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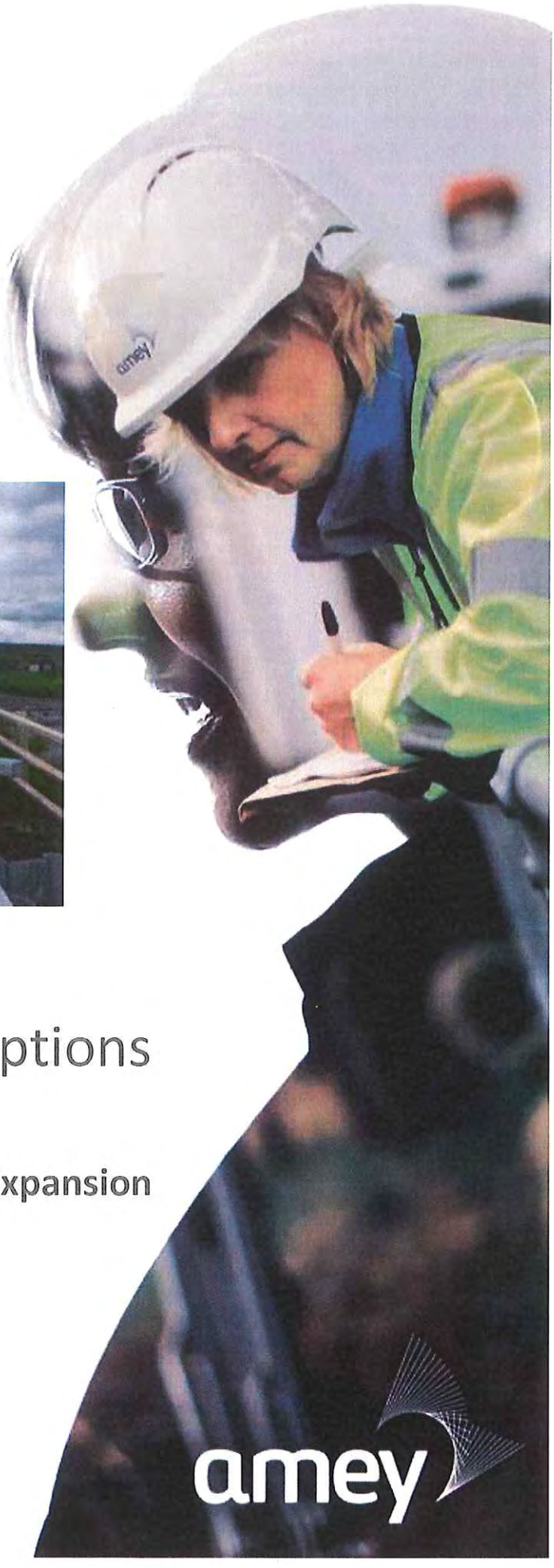

Expansion Joint Options Report

A702 20 Clydes Rail Bridge – Expansion Joints Refurbishment

15/SE/1201/032-02 Revision 01

May 2016

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Document Control Sheet

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Executive Summary

Recently there have been four instances where cyclists have claimed that the skew of the expansion joints at A702 20 Clydes Rail Bridge, along with the width and depth of the gap between the rails, had caused them to lose control of their bicycle, resulting in them falling off and sustaining injuries.

Amey carried out a risk assessment of the site and submitted this to Transport Scotland in September 2015. The risk assessment concluded that the seal of the existing joints should be replaced with a new joint seal that Universal Sealants Ltd (USL) is in the process of developing. The redesigned profile of the seal removes the entrapment hazard posed to cyclists. If there were any issues with the development of USL's seal then replacing the joints with asphaltic plug joints was recommended.

As an interim measure, and as recommended by the risk assessment, Amey installed warning signs on both approaches to the bridge, warning cyclists about the presence of the joints.

During this time Amey has been liaising with USL regarding the development of their new, redesigned profile, joint seal. At this time however the seal is still in its early development stage, therefore the timescales for implementing this solution are not conducive to safeguarding cyclists. Consequently, Amey has reviewed various other joint options to replace the existing joints, thus removing the hazard. It is recommended to replace the existing joints with Permatrack H Asphaltic Plug Joints.

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1 Introduction

The A702 20 Clydes Rail Bridge is located where the A702 trunk road crosses over the West Coast Main Line route north of the junction between the A702 and the A73. This section of the A702 forms the main link between Biggar and the M74, see Figure 1.1.

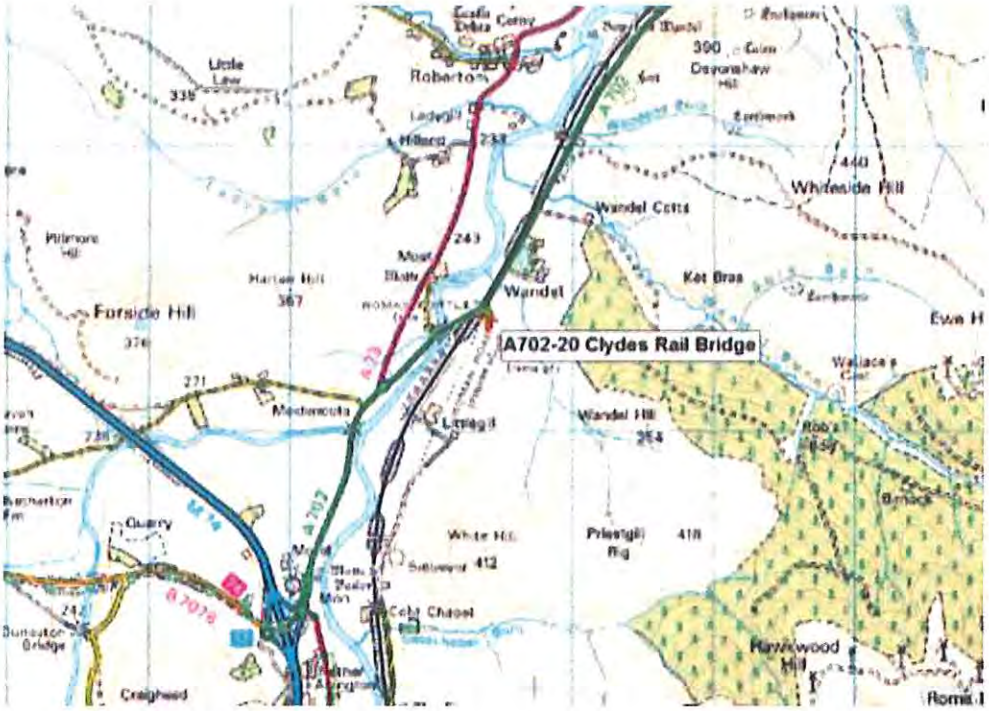


Figure 1.1 – Location Plan

Recently there have been four instances where cyclists have claimed that the skew of the joints, along with the width and depth of the gap between the rails, had caused them to lose control and fall off their bicycles, sustaining injuries. These instances are reported to have taken place on 06/07/2014, 27/07/2014, 28/11/2014 and 11/07/2015. Amey Structures team were first made aware of the latest incident (11/07/2015) on 29/09/2015, after the Risk Assessment Report was issued to Transport Scotland. One claimant alleged that the rails of the joint were slippy when wet.

The purpose of this report is to provide information on previous maintenance works on this structure's expansion joints, to review progress addressing the issues noted in the above claims, and to propose options going forward.

2 Expansion Joint Refurbishment

2.1 Expansion Joint History

There is an expansion joint at both ends of the structure. Each joint is required to accommodate a thermal movement of 11mm. The west joint has a skew angle of 70 degrees and the east joint has a skew angle of 74 degrees normal to the carriageway.

The information presented in Table 2-1, collected from SMS and previous inspection reports, summarises the records available in relation to the expansion joints at this structure.

Table 2-1 Expansion Joint Maintenance Summary

Year	Details
1972	Bridge construction completion and buried joints installed.
2004	Record of Asphaltic Plug Joints (APJ) in place (installation date unknown), part of which was repaired in April 2004.
2005/2006	Existing APJ replaced with mechanical joints (BEJ8) due to the skew of the bridge. 40mm of HRA removed and replaced with 40mm SMA. Full depth surfacing repairs were carried out adjacent to the joints to reduce their overall width.
2010	Principal Inspection noted that the mechanical joints were leaking.
2012	Mechanical Joints were replaced with new mechanical joints.

From inspecting the existing joints at carriageway level, they appear to be in generally good condition. However, there is a small tear present on the seal of the east joint (see Figure 2.1). It is not possible to determine whether there is any leakage through the existing joints without gaining access to the railway track.

Figure 2.1 – Joint Seal Tear

2.2 Scheme Progress

Following on from a risk assessment of the site, prepared by Amey and submitted to Transport Scotland in September 2015, warning signs have been installed at both ends of the structure warning cyclists of the presence of the joints (see Figure 2.2).

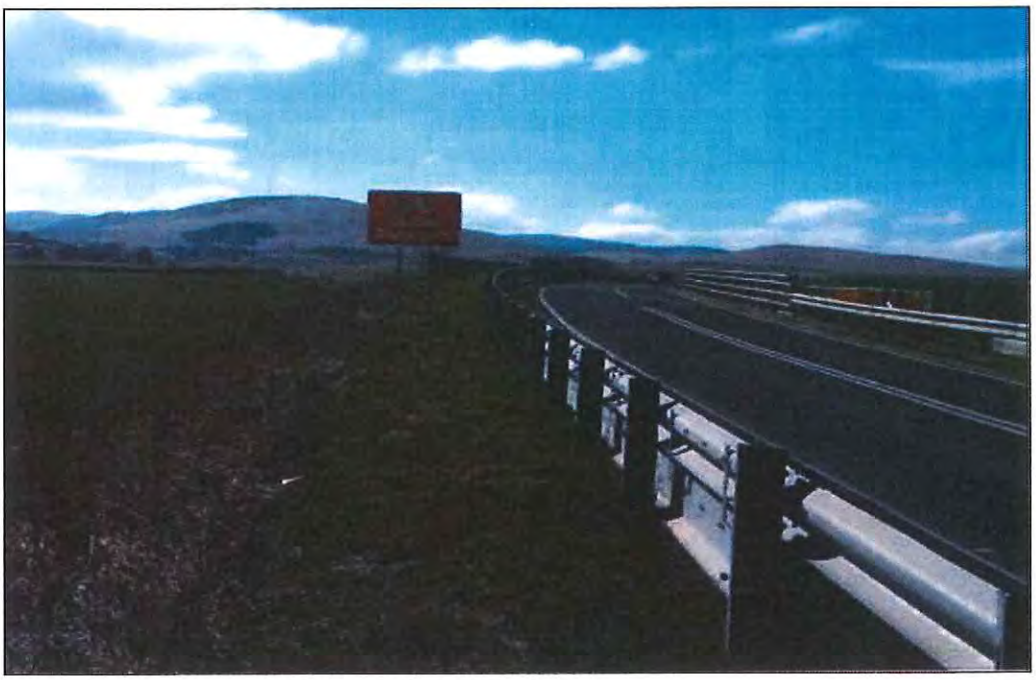


Figure 2.2 – Expansion Joint Warning Signs

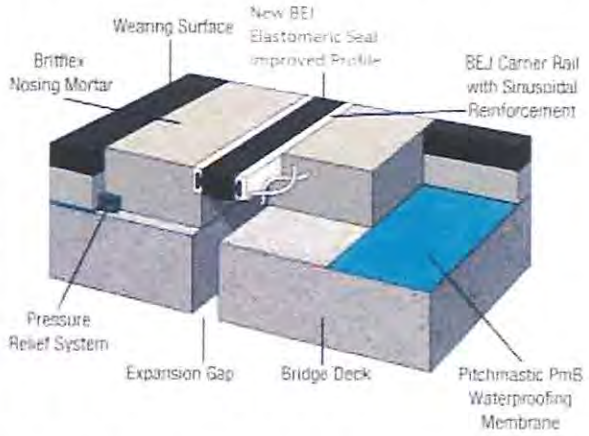
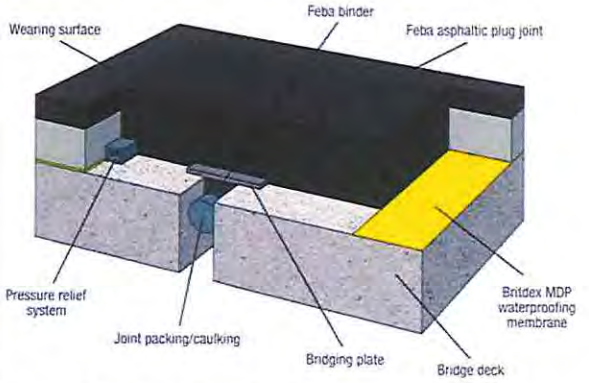
As recommended by the risk assessment report, Amey have been liaising with USL regarding their ongoing development of a new rubber seal profile for use in mechanical joints. This seal, once developed, has the potential to replace the existing joint seals, reducing the difference in level between the top surface of the joint rails and the top surface of the seal. In doing so this would remove the risk of a bicycle wheel becoming entrapped in the joint. Test results on the new seal have not been favourable and it is uncertain when a suitable product will be available.

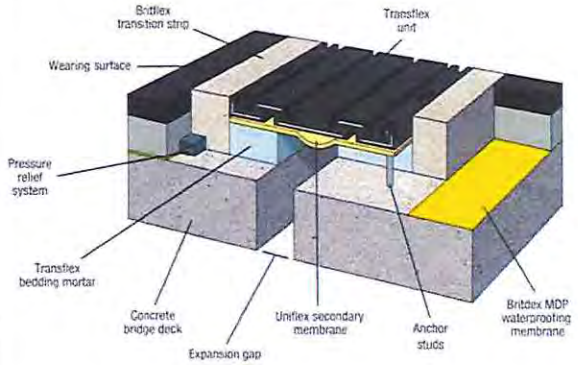
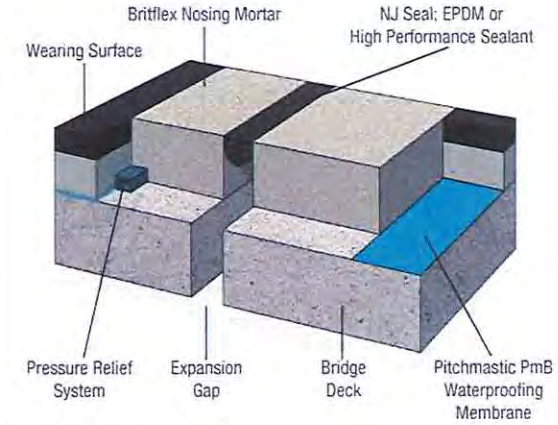
Additionally Amey have enquired about the development of a "joint filler", also in development by USL, consisting of a rubberised type compound which could be used to fill the void in the profile of the existing seal. However, site trials of this product, carried out by USL, resulted in the 'filler' de-bonding two months after install rendering it unsuitable for this particular application.

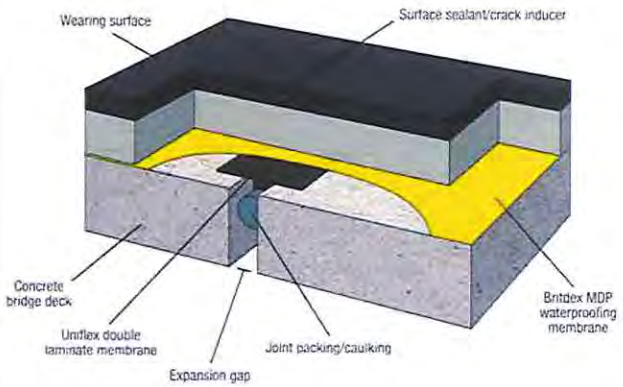
Consequently, Amey has reviewed various other types of joints which could replace the existing joints and remove the bicycle wheel entrapment hazard. All options reviewed are summarised in Table 2.2.

Table 2-2 Expansion Joint Systems Reviewed

Joint Type	Manufacturer	Advantages	Disadvantages
Permatrack H Plug (APJ) Joint.  **Figure 2.3 - Permatrack H Plug (APJ) joint**	RAB Associates	1) Removes entrapment hazard to cyclists. 2) A highly polymerised elastic bituminous membrane is installed around the APJ, effectively isolating the asphalt from skew movements. 3) The APJ portion of the joint is constructed from a high modulus matrix consisting of SBS (Synthetic Rubber Based) modified bitumen and Trinidad Lake asphalt which is more resistant to rutting as a result of wheel tracking compared to a traditional APJ. 4) HA Registered Product	1) It costs approximately 1.3 times more than a traditional APJ. 2) The largest skew this system has previously been installed on is 53° normal to the carriageway. However RAB Associates, with 15 years of Permatrack development and installation experience, have *"no hesitation in recommending its use in highly skewed joints"*. This recommendation is based on Permatrack's additional *"use in both transverse and longitudinal crack repairs on highways, where it is subject to high stresses and shearing, and that it has an excellent record."* Additionally RAB Associates guarantee the installation of the Permatrack H Joint for 10 years (subject to normal exclusions regarding misuse and/or accidental damage caused to the joint)

Joint Type	Manufacturer	Advantages	Disadvantages
New Rail Joint Seal plus High Friction Over banding.  **Figure 2.4 - BEJ Rail Joint with improved Elastomeric Seal Profile – Still in development.**	USL	1) Removes entrapment hazard to cyclists. 2) Utilizes existing rails which are in good condition.	1) Seal currently in an early development stage with no certain timescales for completion and no guarantee of an end product. 2) Not a HA Registered Product
FEBA (APJ) Joint.  **Figure 2.5 - FEBA (APJ) Joint.**	USL	1) Removes entrapment hazard to cyclists. 2) HA Registered Product	1) Rarely installed on a skew as it is subject to rutting and splitting as a result of the increased trafficked width of the joint.

Joint Type	Manufacturer	Advantages	Disadvantages
Transflex (Reinforced Elastomeric) Joint.  **Figure 2.6 - Transflex Joint.**	USL	1) Performs better on a skew that traditional APJ joints. 2) HA Registered Product.	1) Does not remove entrapment hazard to cyclists.
Britiflex NJ (Nosing with Preformed Compressed Seal) Joint.  **Figure 2.7 - Britflex NJ Joint.**	USL	1) Performs better on a skew that traditional APJ joints. 2) HA Registered Product.	1) Reduces but does not remove entrapment hazard to cyclists.

Joint Type	Manufacturer	Advantages	Disadvantages
Buried Joint  **Figure 2.8 - Buried Joint**	-	1) Joint itself is buried so not directly loaded by traffic. 2) Greatly improves water migration over the joint instead of sub-surface ponding associated with alternative systems.	1) The bridge deck surface or waterproofing does not require an entire replacement at this stage. Therefore, the road surface would have to be removed and reinstated locally to where the buried joint is installed most likely over a 5m length and full width of the structure. The joints in the road surfacing and a lack of continuous waterproofing along the base may cause the expansion joint to be vulnerable to water leakage in the future. 2) Damage to adjacent systems not intended for replacement would be at risk.
Various other companies have their own APJ and rail and seal options. However, these have the same limitations as a traditional APJ in terms of being installed on a skew and their seals tend to have similar profiles which do not remove the entrapment hazard to cyclists.			

3 Recommendations

It is recommended to replace the existing expansion joints with high modulus Permatrack H Plug joints at this structure. Through reviewing different joint options, the Permatrack system is the only HA approved system that completely removes the entrapment hazard to cyclists with literature that states it can be installed at any depth and width. The literature also states that the PSB layer and strip effectively isolates the asphalt from skew movements. RAB Associates, with 15 years of Permatrack development and installation experience, recommend the use of the Permatrack H system for highly skewed joints based on Permatrack's excellent record in its additional use for both transverse and longitudinal crack repairs on highways, where it is subject to high stresses and shearing. Additionally RAB guarantee the installation of the Permatrack H Joint for 10 years (subject to normal exclusions regarding misuse and/or accidental damage caused to the joint). See Figure 3.1 for a cross-section of the Permatrack H Plug Joint Design.

Replacing both existing EMR Systems with 50m of Permatrack H Plug joints would cost approximately £25,000.

Figure 3.1 – Permatrack H APJ Cross Section

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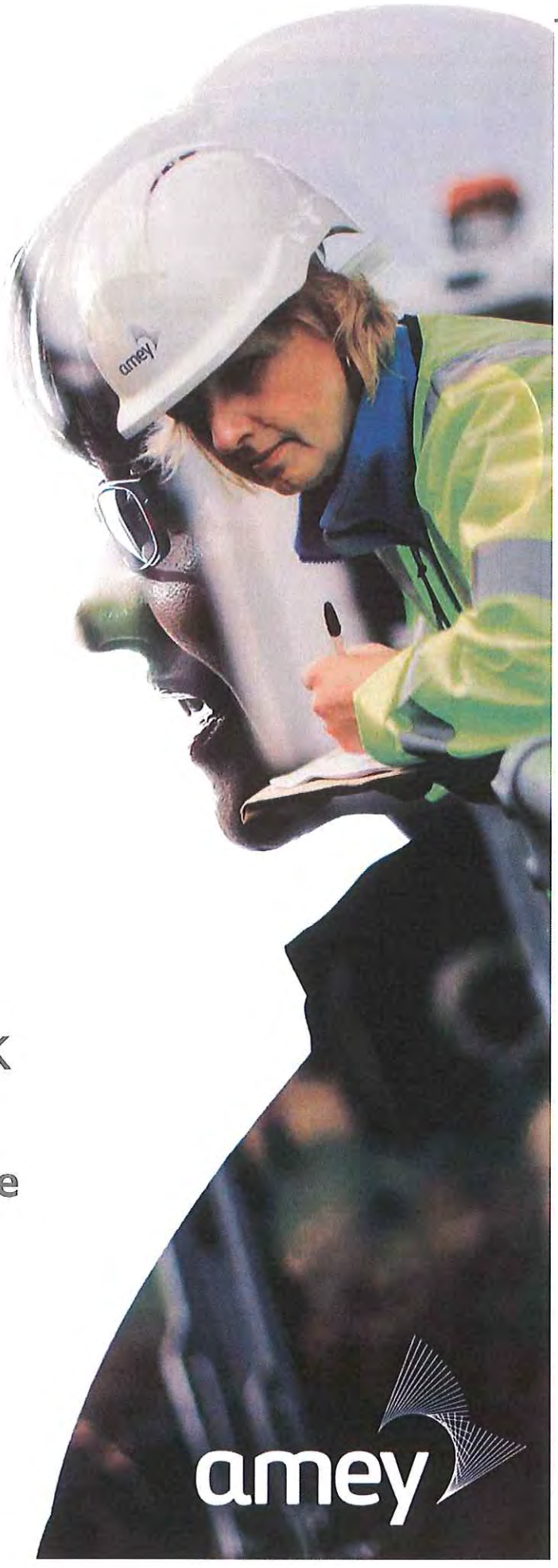

Expansion Joint Risk Assessment

A702-20 Clydes Rail Bridge

15/SE/1201/032 /001 Revision [-]

September 2015

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