

#### 4.1. Schemes currently covered by Marine License

Below is a breakdown of the schemes currently identified in the works programme for the Forth Road Bridge within the proposed extension period. All schemes have been provided with an estimate of the construction period and value of the works to be carried out within the proposed extension period, along with a brief outline description of the works.

<b>Additional Suspended Span Gantry &amp; Underdeck Staging Board Trial</b>	
Construction Period:	October 2020 – April 2021
Construction Value:	£0.75 million
Description of the Works:	The Forth Road Bridge currently has two permanent underdeck access gantries located on the suspended span of the bridge, situated on the North side span and the main span. These gantries are predominantly used for maintenance and inspection purposes. No gantry is provided for the South side span and this works contract will involve the fabrication of a new gantry for this area. The new gantry will take the form of the existing gantries, with some minor improvements. Construction of the gantries will be carried out off-site before being transported to site for assembly and erection on the bridge.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Fabrication and manufacture of gantry components off site</li> <li>2. Transport of gantry components to site for assembly. In order to erect the gantry on the bridge, a barge/pontoon will be required to manoeuvre the gantry beneath the structure for lifting</li> <li>3. Lifting of the gantry on to the bridge using mobile cranes positioned on both sides of the carriageway</li> <li>4. Connection of new gantry to the existing runway beams and removal of lifting equipment</li> <li>5. Removal of barge/pontoon from waterway.</li> </ol>
<b>Main Bridge Expansion Joint Replacement</b>	
Construction Period:	Phase 1: October 2020 – November 2020 Phase 2: April 2021
Construction Value:	£1.5 million
Description of the Works:	There are currently 8 no sets of joint units, 4 no sets in each carriageway. Previous inspections have noted several condition issues, which highlighted the need for replacement of the existing roller shutter joints. These works were procured as a works contract. Southbound joint replacement will be completed in phase 1. Northbound joints will be replaced in phase 2 commencing in April 2021. It is expected that works will begin on the south side of the structure and the north joint will be replaced later in the year to avoid the Tern breeding season.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Full traffic management closure of Northbound carriageway</li> <li>2. Crane out existing steel roller joints and remove for disposal</li> <li>3. Removal of existing bridge expansion joint steelwork</li> <li>4. Installation of new bridge expansion joint steel work</li> <li>5. Crane in new steel roller joints and installation of new anti-slipsurfacing</li> </ol>

<b>Suspended Span Under Deck Access (SSUDA) Phase 6</b>	
Construction Period:	October 2020 – April 2021
Construction Value:	£0.5 million
Description of the Works:	Suspended Span Under Deck Access (SSUDA) system comprises five primary longitudinal walkways, each travel the full length of the bridge. The walkways comprise of aluminium mesh flooring supported on steel angle sections which are suspended from the main bridge structure. The under deck access platforms and temporary staging boards have come to the end of their theoretical design life and will be replaced in phases.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Installation of temporary access</li> <li>2. Remove existing boarding</li> <li>3. Install new boarding</li> <li>4. Paint</li> <li>5. Remove scaffolding</li> </ol>
<b>Viaduct and North Approach Resurfacing</b>	
Construction Period:	January 2021 – April 2021
Construction Value:	£0.5 million
Description of the Works:	The existing surfacing system on the Forth Road Bridge is coming to the end of its working life. Northbound carriageway of the viaduct and north approach and sections around the southbound side towers will be resurfaced.
Outline Method Statement:	<ol style="list-style-type: none"> <li>6. Removal of existing surfacing system by mechanical means, i.e. road planer etc.</li> <li>7. Surface preparation of exposed concrete deck and undertake necessary concrete repairs using rapid repair mortar</li> <li>8. Application of proprietary spray applied waterproofing system</li> <li>9. Laying new epoxy asphalt system</li> </ol>
<b>Suspended Span Painting Contract</b>	
Construction Period:	October 2020 – April 2021
Construction Value:	£1 million
Description of the Works:	Similar to the viaduct painting contract above, the paint system on the suspended span is coming to the end of its working life. A full painting contract is now planned to replace the existing paint system – this is likely to be undertaken over 3 to 4 summer seasons.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Provision of temporary suspended work platform, to provide full encapsulation to the work area</li> <li>2. Removal of existing paint system, by a method to be chosen through further investigation (chemical, grit blasting for example)</li> <li>3. Surface preparation of exposed steel members</li> <li>4. Application of new paint system as per manufacturers guidelines</li> <li>5. Removal of encapsulation and suspended platform</li> </ol>

<b>Suspended Span Strengthening Contract</b>	
Construction Period:	October 2020 – April 2021
Construction Value:	£0.5 million
Description of the Works:	Through recent inspections / investigations it has been noted that strengthening works are required to the suspended span truss arrangement. It is likely that these works will be undertaken in conjunction with the Suspended Span Painting Contract.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Identification area requiring strengthening and provision of temporary suspended platform, with full encapsulation</li> <li>2. Removal of existing paint system, locally to the area to be strengthened by means to be determined through further investigation (chemical removal, grit blasting for example)</li> <li>3. Installation of strengthening steel work by either bolting or welding new steel work</li> <li>4. Application of protective paint system</li> <li>5. Removal of encapsulation and suspended platform</li> </ol>

#### 4.2. Schemes Not Included In 2015 License Application

<b>Side Tower Lateral Thrust Bearing Strengthening</b>	
Construction Period:	November 2020 – April 2021
Construction Value:	£0.75 million
Description of the Works:	Strengthening works to improve the transverse load path for the lateral thrust bearings at the north and south side towers of the Forth Road Bridge. Replacement of the preloaded bars, a key component of the lateral thrust bearing, will also be carried out as part of this work and an additional bearing plate installed on the inside face of the Side Tower.
Outline Method Statement:	<p><b>Replacement of existing prestressed bars:</b></p> <ol style="list-style-type: none"> <li>1. Install temporary jacking frame</li> <li>2. Insert additional bearing plate behind existing internal bearing plate</li> <li>3. Stress bars against bearing plates, one at a time</li> <li>4. Remove temporary jacking frame</li> </ol> <p><b>Steel Reaction Block:</b></p> <ol style="list-style-type: none"> <li>1. Prepare external tower face to receive reaction block</li> <li>2. Erect temporary structure to support internal spreader plates</li> <li>3. Prepare internal tower face to receive internal spreader plate</li> <li>4. Raise internal bearing plates to correct position</li> <li>5. Lower external reaction blocks from roadway level</li> <li>6. Install Macalloy bars and stress to installation loads</li> <li>7. Install new bearing element</li> <li>8. Remove temporary support structures</li> </ol>

<b>Hanger Painting</b>	
Construction Period:	October 2020 – April 2021
Construction Value:	£ 0.15 million
Description of the Works:	The main span hanger cables are spiral strand and made up of 7 cables, each consisting of 19 wires. The steel hanger cables require to be painted periodically to protect them from corrosion and deterioration and a continuous system of maintenance work is ongoing. This comprises of washing the hanger cables with white spirit to prepare them and then applying the new paint system.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Access the hangers using suspended cradle system secured by the riggers to the main cable and top chord.</li> <li>2. Cradle to be sheeted with drip screens in place</li> <li>3. Wires to be washed / degreased prior to paint application using white spirit</li> <li>4. Hangers painted from top to bottom by hand</li> <li>5. Remove cradle from hanger and secure upon completion</li> </ol>

### 4.3. Routine Maintenance Activities

In addition to the maintenance schemes to be taken forward on the Forth Road Bridge, there are a number of smaller routine maintenance activities which can be carried out on a regular basis. In addition, some of these routine maintenance activities may also be encompassed within the overall schemes as outlined in Section 4.1 and 4.2.

Below is a breakdown of some of the routine maintenance activities which may be carried out throughout the duration of the proposed extension along with a description of the proposed works. These works are typically reactive and vary in nature therefore it is not possible to provide an estimate construction value.

<b>Use of Bridge Access Systems</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	<p>Due to the nature of the bridge construction, various access systems have been developed throughout the years in order to provide full access to the bridge. These include:</p> <ul style="list-style-type: none"> <li>• Hanger Access Cradles</li> <li>• Tower Access Platforms</li> <li>• Fixed underdeck access gantries (suspended span and viaducts)</li> <li>• Top Chord Access Platform</li> <li>• Main cable access gantries</li> <li>• Upper front access staging</li> </ul> <p>These systems can be deployed at any time for use during periodic inspection, routine maintenance or for emergency works. All of these systems involve rigging from the bridge itself with the use of electrically powered drive motors for hoisting the platforms into place. All platform systems are fitted with the necessary toe-boards and handrails to prevent the dropping of tools and materials during works.</p>
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Transport of access platform on to bridge, either under temporary carriageway closure or by use of footway/cycle track areas</li> <li>2. Installation of rigging components and access platform in appropriate work location.</li> <li>3. Completion of inspection/work activity using access platform</li> <li>4. Removal and movement of access cradle to next work location or back to storage.</li> </ol>
<b>Weld Repairs</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	<p>The main elements in the construction of the Forth Road Bridge are steel. Throughout the duration of the contract, the bridge is subject to inspections of each element, which in turn produces a programme of defects which would require repair, including defective welds. Weld repairs will involve a number of</p>

	different processes including paint removal, weld testing, weld removal and re-welding.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Provision of access to area of defective weld to be repaired</li> <li>2. Removal of paint system surrounding the defective weld, using chemical removal or grinding</li> <li>3. NDT testing of existing weld to mark out the extent of defective area to be removed.</li> <li>4. Cutting out of existing weld material and preparation of steel substrate before reinstatement of the weld</li> <li>5. NDT testing of new weld to ensure no defects are present</li> <li>6. Re-application of paint system over new welded area</li> <li>7. Removal of access system.</li> </ol>
<b>Bolt Replacement</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	As well as welded connections, as noted above, there are a similar number of bolted connections on the Forth Road Bridge which at some times may require replacement due to corrosion or damage which is affecting the adequacy of the connection.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Provision of access to area of bolt replacement</li> <li>2. Removal of damaged bolt and preparation of painted area locally around the existing bolt</li> <li>3. Installation of new bolt and tightened to manufacturer's specification</li> <li>4. Re-application of protective paint system over the new bolt</li> <li>5. Removal of access system</li> </ol>
<b>Kingpost Replacement (Bottom Lateral Supports)</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	The main suspended span of the Forth Road Bridge is of truss construction. On the underside of the truss arrangement, large cross members are linked to the cross girder by a single slender steel section, known as the kingpost. Due to the vibrations on the bridge, the connections between the kingpost and cross members fail and this leads to a replacement of the kingpost. Kingposts are replaced using either rope access techniques or by use of the bridge's underdeck access gantries.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Riggers access the location of the failed kingpost using rope access techniques or via bridge underdeck access gantries</li> <li>2. The failed kingpost is removed using rope access methods</li> <li>3. Slings / chain blocks are slung round the cross girder and used to raise the cross bracing into position</li> <li>4. The new kingpost is lowered into position using rope access techniques, and secured in place via bolted connections</li> </ol>

<b>Pier Defences Painting</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	The existing paint system is coming to the end of its working life. Regular routine maintenance painting is carried out on localised areas based on the findings of bridge inspections. A full painting contract is now scheduled to replace the existing paint system.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Provision of temporary suspended work platform, to provide full encapsulation to the work area</li> <li>2. Removal of existing paint system, by a method to be chosen through further investigation (chemical, grit blasting for example)</li> <li>3. Surface preparation of exposed steel members</li> <li>4. Application of new paint system as per manufacturers guidelines</li> <li>5. Removal of encapsulation and suspended platform when painting works are completed</li> </ol>
<b>Billet Repair (Half Joint Repairs)</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	The Works involve all permanent and temporary construction associated with the replacement of the existing steel deck half joints including the levelling of the deck panels on the Forth Road Bridge. The works consist of the removal of the existing joints and the installation of two replacement assemblies at defined locations on the suspended structure. The works also include the replacement of the drainage boxes and the associated pipes installed at the outer stringers, alterations to the existing access walkways and installation of the expansion joints between the deck panels at the level of the running surface. During the Works the Forth Road Bridge will remain open to vehicular and pedestrian traffic.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Removal and replacement of existing under deck walkways</li> <li>2. Installation of supporting frames</li> <li>3. Removal of existing half joints</li> <li>4. Levelling of deck panels</li> <li>5. Installation of replacement joints assembly</li> </ol>
<b>Edge Trimmer Replacement / Strengthening (Viaduct Spans)</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	Due to a possible failure of the edge trimmer or concrete finish, at the North Side Tower (South West edge detail at carriageway level) it is proposed that an investigation is carried out to determine the extent of the problem and possibly carry out repairs at the same time. This will involve breaking out of existing road surface and concrete, installing new support brackets, reinstating concrete using Deck Repair Rapid by Nuffins and applying temporary road surface (Note road surface will be permanently repaired by Tarmac during viaduct resurfacing). All

	work will be carried out overnight utilising carriageway closures for resurfacing of the viaducts, the work is programmed whilst Tarmac are working at the South viaduct so access to both Northbound lanes should be available.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Ensure work area is clearly defined and lit and that Tarmac supervisors are aware of FRB area of work.</li> <li>2. Mark the affected area for repair and cut the edges using a Stihl saw to a depth of 100mm minimum, (depth of the repair will be determined by the state of the existing concrete) break out material within the cut edges using Kango hammers or similar.</li> <li>3. Mark position of 2 No new support L 75 x 75 x 10 x 305 lg, place the angle in position and drill 2 No 16 diameter x 90 deep holes in the concrete.</li> <li>4. Install 2 No M12 x 130 lg Hilti rods using Hilti hit resin, fix angles onto the rods and weld onto the existing trimmer.</li> <li>5. Mix the required quantity of deck repair rapid with water, 3 litres of water per 25 kg bag, water should be placed in the mixer with the deck repair rapid being added as required.</li> <li>6. Ensure the affected area is clean and free from loose material, thoroughly moisten the surface but ensure no free water remains.</li> <li>7. Once the deck repair rapid has been mixed immediately place in the area as required.</li> <li>8. Finish the road surface with cold applied bituminous road repair.</li> </ol>
<b>Edge Trimmer Replacement / Strengthening (Suspended Span)</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	Due to a possible failure of the edge trimmer or concrete finish, at the North Side Tower (South West edge detail at carriageway level) it is proposed that an investigation is carried out to determine the extent of the problem and possibly carry out repairs at the same time. This will involve breaking out of existing road surface and concrete, installing new support brackets, reinstating concrete using Deck Repair Rapid by Nuffins and applying temporary road surface (Note road surface will be permanently repaired by Tarmac during viaduct resurfacing). All work will be carried out overnight utilising carriageway closures for resurfacing of the viaducts, the work is programmed whilst Tarmac are working at the South viaduct so access to both Northbound lanes should be available.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Ensure work area is clearly defined and lit and that Tarmac supervisors are aware of FRB area of work.</li> <li>2. Mark the affected area for repair and cut the edges using a Stihl saw to a depth of 100mm minimum, (depth of the repair will be determined by the state of the existing concrete) break out material within the cut edges using Kango hammers or similar.</li> <li>3. Mark position of 2 No new support L 75 x 75 x 10 x 305 lg, place the angle in position and drill 2 No 16 diameter x 90 deep holes in the concrete.</li> <li>4. Install 2 No M12 x 130 lg Hilti rods using Hilti hit resin, fix angles onto the rods and weld onto the existing trimmer.</li> <li>5. Mix the required quantity of deck repair rapid with water, 3 litres of water per 25 kg bag, water should be placed in the mixer with the deck repair rapid being added as required.</li> <li>6. Ensure the affected area is clean and free from loose material, thoroughly moisten the surface but ensure no free water remains.</li> </ol>



	<ol style="list-style-type: none"> <li>7. Once the deck repair rapid has been mixed immediately place in the area as required.</li> <li>8. Finish the road surface with cold applied bituminous road repair.</li> </ol>
<b>Upper Front Staging Installation (Underdeck Access Staging)</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	The walkways and access system to the underside of the suspended span decks and steelwork are located just below deck level. This system allowed effective safe access for inspection and maintenance, especially painting. The access system is made up of aluminium boards which span across and are supported by the main structural members of the walkways. These boards are moved from one location to another on the bridge by a combination of manual handling and lifting equipment.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Staging boards transported on to the bridge using a pickup van via the footway/cycle track area</li> <li>2. Rope access riggers install hangers to the permanent line walkways on the bridge below deck level</li> <li>3. Staging boards lowered below deck level using manual handling methods with board tethered to prevent objects falling beneath the bridge</li> <li>4. Staging boards fitted into position supported on temporary hangers and fixed line walkways</li> <li>5. Handrails and toe boards secured around the perimeter of the temporary staging</li> <li>6. Once works are completed, staging boards are removed in reverse to the installation procedure outlined above.</li> </ol>
<b>Removal of Lead Based Paint</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	At the time of construction of the bridge, all steelwork would have been painted with a protective paint system. Due to the period this was undertaken it is likely that much of the original paint system is lead based. This means that during periods of paint removal for current maintenance activities, further precautions and safety measures have to be put in place to minimise the risk of exposure to operatives and also contamination of surrounding areas.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Method for removal of paint system to be agreed (i.e. chemical removal/ grit blasting etc.)</li> <li>2. Access to be provided to works area and full encapsulation of the work area to be provided.</li> <li>3. Paint removed (either from grit blasting or chemical removal) to be placed in reinforced bags and marked for disposal as special waste</li> <li>4. Upon completion of paint removal encapsulated area to be cleaned thoroughly of all contaminated material and disposed of as special waste.</li> <li>5. Encapsulation to be removed</li> </ol>

<b>Maintenance Painting</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	Maintenance painting to be carried out as and when required. The existing paint system is coming to the end of its working life. Regular routine maintenance painting is carried out on localised areas based on the findings of bridge inspections. A full painting contract is now scheduled to replace the existing paint system.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Provision of temporary suspended work platform, to provide full encapsulation to the work area</li> <li>2. Removal of existing paint system, by a method to be chosen through further investigation (chemical, grit blasting for example)</li> <li>3. Surface preparation of exposed steel members</li> <li>4. Application of new paint system as per manufacturers guidelines</li> <li>5. Removal of encapsulation and temporary access system</li> </ol>
<b>Grit Blasting</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	As outlined previously, for the purposes of paint removal or steelwork preparation, it may be necessary to undertake grit blasting. This involves blasting the steel work area to be cleaned with shot material at using high pressure compressed air. Due to the pressure and nature of the works, encapsulation of each works area is important in order to eliminate contamination of surrounding areas.
Outline Method Statement:	<ol style="list-style-type: none"> <li>1. Installation of temporary access system and full encapsulation of the works area</li> <li>2. Encapsulation surrounding the work area, to be checked to ensure no excessive gaps are present which would allow grit blasting material to spread into surrounding areas.</li> <li>3. Area of steelwork to be cleaned using grit blasting, with good housekeeping maintained at regular intervals by cleaningspent shot material and placing in reinforced bags</li> <li>4. Upon completion of the blasting operation, full area within encapsulation to be fully cleaned to ensure that all grit blasting material has been collected</li> <li>5. Removal of encapsulation and temporary access system</li> </ol>
<b>Chemical Removal of Paint System</b>	
Construction Period:	Routine Maintenance
Construction Value:	£ unknown
Description of the Works:	Another method of paint removal is to apply a chemical solution which acts to strip of the existing paint system. This is often a cleaner and more manageable form of paint removal as compared to that of grit blasting etc. The use of chemical methods currently on the bridge involves application of a paste along

	with a paper backing which is left to set and when removed takes of layers of previous paint. These can then be bagged and removed from the bridge for disposal.
Outline Method Statement:	<ol style="list-style-type: none"><li>1. Access system to be provided to works area</li><li>2. Application of paste system and paper backing to area of paint to be removed.</li><li>3. Paste to be left to cure as per manufacturers guidelines</li><li>4. Once cured, remove paste by peeling backing paper, removing layers of existing paint system</li><li>5. Steps to be repeated until sufficient paint layers have been removed.</li><li>6. All materials to be placed in reinforced bags and disposed of as appropriate</li></ol>