

**IN THE MATTER OF THE EDINBURGH TRAMS STATUTORY INQUIRY**

**SUPPLEMENTARY WITNESS STATEMENT OF MARTIN HEINZ FOERDER**

**PROVIDED ON BEHALF OF BILFINGER CONSTRUCTION (UK) LIMITED**



1. **INTRODUCTION**

1.1 I refer to my witness statements dated 10 December 2015 and 12 July 2017 which have been previously submitted to the Edinburgh Tram Inquiry ("**the ETI**").

1.2 I am aware that certain witnesses, in particular Steven Reynolds and Jason Chandler of Parsons Brinckerhoff, have given evidence to the ETI in relation to the design and construction of the trackform. I have been asked by the ETI to clarify my understanding of the issues surrounding the design and construction of the trackform, particularly in relation to the works on Princes Street.

1.3 In preparation for making this supplementary witness statement, I have seen the ETI Public Hearing Transcripts dated 12 and 13 October 2017. I have also seen the witness statements of Steve Reynolds (both **TRI00000124** and **TRI00000124\_C**), and Jason Chandler (**TRI00000027\_C**) which have been submitted to the ETI.

2. **EVIDENCE PRESENTED TO THE ETI ON TRACKFORM**

2.1 I understand that Steve Reynolds and Jason Chandler have told the ETI that the consortium ("**BBS**") proposed a cheaper, shallow-form trackform design which was less robust than the SDS design proposed by Parsons Brinckerhoff ("**PB**"). Their evidence was that due to the risk of cavities or voids beneath the road surface, and with heavy traffic running over the tram lines on the road, there was a risk of rail breakage and tram derailment. To counter those risks, PB proposed that a reinforced concrete slab should be constructed beneath the trackform layer.

2.2 Steve Reynolds and Jason Chandler were critical of BBS' trackform proposal and their evidence was that it was unsafe, unsuitable and ultimately unbuildable. Jason Chandler in particular expressed concern that the BBS' trackform would fail in subsequent years due to the presence of voids beneath the rail track.

2.3 Additionally, both Steve Reynolds and Jason Chandler were asked whether the acceptance of BBS' cheaper, shallow-form trackform proposal and the subsequent need for full-depth reconstruction could have cost the project millions of pounds in additional expense. There was a suggestion that remedial works were required because of the decision to implement the BBS trackform proposal.

2.4 I disagree with Steve Reynolds and Jason Chandler's presentation of the issues encountered with the design and construction of the trackform for the project. I do not believe that their evidence has fully or accurately portrayed the full facts and circumstances, and has instead confused two very different issues in connection with the trackform design and construction. The two issues are:

2.4.1 the trackform design – the trackform proposed by BBS was Rheda Trackform as shown on slide 1 appended to this witness statement. This was accepted by tie. The reinforced slab (or trackform improvement layer) upon which it sat was designed by SDS. The reinforced slab on Princes Street never had to be replaced. It was installed when Infraco carried out works on Princes Street in 2009. The cost of the reinforced slab was not included within the Infraco Contract Price and was an additional cost which tie had to cover (as a Notified Departure);

2.4.2 issues surrounding the road / rail interface on Princes Street and allegations of faulty workmanship. Infraco ultimately accepted the need to carry out remedial works on Princes Street following mediation in early 2011. All of this work was carried out at Infraco's cost.

I now deal with each of these issues in further detail.



### 3. BACKGROUND AND OVERVIEW OF TRACKFORM DESIGN

- 3.1 As part of the Infraco Proposals put forward with the bid, BBS proposed the Rheda Trackform as the proposal for the trackform design. The Rheda trackform required a formation beneath it capable of achieving 120MPa for the life of the trackform. How this was to be achieved was not part of the Infraco trackform design proposal. tie accepted the Rheda Trackform proposal and allowance was made for the cost of this in the Infraco Contract Price. In other words, the BDDI showed only the trackform itself and this is what was priced by BBS. Had due diligence of this being carried out prior to contract award, it would have been identified that an "improvement" layer would be required underneath the trackform due to the ground conditions within the majority of the "on-street" sections of the tram route – voids, poor ground etc. tie were either unaware of this due to their lack of experience and knowledge in tram projects or they chose to ignore it to keep the overall "visible" project costs down until after contract award.
- 3.2 To be clear on this, the design put forward by BBS was for the trackform only and it clearly showed that a suitable formation layer was required beneath the trackform. The trackform proposal did not show the interface detail between the rail and the road (running surface). This was part of the design integration that needed to take place between the roads designer and the trackform designer as part of the Design Integration process.
- 3.3 The trackform proposal put forward by BBS still had to be integrated into the overall design. The trackform itself cannot be stated to be "unsafe". It was not suitable to be installed without further works, which was apparently clear to SDS and should also have been clear to tie. SDS had an outline Trackform design within their preliminary design; however, as the Trackform was then determined to be a Contractor Proposal, SDS did not detail this further. Ultimately, tie had gone with Rheda trackform as proposed by BBS, even though the requirement for and cost of an improvement layer should have been apparent to tie.
- 3.4 Having selected the Rheda Trackform (as part of the Infraco proposals), there was a misalignment within the overall design and the process to address this was through the Development Workshop Process as outlined in the Infraco Contract. When the Development Workshop for the trackform was held, it identified a misalignment in that the Rheda trackform required a trackform improvement layer capable of providing continuous support of 120MPa throughout the on-street sections of the track for the lifespan of the trackform. Different options to achieve the required 120MPa support were explored with SDS, but ultimately, the only solution that SDS would accept for the on-street works was the reinforced concrete trackform improvement layer. This was the 250mm thick reinforced concrete slab to be constructed beneath the Rheda trackform layer.
- 3.5 The misalignment was as a result of the initial SDS design being based on a different trackform that did not require a formation layer to provide a support of 120MPa.
- 3.6 Any SDS design that was required to be changed as a result of the identified misalignments was a Mandatory tie Change. The need for this reinforced concrete trackform improvement layer was a Mandatory tie Change (a Notified Departure), and Infraco were entitled to the additional cost of this (design and construction costs).
- 3.7 In addition, construction of the trackform improvement layer required ground improvements through much of the on-street sections of the Infraco works due to the poor ground conditions beneath. Those ground improvements required increased depth of construction which would take longer to construct, inevitably leading to an increase in construction costs.
- 3.8 The SDS designed trackform improvement layer for the Rheda trackform, was installed by Infraco when the trackform works were carried out on Princes Street in



2009. There was never any need for remedial works to the trackform improvement layer and it did not cost the Project more than the Contract provided for. To be clear, the remedial works which were carried out on Princes Street much later, had nothing to do with the SDS designed trackform improvement layer.

- 3.9 BBS were paid additional sums over and above the Contract Price to account for the design change required for the trackform improvement layer. Therefore, there were additional costs borne by BBS to install the Rheda trackform with the trackform improvement layer. However, these were anticipated by and allowed for within the Infraco Contract and there was no delay or costs for any rework or remedial works in connection with the trackform improvement layer.

#### 4. THE ROAD/RAIL INTERFACE – INTEGRATION OF SIEMENS AND SDS DESIGN

- 4.1 During Steve Reynolds' evidence, Mr Reynolds was asked about faults in relation to the trackform works on Princes Street and reference was made to remedial works being required because BBS' trackform design was not suitable for the tram project. In particular, Steve Reynolds said:

*"The faults I think you're referring to with the initial implementation of the trackform, yes, because a part of the trackform design, just to amplify what you were talking about there, is the so-called shoulders that run alongside the rails, and our preference was for concrete shoulders to contain the trackform, as it were, whereas the initial BBS offer didn't have those concrete shoulders.*

*"That then resulted in problems with the heavy traffic on Princes Street cutting across the track, the buses and so on and so forth, and then you got the cavities that you were just talking about." (ETI Public Hearing Transcript 12 October 2017, page 43:7-17).*

- 4.2 Immediately after this, Mr Reynolds was asked why BBS' trackform proposals were not suitable for constructing trackform on Princes Street, and Mr Reynolds answered:

*"In our view it wouldn't have been safe because a further characteristic of the trackform design necessary for inner city circumstances like Princes Street, you need what's called void spanning, because you've got to anticipate that there will be cavities under the roadway...So you need the trackform to be capable of spanning those voids so you don't get rail breakage, and obviously if you get rail breakage in an inner city environment, you get a derailment. That's particularly unsafe. You need to be able to avoid that, obviously." (ETI Public Hearing Transcript 12 October 2017, pages 43:22 to 44:11)*

- 4.3 This seems to suggest that the absence of concrete shoulders in the initial trackform construction on Princes Street is either connected to, or is the same issue as the requirement for the track improvement layer (because of the risks of voids beneath the road surface). The "shoulders" formed part of the interface between SDS' design for the road and Infraco' design for the trackform and is an entirely separate issue from the track improvement layer.

- 4.4 Initially, BBS constructed the Rheda trackform on top of the track improvement layer, and then an asphalt layer was installed to form the running surface as shown on slide 2 appended to this witness statement. This was the layer between the rails to bring the "on-street" trackform up to finished road level. This design was signed off by the road and trackform designers. At this stage, the designers (SDS) had not identified any requirement for concrete shoulders.

- 4.5 Ultimately, the road/rail interface failed on Princes Street. We believed that a large part of why this occurred was because the asphalt works were carried out in cold, wet



weather conditions in late November 2009 in order to achieve the deadline for handover of Princes Street imposed by tie. These works would not usually be carried out in such weather conditions as the finished product is likely to be poorer in quality and can often require to be re-done. Another reason for the road/rail interface failure was that buses were permitted to run on Princes Street within only a few hours of the asphalt being laid on the road.

- 4.6 After further investigations on Princes Street when the defects were noted (after the work on Princes Street had been carried out), it was concluded that the design of the trackform with the road was unsuitable for the volume of traffic on Princes Street, including the loading of full buses turning over the tracks. This design issue was not picked up by SDS or Infraco until after the trackform had been installed on Princes Street. It should have been flagged as a misalignment that the road/rail interface needed to be more robust and hence required concrete shoulders rather than merely asphalt. If this had been noticed during the Development Workshop Process, then the need for concrete shoulders would have been priced as a Notified Departure and Infraco would have been entitled to the additional cost of this (design and construction costs).
- 4.7 Ultimately, as a result of both of these issues, it was agreed that remedial works were necessary. The design was reviewed and the solution we arrived at was that concrete shoulders should be installed to provide a more robust road/rail interface on Princes Street as shown on slide 3 appended to this witness statement.
- 4.8 Infraco therefore carried out remedial works on Princes Street. This involved replacing the asphalt "coverage" layer with concrete shoulders at the road/rail interface. This did not involve any works to the trackform or the trackform improvement layer. These works were carried out entirely at the consortium's own cost. These works were carried out after the mediation. There was no additional cost to tie or CEC in connection with those remedial works, nor did this result in any delay to the project given that the MUDFA works remained the critical delay throughout.

5. **CONCLUSION**

- 5.1 The suggestion made by (or to) the ETI was that BBS' failure to comply with the SDS trackform design could have cost the project millions of pounds in additional costs. That is not correct. There were two distinct issues with the design and construction of the trackform. tie accepted BBS' Rheda trackform proposal, although design and costs associated with constructing a trackform improvement layer was to be determined after contract close. Therefore, there was no failure on the part of BBS to comply with the SDS design. Infraco complied with SDS design from the outset and constructed the track improvement layer when the works were carried out on Princes Street. Although the design, where it related to the road/rail interface, did need to be reviewed after the trackform had been laid on Princes Street in 2009, the subsequent remedial works which were performed did not incur any additional costs to the tram project.

I believe that the facts stated in this additional witness statement are true.

Signed:



Martin Heinz Foerder

Date:

.....15/12/2017.....

This document was  
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Inquiry on 15  
November 2017



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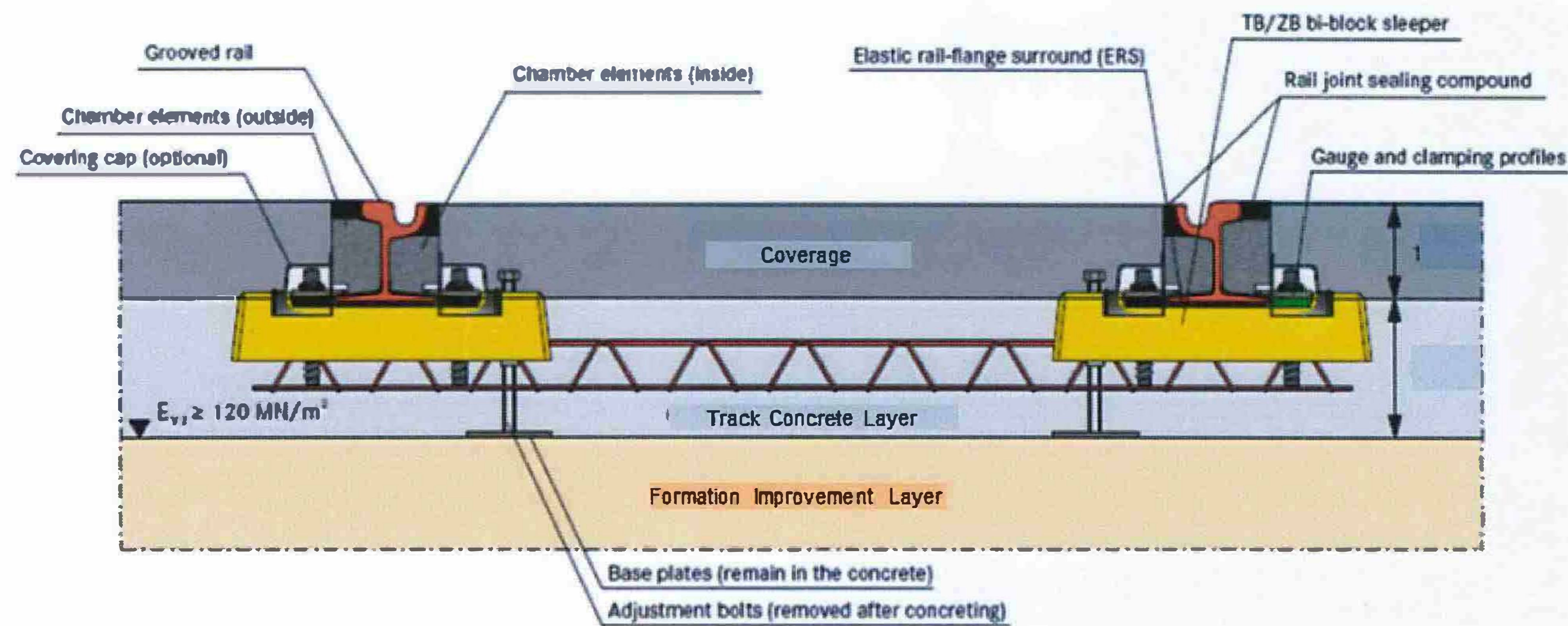
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**APPENDIX**



# Edinburgh Tram Network On Street Trackform

## Introduction to Rheda

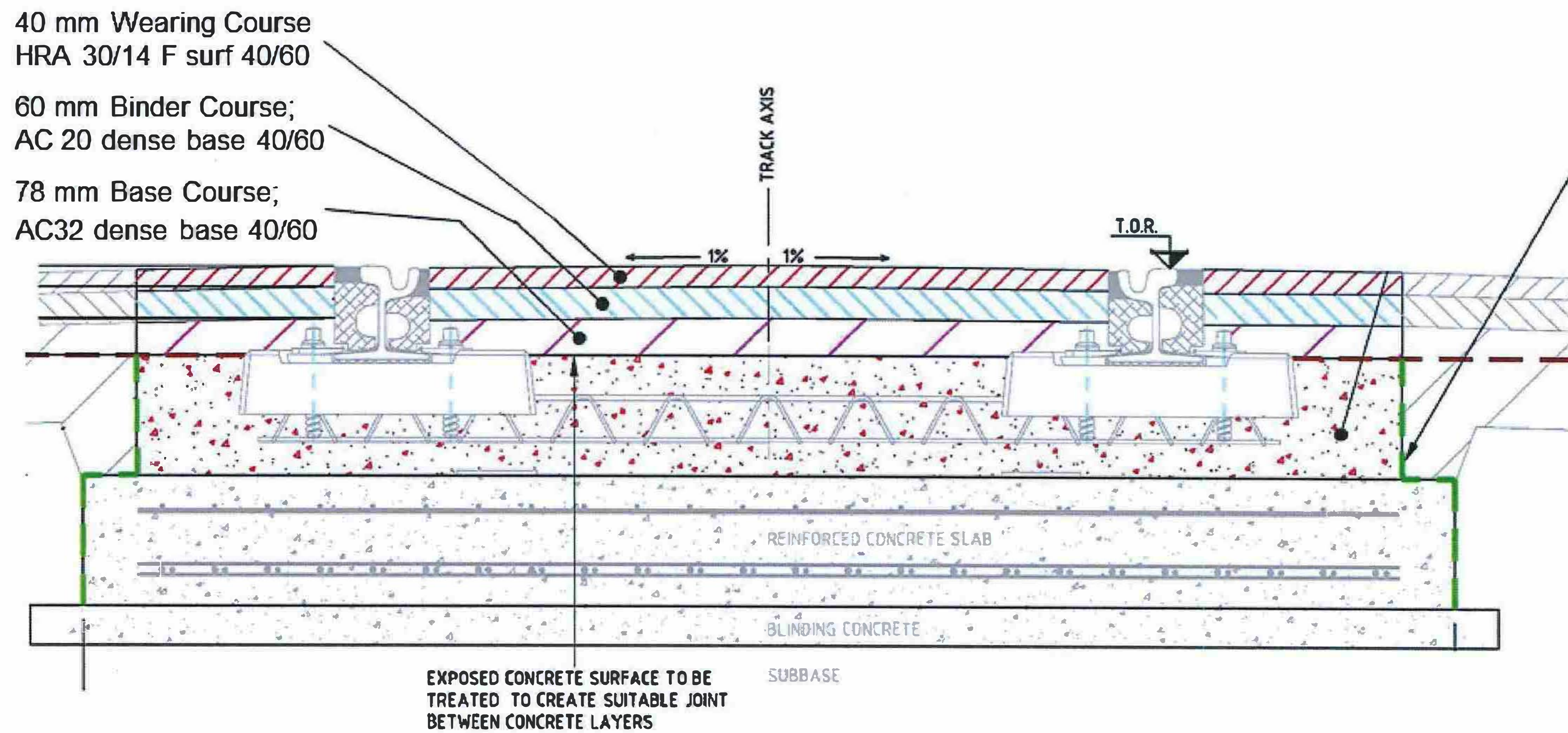




# Edinburgh Tram Network On Street Trackform

## How the Rheda System works

### Pavement Design 'As Built' in Princes Street





# Edinburgh Tram Network On Street Trackform

## Lessons learned



### Concrete Wearing Course Option for Princes Street

