

# Jacobs

BEAR Scotland Ltd

Professional Services Framework NMC

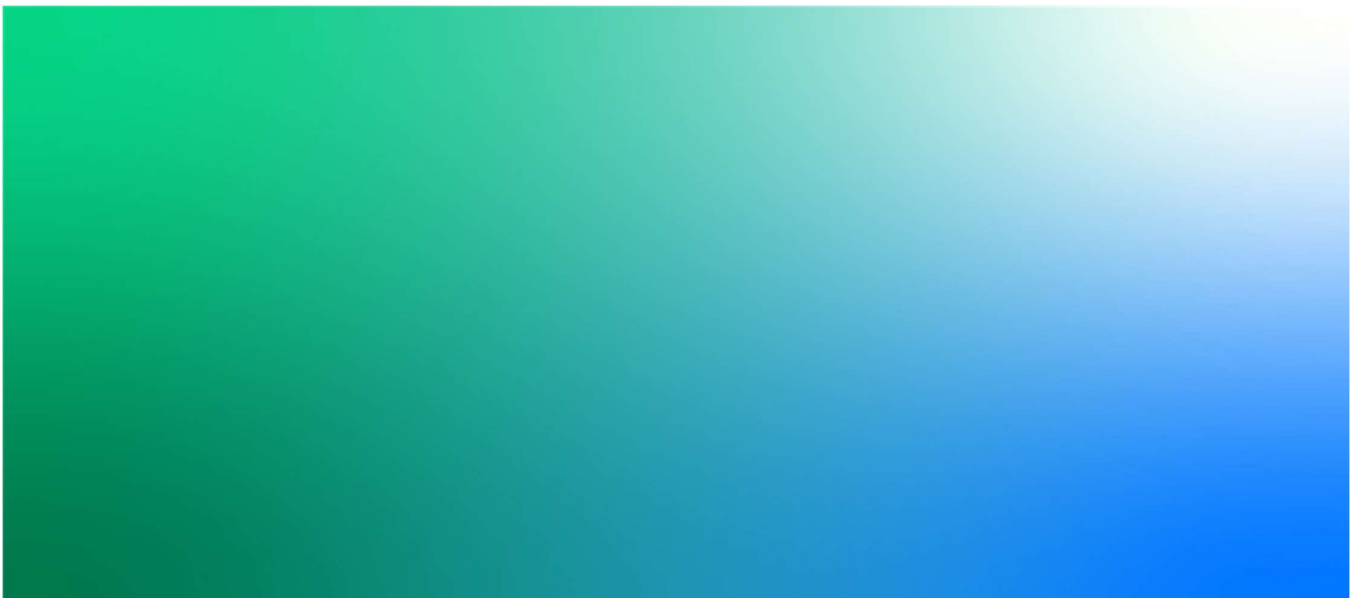
North West Unit

A9 redacted 11(2)

A9 redacted 11(2)

Noise Monitoring Report – Non-Technical Summary

May 2023



## BEAR NW Bridges

Project No: B4040403  
Document Title: A9 redacted 11(2) Noise Monitoring Report – Non-Technical Summary  
Revision: 1  
Date: May 2023  
Client Name: BEAR Scotland Ltd  
Project Manager: redacted 11(2)  
Discipline Lead: redacted 11(2)

### Jacobs U.K. Limited

160 Dundee Street  
Edinburgh  
EH11 1DQ  
United Kingdom  
T +44 (0)131 659 1500  
F +44 (0)131 228 6177  
www.jacobs.com

© Copyright 2023 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

### Document history and status

Revision	Date	Description	Author Initials	PM Approval Initials	PP Approval Initials
0	May 2023	First Issue	redacted	redacted	redacted
1	May 2023	Minor amendments	redacted	redacted	-

## Introduction

Jacobs was commissioned by BEAR Scotland Ltd, on behalf of Transport Scotland, to undertake a noise survey in the vicinity of the A9 redacted 11(2), to investigate noise emitted from the structure and this report provides a non-technical summary of the A9 redacted 11(2) Noise Monitoring Report (Project No: B4040401). The objective of the noise survey was to measure noise generated by vehicles passing over the movement joints of the bridge. The current movement joints were installed during construction of the bridge over 30 years ago. Movement joints are joints between the bridge deck and the abutment that are designed to accommodate movement in the deck to prevent cracking.

In October 2022, a series of short-term noise measurements were undertaken close to the bridge joints, and a longer-term overnight survey was undertaken close to nearby residential properties most affected by any noise emitted. The acoustic specialist's observation at the time of the survey was that noise from traffic crossing the joints was more noticeable at the southern end of the bridge, which is further away from the affected residential properties than the northern end.

redacted 11(2)



Figure 1: Location of redacted 11(2) with inset showing location in wider area

## Measurement of Noise Levels

The World Health Organisation (WHO) Environmental Noise Guidelines strongly recommend that policy makers implement suitable measures to reduce average noise exposure from road traffic below defined guideline levels, with an emphasis on evening and night-time noise which may disturb sleep.

Noise measurements for daytime and overnight surveys were taken using a sound level meter, amplifier, microphone and calibrator. Both daytime and overnight measurements were recorded close to the joints and nearby residential properties. Audible sources of noise observed during the measurements were a mixture of car, van and Heavy Goods Vehicle's (HGV).

Daytime measurements show that the peaks in noise levels were generated as a result of traffic movements, mostly from the A9. From observations during the survey, it was considered that the joints at the southern end of the bridge were louder and exceeded the WHO recommended limits than those at the northbound end, especially during the passage of HGVs.

Overnight measurements show that the maximum noise levels generated exceed the WHO values to avoid sleep disturbance. There are no other significant causes of noise in the area. Table 1 reports the number of times per hour the WHO guideline level considered to lead to sleep disturbance has been exceeded.

Table 1: A9 redacted 11(2) – Hourly Number of Exceedances of WHO Night-time Guideline Level

Start date & time	Hourly Number of Exceedances of WHO Guideline Level
10/10/2022 23:00	17
11/10/2022 00:00	6
11/10/2022 01:00	4
11/10/2022 02:00	3
11/10/2022 03:00	5
11/10/2022 04:00	13
11/10/2022 05:00	30
11/10/2022 06:00	57

### Inspection of Bridge Joints

From the noise measurements undertaken it was observed that peak noise events occurred when a vehicle passed over the joints at either end of the bridge, and because of this the area around the joints were considered the main potential cause of the noise events.

The bridge joints were inspected at the time of the noise survey by the acoustic specialist. The surfacing around the joints appeared to be in good condition, smooth and in-line with the surface of the joint. It was observed that the passage of traffic has led to wear and degradation of the running surface of the joint. This could lead to the increase in noise levels generated by the passage of traffic. When the bridge joints are installed, a rubber surface covering is installed to the edges of the joint, protecting the steel reinforcement of the joint (see Figure 2). During the inspection, it was observed that the joints at both ends are worn in the areas where vehicle tyres run over the joints. Figure 3, on the next page, shows an image of the worn rubber surface, taken during the October 2022 visit.

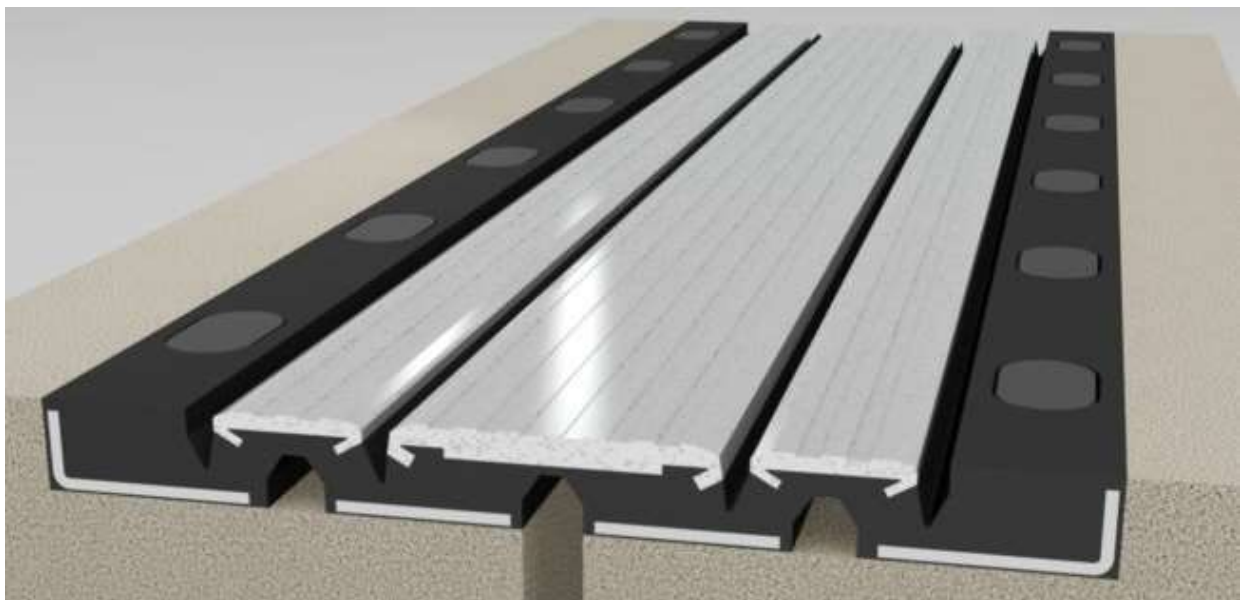


Figure 2: Section through 'as new' bridge joint, as taken from a manufacturer's website

This increase in noise could be caused by the wear pattern. The steel edge reinforcing is now exposed, so vertical impacts through the reinforcing during the passage of vehicles over the softened rubber surface are likely to

generate impact noise and potentially transfer vibration into the structure. This can lead to vibration in the bridge beams and to re-radiated noise from the bridge structure itself. Re-radiated noise is caused by vibrations that pass into other parts of the bridge, such as the beams, which can then cause noise themselves. During the surveys, it was clear that vibration was being transferred into the bridge beams. It was also noted during the surveys, that the plugs used to infill the mounting bolt holes are becoming loose and falling out (see Figure 3), leading to a greater potential for the rubber surrounding to be worn through abrasion from traffic and greater exposure to atmospheric conditions, accelerating the wear.

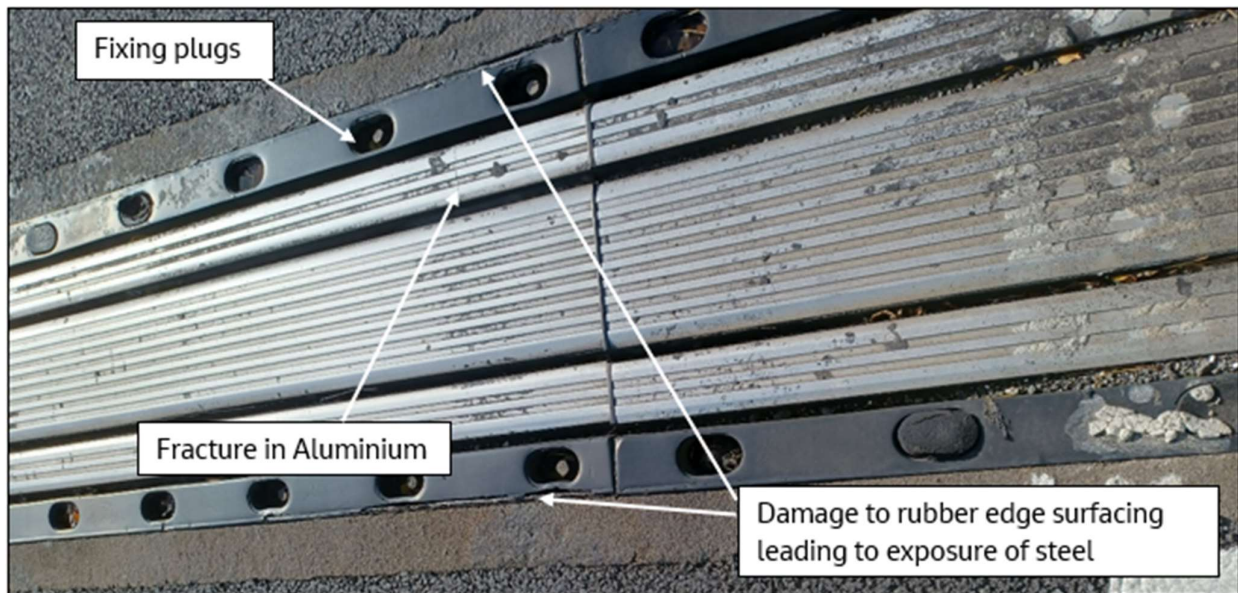


Figure 3: Image taken during October 2022 site visit of joint degradation

It should also be noted that the supporting bridge bearings at the abutments are also worn and there is the possibility that this may also have contributed to the increase of noise levels in the vicinity of the bridge joints.

## Conclusion

From the October 2022 acoustic surveys undertaken in the vicinity of the A9 redacted 11(2) in October 2022, it is evident that the passage of traffic over the bridge often results in noise levels during the night exceeding recommended levels. When this happens there is an increased potential for sleep disturbance to occur. During the overnight survey it was revealed that significant numbers of noise events took place which could lead to sleep disturbance. Measurements close to the joints at both ends of the bridge revealed noise levels exceeding recommended levels from the passage of vehicles compared to those for the adjacent road surface.

During the surveys, it was observed that the bridge joints are worn, although serviceable. The wear and tear on them could be leading to the increase in noise generation results captured during the surveys. As a result of the observations and the measurements taken during the surveys, degradation of the joints is likely to be the principal contributing factor to noise generation therefore it is recommended that the existing bridge joints are replaced. However, prior to any replacement, the functionality of the existing bridge bearings should be assessed to ensure any new joints can operate effectively, and as designed.