Dear Mr Farrell

Infrastructure and Capital Investment Committee

Forth Replacement Crossing Update 10

I refer to the commitment given by Transport Scotland to provide regular updates in relation to the Forth Replacement Crossing (FRC) project. This is the tenth update and covers the following topics:

- Progress Update
- Stakeholder Engagement
- FRC Public Transport Strategy

Photographs illustrating progress can be found at Annex A.

Progress Update

Since the last Committee update provided in February, progress has remained on time and on budget.

I am pleased to report that two shipments of materials have now been delivered to the Port of Rosyth from Shanghai. The tower cable anchor boxes and six deck erection gantries arrived on 9 May, followed by the first shipment of deck segments for the Queensferry Crossing on 19 May. (photograph 1)

Completion of the deck units by the addition of the concrete deck will be undertaken at the quayside which has been upgraded to cope with the heavy lifting and storage areas required for these units. This is a lasting legacy of long term investment for Rosyth port area along with the immediate additional benefits to local labour and suppliers.
Other significant milestone events are –

- The construction of Queensferry Junction bridges is nearing completion. Finishing works are in progress in preparation for diverting the A904 over these bridges by the summer. (photograph 2)
- On the South side, piling works for the early gantries have commenced.
- Successfully launching the northbound carriageway of the south approach viaduct steelwork over Society Road in early-April 2014 followed by similar launching of the Southbound carriageway in early-May 2014. (photograph 3)
- Completion of approach viaduct pier S6 ready to support future launches of the south approach viaduct steelwork. (photograph 4)
- Construction of approach viaduct pier S5 will be completed this month and construction of pier S4 has commenced.
- Sheet piling for pier S3 is complete and excavation is in progress.
- Foundation works have started on pier S2 with sheet piling.
- The fourteenth concrete pour at the Centre Tower, which is close to reaching deck level, is about to take place (photograph 5)
- Nine concrete pours on the North Tower have been completed. (photograph 6)
- Eight concrete pours on the South Tower have been completed. (photograph 7)
- On the North side, construction of the North abutment and assembly area for the North approach viaduct steelwork has made good progress.
- The construction of the B981 overbridge is substantially complete. Construction of Ferrytoll Gyratory Railway Bridge (West) is also nearing completion.
- Substructure construction of Ferrytoll Gyratory North and South Bridges is in progress. (photographs 8 & 9)

**Stakeholder Engagement**

Interest in the project remains strong. The Contact and Education Centre is now open to members of the public each Saturday between 10 am and 4 p.m. until the end of October. 675 visitors have attended the centre since the launch of regular Saturday openings on 29 March 2014. In the first year of opening to date, over 3,000 members of the public have visited the Contact and Education Centre. In addition over 3,000 pupils have attended the CEC to undertake educational activities organised by the project team.

In addition, a series of technical presentations are being held on the last Friday of each month, which aims to provide the public with additional, specialised presentations on various aspects of the project.

Meetings of the North and South Community Forums were held at the Contact and Education Centre on 21 and 28 May.

In addition to hosting a visit by members of the Infrastructure and Capital Investment Committee last month, the project also welcomed the 2 winning schools of the ‘Name the Bridge’ competition, Cleish Primary and Madras College who received a VIP tour of the site and activity and education session at the Contact and Education Centre.

The latest Quarterly Project update newsletter was published in May, a copy of which I enclose for your information.
FRC Public Transport Strategy

Arrangements are being made to hold the next meeting of the Public Transport Strategy (PTS) Working Group in July 2014. This will include reporting on progress during May and June towards work streams being commissioned which link directly to the PTS. The procurement process for a study into public transport improvements in the Newbridge area is ongoing. This is being led by City of Edinburgh Council (CEC), and undertaken in conjunction with Transport Scotland, West Lothian Council and SEStran. A co-ordination meeting is being organised, and hosted, by CEC on 23 June 2014 to discuss progress to date and next steps. The M90/M9 Bus Lanes and associated gantries are reported to continue to be effective in reducing journey times and providing benefits to buses during queuing incidents. Transport Scotland continue to liaise with Fife Council, who have reported increasing patronage at Halbeath Park and Ride.
A regular written update will continue to be provided to the Infrastructure and Capital Investment Committee.

Yours sincerely

David Climie CEng FICE
FRC Project Director
Annex A – PHOTOGRAPHS

Photograph 1 Deck segments arriving from China on 19 May 2014

Photograph 2 Queensferry Junction Bridges

Photograph 3 Launch of Northbound carriageway of the south approach viaduct steelwork over Society Road
Photograph 4 Completion of pier S6 with pier S5 also nearing completion

Photograph 5 Centre Tower
Photograph 6 North Tower

Photograph 7 South Tower
Photographs 8&9 Columns for the Ferrytoll Gyratory Bridges
The only way is up: a view of the Centre Tower and tower crane rising from Beamer Rock in mid-estuary

Reaching for the sky!
The Queensferry Crossing’s three main towers are rapidly rising from the waters of the Forth. We take a look at the technical processes underway. Page 2

Viaducts are vital, too
The Southern Approach Viaduct will soon be out over the water. We explain how it is being constructed and launched out towards the towers. Page 4

Road Connections
The complex road works to connect the new bridge to the existing trunk road network are moving ahead quickly. Find out more about what is involved. Page 5
Construction works are moving ahead strongly on all fronts. All three of the bridge's towers are now well above the level of the foundation caissons (or cofferdams on the Centre Tower) and are heading steadily upwards. We expect the towers to reach deck level during the summer. Later this month, the first steel bridge box sections will arrive on-site during the summer. Later the towers to reach deck level.

The towers are built in 4 metre high segments, each called a “lift”. Each of the reinforced concrete towers will be more than 200m high containing over 6,000 tonnes of steel reinforcement. The towers are hollow and have an internal steel access caisson (or 25%) higher than the towers of the neighbouring Forth Road towers moved into full swing.

The formwork (or “jumpform”) into which the concrete is poured is hydraulically jacked up to the next level once the concrete in each lift has gained sufficient strength to support itself and the jumpform. This takes approximately 36 hours. The high-performance concrete is produced at FCBC’s concrete batching plant in Rosyth Docks and is delivered to the towers by specially designed barges in an operation similar to the record breaking foundation concrete pour last year. One of the most powerful pumps in the world pumps the concrete up to a concrete distributor on top of the jumpform where it is then poured into the mould to make the next lift. A man-lift (or elevator) on the outside of the tower transports the teams up and down.

What are the main tower features?

What are the biggest challenges in constructing towers such as these?

Are we in good shape?

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Viaducts are the first recognisable bridge elements

A cable stayed bridge, such as the Queensferry Crossing, is that part of the overall structure which is supported by the cables anchored to the towers.

In order to allow traffic to flow over the bridge, we must have viaducts at both ends which join the bridge to the land.

So, the North and South Approach Viaducts (as we call them) are a critical component to the success of the Forth Replacement Crossing project as a whole. Just as with the bridge structure itself, foundations are vital to the construction of the viaducts. On this project, there are three types of viaduct foundation. First of all, in the deepest of the viaduct foundations, there is a cylindrical caisson sunk to the seabed just as we did with the North and South Tower caissons previously reported on in the Project Update. This is the foundation for pier SI, the largest of the viaduct support piers on the south side. Then we have more traditional caisson foundations, constructed from sheetpiles to create a box which sits in the seabed above the bedrock. The box is partially filled with mass concrete on top of which the reinforced concrete pier is built. Lastly, on dry land we perform a straightforward open excavation in which we construct the base and pier.

Work on the foundations and pier construction has gone well, allowing us to begin work on the South Approach Viaduct steel superstructure on schedule. (Work on the — much shorter — North Approach Viaduct superstructure is scheduled to start in early 2015.) In February this year, we began the “launch” of the steel sections for the north and southbound carriageways of the South Approach Viaduct. These were fabricated in Darlington by Cleveland Bridge, with finishing welds and preparation for installation carried out on-site. They will have a remarkable total weight of 7000 tonnes. Local people have recently seen the giant steel structures emerging over Society Road. These steel sections will carry the road deck out to the new bridge, but the actual process to lay the road deck does not begin until the viaduct launches are complete. This is scheduled for early 2015.

The launch process involves welding steel sections together on land before using powerful hydraulic strand jacks to pull them out over the piers. Cables attached to king posts rising at right angles to the steel sections lift the front edges of the structures to counteract the effect of gravity and ensure that they are at the correct height to meet the lateral guides positioned on the top of each pier. These guides make sure that the viaduct steel sections are in exactly the right alignment as they head out towards the bridge. We believe this may be the first time this launch system has been used in the UK.

Our aim for the rest of 2014 is to carry out one new launch per month on average, so people will soon see the South Approach Viaduct making its way out over the water. In total, there will be 12 launches. It is an exciting phase as the viaduct superstructures represent the first horizontal elements of the project — in other words, the first time the public have seen something that is recognisably a bridge in the making.

The main challenges involved in the construction of the viaducts are the same as with other parts of the Queensferry Crossing project — ie. weather, especially wind! Logistically, we are working in a confined space which makes the delivery of the steel sections and their preparation for launch a tricky operation. But we have succeeded without any problems so far thanks to careful planning and the skills of the team. Working at height is another consideration. The launch procedure has the benefit that all steel sections are assembled in a launching bay behind the abutment at ground level, so works at height are minimised in comparison to other erection techniques. The alignment of each new section as it is welded on to the section in front of it is critical, so great care is taken to get it 100% right before each launch. During each launch operation, a sophisticated monitoring system is used to control all movements and positioning. It would be too late to make adjustments once the superstructure is fixed into place on top of the piers!

By Juan Jose Consuegra Perez, FCBC Approach Viaducts Manager

Making Connections

In April, “New Civil Engineer”, one of the country’s most respected civil engineering journals, published a feature article looking at the construction of the new roads, north and south of the Forth, which will connect the Queensferry Crossing to the existing trunk road network.

 vrouw als iconen met tekst naar rechts

NCE articles such as this are a credit to all involved in the project: FCBC (pumping HDOC-IFES Solutions, Dragados, American Bridge International and Morrison Construction), the Design Joint Venture (Ramboll, Grant Thornton and Leonhardt Andra & Partner) and the client, Transport Scotland, and their advisers, Jacobs and ARUP. Here, we publish excerpts from the article (with thanks to NCE).

New road links from the bridge site to the existing motorway network are fast becoming reality on both banks of the estuary. As innovative in design and construction as the new bridge itself, this £460m of new and upgraded motorway link road contributed significantly to the project’s £7.9bn tender bid three years ago from winning contractor, Forth Crossing Bridge Constructors (FCBC).

Now half complete, this £109 million package of largely raised motorway both sides of the bridge boasts half a dozen different ground treatment techniques, plus considerable brownie points for sustainable construction, as the contractor swapped the client’s suggested piled viaduct designs for a single, record height embankment.

To create the initial 300m of elevated motorway, sweeping off the bridge’s northern end, the client had proposed a multi-span piled viaduct. Instead, FCBC designed a much shorter 100m viaduct, carrying the approach motorway over a local road and dedicated bus lane, with the remainder one impressive 200m long embankment, up to 25m high.

Reducing construction costs for this section by some £30 million has, though, given FCBC engineers a considerable technical challenge.

“This initial length of road is routed across a complex mix of hard, soft, weak and reclaimed ground with local contamination — hence the initial piled viaduct design,” explains FCBC head of network connections Ross Glendinning. “By opting for one large embankment we must first treat the ground beneath with a wide variety of strengthening techniques.”

The route crosses reclaimed riverside, now a marsh created with material excavated a century ago to form a nearby dockyard. It then sweeps over an old quarry loosely filled with boulders and a landfill site containing domestic waste. Ground treatment for the new Ferrytall embankment ranges from the relatively conventional dig and replace, surcharging, sand and band drains, to more complex trench mixing and controlled modulus columns (CMC). These last two techniques have been needed mainly in the weak, reclaimed riverside area lying beneath an adjacent smaller second embankment that carries the realigned B981 and the new bus lane. These columns leave soft ground undisturbed and are much more economic than the alternative precast piling often earmarked for particularly weak areas.

Ground strengthening is now complete and about two thirds of the main 160m wide embankment laid over the top. Topping up to 25m, it is claimed to be one of the UK’s highest man-made embankments and is being formed conventionally in maximum 800mm layers.

FfI for both embankments is sourced locally. A 20m high dolerite hill lies to the north near the motorway trace and could have been left alone, but FCBC opted to remove it to provide a valuable 120,000m³ of fill for the main embankment. The remaining 380,000m³ of fill is also won from near the bridge site. This material is recycled from a vast stockpile of spent oil shale, the discarded by-product of the area’s once booming shale oil industry sited near the estuary’s southern shoreline.

“The contractor has developed a varied geotechnical design which is working well and has saved us all time and money,” says Transport Scotland’s roads and infrastructure manager, Steven Brown.

By opting for one large embankment we must first treat the ground beneath with a wide variety of strengthening techniques

ROSS GLENDINNING

An aerial view showing the new Queensferry junction under construction and the route of the new stretch of the M90 to the south of South Queensferry

An aerial view of the South Approach Viaduct being launched out over the support piers

The Southern Approach Viaduct being launched over Society Road
Environmental Monitoring – Monitor Hosts & Good Causes

FCBC carries out all construction activity under a contractual requirement to monitor its environmental performance. Since the beginning of the Forth Replacement Crossing project, a number of our neighbours have selflessly volunteered to host, on their properties, the technical monitoring instruments involved.

Liam Soden, FCBC’s Environment Manager, explains: “Equipment to measure potential pollutants is strategically placed so that FCBC can accurately measure, record and report on our performance in controlling the levels of dust, noise and vibration throughout the construction period. We are extremely grateful to local residents who host these instruments in their gardens, and/or provide the power source to operate them.”

Emwen Macdonell, FCBC’s Community Liaison Officer, recently hosted a lunch at the Contact & Education Centre to thank the “Monitor Hosts”, for their support. They were also given a presentation on the progress of the Queensferry Crossing as well as a site tour.

We have 16 “Monitor Hosts” who, as part of this initiative, are asked each year of the project to nominate a good cause to receive a donation of up to £500 from FCBC. This is the third year that the scheme has been in place and a large variety of causes are benefiting.

CEC Update

The FRC exhibition at the Contact & Education Centre (CEC) attracted 2,400 visitors over a series of Open Days held between April and November 2013 and, due to the positive feedback received, we are now open every Saturday from 10am – 4pm until 25 October 2014.

The Project Outreach & Education programme is going from strength to strength as the project progresses, with over 2,000 school pupils having visited the CEC since the beginning of the 2013/14 academic year and over 2,500 people attending one of our pre-booked talks or presentations.

Considerate Constructors Gold Award

In March, the FRC Project received a second successive Gold Award from the Considerate Constructors Scheme. The objective of this national scheme is to promote the highest possible standards within the construction industry via continuous improvement.

Carlo Germani, FRC’s Project Director commented: “To win successive Gold Awards is testament to the effectiveness of our ongoing quest for improvement in everything we do.”

Many initiatives have caught the eye of the Considerate Constructors Scheme, including the Monitor Host Good Cause Initiative (see above) and last year’s Forth Road Bridge Veterans Day to name but two, but the scheme doesn’t let us rest on our laurels. We need to strive to do better in many different areas…… and so the quest goes on!

The best seat in the house!

Destined to become the highest in the UK, three large yellow cranes are now an increasingly visible and rapidly growing feature of the Queensferry Crossing construction site out on the Forth. We talk to Andrew Hume, FCBC Crane Controller, to find out more about what these tower cranes are for and how they operate.

Q: What is a crane?
A: The cranes are made of modular structural steel components connected using high tensile steel bolts. They will rise to a staggering total height of 235 metres (770 feet) above the water when the three bridge towers are nearing completion. At that point, they will weigh about 450 tonnes. The maximum lift capacity of the cranes is 40 tonnes. They are independent structures adjacent to the towers themselves, being based on separate foundations pre-driven into the seabed. This makes them by far the largest single element of the project’s temporary works (Ed note: see October 2013 Project Update for more details of the all-important temporary works).

Q: How do the cranes increase in height?
A: The process is ingenious and, for the uninhibited, rather surprising. At the top of the crane just below the cab and jib (the long horizontal “arm”) at the top of the crane, there is a separate hydraulically operated external climbing frame. This pushes the jib upwards 6 metres allowing the crane to climb up the next new section of tower, and the concrete distributors which ensure an even spread of concrete during concrete pours. The cranes also lift into place each of the three bridge towers as they rise to a staggering total height of 235 metres (770 feet) above the water when the three bridge towers are nearing completion. At that point, they will weigh about 450 tonnes. The maximum lift capacity of the cranes is 40 tonnes. They are independent structures adjacent to the towers themselves, being based on separate foundations pre-driven into the seabed. This makes them by far the largest single element of the project’s temporary works (Ed note: see October 2013 Project Update for more details of the all-important temporary works).

Q: How do the cranes perform?
A: The cranes are used to lift into place materials used in the construction of the bridge’s towers. This includes steel reinforcement bars (known as “rebar”) which reinforce the concrete in each new section of tower; and the concrete distributors which ensure an even spread of concrete during concrete pours. The cranes also lift into place each of the three bridge towers as they rise to a staggering total height of 235 metres (770 feet) above the water when the three bridge towers are nearing completion. At that point, they will weigh about 450 tonnes. The maximum lift capacity of the cranes is 40 tonnes. They are independent structures adjacent to the towers themselves, being based on separate foundations pre-driven into the seabed. This makes them by far the largest single element of the project’s temporary works (Ed note: see October 2013 Project Update for more details of the all-important temporary works).

Q: What is the scale of the cranes enormous.
A: Are they safe?
Yes, they are! We closely follow the manufacturer’s operating instructions and HSE regulations and guidance (LOLER 1998 and BS7121). The cranes are inspected daily before use and a weekly inspection is also carried out. The cranes are serviced every 8 weeks and undergo a thorough examination every 6 months which is necessary to maintain the operating certificates issued by the Health & Safety Executive without which we are not allowed to work. In addition, we liaise very closely with our colleagues in the Marine Office who receive hourly wind forecasts from the Met Office (Ed note: see February 2014 issue for information on the close liaison between FCBC and the Met Office). The maximum wind speed we are allowed to work is 38mph – about Force 7. An anemometer gauge fixed to the top of the crane feeds constant wind speed data to the crane operator sitting in the cab.

Q: How does the crane operator get to his cab?
A: At the moment, with the cranes at only 25% of their eventual height, the operator climbs up the steps contained within the structure of the crane’s mast. It certainly keeps you fit! Later on, as the bridge towers reach ever higher, there will be an elevator attached to the outside of the towers to take the construction teams up to the top. The operator will then cross a gantry between the tower and the crane from where steps will take him further up to the cab. It’s a similar process, really, to astronauts making their way to the control capsules at the top of rockets prior to launch.

Q: How do the cranes stabilised?
A: Well, apart from the sizeable foundations at the bottom, a series of steel “legs” will be fixed at regular intervals from each crane mast to the concrete bridge tower. There will be six ties in total. The crane is designed to flex, or twist, with the wind and under the weight of whatever it is carrying at the time, but it is clearly essential – especially at the extreme heights we are talking about – that the crane is securely attached to the permanent bridge structure.
SCHOOLS UPDATE

Camdean Primary School, Rosyth – Science Week

Staff from FCBC (engineers, surveyors, planners, environmental and health & safety advisors) took part in Camdean Primary School’s Science Week in March. This involved an initial address to the school assemblies on the Friday to set the scene, followed by a number of staff members spending two periods each in different classes the following week. The cumulative effect was that 26 separate classes received a talk from an FCBC staff member. Carrie Parkyn, Camdean’s Depute Headteacher, was delighted: “FCBC’s talks completely captivated the children and will hopefully help to inspire the next generation of engineers! It was fantastic to have so many people from different fields of science and engineering and it really helped the children to understand the variety of different jobs and their role in such a big project. All of the speakers engaged really well with the children and I hope they enjoyed the experience as much as the children!”

Bridges to Schools

Local primary school pupils enjoyed building their own cable stayed bridge at the FRC Contact & Education Centre at the end of April. “Bridges to Schools” week has become a popular annual event for FCBC, organised in conjunction with the Institution of Civil Engineers. The event is intended to give primary school children an insight into the challenges of civil engineering while having some fun along the way.

Almost 300 pupils from seven local schools attended the event over the course of the week. Dressed in hard hats and high visibility vests, they participated in the construction of a 12 metre long model of a cable-stayed bridge, supervised by volunteer civil engineering staff from the Queensferry Crossing project. The pupils were then able to walk across the bridge (some asked their teachers to test it first!) before deconstructing it. The whole construction and dismantling process takes little more than an hour:

In addition to learning about the new Queensferry Crossing itself, the focus was on health and safety, teamwork and civil engineering in general.

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

You can find us at: FRC Contact and Education Centre, Ferry Muir Gait, South Queensferry, EH30 9SF.
(See map below)