



# Saltire Civil Engineering Awards 2017

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## Background



The Saltire Society and its members believe that culture is at the heart of who they are. Since 1936 they have worked tirelessly to support and celebrate all that is best in Scottish cultural life, from literature to the built environment, arts to heritage. Their annual programmes reflect the breadth of their interest with debates, discussion, awards and performances taking place across Scotland and online (most notably in the shape of Scotland's largest virtual festival, ScotLitFest). By becoming a member you can help them to promote Scotland's achievements and ambitions and discover their wealth of resources and events. [www.saltiresociety.org.uk](http://www.saltiresociety.org.uk) @Saltire\_Society Registered charity number SC 004962

The Institution of Civil Engineers is a global professional body with 90,000 members around the world. Our 8,000 Scottish members design, build, operate and maintain the water, flooding, waste, energy and transport infrastructure on which our society depends. ICE supports its members to become qualified and develop professionally throughout their careers with events and publications. As well as promoting the profession and inspiring the next generation of engineers ICE inform debate on the key issues of the day through policy reports such as their State of the Nation Infrastructure scorecard and work with government and opposition for public benefit. [www.ice.org.uk/scotland](http://www.ice.org.uk/scotland) @ICEScotland

# Foreword

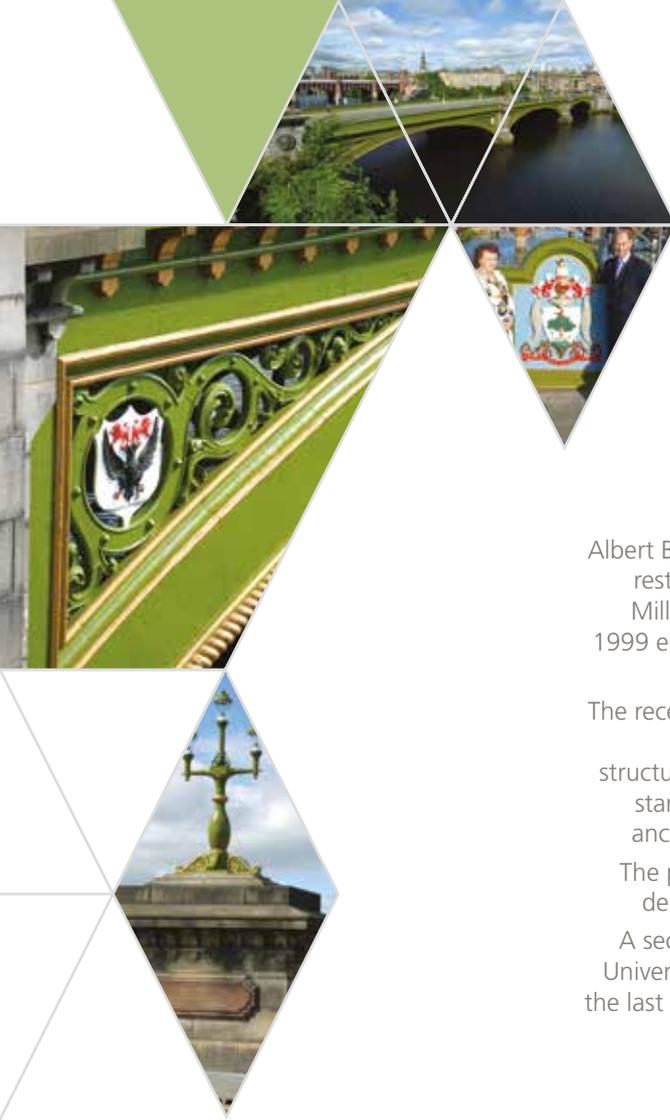
Jamie Hepburn MSP  
Minister for Employability and Training

The Saltire Civil Engineering Awards provide an opportunity to recognise and celebrate civil engineering at its best across Scotland and worldwide in 2017. Transport projects remain a feature of the projects shortlisted and which can make a significant contribution to our vision for a prosperous, fair and well-connected Scotland. In addition, Scottish civil engineering expertise can be seen in action, from the major improvements to the M8, M73 and M74 motorways, to redevelopment of port facilities which serve some of Scotland's remoter population, and further afield to the Stockholm bypass. Since 2007, the Scottish Government has invested almost £20 billion in transport infrastructure and services to deliver the largest transport investment programme that Scotland has ever seen.

I am, however, impressed at the range and diversity of projects across a range of locations within and outwith Scotland, in both public and private sectors which show clearly that Scotland remains open for business and that civil engineers have the skill and talent to meet the needs of Scotland and beyond.

As Scotland works towards achieving a low carbon, sustainable economy, I am particularly pleased to see two projects shortlisted projects: the Beaully-Denny Overhead Transmission Line which will effectively double the renewable energy capacity of the network, linking renewable energy schemes to where there is demand for electricity; and the Grudie Hydro Scheme, which provides renewable, clean energy which is feeding directly into the local power network, providing sufficient power for almost 1700 homes.





## Albert Bridge, Glasgow

Client: **GLASGOW CITY COUNCIL**

Contractor: **BALFOUR BEATTY**

Sub-Contractors: **BALLANTINE CASTINGS LTD and MacLEAN & SPEIRS**

Albert Bridge, which crosses the River Clyde beside Glasgow Green, has now been restored to its former splendour. The bridge, designed by Engineer R. Bell & D. Miller of Glasgow, originally opened on 21 June 1871. Strengthening works in 1999 ensured the long-term safety of the structure but did not include renovation of the ornate details, or strengthening of the footway and parapets.

The recent refurbishment works included replacing the cast iron parapets, erecting new lighting and life belt poles, and stripping, repairing and repainting the structural ironwork. The lighting and life belt poles replicate the original gas lamp standards. The new parapets also match the originals but are cast ductile iron, anchored into the deck. All the castings were made using traditional methods.

The paintwork is a rich green with gold highlights and colourful heraldic shields depicting the Glasgow coat of arms and significant organisations of the time.

A section of original parapet is now in the ICE Scotland Museum at Heriot Watt University. A Clyde Navigation Ferry Token from the mid-1800s, discovered under the last section of parapet to be removed and believed to have been placed during construction as a good luck gesture, is in the Riverside Museum collection.

# Beauly-Denny Overhead Transmission Line

Joint Clients: SCOTTISH HYDRO ELECTRIC TRANSMISSION LTD,  
SCOTTISH POWER ENERGY NETWORKS

Contractors: BALFOUR BEATTY (SHEL SECTION) and  
BABCOCK INTERNATIONAL GROUP (SPEN SECTION)

One of the key challenges facing engineers is to transport electricity from windfarms and other renewable energy schemes in the north of Scotland to consumers across the UK, helping to 'keep the lights on'.

A new 220km overhead transmission line between Beauly and Denny has effectively doubled the renewable energy capacity of the network enabling Scotland to meet nearly half its target of 50% renewable energy supply and UK and EU targets of 20% of all energy requirements from renewable sources by 2020. It is the most significant electricity infrastructure project Scotland has seen in a generation.

The project involved the construction of more than 250km of access tracks across some of Scotland's most remote, inhospitable and environmentally-challenging terrain; the design and construction of 579 unique transmission towers; and the installation of more than 2600km of electricity conductor. A new 400kV line replaces the existing 132kV line.

At its peak it was the largest piling project in Europe and required 25,000 tonnes of '355 high tensile J2' steel, never before used in the manufacture of transmission towers.

The project was subject to considerable scrutiny with 17,000 objections resulting in the biggest ever public enquiry in Scotland.



# Brodick Ferry Terminal Redevelopment

Client: CALEDONIAN MARITIME ASSETS LTD (CMAL)

Port Operator: CALMAC FERRIES LTD

Contractor: GEORGE LESLIE LTD

Lead Consultant: CH2M

Consultants: MAX FORDHAM

Design Consultant: WALLACE STONE

Architect: NORR



The construction of a new ferry terminal facility at Brodick on the Isle of Arran enhances the lifeline ferry services to mainland Scotland and creates 21st century facilities for the next 60 years. The £30 million investment secures a safe, efficient and reliable ferry terminal and service supporting local people and businesses and a thriving tourism industry. The works comprised a berthing structure complete with link-span to accommodate a new 100m long vessel, a two-storey terminal building and land-side marshalling areas constructed on reclaimed land.



A five-phase construction programme ensured that construction works were carried out with no detriment to live port operations. Detailed traffic management plans enabled progress whilst maintaining an uninterrupted ferry service.

Benefits to the local community included the reinstatement of the severely eroded Brodick Beach with the placement of 10,000t dredge material. A new covered site was provided for the memorial to HMS Dasher, lost off the coast of Arran in the WW2.



Electric vehicle charging points, photovoltaic roof panels, a biomass heating system fuelled by locally sourced wood chip, a non-mechanical ventilation system and segregated bicycle routes and storage ensure that the facility is fit for a low carbon future.

# Cuningar Woodland Park & Footbridge

Joint Clients: FORESTRY COMMISSION SCOTLAND (WOODLAND),  
GLASGOW CITY COUNCIL (BRIDGE) and CLYDE GATEWAY  
(WOODLAND PARK)/FUNDER (BRIDGE)  
Contractor: ROBERTSON GROUP  
External Project Manager: PICK EVERARD (WOODLAND PARK)

The regeneration of the £5m, 15-hectare Cuningar Loop site in the East End of Glasgow has transformed a vacant, derelict and unusable stretch of land into a popular community woodland park. Part of the 2014 Commonwealth Games Legacy, the finished site features an extensive path network, adventure play facilities, a bike skills area, Scotland's first bouldering park, a woodland workout, large meadow and picnic areas, an outdoor classroom, and a riverside boardwalk.

A 99m span footbridge constructed between the Athletes' Village and Cuningar Woodland Park, connects the local communities, improving accessibility and significantly increasing visitor numbers.

The site of Glasgow's first water treatment works in the 19th century, Cuningar Loop became a landfill site for demolition rubble from the Gorbals in the 1960s. Topsoil for the new greenspace was manufactured on site by diverting and treating materials from other developments, otherwise bound for landfill.

The project provided learning and employability skills for students and disadvantaged young people, generating 76 work placements, 18 apprenticeships and hundreds of curriculum support events.

This project has enormous benefit for the community. It also has enormous potential as an example of a successful sustainable natural park design on a derelict and/or contaminated site.



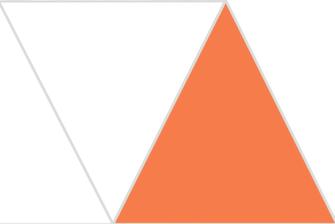
## Dales Voe South Quay Extension, Lerwick Port Authority

Client: **LERWICK PORT AUTHORITY**

Contractor: **BAM NUTTALL LTD**

Client Designers/Project Managers: **ARCH HENDERSON & PARTNERS**

Piling & Ground Anchors: **BAM RITCHIES**



The extension to the quay at Dales Voe provides a multi-purpose deep-water facility to serve the emerging needs of the offshore industries including renewables and decommissioning. The £11.95m investment secures Shetland's position at the forefront of decommissioning works in the North Sea and enhances its reputation as a UK onshore centre of excellence, enabling the island to compete with overseas locations with significant benefits for the island, Scottish and UK economies.

The Lerwick Port Authority led project added 75 metres to bring the quay to 127 metres, providing the offshore industry with the strongest quay in the UK (60 tonnes per square metre). A new quayside was created with 55,000m<sup>3</sup> reclaimed site-won aggregate and rock sockets were formed using the largest cluster drill in the UK.

Engineers mitigated the risk of programme delays associated with severe Shetland winter weather and avoided use of expensive jack-up barges with a bespoke temporary works modular piling platform. The use of fixed modules improved productivity.

Digital representations of the temporary works using Building Information Modeling (BIM) technology enabled detailed visualisations of the sequencing and optimisation of the temporary works, including the rig support and pile installation gates.

The infrastructure is the deepest of its type in Scotland.

## Dalmunach Distillery, Moray

Client: [CHIVAS BROTHERS LTD](#)

Lead Consultant, Civil & Structural Engineering Designers, & Contract Administrators: [BLYTH AND BLYTH CONSULTING ENGINEERS LTD](#)

Principal Contractor: [ROBERTSON CONSTRUCTION](#)

Quantity Surveyors & Costs Consultants: [THOMSON BETHUNE](#)

Architect: [ARCHIAL NORR](#)

The new Dalmunach distillery replaces the former Imperial Distillery on the banks of the River Spey near Aberlour.

The most energy efficient distillery in Chivas' portfolio, Dalmunach incorporates a sophisticated heat recovery system, cooling pond and new water abstraction scheme for the cooling water needed during the distilling process. The pond to the front of the building both enhances the setting of the building and drains surface water in a sustainable urban drainage system (SUDS). The ingenious 'open loop' water abstraction system ensures no detrimental impact on water volumes within the Spey and no impact on fishing or local ecology.

The distillery is capable of producing up to 10 million litres of spirit every year in the most efficient and sustainable manner possible with a 20% efficiency improvement over 'traditional' distilleries, and energy saving initiatives targeted at reducing the amount of energy the process uses.

Sustainability in the industrial process and building design was a key design driver for the project and incorporated re-use of the existing site; site crushing and incorporation of all demolition arisings, the use of salvaged Oregon pine to clad parts of the building, and salvaged bricks and kiln doors in the entrance area heritage wall.





## Edinburgh Gateway

Client: **NETWORK RAIL**

Contractor: **BALFOUR BEATTY**

Consultant: **WSP**

Consulting Engineers: **HEWSON CONSULTING ENGINEERS**

Architect: **IDP ARCHITECTS**



Edinburgh Gateway Station is a new multi-modal station on the main Edinburgh to Aberdeen railway line.

The new interchange, hailed the 'Gateway to Scotland', is the flagship station of a £1bn investment programme in the railway between Edinburgh and Glasgow (EGIP). It is the first station in Scotland to link train and tram services to the airport giving direct access to the airport via public transport. The brief was to provide 'airport quality' finishes.

The constrained site is tightly bound between the busy A8 Glasgow road into Edinburgh, the east coast mainline, Edinburgh tram mainline and depot access tracks and Edinburgh Airport's second runway. The station comprises two tracks, two 265m long railway platforms (partially canopied), with a linking accessible footbridge, station building and concourse. A pedestrian underpass below the A8, associated car parking, and highway alterations facilitate access to the station. A linking structure houses walkways, lifts and escalators, connecting the tram and train elements. Associated landscaping includes retaining structures and walls used to enhance and complete the visual dynamics, seamlessly linking the two elements.

The station is step-free and the first in the UK to have tactile floor studs at key decision points for blind and partially sighted people.



# Glasgow Queen Street Tunnel Slab Track Renewal

Client: NETWORK RAIL

Contractors: MORGAN SINDALL, BABCOCK INTERNATIONAL, COSTAIN, STORY CONTRACTING LIMITED, CPR, SIEMENS, RHOMBERG SERSA, RAILWAY ELECTRICAL SERVICES LTD, CORECUT, ACE BUILDERS LTD, RVT GROUP, KENT GROUP and CAIRNHILL STRUCTURES

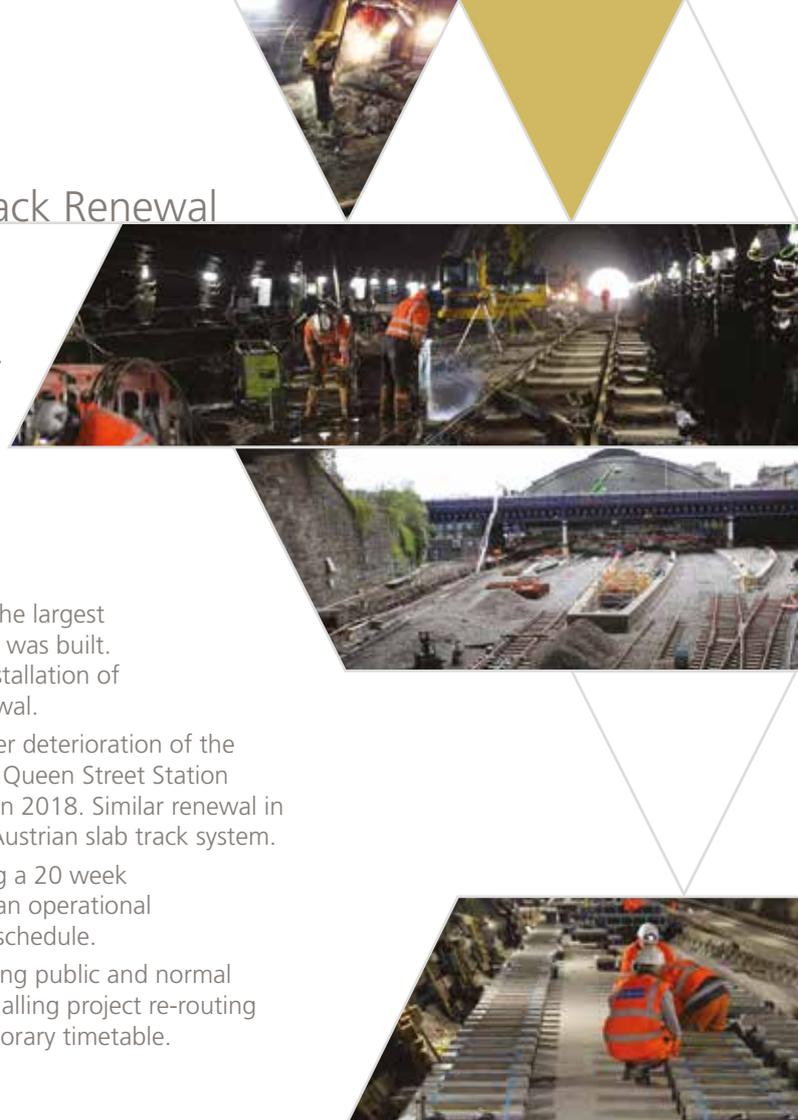
Designer: JACOBS UK LIMITED

The Edinburgh to Glasgow Improvement Programme (EGIP) is the largest piece of engineering works on the Scottish rail network since it was built. The electrification of the line between the cities involves the installation of vital equipment including overhead power lines and track renewal.

The electrified fleet will achieve greater speeds resulting in faster deterioration of the slab track. Renewing the life-expired concrete slab track within Queen Street Station tunnel was vital for the introduction of electrified rolling stock in 2018. Similar renewal in Winchburgh Tunnel in 2015 informed the choice of the same Austrian slab track system.

Engineers worked around the clock on the £60m project during a 20 week blockage from March to August 2016 returning the station to an operational environment and normal passenger service two days ahead of schedule.

As one of the busiest stations in Scotland impact on the travelling public and normal services was unavoidable. It was minimised by an earlier re-signalling project re-routing services in and out of Glasgow Queen Street Station on a temporary timetable.





## Grudie Hydro Scheme

Client/Developer: **INNOGY UK LTD**  
Contractor: **FARRANS CONSTRUCTION**  
Civils Designer: **MWH UK LTD**  
Hydroplant Designer: **GILKES**  
Grid Connection Contractor: **SCOTTISH AND SOUTHERN ENERGY POWER DISTRIBUTION (SHEPD)**  
Landscape Consultant: **ASH DESIGN AND ASSESSMENT**



Located near the beautiful loch and nature reserve Loch Maree, Grudie Hydro Scheme collects water from the river through an intake structure which transfers water through a buried penstock to a powerhouse. The water passes through turbines located in a powerhouse and discharges through a tailrace back into the river. Renewable and clean electricity generated by the scheme feeds directly into the local distribution network sufficient to power nearly 1,700 homes.

The scheme consists of a powerhouse, intake structure, buried pipeline, access tracks and connection to a 33kV local distribution network. The concrete powerhouse was built into an existing hillock and houses two 1MW turbines. The 500m<sup>3</sup> concrete intake structure is located on the river 2.5km from the A832 and 125m above the road. Its construction took place while the river was diverted around it. The 1800m buried pipeline of 1200mm glass fibre reinforced plastic (GRP) was laid in 12m lengths in an open trench averaging 3m deep.

The 2.5km of access tracks required were constructed from site-won processed stone.

The quality of design and construction is an asset to Scotland's power generation network and enhances the local environment. The consideration given to local environment will set a benchmark for future projects of this kind.



## Mair's Pier, Lerwick Harbour

Client: [LERWICK PORT AUTHORITY](#)

Designer & Project Manager: [ARCH HENDERSON](#)

Contractor: [TULLOCH DEVELOPMENTS LTD](#)

Mair's Pier – the largest single capital marine project undertaken in Lerwick Port Authority's 140-year history – was completed in November 2016 after nearly two years' construction.

Lerwick Harbour is Britain's 'Top Port' – the most northerly commercial harbour in the country. The sheltered, deep-water port is open to shipping in all weathers and operates around the clock, handling more than 5000 vessels annually.

The 804 metre L-shaped jetty provides deeper berthing and a substantial working area of more than 1.5 hectares for the fishing fleet and oil logistics. The outer arm quay created a dock sheltering the planned new whitefish market. It is also suitable for berthing offshore industry vessels and large cruise ships visiting Shetland.

The first 110-metres section was released to client early allowing lay-by of fishing vessels, whilst construction work continued laying 15,500 square metres of concrete deck area and demolition of the former smaller jetty.

The construction utilised a drill and blast toe stabilisation technique, eliminating the need for low-level tie-rods requiring significant underwater diving activities and reducing site accident risk.

The Marine Scotland approved construction environmental management plan included full mitigation and monitoring measures preventing disturbance to a large population of cetaceans and seals.





## M8, M73 & M74 Motorway Improvements

Client: **TRANSPORT SCOTLAND**

DBFO SPV: **SCOTTISH ROADS PARTNERSHIP**

Contractors: **FERROVIAL AGROMAN UK LTD and LAGAN CONSTRUCTION GROUP LTD**

Designer: **AMEY OW LTD**

Operation & Maintenance Contractor: **AMEY LG LTD**

Scottish Ministers' Site Representatives: **MOUCHEL and FAIRHURST**

One of Scotland's largest infrastructure projects, the M8 M73 M74 Motorway Improvements Project completes the missing link in central Scotland's motorway network. The £500m project brings safer roads with improved connections, journey time reliability and a better quality of life for road users, communities and industry in the west of Scotland and beyond as well as promoting significant sustainable economic growth.

The project combined the construction of a new motorway with upgrades to three of the busiest arterial motorways in Scotland, all with more than 100,000 vehicles using the network daily.

This three-year project improved 37km of road network and included new 12km six-lane M8 motorway connecting Glasgow and Edinburgh by continuous motorway for the first time; three new motorway junctions; 10km of dual lane all-purpose roads; widening of 25km of motorway carriageways; upgrades to two interchanges; construction or upgrade of 70 structures; and improved air and water quality, and reduced noise impact.

Works impact was minimised with effective communications and community engagement.

The construction and management of such a project requires skill and ingenuity. Raith Interchange and Braehead Rail Bridge particularly stand out in this regard.

# Oriam – Scotland's Sports Performance Centre – Steelwork Frame

Client: **ORIAM**

Design & Build contractor (steel frame): **J&D PIERCE (CONTRACTS) LTD**

Main Contractor: **BOWMER & KIRKLAND**

Engineer: **ENGENUITI**

Architect: **REIACH & HALL**

Oriam is Scotland's new sports performance centre combining the principal performance base for the Scottish Football Association and Scottish Rugby Union, training facilities for various other professional sporting organisations, as well as operating as a sports centre for the general public.

The roof design follows the profile of a free kick taken by Roberto Carlos of Brazil against France. JDP's redesign of the roof support structure generated £3m cost savings over the original highly aesthetically-driven trapezoidal box girder. The use of tubular members in truss form generated airiness to the design, whilst the complex nature of loads from the tensile membrane necessitated careful detail to achieve the desired effect. Incorporating the temporary works for building in the permanent works was of critical importance, with the trusses being assembled in the air. At 25m deep they would have fractured if lifted from the flat.

The membrane fabric cladding surfaces is formed into anticlastic curves to maintain its shape under wind and snow loads.



# Selkirk Flood Protection Scheme

Client: **SCOTTISH BORDERS COUNCIL**

Contractor (main works): **RJ McLEOD (CONTRACTORS) LTD**

Contractor (advanced works): **SBcCONTRACTS**

Project Management: **CPE CONSULTANCY**

Design Consultant: **CH2M**



The town of Selkirk in the Scottish Borders has been susceptible to flooding from the Ettrick Water for many years, resulting in property damage, infrastructure disruption, business loss and human distress for the population of 6000.

The £32.1million flood protection scheme has already proved its worth, protecting the town from flooding on six occasions. Collaborative working between multiple agencies and an extensive consultative framework has delivered multiple benefits, including 6000m of new footpaths and park land areas. Five new footbridges provide excellent access routes to allow pedestrians and cyclists to get out and about.

The scheme affords flood protection to some 700 individual residences and 120 businesses delivering considerable economic benefits (BCR of 1.92).

The scheme embraces the progressive and innovate ethos of the new Flood Risk Management (Scotland) Act 2009 and sets the benchmark for future schemes.

The most innovative element of the scheme is the adaption of the existing outlet at St. Mary's Loch to provide multiple improvements to the overall management of water in the Yarrow Water catchment.

Completed on schedule and within budget in December 2016, the scheme is the culmination of eight years' planning, stakeholder engagement, design and construction.

# SPT Subway Modernisation Infrastructure Asset Renewal

Client: [STRATHCLYDE PARTNERSHIP FOR TRANSPORT \(SPT\)](#)

Contractor: [FREYSSINET](#)

Key Partner: [COWI UK](#)

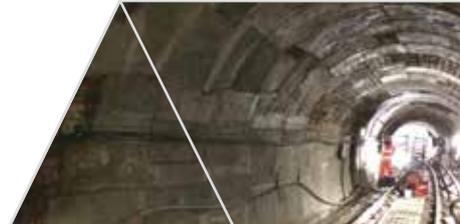
Glasgow's subway is the third oldest underground railway in the world (opened 1896), after London and Budapest. Its biggest modernisation programme in more than 30 years saw 150 people deployed to modernise and strengthen the 120-year-old Victorian tunnels while the city slept. The 40,000 passengers, who use the subway every day, were barely aware of the hive of industry which took place in the tight working window before the reopening of the subway each morning.

In an impressive logistical feat, engineers cleaned and inspected 14,600m of tunnel and 14,000m of track bed and drainage channel, repairing 2,800m<sup>2</sup> of tunnel and carrying out 3,000m<sup>3</sup> of grouting work over a two year period.

Bespoke equipment was designed and fabricated to transport approximately 175,000 bags of grout materials and the various equipment required into SPT stations. The remedial works were carried out in a 4½ hour working window until re-opening of the subway each morning. These works were undertaken over more than two years.

Freyssinet miniaturised their spraying system combining the existing wet and dry spray techniques with bespoke equipment fit for Strathclyde Passenger Transport (SPT) work environment.

The implementation of the works was inspirational and a credit to the civil engineering profession, extending the life of a critical piece of public infrastructure.





## E4 Stockholm Bypass

Client: TRAFIKVERKET, SWEDEN

Designer: AECOM

Designer (JV with AECOM): ÅF CONSULT

The £2.7bn E4 Stockholm Bypass is a new motorway linking Southern and Northern Stockholm. To reduce impact on sensitive natural and cultural environments, over 18km of the 21km length of the motorway is in tunnels. When the route opens for traffic in 2026 it will form one of the longest road tunnels in the world.

In addition to the main carriageways there are six interchanges as well as ventilation, emergency egress and drainage tunnels giving a combined total of 54kms of tunnels.

The design of all tunnel sections of the project were undertaken by AECOM in association with project partner, ÅF Consult, based in Stockholm. AECOM's input has been managed from their Glasgow office, with a significant part of the design input provided from Scotland.

The project has been pioneering in the use of innovative collaboration processes and the implementation of Building Information Modelling (BIM).

AECOM introduced BIM to the project and it is the first major Swedish infrastructure project to implement BIM. Trafikverket used the project as a pilot for BIM and now requires BIM in all new projects.

Included in the design are three temporary jetties allowing export of 19 million tonnes of rock excavated on the project.

# Sponsors



ICE Scotland and the Saltire Society gratefully acknowledge the support of Transport Scotland and the Civil Engineering Contractors Association (CECA) Scotland

## Judging Panel

Ainslie McLaughlin – CEng FICE, Convener, ICE Scotland

John Fraser – CEng MICE, Honorary Secretary, ICE Scotland

Mac West – CEng MICE, ICE Scotland

Susan Briggs – CEng MICE, ICE Glasgow and West of Scotland Branch

John Wotton – CEng FICE, ICE Glasgow and West of Scotland Branch

Martin Lorimer – CEng MICE, ICE Dundee Area Branch

Andy Boxall – EngTech MICE, ICE Edinburgh Area Branch

Graham Porteous – CEng MICE, Transport Scotland

Belinda Oldfield – CEng FICE, Scottish Water

Andrew Wallace – Scottish Environment Protection Agency (SEPA)

Alvar Kenwell – Civil Engineering Contractors Association (CECA) Scotland

Simon Innes – CEng FICE, Association for Consultancy and Engineering (ACE)

Tom Scott – CEng FICE, FIStructE, The Institution of Structural Engineers

Prof Joseph Akunna – CEng MCIWEM, Chartered Institution of Water and Environmental Management (CIWEM)



The Saltire Civil Engineering Awards celebrate outstanding achievements in infrastructure and have grown into the highest honour for engineering excellence. They showcase innovation and ingenuity in civil engineering and celebrate the vital contribution civil engineers make to our quality of life. The awards are run in partnership between ICE Scotland and the Saltire Society. Previous winners of our awards include the Helix urban park, Forth Road Bridge reopening and the M74 completion project.



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