvious need of restoration, with lock walls bulging, and it was estimated that repairs would cost £60 million. With no prospect of the Government funding this, British Waterways devised a repair plan, and between 1995 and 2005, sections of the canal were drained each winter. Stainless steel rods were used to tie the

double-skinned lock walls together, and over 25,000 tonnes of grout were injected into the lock structures. All of the lock gates were replaced, and the result was a canal whose structures are probably in a better condition than they have ever been. The amazing effectiveness of this repair works made possible for the entire project to obtain a commendation in the awards ceremony in 1997. The canal is now a Scheduled Ancient Monument, and attracts over half a million visitors each year. British Waterways, who work with the Highland Council and the Scottish Forestry Commission through the Great Glen Ways Initiative, were hoping to increase this number to over 1 million by 2012.

Let's make a jump of approximately 7 years, during which, many innovative infrastructures, contributing to the connectivity and the functionality of the country, have been located all around Scotland and merit recognition.

In 2005 the award went to an amazing example of innovative engineering project: the Falkirk Wheel.

Falkirk Wheel

It is a rotating boat lift in Scotland, connecting the Forth and Clyde Canal with the Union Canal. The lift is named after the nearby town of Falkirk in central Scotland. It opened in 2002, re-connecting the two canals for the first time since the 1930s as part of the Millennium Link project.

The plan to regenerate central Scotland's canals and reconnect Glasgow with Edinburgh was led by British Waterways with support and funding from seven local authorities, the Scottish Enterprise Network, the European Regional Development Fund, and the Millennium Commission. Planners decided early on to create a dramatic 21st-century landmark structure to reconnect the canals, instead of simply recreating the historic lock flight. The wheel raises boats by 24 metres , but the Union Canal is still 11 metres higher than the aqueduct which meets the wheel. Boats must also pass through a pair of locks between the top of the wheel and the Union Canal. The Falkirk Wheel is the only rotating boat lift of its kind in the World, and one of two working boat lifts in the United Kingdom, the other being the Anderton boat lift.

After other 9 years another very interesting project managed to obtain an award. It is a wonderful product of a big creation process, due to the will to transform under-used land between Falkirk and Grangemouth into a thriving urban greenspace called "The Helix". This includes a performance area, on which large scale events can be held, facilities for water sports provided by the construction of a large lagoon, all surrounded by play areas and high quality pathways.

The central area is known as Helix Park. The name 'Helix' comes from the distinctive shape of the project as it spirals down from Langlees to Laurieston and Polmont.

It is impssible in this short essay to give proper justice to the range and quality of the engineering projects which have made what Scotland is today. They have been been vital for the growth and development of the country. Here I have tried to report just few examples of the amazing works that has been carried out by engineering companies all over Scotland, to improve both economically and socially their country and that have left a significant sign in its history. While I was researching the various works, I realized how many they have been and in such a small period of time. If we think about that, from 1981, when the first award ceremony took place, until now, Scotland has changed significantly. New infrastructure projects like bridges, motorways, new flood protection and renewable energy schemes have had a key role in the development of a modern country taking account of its unique and diverse geography.

This anniversary of the Saltire Society allows us a moment to reflect upon, understand and appreciate what has been done so far and inspire what is possible in the future.

Brunella Balzano

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We are;

- An apolitical membership organisation open to all
- An international supporter and patron of the arts and cultural heritage of Scotland
- A champion of free speech on the issues that matter to the cultural life of every Scot
- A promoter of the best of what we are culturally, now and in the future
- A catalyst to ensure new ideas are considered and the best of them are made real

We believe we have an important and unique role to play, as an independent advocate and celebrant of all that is good and important about our cultural lives and achievements. The Society has played a crucial role over the last seventy five years, in recognising our cultural achievements. And while times have changed the need for that independent voice remains.

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