



## A9000 Forth Road Bridge

### Construction Noise Management Plan - 5-Year Marine Licence

Revision V1

June 2021

BEAR Scotland

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## Forth Road Bridge

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## **Executive Summary**

Jacobs, on behalf of BEAR Scotland, have undertaken a Construction Noise Management Plan for the Forth Road Bridge which covers the duration of the proposed Marine Licence from October 2021 for a period of 5 years.

The Construction Noise Management Plan covers the methods proposed to be put in place to consider the potential impacts upon the resident Tern species that inhabit Long Craig Island SPA. This assessment forms part of the application for a Marine Licence for the works. This has included a baseline noise assessment in the vicinity of the SPA, and construction noise calculations for the works currently designed and programmed.

Mitigation in order to minimise noise and vibration impacts will be employed in order to reduce the impacts of the construction works as much as possible. Compliance measurements will be undertaken throughout the duration of the Marine Licence to ensure that the construction noise levels remain acceptable.

## 1. Introduction

### 1.1 Background

In August 2020, BEAR Scotland were appointed the Operating Company for the Fifth Generation Term Maintenance (TMC) Contract for the South East Trunk Road Unit. This contract sees BEAR Scotland responsible for the management and maintenance of trunk road assets in the south east of Scotland, until at least 2028. Previously part of a separate TMC, the A9000 Forth Road Bridge (FRB) and the Queensferry Crossing are now included within the South East Trunk Road Unit. Jacobs have been engaged by BEAR Scotland to consider the impacts of noise generated by proposed maintenance works to be undertaken over the next 5 years.

### 1.2 Forth Road Bridge

The Forth Road Bridge is a long span suspension bridge which carries the A9000 over the Firth of Forth, opened in 1964, and together with the approach viaducts is just over 2.5km in length. The Forth Road Bridge is designated by local authorities (Edinburgh City Council and Fife Council) as a Category A Listed Building. The Annual Average Daily Traffic (AADT) in 2018 was 643 movements, including motorcyclists, buses and taxis. As of September 2017, all other traffic has used the new Queensferry Crossing.

Most of the maintenance on the bridge is carried out during the day, and bridge workers routinely work in challenging conditions, including exposure to the elements and working at height, or in confined spaces, to keep the bridge safe and open to traffic.

The Forth Road Bridge spans sections of the Firth of Forth Special Protection Area (SPA) and Ramsar site and the Forth Islands SPA. Long Craig Island is located directly under the northern side span of the Forth Road Bridge and forms part of the Forth Islands SPA and is also designated as a Special Site of Scientific Interest (SSSI).

As maintenance works will be undertaken over the Forth Estuary, within the Mean High-Water Springs (MHWS) a marine licence is required under Part 4 of the Marine (Scotland) Act 2010 and Part 4 of the Marine and Coastal Access Act 2009.

### 1.3 Marine Licence

A marine licence application has been prepared for the next 5 years of maintenance works on the bridge which includes a Habitats Regulations Assessment (HRA) and an indicative programme of works. This CNMP has been produced in support of the marine licence application.

Long Craig Island supports populations of common tern, but more notably is a historic breeding colony of roseate terns (*Sterna dougallii*), which are one of the rarest breeding seabirds in the UK. Their breeding distribution is now restricted to just a few breeding colonies in the UK, with a noted decline of breeding pairs on Long Craig Island. The completion of maintenance activities under the previous 5-year marine licence (prior to BEAR Scotland taking over the TMC for the South East Unit) resulted in noted disturbance issues to populations of terns present on Long Craig Island. Construction noise from maintenance activities was thought to be one of the key issues which resulted in disturbance events.

## **1.4 Purpose**

The aim of the Construction Noise Management Plan is to put in place reasonable measures to reduce the apparent noise impact wherever possible of maintenance activities to avoid disturbance to breeding birds, particularly during their breeding season, at the Natura 2000 Sites including Long Craig Island.

It does not cover worker Health & Safety issues relating to noise and vibration, and nor does it cover the construction noise impacts upon bridge users.

The Plan will:

- Provide BEAR Scotland employees and sub-contractors with a clear and concise description of their responsibilities, regarding noise management.
- Address the conditions of licence pertaining to noise contained within the previous 5 year marine licence for the Forth Road Bridge.
- Address legislative requirements and British Standards relevant to the CNMP.
- Provide a process to address any complaints received from statutory bodies.

## **1.5 Scope**

This CNMP applies to all activities undertaken by BEAR Scotland, including its contractors, over the next five years, between 1<sup>st</sup> October 2021 and 30<sup>th</sup> September 2026.

The plan will outline the existing noise environment, indicate the noise levels from the proposed maintenance works, and identify the control measures to be used to minimise wherever possible the noise footprint of activities and mitigate where necessary.

The monitoring and measurement protocol for noise will be described and reporting procedures detailed, as well as establishing responsibilities for the management of noise.

This CNMP will be reviewed at set intervals to ensure it remains valid and accurate. The CNMP will also be reviewed / updated to account for any changes to the conditions of licence, proposed works planned, proposed mitigation / monitoring strategy, etc., as deemed appropriate by a suitably qualified acoustician.

## 2 Legislation and Guidance

### 2.1 Guidance on Noise Management

BEAR Scotland is committed to implementing the best practicable means to minimise construction noise and vibration during the maintenance activities to meet all requirements within the contract documents for the maintenance of the Forth Bridge STRU. This Construction Noise Management Plan stipulates the guidance to be followed to ensure that BEAR Scotland's activities do not cause pollution by way of deterioration in noise levels in accordance with Part III of the Environmental Protection Act (EPA) 1990.

### 2.2 Relevant Guidelines and Standards

#### 2.1.1 BS 5228-1: 2009 + A1:2014 Code of practice for noise and vibration control on construction & open sites - Part 1 (Noise)

This code of practice provides guidance and recommendations on methods for the measurement of construction noise and assessing its impact on those exposed to it. It also refers to the legislative background to noise control on construction sites and gives recommendations for basic methods of noise control. Suitable methods are provided for the calculation of noise from construction activities, including basic information regarding noise levels from a range of construction equipment.

The Standard provides guidance for the identification of the significance of noise levels from surface construction activity. Significance can be considered in relation to fixed limits for noise and vibration, or alternatively in considering the potential change in the ambient noise level with the construction noise.

A significance criterion is developed from noise measurements of existing ambient noise levels at the nearest sensitive receptors to the site. Sensitive receptors are residential housing; hotels and hostels; buildings in religious use; buildings in educational use and buildings in health and/or community use. Such issues of significance are in this case moot, and comparison with guidance from or the responses to consultation with NatureScot (formerly Scottish Natural Heritage) in relation to the potential impacts of noise on the bird population being of more relevance.

#### 2.1.2 Best Practicable Means

All maintenance and construction work will be carried out using the Best Practicable Means (BPM) as defined in Section 72 of the Control of Pollution Act, 1974<sup>1</sup> and British Standard BS 5228:2009+A1:2014 for Noise and Vibration<sup>2</sup>.

For static operations, or activities where works are taking place close to sensitive receptors, temporary barriers or enclosures should be employed, which will reduce the impacts somewhat. In addition, in accordance with good site practice, the following measures should be implemented.

Generic measures to assist in the reduction of noise levels generated from the site at sensitive receptors could include, but are not limited to the following:

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<sup>1</sup> Scottish Government (1974), *Section 72, The Control of Pollution Act*

<sup>2</sup> British Standards (2009), *BS 5228-:2009+A1:2014, Code of Practice for noise and vibration control on construction and open sites. Part 1 Noise and Part 2 Vibration.*

- Noise and vibration control at source: e.g. selection of quiet and low vibration equipment, location of equipment on site, control of working hours and the provision of acoustic enclosures; and,
- Screening: e.g. local screening of equipment or perimeter hoarding.

The measures to be addressed for each activity could include, but are not limited to the following:

- Careful selection of equipment by consideration of the EC Directive to ensure that the quietest available equipment is specified;
- Specification of the quietest methods or use of the programme to ensure that noise levels are minimised;
- Use of hoarding or specific noise barriers where this is possible and practicable. No equipment is expected to operate at night, but any that does (such as pumps and generators) will be shielded from surrounding sensitive receptors, and all noisy hand-held equipment such as 'Stihl' saws and concrete breakers shall be shielded using temporary barriers such as 'Heras' fencing fitted with acoustic shielding panels (similar to 'Blok N Mesh');
- Site layout to locate noise sources as far away from sensitive receptors as possible, although given the site constraints for some activities this might be difficult;
- Provision of lined and sealed acoustic covers for all equipment where this is practicable;
- Regular maintenance of all equipment;
- Operation of equipment in the mode of operation that minimises noise;
- Shutting down equipment when not in use;
- No waiting or queuing on the public highway with engines running;
- Construction of temporary infrastructure to minimise noise and vibration;
- Handling all materials in a manner which minimises noise; and
- Audible warning systems designed to minimise noise.

Experience of the use of these forms of mitigation on other sites has shown that combined they have the potential to reduce construction noise levels by 5-10 dB. Nonetheless there is the potential that some of the proposed activities could still result in significant construction noise levels at sensitive receptors.

## **2.3 Marine Licence Conditions**

The document forms part of the application for a Marine Licence for all proposed maintenance activities on the bridge for the next 5 years.



During previous works on the Forth Road Bridge where construction noise impacts might have been expected to occur the competent authority, Marine Scotland, has had a duty under regulation 48 of the Conservation (Natural Habitats, &c) Regulations 1994 to consider the implications of the activity in relation to Natura 2000 sites. This was to decide whether any aspect of the proposed works was likely to have a significant effect on the Firth of Forth SPA or the Forth Islands SPA.

The Marine Licence 05568/15/0 was approved 22<sup>nd</sup> October 2015 and was originally due to expire on the 21<sup>st</sup> October 2020, although this was subsequently extended on two occasions and is now valid until 30<sup>th</sup> of September 2021. Conditions were put in place and noted below are those which relate to noise:

*17. The licensee shall ensure a "soft-start" approach is adopted for all noisy activities resulting in an increase of  $\geq 3\text{dB}$  in the ambient noise level at Long Craig Island.*

*29. The licensee shall ensure that noise does not exceed a maximum of 75dB for any works that takes place within 400m of Long Craig Island between 1 May to 15 August (inclusive).*

*30. The licensee shall, no later than 1 month prior to commencement of the works, submit a Construction Noise Management Plan (CNMP) for the written approval of the licensing Authority in consultation with Scottish Natural Heritage (SNH) and any other consultee at the discretion of the Licensing Authority. This should include, but not be limited to:*

- 1. Specific monitoring and measures required to be undertaken by the licensee within 400m of Long Craig Island between 1 May to 15 August (inclusive);*
- 2. Bi-monthly submission of noise reports during May to 15 August (inclusive) the licensee shall notify the Licensing Authority of noise levels generated during the Works within 400m of Long Craig Island. The noise reports shall include daily records, work start/stop records, delays and a summary of noise monitoring undertaken;*
- 3. Written obligation to cease works where noise levels exceeds the maximum limit of 75dB within 400m of Long Craig Island between a May to 15 August (inclusive). Works shall not continue until effective mitigation is put in place, and noise monitoring equipment is working.<sup>3</sup>*

It could be expected that similar conditions might be imposed to the current application for marine licence, and consequently this CNMP has been written to consider compliance with these conditions<sup>4</sup>, although it is accepted that NatureScot are not keen on the retention of the present construction noise limit.

<sup>3</sup> Marine Scotland (October 2015), *Licence for Marine Construction Works*, Licence Number: 05568/15/0

<sup>4</sup> If conditions imposed by the proposed 5 year marine licence vary significantly from those detailed in the previously awarded 5 year marine licence, then this CNMP will be required to be updated in advance of construction activities commencing.

### 3. Existing Noise Environment

#### 3.1 Ambient Noise Surveys

A noise survey was carried out on 1<sup>st</sup> and 2<sup>nd</sup> March 2021 during both day and night hours at various locations to determine the ambient noise levels. The locations identified in Appendix C were:

- The Boathouse;
- Ferry Barn Court;
- Forth Road Bridge, directly above Long Craig Island; &
- Off Ferry Barn Court on the northern shore under the bridge.

Weather conditions during the surveys were predominantly dry and winds during the measurement survey were low (<5m/s) with all measurements taken within a free-field environment.

As a conservative measure, the ambient noise level in the absence of the noise emissions of any construction works was not subtracted from the measured levels. The results of the survey are reported in Table 3.1:

Table 3.1: Results of Baseline Survey

The Boathouse									
Start Time	Duration	L <sub>Aeq</sub>	L <sub>AMax</sub>	L <sub>AMin</sub>	L <sub>A1</sub>	L <sub>A10</sub>	L <sub>A50</sub>	L <sub>A90</sub>	L <sub>A99</sub>
01/03/2021 12:53	00:15:00.0	52.3	80.5	40.5	62.4	56	46.3	43.2	41.6
01/03/2021 23:13	00:15:00.0	40.2	55.4	29.2	50.8	43.2	35.9	31.7	30.2
Ferry Barns Court									
Start Time	Duration	L <sub>Aeq</sub>	L <sub>AMax</sub>	L <sub>AMin</sub>	L <sub>A1</sub>	L <sub>A10</sub>	L <sub>A50</sub>	L <sub>A90</sub>	L <sub>A99</sub>
01/03/2021 13:18	00:15:00.0	54.5	71	46.9	63.5	56.1	52.7	50.1	48.4
01/03/2021 23:36	00:15:00.0	45.5	59.3	28.4	55.8	48.8	41.9	34.8	29.6
Grassed Area off Ferry Barns Court									
Start Time	Duration	L <sub>Aeq</sub>	L <sub>AMax</sub>	L <sub>AMin</sub>	L <sub>A1</sub>	L <sub>A10</sub>	L <sub>A50</sub>	L <sub>A90</sub>	L <sub>A99</sub>
01/03/2021 13:44	00:15:00.0	55.6	67.8	49.6	64.3	58.2	53.3	51.4	50.5
01/03/2021 23:58	00:15:00.0	46.4	66.5	34.1	57.1	49.4	42.9	38.8	35.7
On Forth Road Bridge Above Long Craig Island									
Start Time	Duration	L <sub>Aeq</sub>	L <sub>AMax</sub>	L <sub>AMin</sub>	L <sub>A1</sub>	L <sub>A10</sub>	L <sub>A50</sub>	L <sub>A90</sub>	L <sub>A99</sub>
01/03/2021 14:22	00:15:00.0	58.8	81.5	46.9	71	58.8	52.4	49.4	48
02/03/2021 00:37	00:15:00.0	46.1	66.8	34.9	54.8	46.6	43.2	38	36.1

From the above it is apparent that daytime levels in the area of the North Queensferry, rounded to the nearest 5dB, range from 50 to 55dB L<sub>Aeq</sub> whereas the night-time noise levels are between 40 and 45dB L<sub>Aeq</sub>.

The noise levels at the area directly above the designated site upon the bridge were identified as 60dB L<sub>Aeq</sub>, daytime and 45dB L<sub>Aeq</sub> night-time when rounded.

It was considered that the noise sources in the surrounding area were predominantly road traffic noise in the vicinity, with the Queensferry Crossing apparent both day and night. The main observed noise sources are associated with road traffic and the noise emissions from the noise produced from vehicles passing over the bridge joints.

## 4. Noise Management & Assessment Process

### 4.1 Reporting and Responsibilities

Table 4.1 describes the roles and responsibilities of the noise management process.

Table 4.1: Roles and responsibilities

Roles	Responsibilities
Project Design Manager	Ensure that all conditions are included as part of the design to guarantee that the noise levels are reduced where possible.
Operations Manager	<p>Approve appropriate resources for the implementation of this Plan.</p> <p>Ensure the effective implementation of strategies designed to reduce noise impacts from the operation.</p> <p>Ensure that any sub-contractor abides to all conditions relating to the Marine Licence.</p> <p>Ensure any potential or actual noise issue is reported in accordance with legal requirements and the corporate standard.</p>
Project Managers, Supervisors, and Task Co-ordinators	<p>Provide that sufficient resources are allocated for the implementation of this Plan, as required.</p> <p>Ensure adequate resources are budgeted for in relation to noise monitoring for their task/project if required.</p> <p>Monitor the team members and contractors that carry out maintenance tasks and request noise monitoring where required.</p> <p>Preparation of method statements.</p> <p>Ensure Daily works form (Appendix C) is filled out during all works and provides all the information with regards to noise on site. This includes all plant used any delays, stop/start approach and description of noise and note any issues.</p> <p>Authority to stop or modify works if any noise exceedance.</p> <p>Ensure any potential or actual noise management issue is controlled, or otherwise isolated.</p> <p>Ensure any potential or actual noise management issues, including environmental incidents, are reported to senior staff and recorded within Non-conformity register and Internal Incident Register. Ensure personnel working at the operation are aware of the noise obligations.</p>
<p>Noise Specialists: Noise Competency</p> <p><b>Principal Acoustician</b></p>	<p>Manage and maintain the noise monitoring programs in accordance with this plan.</p> <p>Ensure monitoring equipment is operated in accordance with relevant industry standards and protocols.</p> <p>Ensure that all monitoring records are effectively maintained within scheme folders, where appropriate.</p> <p>Authority to instruct the relevant site manager to stop works for any noise exceedance of a noise limit agreed with Marine Scotland &amp; review data to ascertain what element of generated noise is causing unacceptable responses in the bird population.</p> <p>Coordinate the collation and evaluation of monitoring data.</p> <p>In conjunction with E&amp;S Manager, provide Marine Scotland with bi-monthly reports.</p>
<b>Acoustician</b>	<p>Ensure monitoring equipment is operated in accordance with relevant industry standards and protocols.</p> <p>Ensure that all monitoring records are effectively maintained within scheme folders, where required.</p> <p>Interface with construction team.</p>
Environment and Sustainability Manager	<p>Ensure that the requirements of Construction Noise Management Plan are being adhered to and that roles and responsibilities are suitably adhered to.</p> <p>Authority to instruct the relevant site manager to stop works for any noise exceedance of a noise limit agreed with Marine Scotland, or such amended limit is found to be more responsive to bird population reactions.</p>

Roles	Responsibilities
	In conjunction with Noise Specialists, provide Marine Scotland with bi-monthly reports as per Marine Licence conditions.
All employees and contractors	Ensure the effective implementation of this Plan with respect to their work area. Ensure any potential or actual noise management issues, including environmental incidents, are reported to the Project Manager, Supervisor or Task Coordinator. Ensure all equipment (relevant to task/area of responsibility) is maintained and operated in a proper and efficient manner.

## 4.2 Phases of Construction Work and Plant and Equipment Utilised

The proposed programme of works to be undertaken over the 5-year duration of the Marine Licence are appended to this document as Appendix A.

A desktop analysis has been undertaken to determine the proposed machinery that could be used within the area, and the potential noise levels generated by the combination of plant and equipment proposed to be used for programmed operations.

Source noise levels were obtained from Annex C of BS 5228:2009+A1:2014 mainly as sound pressure levels at 10 m from the noise source (dB  $L_{Aeq}$  at 10m). This list is not exhaustive and may change depending on the proposed works. Where the Standard does not include data for the plant and equipment to be used, manufacturer's data or measured levels have been used.

Tables 4.2 and 4.3 illustrates the type of plant that may potentially be used for maintenance of the Forth Road Bridge. The location of Long Craig Island to the road level is approximately 50m and to the underside walkway approximately 44m. Table 4.2 provides calculations as to the predicted A-weighted Sound Pressure Level  $L_{Aeq,T}$  dB at these levels.

For the avoidance of doubt, the Sound Power Level ( $L_{WA}$ ) dB is the acoustic power from a specific device or machine. It is an intrinsic characteristic of the machine. It does not depend on the location, whereas, the Sound Pressure Level ( $L_{Aeq,T}$ ) dB is the noise measured by the sound level meter at a given distance. It represents the loudness of sound. It depends on the location. If you measure further away from the noise source the Sound Pressure Level will be lower than if you measure close to the source.

It should be noted that every time the distance from a point source is doubled, the noise levels reduce by approximately 6dB  $L_{Aeq}$ , assuming hard ground between the source and the point of measurement<sup>5,6</sup>.

The relation between the sound power level of a specific machine ( $L_{WA}$ ) and the sound pressure level that would be measured at 10m from the noise source ( $L_{Aeq}$  at 10m), has been assumed to be 28dB(A)<sup>7</sup>. That is  $L_{WA} = L_{Aeq}$  at 10m + 28 dB(A).

This assumes that noise spreads in a hemispherically equally in all directions from a point source.

<sup>5</sup> When the surface between the noise source and the measurement point is water, it is usually assumed hard ground conditions.

<sup>6</sup> See BS 5228-1:2009+A1:2014 formula F.1.

<sup>7</sup> See BS 5228-1:2009+A1:2014 section F.2.3.1.

Table 4.2: List of Plant used upon the Forth Road Bridge – Scheme Works

Phase of Operations	Plant Description	No	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	Total L <sub>w</sub> dB	Calculated Noise Level, dB L <sub>Aeq</sub> at Generic Distances					
							10m	20m	40m	50m	100m	200m
Main Bridge Expansion Joint Replacement	Liebherr LTM1200 Mobile Crane	2	40%	10	8	107.0	79.3	73.2	67.2	65.3	59.3	53.2
	Lorry with HIAB	1	30%	10	8	105.0						
	Impact Wrench	1	20%	10	8	110.0						
	Hammer Drill Under Load	1	20%	10	8	101.0						
	Angle grinder (grinding steel)	1	15%	10	8	108.0						
	Hand-held welder	1	20%	10	8	101.0						
	Large concrete mixer	1	10%	10	8	104.0						
	Generator for Welding	1	20%	10	8	85.0						
Suspended Span Painting Contract	Shotblast Nozzle	1	30%	10	8	115.0	81.6	75.6	69.6	67.7	61.6	55.6
	Compressor – Compair C115-12	1	35%	10	8	101.0						
	Scabbler	1	30%	10	8	97.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Generator for Welding	1	25%	10	8	85.0						
	Scabbler	1	30%	10	8	97.0						
Suspended Span Strengthening Contract	Shotblast Nozzle	1	30%	10	8	115.0	82.0	75.9	69.9	68.0	62.0	55.9
	Compressor – Compair C115-12	1	35%	10	8	101.0						
	Scabbler	1	30%	10	8	97.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Generator for Welding	1	25%	10	8	85.0						
	Impact Wrench	1	10%	10	8	110.0						
	Hand Tools	1	30%	10	8	87.0						
Viaduct Span Painting Contract	Shotblast Nozzle	1	30%	10	8	115.0	81.5	75.5	69.5	67.5	61.5	55.5
	Compressor – Compair C115-12	1	35%	10	8	101.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Generator for Welding	1	25%	10	8	85.0						
	Hand Tools	1	30%	10	8	87.0						
Viaduct and North Approach Resurfacing	Road planer	1	25%	10	8	110.0	79.2	73.2	67.2	65.3	59.2	53.2
	Lorry (4-axle wagon)	1	20%	10	8	108.0						
	Road sweeper	1	15%	10	8	104.0						

Phase of Operations	Plant Description	No	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	Total L <sub>w</sub> dB	Calculated Noise Level, dB L <sub>Aeq</sub> at Generic Distances					
							10m	20m	40m	50m	100m	200m
	Asphalt paver (+ tipper lorry)	1	25%	10	8	103.0						
	Vibratory roller	1	30%	10	8	108.0						
	Scabbler	1	15%	10	8	97.0						
Suspended Span Resurfacing	Road planer	1	25%	10	8	110.0	79.2	73.2	67.2	65.3	59.2	53.2
	Lorry (4-axle wagon)	1	20%	10	8	108.0						
	Road sweeper	1	15%	10	8	104.0						
	Asphalt paver (+ tipper lorry)	1	25%	10	8	103.0						
	Vibratory roller	1	30%	10	8	108.0						
	Scabbler	1	15%	10	8	97.0						
Footpath Resurfacing	Scabbler	1	25%	10	8	97.0	73.2	67.2	61.2	59.2	53.2	47.2
	Hand-held welder	1	20%	10	8	101.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Generator for Welding	1	25%	10	8	85.0						
Suspended Span Under Deck Access	Impact Wrench	1	25%	10	8	110.0	75.0	69.0	63.0	61.1	55.0	49.0
	Hand Tools	1	30%	10	8	87.0						
Footpaths Elastomeric Pads Replacement	Impact Wrench	1	25%	10	8	110.0	75.0	69.0	63.0	61.1	55.0	49.0
	Hand Tools	1	30%	10	8	87.0						
Side Tower Lateral Thrust Bearing Strengthening	Lorry with HIAB	1	30%	10	8	105.0	77.3	71.3	65.2	63.3	57.3	51.3
	Impact Wrench	1	15%	10	8	110.0						
	Hammer Drill Under Load	1	20%	10	8	101.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Hand-held welder	1	20%	10	8	101.0						
	Generator for Welding	1	20%	10	8	85.0						
Main Tower Lateral Thrust Bearing Replacement	Lorry with HIAB	1	30%	10	8	105.0	77.3	71.3	65.2	63.3	57.3	51.3
	Impact Wrench	1	15%	10	8	110.0						
	Hammer Drill Under Load	1	20%	10	8	101.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Hand-held welder	1	20%	10	8	101.0						
	Generator for Welding	1	20%	10	8	85.0						
Side Tower Elastomeric Bearings Replacement	High Pressure Water Jetter	1	45%	10	8	111.0	82.1	76.1	70.1	68.1	62.1	56.1
	Suction Pump	1	50%	10	8	108.0						
	Suction Tanker	1	50%	10	8	96.0						

Phase of Operations	Plant Description	No	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	Total L <sub>w</sub> dB	Calculated Noise Level, dB L <sub>Aeq</sub> at Generic Distances					
							10m	20m	40m	50m	100m	200m
	Impact Wrench	1	20%	10	8	110.0						
	Hammer Drill Under Load	1	15%	10	8	101.0						
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Hand-held welder	1	25%	10	8	101.0						
	Generator for Welding	1	25%	10	8	85.0						
Main Cable Intrusive Investigation	Lifting platform 8t	1	20%	10	8	95.0	60.0	53.9	47.9	46.0	40.0	34.0
	Hand Tools	1	30%	10	8	87.0						
Pedestrian Balustrade Strengthening	Hammer Drill Under Load	1	15%	10	8	101.0	73.6	67.5	61.5	59.6	53.6	47.5
	Angle grinder (grinding steel)	1	20%	10	8	108.0						
	Hand-held welder	1	25%	10	8	101.0						
	Generator for Welding	1	25%	10	8	85.0						
	Hand Tools	1	30%	10	8	87.0						
New Suspended Span Underdeck Access Gantry	Liebherr LTM1200 Mobile Crane	1	40%	10	8	104.0	80.5	74.5	68.5	66.6	60.5	54.5
	Barge (On Idle)	1	50%	10	8	112.0						
	Hand Tools	1	30%	10	8	87.0						

Table 4.3: List of Plant used upon the Forth Road Bridge – Routine Maintenance Activities

Phase of Operations	Plant Description	No	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	Total L <sub>w</sub> dB	Calculated Noise Level, dB L <sub>Aeq</sub> at Generic Distances					
							10m	20m	40m	50m	100m	200m
Hangar Painting	Lifting platform 8t	1	25%	10	8	95.0	60.0	54.0	48.0	46.0	40.0	34.0
Weld Repairs	Angle grinder (grinding steel)	1	25%	10	8	108.0	73.7	67.7	61.6	59.7	53.7	47.7
	Hand-held welder	1	20%	10	8	101.0						
	Generator for Welding	1	25%	10	8	85.0						
Bolt Replacement	Impact Wrench	1	25%	10	8	110.0	75.0	69.0	63.0	61.1	55.0	49.0
	Hand Tools	1	30%	10	8	87.0						
Kingpost Replacement	Impact Wrench	1	25%	10	8	110.0	75.0	69.0	63.0	61.1	55.0	49.0
	Hand Tools	1	30%	10	8	87.0						



Phase of Operations	Plant Description	No	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	Total L <sub>w</sub> dB	Calculated Noise Level, dB L <sub>Aeq</sub> at Generic Distances					
							10m	20m	40m	50m	100m	200m
Pier Defences Painting	Shotblast Nozzle	1	25%	10	8	115.0	80.2	74.2	68.2	66.2	60.2	54.2
	Compressor – Compair C115-12	1	30%	10	8	101.0						
Billet Repair	Angle grinder (grinding steel)	1	20%	10	8	108.0	73.0	67.0	61.0	59.1	53.0	47.0
	Hand-held welder	1	25%	10	8	101.0						
	Generator for Welding	1	35%	10	8	85.0						
Edge Trimmer Replacement/ Strengthening (Viaduct Spans)	Petrol hand-held circular saw	1	10%	10	8	119.0	84.3	78.3	72.3	70.3	64.3	58.3
	Hand held hydraulic breaker	1	10%	10	8	121.0						
	Hydraulic breaker power pack	1	10%	10	8	102.0						
	Hammer Drill Under Load	1	20%	10	8	101.0						
	Hand-held welder	1	25%	10	8	101.0						
	Generator for Welding	1	35%	10	8	85.0						
Edge Trimmer Replacement/ Strengthening (Suspended Span)	Petrol hand-held circular saw	1	10%	10	8	119.0	84.3	78.3	72.3	70.3	64.3	58.3
	Hand held hydraulic breaker	1	10%	10	8	121.0						
	Hydraulic breaker power pack	1	10%	10	8	102.0						
	Hammer Drill Under Load	1	20%	10	8	101.0						
	Hand-held welder	1	25%	10	8	101.0						
	Generator for Welding	1	35%	10	8	85.0						
Removal of Lead Based Paint	Shotblast Nozzle	1	25%	10	8	115.0	80.2	74.2	68.2	66.2	60.2	54.2
	Compressor – Compair C115-12	1	30%	10	8	101.0						
Grit Blasting	Shotblast Nozzle	1	25%	10	8	115.0	80.3	74.3	68.3	66.4	60.3	54.3
	Compressor – Compair C115-12	1	30%	10	8	101.0						
	Water pump (diesel)	2	30%	10	8	99.0						

Tables 4.2 and 4.3 show that all calculated noise emissions from the proposed operations are below the current 75dB licence limit at 40m. As a consequence, all proposed activities, using the plant and equipment noted in Tables 4.2 and 4.3 should not give rise to unacceptable noise levels under the current licence conditions; it will be open for discussion with NatureScot and Marine Scotland to ascertain whether a fixed limit will be retained during the new licence or if an alternative method of noise control is proposed. If any new plant is used within this period that is not listed in Tables 4.2 and 4.3, the Project Manager must contact the Noise Specialist to determine if there are any impacts to Long Craig Island.

#### **4.3 Site Working Hours**

The Forth Road Bridge maintenance works are generally undertaken between the hours of 08:00 and 18:00, Monday to Friday. Due to a variety of reasons, there is the occasional requirement for night-time and / or weekend working.

## 5. Noise Monitoring Program

### 5.1 Monitoring Programme

Following the installation of permanent noise monitoring equipment adjacent to the Forth Road Bridge in 2019, noise levels will continue to be measured on a continuous basis, but the parameters being measured will be kept under review based on the inter-relation between noise levels and startle effects in the Tern population, and agreed with Marine Scotland and NatureScot.

Noise levels of the agreed parameters will be made available to all relevant stakeholders on an ongoing basis. During the period 1 May to 15 August each year of the licence (2022 – 2026), this will be configured to produce and alert relevant operational staff when noise levels are approaching the threshold which is expected to be set out in the Marine Licence, at a level agreed with NatureScot and Marine Scotland.

Supplementary noise monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining work methods or techniques to minimise noise. All attended monitoring will be carried out by an appropriately qualified noise specialist. Records of equipment calibration and testing will be kept on site and saved electronically in order to permit sharing as required.

Details of the site activities and equipment usage will be recorded during the attended noise monitoring events. Short reports prepared by a noise specialist after each attended noise monitoring event will include the following information, but not limited to:

- The locations and results of noise monitoring
- Tabulation of noise measurement results (including  $L_{Amax}$ ,  $L_{Amin}$ ,  $L_{A1}$ ,  $L_{A10}$ ,  $L_{A50}$ ,  $L_{A90}$ ,  $L_{A99}$  and  $L_{Aeq}$  noise levels) together with notes identifying the principal noise sources and operations
- Summary of any measurements exceeding the noise criteria levels, and descriptions of the plant or operations causing these exceedances
- Details of corrective actions to address any noise criteria exceedances, and confirmation of its successful implementation.

Statistical descriptors recorded during each survey include  $L_{Amax}$ ,  $L_{Amin}$ ,  $L_{A1}$ ,  $L_{A10}$ ,  $L_{A50}$ ,  $L_{A90}$ ,  $L_{A99}$  and  $L_{Aeq}$  noise levels. Meteorological conditions will be recorded throughout the surveys.

#### 5.1.1 Noise Monitoring Equipment

##### 5.1.1.1 Permanent noise monitoring

The permanent equipment meets the requirements for a Type 1 Sound Level Meter under BS EN 61672-1:2013. The make and model are:

- NTi Audio XL2-TA Sound Level Analyser (Serial No. A2A-16378-E0)
- NTi Audio XL2-TA Sound Level Analyser (Serial No. A2A-16298-E0)

Noise monitoring equipment has been installed at two locations on and adjacent to the Forth Road Bridge structure between the north west and north east tower legs and adjacent to the north west side tower.

Calibration is recommended to be undertaken by the manufacturer on an annual basis, using their suitably calibrated equipment. A certificate will be provided following each annual calibration.

Wherever possible, the annual calibration will be undertaken outside the periods when construction works are taking place, in order that the equipment can record noise levels throughout the construction works.

#### **5.1.2 Attended noise monitoring**

The sound level meter to be used in the surveys will meet the requirements of Type 1 under BS 7580-1:1997 or Class 1 under BS EN 61672-1:2013.

The Sound Level Meter (SLM) will be mounted on a tripod, with microphone set approximately 1.2m above ground level and set at grazing incidence in 'free field' conditions. All surveys will be attended surveys.

A windshield will be fitted to the microphone to minimise the effects of wind-induced noise across the microphone diaphragm.

Any sound level meter and calibrator used on site during the works will be calibrated in a UKAS or NPL accredited laboratory every year for the calibrator and two years for the sound level meter. Before the commencement of any measurements during construction works the noise specialist will check that all equipment holds a valid certificate.

#### **5.1.3 Monitoring Locations**

Monitoring locations will be tailored to the nearby operations wherever possible, with the locations utilised for the baseline noise survey unless there are closer receptors to the proposed works. Monitoring locations will be kept under review, and where required agreement with Marine Scotland and NatureScot will be gained before new measurement locations are added.

### **5.2 Exceedance of Noise levels**

At present it is not yet known whether a specific noise limit will be agreed for construction works.

Should a noise limit be agreed, the protocol for any exceedances of noise levels is proposed to be as follows:

1. If the  $L_{Aeq}$  exceeds agreed construction noise limit, then the acoustician will contact the Site Supervisor to stop the works. Check that all mitigation within the CNMP has been implemented. Additional mitigation maybe required before works commence.
2. Site Supervisor should implement the measure as soon as practicable for daytime working, or by next shift if night-time working.
3. This should be reported as Non-Conformity which the client will be able to review via BEAR's Environment Incident register. Corrective and Preventative Actions will need to be effected to close the Non-Conformity.
4. This will be managed through site inspections, internal communication, incident reports and auditing findings. All reporting/findings will be provided to Marine Scotland.

Noise levels measured close to the works will be converted to noise levels at the designated sites assuming a minimum distance of 44m to the under walkway and of 50m to the road level. The conversion will follow the methodology stated in BS 5228-1:2009+A1:2014 Annex F.

## **6. Training and Awareness**

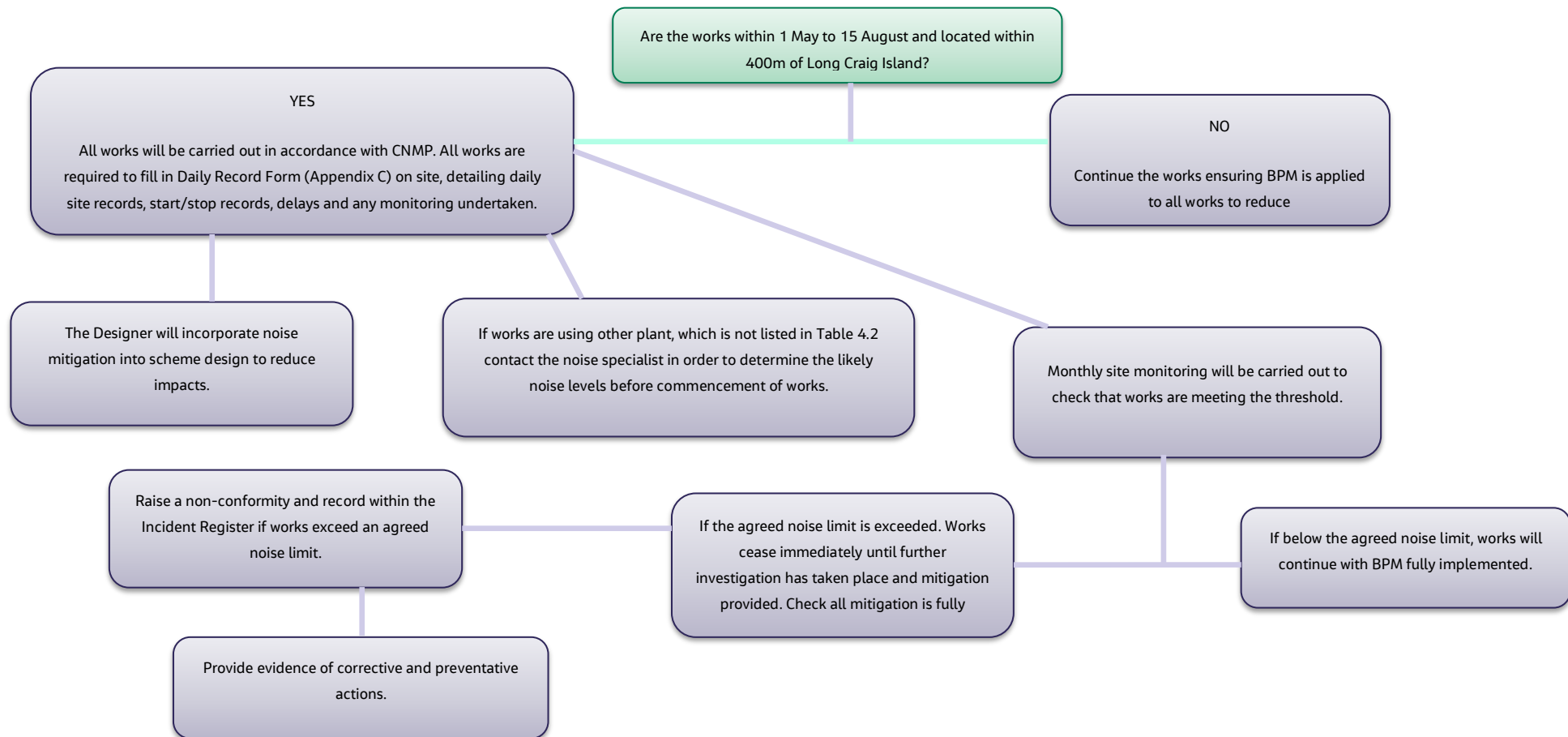
The CNMP will be briefed to all managers and staff working within this environment. The aim is for the Noise Specialist to roll this procedure and guidelines out at meetings and the project managers will cascade to all team members. This should be recorded and kept on record.

Further awareness of the marine licence conditions will be discussed as part of the Environmental Training for the Contract once the new Marine Licence has been issued.

## 7. Review and Improvements

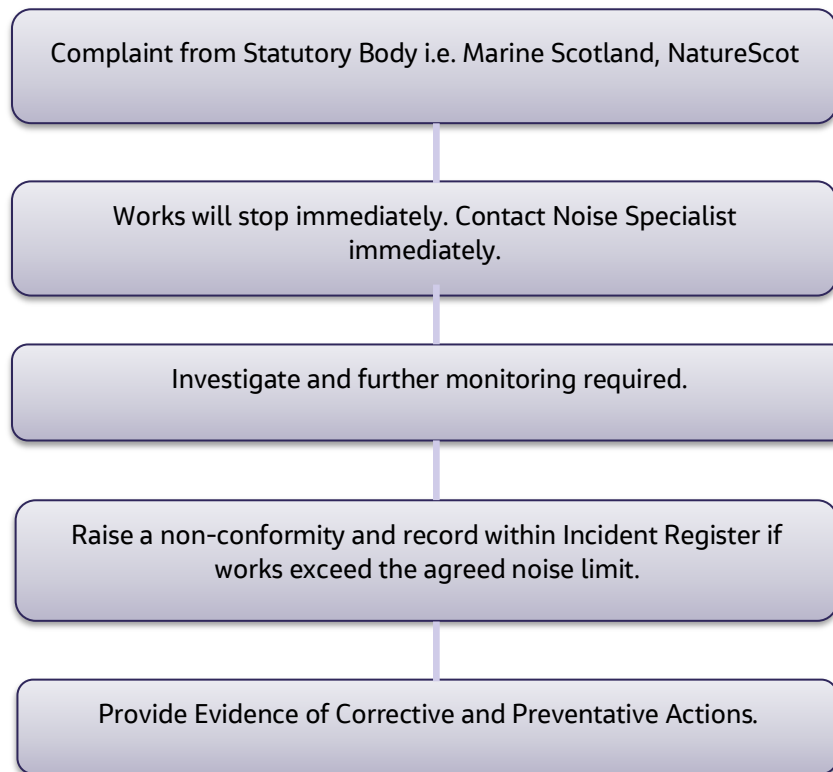
### 7.1 Summary of Procedure for Marine Licence Conditions

Figure 1 illustrates the procedure to comply with the current Marine Licence conditions. This is subject to review based on new Licence Conditions:



## 7.2 Summary of Procedure in the event of Complaint

Figure 2 illustrates the procedure in the event of a complaint from a Statutory Body.



## 7.3 Summary of Mitigation Measures to address potential noise impacts

In general, all works should adhere to BPM in accordance with Section 72 of the Control of Pollution Act 1974 and BS 5228:2009+A1:2014, Parts 1 & 2 Noise and Vibration. Refer to Appendix A and B.

Specifically, to meet the likely requirements of the Marine Licence, Bear Scotland must ensure the following for works within 400m of Long Craig Island during the tern breeding season:

- Undertake monthly noise monitoring
- Provide additional mitigation measures such as screens, enclosures if required.
- Submit monthly reports to Marine Scotland with evidence of any noise exceedance.

When works are taking place outside 400m of Long Craig Island, noise monitoring equipment will still be operational and will be available for interrogation as required.

## 7.4 Improvements

On an annual basis the CNMP will be reviewed and any improvements will be incorporated by a noise competent person with approval from the Operating Company Representative. All findings will be reported within the Annual Report submitted to the Client.



## 8. Definitions

Term	Definition
BPM	Best Practicable Means
CNMP	Construction Noise Management Plan
L <sub>A1</sub>	The L <sub>A1</sub> level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L <sub>A1</sub> level for 99% of the time.
L <sub>A10</sub>	The L <sub>A10</sub> level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L <sub>A10</sub> level for 90% of the time. The L <sub>A10</sub> is a common noise descriptor for environmental noise and road traffic noise.
L <sub>A50</sub>	The L <sub>A50</sub> level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L <sub>A50</sub> level for 50% of the time.
L <sub>A90</sub>	The L <sub>A90</sub> level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L <sub>A90</sub> level for 10% of the time. This measure is commonly referred to as the background noise level.
L <sub>A99</sub>	The L <sub>A99</sub> level is the noise level which is exceeded for 99% of the sample period. During the sample period, the noise level is below the L <sub>A99</sub> level for 1% of the time.
L <sub>Aeq</sub>	The equivalent continuous sound level (L <sub>Aeq</sub> ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
L <sub>Amax</sub>	Maximum Noise Level – The maximum noise level, measured on fast response, during the sample period.

## Appendix A. Proposed Programme of Works, 2021 – 2026

### Scheme Works Programme

Works Title	Date for Works	Description
Main Bridge Expansion Joint Replacement	2021	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. It is hoped that these works will be completed before the end of September 2021 but the northbound joints may still be ongoing in October 2021.
Suspended Span Painting Contract	2021 - 2026	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.
Suspended Span Strengthening Contract	2021 - 2026	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.
Viaduct Span Painting Contract	2021 - 2026	The existing paint system on the viaduct spans of the Forth Road Bridge 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. These works are likely to be undertaken over 3 painting seasons.
Viaduct and North Approach Resurfacing	2021 - 2022	The existing surfacing system on the Forth Road Bridge is coming to the end of its working life. The existing surfacing system on the suspended span is a thin layer epoxy asphalt system, approximately 40mm thick. These works will require the alternate full closure of either the northbound or southbound carriageway.
Suspended Span Resurfacing	2021 - 2022	The existing surfacing system on the Forth Road Bridge is coming to the end of its working life. The existing surfacing system on the suspended span is a thin layer epoxy asphalt system, approximately 40mm thick. These works will require the alternate full closure of either the northbound or southbound carriageway.
Footpath Resurfacing	2021 - 2023	The existing waterproofing / surfacing system on the Forth Road Bridge footpaths is coming to the end of its working life. These works will require the alternate full closure of either the east or west footpaths.
Suspended Span Under Deck Access (SSUDA)	2021 – 2026	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 over several years.
Footpath Elastomeric Pads Replacement	2021 – 2026	Inspection of the elastomeric bearing pads supporting the footpath deck panels has identified that the pads have become cracked and distorted and require replacement. This scheme will involve the repetitive jacking of each footpath panel, removal of the existing pad and installation of the new elastomerics before returning the deck panel to its original position. A programme of bearing pad replacements will be determined each financial year.
Side Tower Lateral Thrust Bearing Strengthening	2022 - 2023	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.
Main Tower Lateral Thrust Bearing Replacement	2022 - 2023	The existing main tower lateral thrust bearings are thought to be part of the original bridge construction. They are heavily worn and have been identified by the FRB critical element programme (CEP) posing very high risk: they are to be replaced with new preloaded bearings.
Side Tower Elastomeric Bearings Replacement	2022 - 2023	Forth Road Bridge's Side Tower elastomeric bearings are part of the original 1960s bridgeworks. They are visibly degrading and in poor condition. Defects outlined in the recent PI report include rust stained cracking to bearings' visible faces and water ingress between the bearings and their plinths. Despite their degrading condition, the bearings have performed well. As such, like-for-like replacement using contemporary elastomeric bearings is proposed. The existing holding down arrangement, consisting of the holding down bolts, base plates and bearing plinths, shall be replaced. Bearing top plates will also be replaced. Replacement bearing plinths may be constructed of either steel or reinforced concrete.
Main Cable Intrusive Investigation	2025/2026	The main cables of the Forth Road Bridge are the primary load carrying members and are regularly inspected externally and have also been subject to internal intrusive inspection to determine the condition of the individual wires. The first internal inspection was carried out in 2004, prior to a dehumidification system being implemented to arrest

Works Title	Date for Works	Description
		the development of corrosion. Further internal inspections have been undertaken in 2008 and 2012, with further inspections planned in future.
Pedestrian Balustrade Strengthening	2022 - 2024	The pedestrian balustrades have been identified as being sub-standard and require additional strengthening / modification to increase the height and containment. Investigation and designs are on-going and therefore the outline method statement provided below is indicative at this stage.
New Suspended Span Underdeck Access Gantry	2021 - 2022	New runway beams were installed on the bridge under a previous contract, leaving only the installation of the gantries to be undertaken. The new gantry for the main span will be installed in April 2021. The gantry will be delivered, by road, to a yard on the River Forth, from where it will be barged to the FRB. 2 no. 200T cranes will be located on the bridge deck and will perform a tandem lift to lift the gantry from the barge to position at the runway beams. The roller guides will then be positioned around the runway beam and the load transferred from the cranes to the beams in incremental stages. Finally, the gantry will be inspected, tested and commissioned prior to use. A further two gantries for the side spans will be fabricated throughout the summer of 2021 and installed in a similar manner to the main span gantry. It is anticipated that this installation will be carried out in late 2021 or early 2022.

## Routine Maintenance

Works Title	Description
Use of Bridge Access Systems	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: <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> These systems can be deployed at any time for use during periodic inspection, routine maintenance or for emergency works. All 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.
Hanger Painting	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.
Weld Repairs	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 several different processes including paint removal, weld testing, weld removal and re-welding.
Bolt Replacement	As well as welded connections, as noted above, there are a similar number of bolted connections on the Forth Road Bridge which at sometime may require replacement due to corrosion or damage which is affecting the adequacy of the connection.
Kingpost Replacement (Bottom Lateral Supports)	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.
Pier Defences Painting	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.
Billet Repair (Half Joint Repairs)	The Works involve all permanent and temporary construction associated with the trial 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.
Edge Trimmer Replacement / Strengthening (Viaduct Spans)	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,

Works Title	Description
	the work is programmed whilst Tarmac are working at the South viaduct so access to both Northbound lanes should be available.
Edge Trimmer Replacement / Strengthening (Suspended Span)	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.
Upper Front Staging Installation (Underdeck Access Staging)	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.
Removal of Lead Based Paint	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 must be put in place to minimise the risk of exposure to operatives and also contamination of surrounding areas.
Maintenance Painting	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.
Grit Blasting	As outlined previously, for the purposes of paint removal or steelwork preparation, it may be necessary to undertake grit blasting. This involves blasting the steelwork 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 to eliminate contamination of surrounding areas.
Chemical Removal of Paint System	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.
Repair of Cathodic Protection Systems	Cathodic protection is used on some of the reinforced concrete elements of the structure to protect the steel reinforcement from corrosion. Routine maintenance of the CP systems may be required and may involve replacement of faulty electrical equipment, replacement of sacrificial anodes, replacement of cabling and replacement of faulty cathodes or installation of new cathodes.
Replacement of SHM Sensors	There are a number of sensors attached to various elements of the bridge as part of the ongoing structural health monitoring. Occasionally, these sensors will require maintenance or replacement due to a fault.

## **Appendix B. Best Practical Means**

The following text is taken from the relevant Legislation and Guidance in relation to Best Practical Means:

### **Control of Pollution Act 1974 - Section 72**

- This section applies to "Best Practicable Means (BPM)".
- In that expression "practicable means reasonably practicable having regard among other local conditions and circumstances including technical knowledge and financial implications.
- BPM should be employed during design, installation maintenance, during operation of plant and machinery and any maintenance of acoustic enclosures.
- Subject to the preceding provisions of this section, regard shall be had, in construing references to "BPM" to any relevant provision of a code of practice approved under the preceding section.

All these techniques will minimise to a reasonable level of noise which operators, neighbours site operations will be exposed.

### **BS 5228: 2009+A1 2014 – Code of practice for noise and vibration control on construction & open sites**

Section 7.3 of BS 5228: 2009+A1 2014 'Execution of works' states that all available techniques should be used to minimize, as far as is appropriate, the level of noise to which operators and others in the neighbourhood of site operations will be exposed.

Measures which should be taken include the following.

- The hours of working will be planned and account will be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on site, taking into account the nature of land use in the areas concerned, the duration of work and the likely consequence of any lengthening of work periods.
- Where reasonably practicable, quiet working methods will be employed, including use of the most suitable plant, reasonable hours of working for noisy operations, and economy and speed of operations. Site work continuing throughout 24h of a day will be programmed, when appropriate, so that haulage vehicles will not arrive at or leave the site between 19.00h and 07.00 h.
- Noise will be controlled at source and the spread of noise will be limited, in accordance with Clause 8.
- On-site noise levels will be monitored monthly during May to August, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose.

When potential noise problems have been identified, or when problems have already occurred, consideration will be given to the implementation of practicable measures to avoid or minimise those problems. Local authorities, consulting with developers and their professional advisers or with site operators, will need to consider the extent of noise control measures necessary to prevent the occurrence of significant problems, and will also need to consider whether the implementation of those measures will be practicable. Local authorities might wish to consider whether to specify quantified limits on site noise and whether, additionally or instead, to lay down requirements relating to work programmes, plant to be used, siting of plant, periods of use, working hours, access points, etc. The latter approach will often be preferable in that it facilitates the monitoring of formally or informally specified requirements, both for the authorities and for the site operators.

In relation to best practicable means, the contractor will employ appropriate measures which may include:

Appropriate selection of plant, construction methods and programming, including appropriate scheduling of noisier activities within the permitted working hours. Only plant conforming with or better than relevant national or international standards, directives or recommendations on noise and vibration emissions will be used. Construction plant will be maintained in good condition regarding minimising noise output and workers' exposure to harmful noise and vibration.

- In addition to minimising noise and vibration at source or adverse effects through other mitigation measures, the contractor will demonstrate in its planning and assessments that it has considered undertaking works in those hours that minimise potential disturbance.
- Construction plant will be operated and maintained appropriately, having regard to the manufacturer's written recommendations, or using other appropriate operation and maintenance programmes which reduce noise and vibration emissions. All vehicles and plant will be switched off when not in use.
- Where practicable, erection of noise barriers as early as practicable to provide additional protection against construction/maintenance noise.
- The positioning of construction plant and activities to minimise noise at sensitive locations.
- The use of mufflers on pneumatic tools.
- The use of non-reciprocating constructional plant.
- The use, where necessary, of effective sound reducing enclosures.



## Appendix C. Figures – Including Monitoring Locations

Sample Measurement Locations – baseline survey 1<sup>st</sup> & 2<sup>nd</sup> March 2021



Permanent Measurement Location 1





Permanent Measurement Location 2

