

Forth Replacement Crossing

project update

August 2014



The old greets the new: the first of four shipments of steel box sections which will form the deck of the Queensferry Crossing sails beneath the Forth Bridge in May

Technical Focus

Find out more about the processes now underway to prepare the new bridge's steel box sections for installation on the towers.

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Environment Matters

Managing waste material is an important aspect of the construction works. FCBC is aiming for a first class performance in this area.

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Q&A Article

With the southern approach viaduct becoming ever more visible, we take a look at how these vital structures are constructed.

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All go on all fronts!

The project to construct the Queensferry Crossing has now passed the halfway mark in terms of time schedule.

Construction work first got underway in mid 2011 and we are on course to open the bridge to traffic on schedule by the end of 2016. The speed with which these three years have passed concentrates the mind very effectively on the major tasks which lie ahead in the next two and a half years. It is good to report, therefore, that activity is moving ahead strongly right across the project.



Carlo Germani and David Climie

A little later this summer, all three towers will reach road deck height (64 metres/210 ft). This represents a significant milestone for the project. Since the arrival in May of the first shipment of Queensferry Crossing steel box sections, activity has ramped up in the on-site fabrication yard where work is already well underway to create the reinforced concrete deck which will sit on top of these sections and which will eventually carry the road surface of the new bridge (see article on page 3).

In the next few weeks, a specially designed, giant shearleg crane (similar to the one which previously handled the foundation caissons) will arrive on-site. One of the biggest floating cranes in the world, this will be an unmistakable landmark out on the water when it is used in the autumn to lift the temporary falsework into place around the towers which will support the initial deck sections.

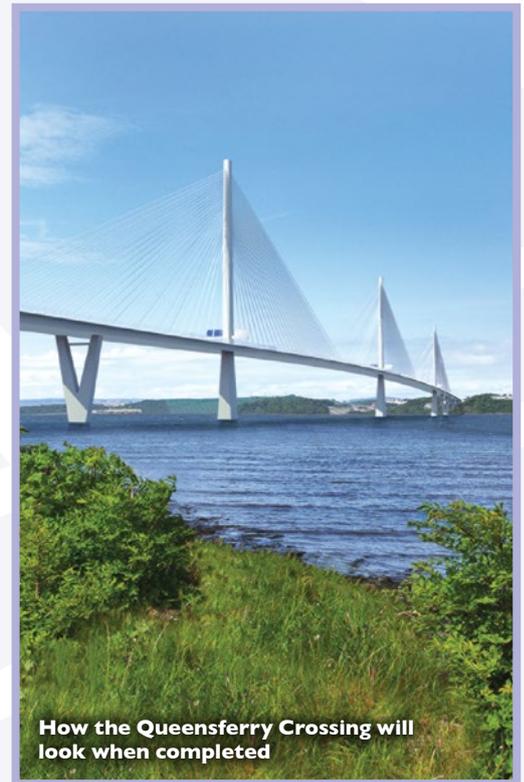
On the south shore, several successful launches of the southern approach viaduct have taken place in recent months. The two steel box girder structures which will form the north and southbound carriageways of the viaduct are now clearly visible stretching out above the shore and towards the waters of the Forth (see article on page 6). On the northside, construction of the two piers which will support the northern approach viaduct has begun. Work on the viaduct girders themselves will start on schedule by the end of the year.

Turning to the connecting roads, we are taking full advantage of the school holidays – and consequent lower levels of traffic - to undertake the necessary works on the new Ferrytoll Road junction near Rosyth. Work started in July and the new junction will open to traffic in August. In September, traffic to and from North Queensferry will start flowing along the realigned B981 which will connect with the new junction. Nearby, work has started on the construction of the Ferrytoll motorway viaduct and the surrounding network of road realignments and public transport links in the existing Ferrytoll roundabout area. Public information leaflets and drop-in sessions will be held in the autumn to keep local residents informed of the programme of works in this area. These briefings will be advertised in the local press and on the project website.

On the southside, preparations are being made to re-align the A904 through the roundabout element of the new Queensferry Junction in August. On the nearby M90 extension, work is moving ahead rapidly on the construction of environmental bunds and barriers in the Dundas area which will provide visual screening and noise reduction for the adjacent residents. So, activity continues apace!

David Climie
Transport Scotland
Project Director

Carlo Germani
FCBC
Project Director



How the Queensferry Crossing will look when completed

On-line information – only a Quick Click away

There are various ways to keep up-to-date on-line with construction progress on the Queensferry Crossing.

Ever since the project launched in 2007, the internet has always been an important resource for keeping people informed about the Forth Replacement Crossing. Recently, we've expanded the range of digital channels we use to meet the growing interest in the project both at home and internationally.

- www.forthreplacementcrossing.info remains the main project website hosted by Transport Scotland.
- www.queensferrycrossing.co.uk focuses on the bridge construction, with features, blogs, pictures and videos from the site.
- Or you can follow the official Twitter account @FRC_Queensferry.
- Finally, new videos are regularly uploaded to the project's own YouTube channel. Simply search for "Queensferry Crossing" on YouTube and view or subscribe to the channel from the results page.

Information at your finger tips!



Deck segment casting gets underway

Now that the new bridge's steel box sections have started to arrive on-site, the works to cast the reinforced concrete decks which sit on top of these sections can get underway. Here, **Meinolf Droste**, FCBC Towers & Deck Manager, takes us through the various steps involved.

The next major phase in the construction of the Queensferry Crossing is the casting of the bridge decks – which will eventually carry traffic across the bridge – and associated yard works. A total of 110 sections will be prepared over the next 18 months. Standard sections are 16.2m long and 40m wide meaning that the deck area on each would easily accommodate an entire tennis court.

Deck construction is carried out in three major steps:

1. Fabrication of the steel box sections in China
2. Concrete deck casting in the Rosyth Docks
3. Section assembly to form the bridge deck

Over the past two years, the Precast & Yard Team, headed by Section Manager Michael Marxer and Works Manager John Rodgers, have prepared FCBC's deck fabrication facilities in Rosyth Docks. Four huge hangar-style doors were engineered and installed in the existing buildings to provide access into the 8,000m² Production Shed.

Over the past 12 months, a 50,000m² Storage Yard, the equivalent of seven full sized football pitches, was prepared with



450 fixed and 350 moveable concrete support plinths on which the newly off-loaded steel box sections rest while waiting to enter the Production Shed.

The steel sections each weigh between 200-350 tonnes and are transported by FCBC-owned and operated SPMTs (self-propelled modular transporters). The powerful remote-controlled SPMTs have the capacity to transport more than 1200 tonnes.

The reinforced concrete decks are cast inside the Production Sheds using concrete produced in FCBC's batching plant next door. Once the concrete has reached sufficient strength, the decks are post-tensioned to provide sufficient stability for transportation back into the Storage Yard. At this stage, the weight of the segments

has increased to 750 tonnes, still within the capacity of the SPMTs.

The remaining concrete related works in the yard include stripping out the internal formwork and final stressing and grouting. Various other preparation works are carried out in the yard before the sections can be transferred to the bridge for final erection: these include first stage installation of mechanical and electrical systems and the Vehicle Restraint System parapets as well as various temporary work components designed to aid the final installation of each segment.

The last part of the yard operations is the roll-on onto the transport barge which will take the deck sections out to the towers. The barge is moored against the quay wall and the SPMTs drive the segments directly on to the barge. This activity is due to commence early next year.

Technical challenges include the massive 5m cantilever wings and the vast amount of cast-in items required for the various installations of the bridge, such as the vehicle restraint system, windshields, drainage inlets, guide pipes for the cable installation and many others.

The activities in the Precast Yard are a major logistical challenge, a bit like a giant, three-dimensional game of chess, with all the sections having to be moved about and stored in the correct order for transportation and assembly in the required sequence. Once casting is in full swing, two segments per week will be processed.

Members of the public will not have long to wait until they see the first section of deck installed: this is due to take place at the Centre Tower in the autumn.



Busy times at the Contact & Education Centre

The Forth Replacement Crossing Contact & Education Centre (CEC) and Project Exhibition have continued to attract great interest from a range of visitors.

June saw the end of the first academic year since the CEC opened, with over 3,600 pupils from schools right across Scotland visiting the building to undertake a range of educational activities. These included hands-on bridge building activities as well as science, technology, engineering and mathematics related topics focusing on the construction of the new bridge. The CEC team is now preparing for the new school year ahead, with many bookings already in the busy calendar.

VIP school visits have taken place recently when the "Name the Bridge" competition winners, Madras College

(St Andrews) and Cleish Primary School, visited the project for a close-up look at the latest construction progress on-site.

Bellyeoman Primary School (Dunfermline) visited the CEC to mark the start and end of their Parent Staff Association sponsored walk across the Forth Road Bridge. The CEC project team welcomed over 150 participants and hosted a fiercely contested quiz before handing out Queensferry Crossing medals and mementos to all those who completed the gruelling challenge.

Just under 4,500 people have now visited the FRC Project Exhibition since it opened in 2013 with the weekly Saturday Open Days in 2014 (from March until end of October) continuing to prove popular. With an average of over 100 people visiting per Open Day, many visitors are taking the opportunity to view the construction works from the Forth Road Bridge west walkway which has been opened each Saturday and provides an excellent and safe vantage point for visitors to the Forth Bridges.

The project team has continued to provide talks and presentations to a wide range of international visitors in the CEC with recent groups visiting from Uzbekistan, Russia, Norway, Sweden and the USA, all anxious to learn more about the project and take in the panoramic views on offer from the CEC.



Happy pupils from Bellyeoman Primary School with their prize-winning quiz certificates



Pupils from Cleish Primary School sporting their special Queensferry Crossing T-shirts



Civil Engineering students from Strathclyde University are given a tour of the southern approach viaduct construction site by FCBC's Ewen Macdonell and Chris Higgins

Inspiring the next generation of engineers

The Forth Replacement Crossing represents a unique opportunity to leave a lasting legacy through education and engagement. As part of the project's commitment to community engagement, we support a range of educational initiatives. An example of this is the relationship FCBC has developed with the University of Strathclyde's Department of Civil & Environmental Engineering. The mentoring programme between FCBC and the University's civil engineering students promotes good practice and ensures students receive the support and guidance they need to reach their full potential.

Following the mentoring of a group of 3rd year civil engineering students over the 2013-2014 academic session, Dr. Mike Murray, Teaching Fellow in Construction Management at the University of Strathclyde, commented: "The students really appreciated the guidance and advice that FCBC engineers offered. This is a particularly important activity for our 3rd Years who have yet to secure a summer placement and the output from the mentoring you have undertaken adds true value to their studies. Overall, we see that on return to 4th year studies the students have a more determined and focused nature and, most importantly, they all recognise the importance of their own continuing professional development."

Further information on the Department of Civil & Environmental Engineering mentoring scheme can be found at:
www.strath.ac.uk/civeng/ug/mentoring/

Feedback from the students was extremely encouraging:

"Our mentors were knowledgeable and friendly and helped cement my desire to be a civil engineer."

"The visit to the Queensferry Crossing was an excellent opportunity to see one of the biggest projects in the country in action. The most exciting part was the opportunity to stand inside the steel supports to the approach viaduct, this was a real opportunity to see the construction of the bridge in action."

"This mentoring experience has been an incredibly useful tool for me in confirming my belief that I want to be an e-ngeiner."



Madras College pupils pose in front of their completed model of the Queensferry Crossing

Implementing effective waste management

By **Stuart Swainson**, FCBC Environmental Advisor

Constructing enormous concrete and steel structures out in the middle of a busy and fast flowing estuary such as the Forth brings with it many obvious challenges. The logistics of transporting thousands of tonnes of steel and concrete takes a huge amount of expertise, careful procedural planning and the right equipment. It also takes environmental awareness.

As with any construction project, waste is an unavoidable by-product of the Queensferry Crossing project. Our construction activities create a number of waste streams: these include wood and scrap metal, hazardous waste materials (such as used oil and paint remnants), plastics, paper, card, food and general waste from office and welfare facilities. How these waste products are minimised, transported, re-cycled and responsibly disposed of is the responsibility of FCBC's Environmental Management team.

Marine locations are especially susceptible to pollution from waste products and great care has to be taken to ensure all waste is handled appropriately. Parts of the Firth of Forth are Special Protection Areas (SPAs) and the bridge works are also in close proximity to a number of Sites of Special Scientific Interest (SSSIs), making effective environmental performance by everybody involved particularly critical.

FCBC is determined that the construction of the Queensferry Crossing and its network connections will, in future, be seen as an international benchmark for best practice environmental care in large scale construction projects. Achieving success in this area takes a properly co-ordinated team effort which includes every member of the project team across all FCBC departments as well as the client, our sub-contractors and suppliers.

Key to achieving a first class waste management performance is ensuring that everyone is briefed on the correct use of the facilities in place to segregate any waste



Barge mounted waste management skips awaiting transportation to shore

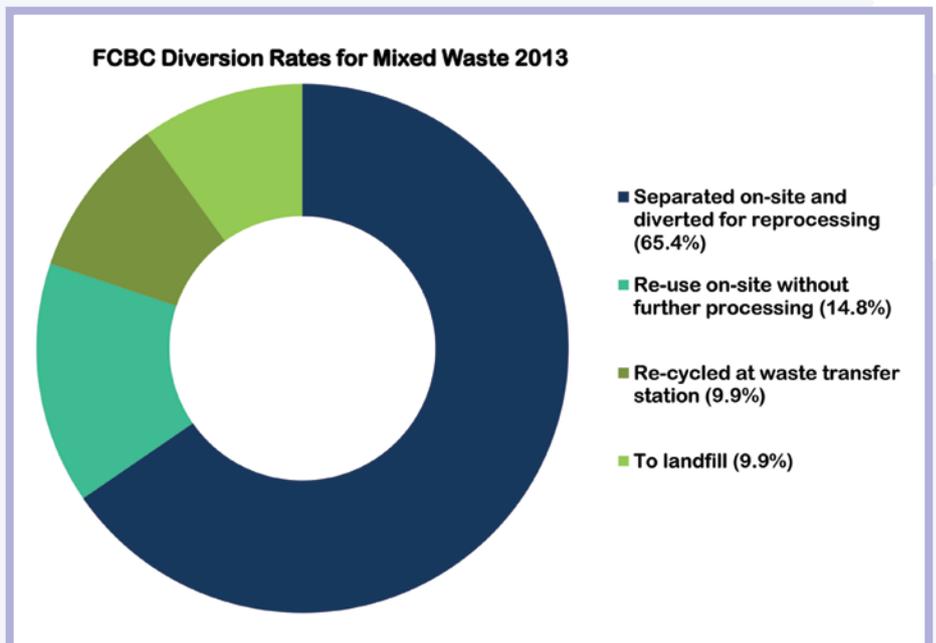
correctly at source. For example, all waste material generated on the construction of the towers is transported back to shore for collection by FCBC's waste contractor, Skipeez. It is then segregated a second time at Skipeez's purpose-built waste compound on-site before being sent for recycling, ensuring that an absolute minimum is sent to landfill.

The success being achieved in respect to waste is not only vital in protecting the marine environment within which we work, but contributes greatly to FCBC's ability to meet the stringent waste management

obligations set out in our contract with the Scottish Government.

So, how are we doing? Well, in 2013 (the latest figures available), FCBC generated a total of over 800 tonnes of waste across the project as a whole. We are proud that we comfortably exceeded our original target of diverting 81% of that waste from landfill, in fact achieving a figure of 90% (or less than 90 tonnes sent to landfill).

Our aim is to maintain and exceed this level of performance in 2014 and throughout the rest of the project.



On-site waste management bins segregate all waste before being sent to re-cycling



Viaducts vital to bridge viability

The southern approach viaduct is rapidly taking shape on the south shore of the Forth Estuary. We talk to **Marcos Gonzalez**, FCBC Construction Director, to find out why the viaducts are so important to the Queensferry Crossing project and what technical challenges his team faces in their construction and installation.

Q What is the function of the viaducts?

A The viaducts will carry all north and southbound traffic to and from the bridge. They are part of the new cable-stayed main crossing, connecting the new bridge to the land on either side. They are a perfect fit with the construction method chosen. Incremental launches, such as we are carrying out at the moment, are suited for bridging shallow waters such as those found on either side of the Forth Estuary where land and water access is restricted. The main bridge itself, with its long spans, massive foundations and huge towers, performs the function of crossing the deeper water in mid estuary while leaving navigational channels open.

Q How are the viaducts constructed?

A The steel viaducts come in short sections fabricated off-site. They are pre-painted with a zinc primer and four coats of grey epoxy resin paint. Once on-site, the sections are welded and bolted together into longer sections up to 90m in length before final preparation for launch out over the V-shaped support piers.

Q How are the viaducts launched out?

A Powerful hydraulic machines, called strand jacks, are fixed to the bridge abutment and connected to the sections via steel cables. This jack and cable system then slowly pulls the sections out towards and over each support pier. A further strand jack and cable system attached to vertical

"king posts" lifts the leading edges of the structures to counteract the effect of gravity, ensuring the viaducts are at the correct height to slide over the top of each pier. We believe this is the first time king posts have been used in this way in the UK. As each incremental launch phase is completed, we free up space to start the assembly of the following phase.

Q What is the biggest challenge in constructing the viaducts?

A There are lots of challenges! The first is getting the initial design right so the structures can cope with the enormous loads generated during the launch phases. This takes close co-operation between our expert teams of temporary works designers and the permanent designers. Secondly, we are working in a restricted space so each new section of viaduct has to arrive just at the right time to allow us to fix it to the end of the growing structure. This means we have to complete each launch out over the water on time. Thirdly, it is critically important to make sure the viaducts maintain exactly the right line of



Welding operations on the southern approach viaduct

travel as they are launched out. Lateral guides and temporary bearings, coated with Teflon, are fixed on top of each pier and these ensure tracking accuracy. Only once the viaducts are in place is the reinforced concrete road deck poured which will carry the traffic. Otherwise, the sections would simply be too heavy to launch without increasing the amount of structural steel. At times, it is like trying to complete a giant jigsaw puzzle which is constantly on the move! Success comes down to careful planning and the technical expertise of the whole viaducts team.

Q What stage are the viaducts at?

A Our focus so far has been on the southern approach viaduct. At 543m in length when complete, this will be much longer than its northern neighbour (202m) which will be launched next year. To date, we have launched out 290m, so we are well over half way through the process. With a total weight of 5,000 tonnes, placing the viaduct is a demanding task and an impressive feat of engineering in its own right.



General view showing the southern approach viaduct and the all-important king posts



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**

Log on to the project website at

www.forthreplacementcrossing.info

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

