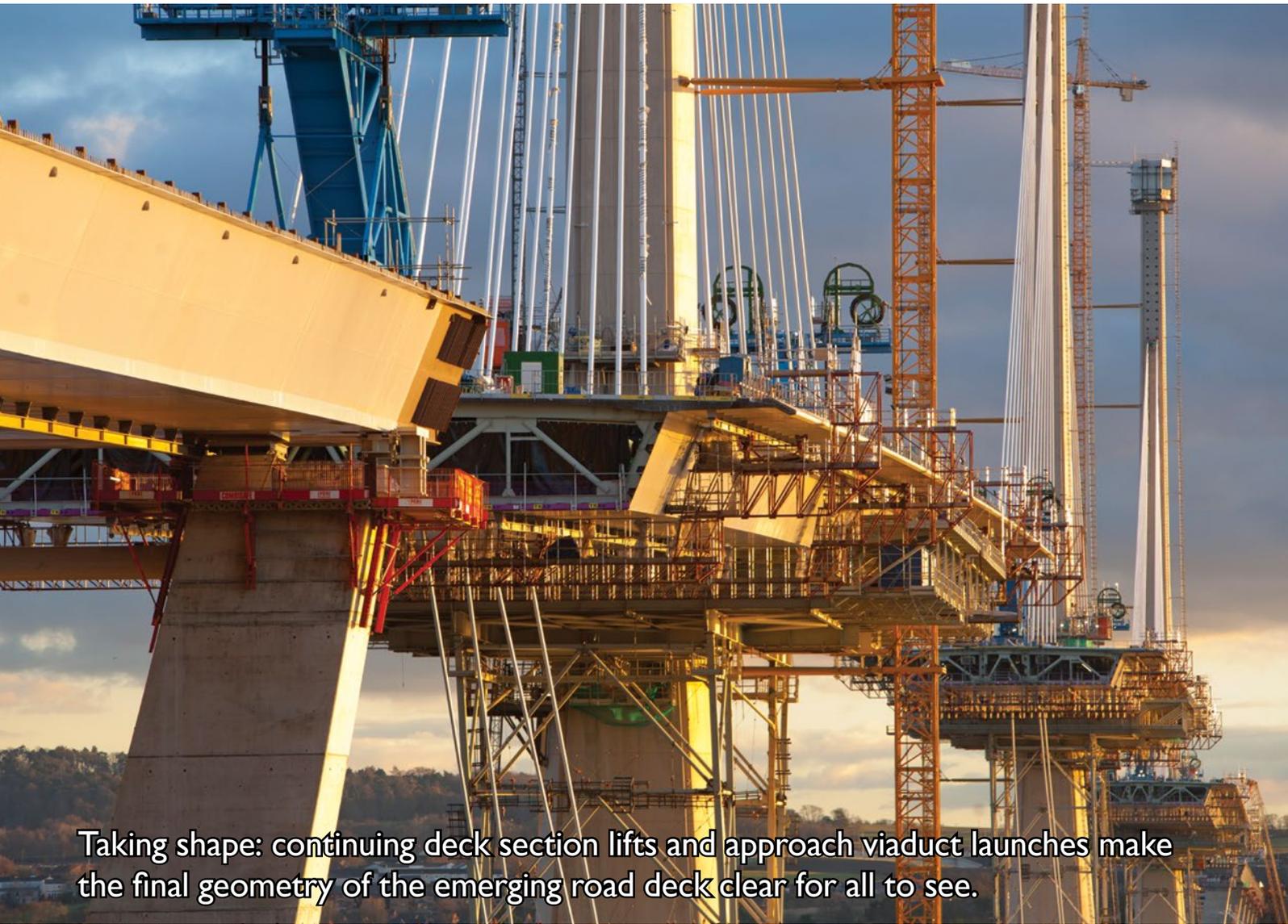


Forth Replacement Crossing

# project update

April 2016



Taking shape: continuing deck section lifts and approach viaduct launches make the final geometry of the emerging road deck clear for all to see.

## Project Directors' Update

A round up of all the latest construction activity in the creation of the iconic Queensferry Crossing.

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## Working in the Community

Latest news from the Queensferry Crossing's community liaison programme.

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## Technical Focus

We take a look at how the new bridge's signature feature, the 288 stay-cables, are made and installed.

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HOCHTIEF | MORRISON CONSTRUCTION

## The Bridge Takes Shape

Welcome to the April 2016 edition of the Queensferry Crossing's "Project Update" newsletter. In recent weeks, as the number of individual deck sections being lifted up 60m into position on either side of each tower has increased, we have received many favourable comments from members of the public excited that the final shape of the bridge is really beginning to emerge clearly.



David Climie & Michael Martin

At the same time, the number of visitors to the Project Exhibition and briefing sessions in the Contact & Education Centre at South Queensferry (see page 4 for dates and opening times) continues to rise. People have always taken a keen interest in this gigantic construction project. Now it is capturing their imaginations. Those of us involved in the design and construction of this magnificent new bridge know that we are privileged to be a part of this little bit of history.

As ever, a great deal of construction work has been taking place on-site. At the time of writing, we have achieved a milestone by reaching the halfway point in our deck section lifting operations. By the end of March, we had lifted 55 out of a final total of 110 sections. Weighing on average a massive 750 tonnes each, these sections are held in place by high-tensile steel stay-cables formed on-site. (Turn to the back page for more details of how these all-important cables are made.) Eventually, the deck sections and signature feature stay-cables will carry the road surface all of us will be driving across in the years to come. Keeping a close eye on wind and tide conditions, each section is lifted up from barges by one of six "erection traveller" cranes situated at each of the leading edges of the emerging deck. The lifting operation takes four hours and, once underway, cannot be halted. That's why we liaise so closely with the Met Office to identify "wind windows of opportunity" where we can be certain of being able to complete the operation. Working at height with the enormous loads involved, wind is the most significant daily challenge we face, especially in such an exposed location as the Firth of Forth. We don't mind the wind blowing – so long as it does so when it suits us! We plan our lifting schedule around the wind forecasts which can mean lifting a section at any time of the day or night and sometimes two sections on the same day.

Once at road deck height, each section is bolted and welded into place while a reinforced concrete "stitch" is laid to complete the top surface. Then begins the process of inserting and tensioning the stay-cables which will carry not just the weight of the section but also, after completion, the road surface, passing traffic and wind load which, on occasions, can be considerable out there.

Turning to the three towers, as previously reported these had all topped out by December last year and work is continuing on the installation of the internal access infrastructure which will include stairways and elevators. Recently, we began to remove some of the temporary steel formwork which has made the building of the towers possible during the last three years or so. This is most noticeable at the North Tower where the topmost platforms and shuttering walls were removed in March. It is worth mentioning again, however, that the vast yellow cranes next to each tower – the highest in the country – will be staying in place for several months to come since they are being used to lift the 288 stay-cables which will support the road deck below.

March also saw the completion of the launch of the Approach Viaduct North. In one of the most technically challenging operations of its type ever performed, the launch involved shifting the massive steel and reinforced concrete structure, with a total launch weight of 6,300 tonnes, some 230m out towards the North Tower. What made this operation really special is the fact that we had to slide the trailing edge of the moving structure down two ramp walls and pivot the structure over the top of one of the two support piers beneath, rather like a gigantic seesaw. This raised the front edge by 2 metres, resulting in the viaduct structure being at the correct geometry to match the emerging deck coming from the North Tower. Cutting edge civil engineering successfully accomplished. Full details of the process were contained in the January 2016 "Project Update".

On the Approach Viaduct South, which was launched into its final position during 2015, work is continuing to lay the reinforced concrete deck, including hard shoulders, along the entire 543m length.

Turning to network connections, on the north side of the bridge all north and southbound traffic has now been switched on to the new permanent northbound carriageway and hard shoulder. This has allowed work to start on building the new southbound carriageway and on demolishing the existing Ferrytoll roundabout structures required as part of the programme to create a new, re-sited Ferrytoll roundabout. Nearby, construction of the new Castlandhill Road junction is underway which involves some temporary traffic diversions at the King Malcolm Drive roundabout. The new junction is scheduled to open during the summer. On the south side, work is progressing well on the laying of the road base along the 2.5km new stretch of motorway to the south of South Queensferry. Once all the verge works are complete, including seeding and landscaping, the final road surface will be laid starting in the autumn and all the ITS and sign gantries will be installed.

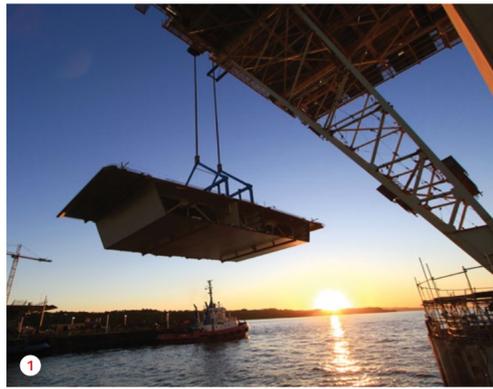
Space only allows a very brief summary of the many and varied operations being carried out in the construction of the new Queensferry Crossing and its approach roads. A whole host of information is available online at [www.queensferrycrossing.co.uk](http://www.queensferrycrossing.co.uk) where you can also find electronic copies of all the "Project Updates" published since early 2012.



**David Climie**  
Transport Scotland Project Director



**Michael Martin**  
FCBC Project Director



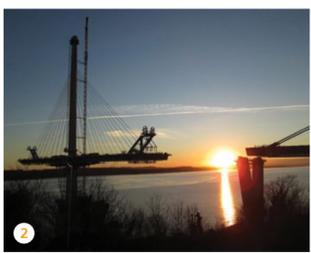
**TOWERS:** 1 The temporary formwork – sometimes called “bird’s nest” – is removed from the top of the North Tower in March. 2 Pretty as a picture: the Queensferry Crossing at sunset. 3 Aerial view of the completed towers, each over 200m in height, which now act as anchors supporting the weight of the emerging road deck. 4 The North Tower standing proud. Later this year, the deck “fan” at its neighbour, the Centre Tower, will become the longest, free-standing, balanced cantilever structure ever constructed. 5 The unique and impressive view from the back of the crew boat as it heads back to land. 6 Looking down from the top of the Centre Tower to the ever-growing road deck 140m below.



**DECK:** 1 750 tonnes aloft! A deck section lift operation underway at the South Tower. 2 Halfway there! The FCBC team at the Precast Yard celebrates pouring the reinforced concrete deck on the 55th deck section out of 110 to be lifted. 3 A deck segment, weighing 250 tonnes, enters the Precast Yard on two SPMTs (Self-Propelled Modular Transporters). A few days later, it will re-emerge having had its reinforced concrete deck laid on top – and now weighing approximately 750 tonnes. 4 Closing the Gap: an aerial view of the North Tower and the Approach Viaduct North. 5 A deck lift almost complete on the North Tower. 6 Early shift: FCBC team members board the 6:15am crew boat out to the towers. 7 The crew boat arrives at the Centre Tower after another bonny commute. Sure beats the M8!



Recent photographs show the scope of the construction works ‘in the round’.



**ROADS:** 1 An aerial view of the Ferrytoll area road works north of the Queensferry Crossing. 2 Network connections: work progressing on the construction of the South Abutment where the Approach Viaduct South connects with a new stretch of M90 motorway which will connect the bridge to the existing roads network. 3 Aerial view of the new Queensferry motorway junction to the south of the new bridge. 4 Here you can see the entire length of the new, under-construction M90 link between the Queensferry Crossing and the existing trunk road network. 5 Construction work on-going on the South Abutment which connects the Approach Viaduct South to the new approach roads.



**VIADUCTS:** 1 Sunset shot of the Approach Viaduct North during its launch over one of its two supporting piers. 2 End of another busy day: closing the gap between the North Tower and the Approach Viaduct North. 3 The 5,600 tonne Approach Viaduct North completes its launch into position on a foggy day in March. 4 During its launch, the approach Viaduct North slid down two ramp walls in order to lift up the front edge by 2m. This allowed the enormous structure to pivot – like a seesaw – on the top of supporting Pier N2 below and match the geometry of the road deck coming from the North Tower. 5 The Approach Viaduct North team celebrates the completion of the technically challenging launch operation with FCBC Project Director, Michael Martin. 6 Work is continuing on laying the reinforced concrete deck on the north and southbound elements of the Approach Viaduct South which was launched into place in 2015.



## Go Forth!

Ten pupils from Trinity Academy, Edinburgh, recently enjoyed some winter sunshine at the Queensferry Crossing. Their visit launched SCDI's (Scottish Council for Development and Industry) "Go Forth 2016" initiative which involves 300 schools, Scotland-wide, vying to be best designer and constructor of a model bridge using prescribed materials and designed to withstand specified loads.

A flying visit to the Contact & Education Centre was followed by a site tour to whet the appetite of these engineers-in-the-making. With the Queensferry Crossing as the inspiration, Young Engineers and Science Clubs Scotland developed this exciting project which is sponsored by FCBC partner company, Morrison Construction.

What is sure to be a keenly contested competition for three separate age categories will be held at Celebration of Engineering and Science events in Scotland throughout 2016. According to SCDI's Rebecca MacLennan: "The pupils were so enthused and inspired by their visit and site tour that they've all gone away buzzing with ideas about how to develop their model bridge – and keen to find out more about career options!"

Pictured are the Trinity Academy pupils accompanied by their class teacher, bus driver and Alice Harley from Morrison Construction.



## Environmental Monitor Hosts

Environmental monitoring plays an important part in the Queensferry Crossing Project. FCBC is extremely grateful to local residents who host noise and air quality monitoring instruments in or near their gardens and provide the power source to operate them. Since the beginning of the Project, 16 local residents have volunteered to assist and, as part of this initiative, every year they are asked to nominate a good cause to receive a donation from FCBC. This year, FCBC has donated £500 to each of the nominated organisations. In February, FCBC welcomed the "Monitor Hosts" (pictured) to the Contact & Education Centre for an update presentation on the Project and a site tour.

## Raffle Raises Funds for Children's Hospice

FCBC's Charity Raffle raised a grand total of £552 for Rachel House Hospice in Kinross, part of CHAS (Children's Hospice Association Scotland). The charity provides hospice services for children who have life shortening conditions for which there is no known cure. Each Christmas, all festive gifts kindly given to FCBC staff by suppliers are put into a staff raffle and the money raised is donated to a local charity.

Earlier this month, some of the children from Rachel House came on a visit to the Contact & Education Centre to learn more about the construction of the Queensferry Crossing. Here, Hannah Gell from CHAS (left) receives the cheque from Lilius Murphy of the FCBC Community Liaison team.



## FORTH REPLACEMENT CROSSING CONTACT & EDUCATION CENTRE

### PROJECT EXHIBITION AND PRESENTATION SERIES

The Project Exhibition is open every Saturday (10:00 until 16:00) during 2016. Visitors are able to learn about the Project, ask engineers questions and view the exhibition and 3D models.

Presentations providing an in-depth look at the construction of the Queensferry Crossing and its connecting roads will take place on the last Friday and Saturday of every month until November 2016. The presentations start at 10:30 and 13:00 and last approximately 45 minutes with an opportunity for questions and discussion afterwards.

Further details are available on the project websites:  
[www.forthreplacementcrossing.info](http://www.forthreplacementcrossing.info) and [www.queensferrycrossing.co.uk](http://www.queensferrycrossing.co.uk)



## Cable the News!

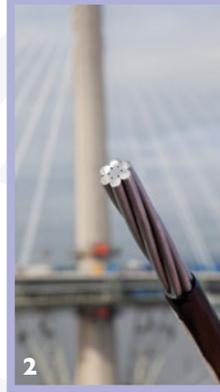
The highly visible white cables which form the Queensferry Crossing's emerging "fans" are one of the new bridge's signature features. Here, **Brian Gordon**, FCBC Cable Stayed Bridge Construction Manager, explains how the cables are made and fastened into position.

The Queensferry Crossing is a cable-stayed bridge. In fact, when complete it will be the longest three-towered cable-stayed bridge in the world. But what does "cable-stayed" mean? Essentially, a cable-stayed bridge transfers the massive weight of the road deck directly through the cables to the towers which are anchored in the seabed. On a suspension bridge (such as our neighbour, the Forth Road Bridge) the weight of the road deck is carried by the two main cables which are held aloft by the towers and are anchored on land at either end.

On the Queensferry Crossing, the finished road deck will weigh an amazing total of approximately 100,000 tonnes, so the job the cables are going to be asked to do is considerable. To say the least!

Typically, each pair of parallel cables on the Queensferry Crossing supports an individual road deck section below. In mid span, however, this bridge will uniquely feature some sections which will be supported by four cables, the cables coming from neighbouring towers crossing over in a diamond pattern. In all, the bridge will have 288 cables, the longest being 420 metres and the shortest 90. Here's how we make them.

Each cable consists of a number of strands (up to 109 for the largest cables) which are threaded through an external white pipe (photo 1). This pipe is essentially a protective covering or sleeve made from



high density polyethylene (HDPE). Each strand is made up of seven high-tensile, galvanised steel wires, 5.2 millimetres in diameter (photo 2). Six of the wires, coated in wax, are wound in a helix pattern around a central "king wire" which is straight. The strands are also sheathed in an HDPE coating. Think of it this way: 7 wires = 1 strand. A bundle of strands (up to 109) = 1 cable.

The external white pipe is welded to the correct length while lying flat on the road deck out at each tower. A single strand is threaded through the pipe before it is lifted up and fixed into position on the tower using the enormous, yellow tower cranes connected to the side of each tower. The remaining strands are then threaded through the pipe using a winch and shuttle system which brings the strands through the pipe one at a time. Each strand is cut to

length, tensioned and wedged into a steel anchor plate (photo 3) at both ends using small, high-tensile steel wedges (photo 4). The result is one of the strongest steel cables in the world, capable of supporting the Queensferry Crossing road deck for decades to come.

The beauty of the cable-stayed system lies in its ease of long term maintenance. In years to come, if an individual strand needs to be replaced, it can be simply pulled out and a new one inserted. This process can take place without significantly affecting the strength of the cable in question, with no ill effects on the operation of the bridge and with no disruption to the flow of traffic. This is where cutting edge bridge technology is "at" in the 21<sup>st</sup> century and the Queensferry Crossing will become one of the finest exponents of the system anywhere in the world.



## Contacting the FRC team

There are a number of ways you can contact us to ask questions, provide comments, make a complaint or find out more about the Forth Replacement Crossing project:

Call the dedicated 24 hour Project Hotline **0800 078 6910**

Email the team **enquiries@forthreplacementcrossing.info**

Look for us online:

[www.forthreplacementcrossing.info](http://www.forthreplacementcrossing.info)

[www.queensferrycrossing.co.uk](http://www.queensferrycrossing.co.uk)

@FRC\_Queensferry

Or go to the Queensferry Crossing YouTube channel

Or drop into the **Contact & Education Centre**

Adjacent Forth Road Bridge Administration Office,  
South Queensferry, Edinburgh EH30 9SF

**Opening times**

Mon-Thu: 0900-1700, Fri: 0900-1600, Sat: 1000-1600

