THE PWI
THE INSTITUTION FOR RAIL INFRASTRUCTURE ENGINEERING

SWITCHES & CROSSINGS: From manufacture to maintain

Precast Slab Track S&C – A UK Industry First

12 July 2023, Birmingham

PRECAST SLAB TRACK S&C - A UK INDUSTRY FIRST

#SWITCHES&CROSSINGSSEMINAR

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Barnaby Temple, Chief Engineer, Rhomberg Sersa UK

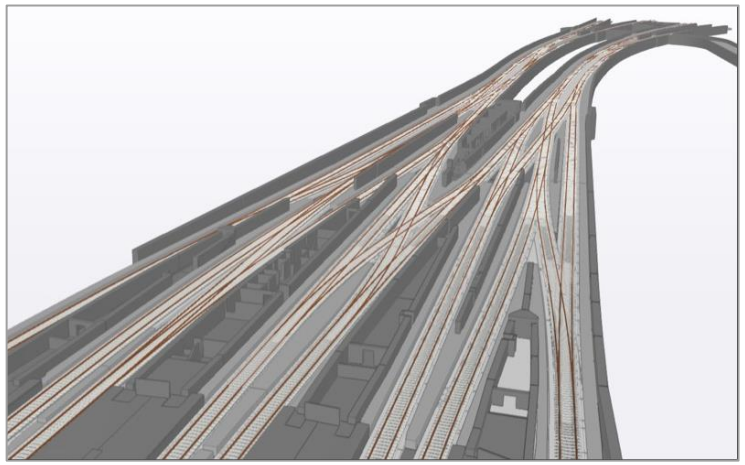
RHOMBERG SERSA RAIL GROUP


We are known for specialised machines and mechanised track construction and renewal
www.sersa.ch

AND FOR SLAB TRACK CONSTRUCTION, WHETHER NEW BUILD…

Stuttgart 21, DE, following opening of the Wendlingen-Ulm line, RSRG is now working with JV partners Strabag and DB Bahnbau on:

- 41.4 km of ballastless track type Rheda2000
- Includes 72 switches and 2 fixed crossings
- Utilising new semi-automated installation equipment (RhoMAT)



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…OR REFURBISHMENT

In-situ plain line and S&C at Heitersberg Tunnel, CH

- 4 switches and 1300m of plain line ballastless track
- Completed in 56-hour possessions
- Refurbishment of complete track in constrained tunnel environment
- Track Type Sonneville LVT

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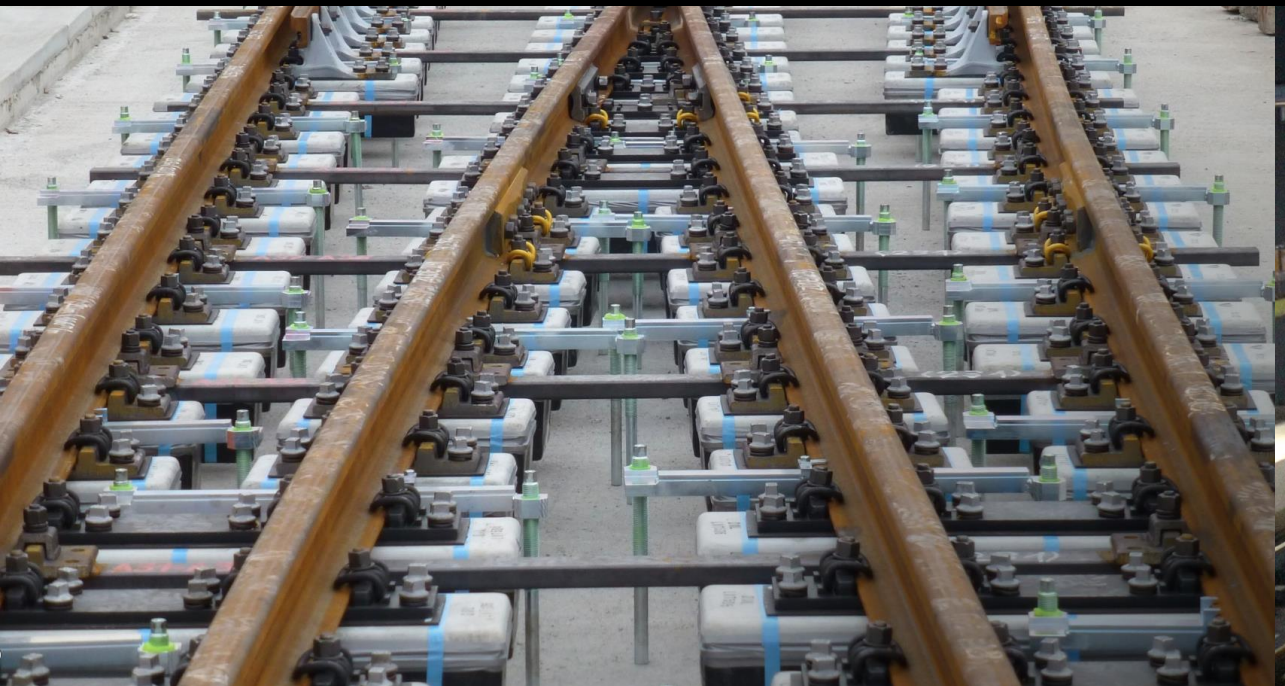


BARKING RIVERSIDE EXTENSION (BRE)
BRIEF INTRODUCTION

- Development area with over 10,000 new homes – required sustainable infrastructure.
- Railway extension from Barking to new terminus near the Thames North bank “Barking Riverside”
- Track system specified as the precast Slab Track Austria for the 1.5km viaduct
- Includes a scissors crossover close to the station
- Set on a circa 100m viaduct deck with joints to adjoining spans at each end

FIRST QUESTION: WHY PRECAST?

Selected for plain line primarily:

- Minimises track weight on the structure
- Quality-assured slab elements
- Reduced requirement for in-situ concrete
- More weather resilient during construction
- Potential programme benefits

For S&C however, this would be new to the UK

- The Porr STA system has been installed in several other countries, including Germany (top) and Qatar (bottom)
- Site visit arranged in 2017 to Germany
- Several key challenges identified:
- **Points operating equipment (POE)**
- **Platework**
- **Interfaces with rail components and viaduct structure**
- **Product acceptance – and as a system**

ACCEPTANCE PROCESS – NETWORK RAIL + SUPPLY CHAIN

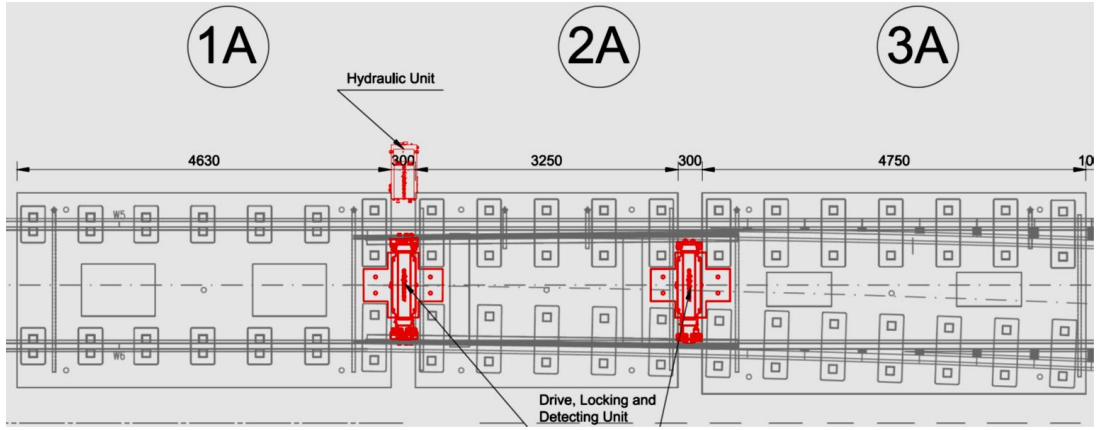
Key was to ensure

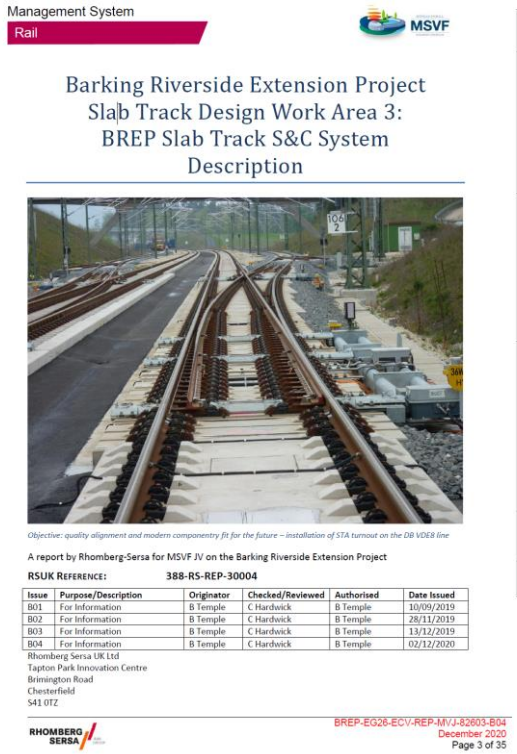
- Network Rail understood why and the benefits to them
- **POE is a sensitive topic and crosses to signalling**
- **Compatibility between elastic platework and POE**

- Process began upstream with various supply chain discussions
- Several feasible options presented to Network Rail for the platework
- Only one realistic option for POE

Acceptance involved:

- Workshops with NR Technical Authority
- Separate pathways to acceptance for suppliers
- Concluded with acceptance for voestalpine, Schwihag and Porr




Management System
Rail
MSVF

Barking Riverside Extension Project
Slab Track Design Work Area 3:
BREP Slab Track S&C System Description

Objective: quality alignment and modern componentry fit for the future – installation of STA turnout on the DB VDE8 line

A report by Rhomberg-Sersa for MSVF JV on the Barking Riverside Extension Project

RSUK Reference: 388-RS-REP-30004

Issue	Purpose/Description	Originator	Checked/Reviewed	Authorised	Date Issued
B01	For Information	B Temple	C Hardwick	B Temple	10/09/2019
B02	For Information	B Temple	C Hardwick	B Temple	28/11/2019
B03	For Information	B Temple	C Hardwick	B Temple	13/12/2019
B04	For Information	B Temple	C Hardwick	B Temple	02/12/2020

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BREP-EG26-ECV-REP-MVJ-82603-B04
December 2020
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Table 2: Interface Matrix

Sub-Systems	Rail elements	Unistar HR POE	Baseplates DFF SW	Precast Slabs	Substructure
Rail elements		1. Displacement under traffic – interface to ground connection	2. Rail moves across slide plates 3. Rail to rail track circuit isolation check with baseplates	4. Clearance below rail for welds and clamps 5. Point load from temporary works in positioning the S&C	n/a
Unistar HR POE	6. Connects to holes in rail web; moves switches to position 7. Gauging check between rail switch toe and stock rail		8. Rail to slab height requires level compensation in fixing	9. Force applied by actuation transmitted to the precast slab	10. Position of Hydraulic motor can be within 30m
Baseplates DFF SW	11. Elastic displacement in operation 12. Correct size, with adjustability post installation 13. Space between supports around IBJs	14. Clearance to the switch drive casing		15. Baseplates grouted to fix within pockets – fixity and shear strength	n/a
Precast Slabs	n/a	16. Fixing points for drive unit	17. Pocket positional accuracy		18. Slabs fixed in place with SCC
Substructure	19. Deck hogging over piers	n/a	n/a	20. Deck flexure under load	

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THE POE – VOESTALPINE UNISTAR HR

- Now accepted for use by both LUL and NR
- Can be used on sleepers in ballasted track as well as for slab track
- Permits vertical displacement of the rail relative to the slab on which the motor is fixed
- Reliable, modern, high-performance equipment
- Fits to existing drilling pattern – no change needed to REPW design

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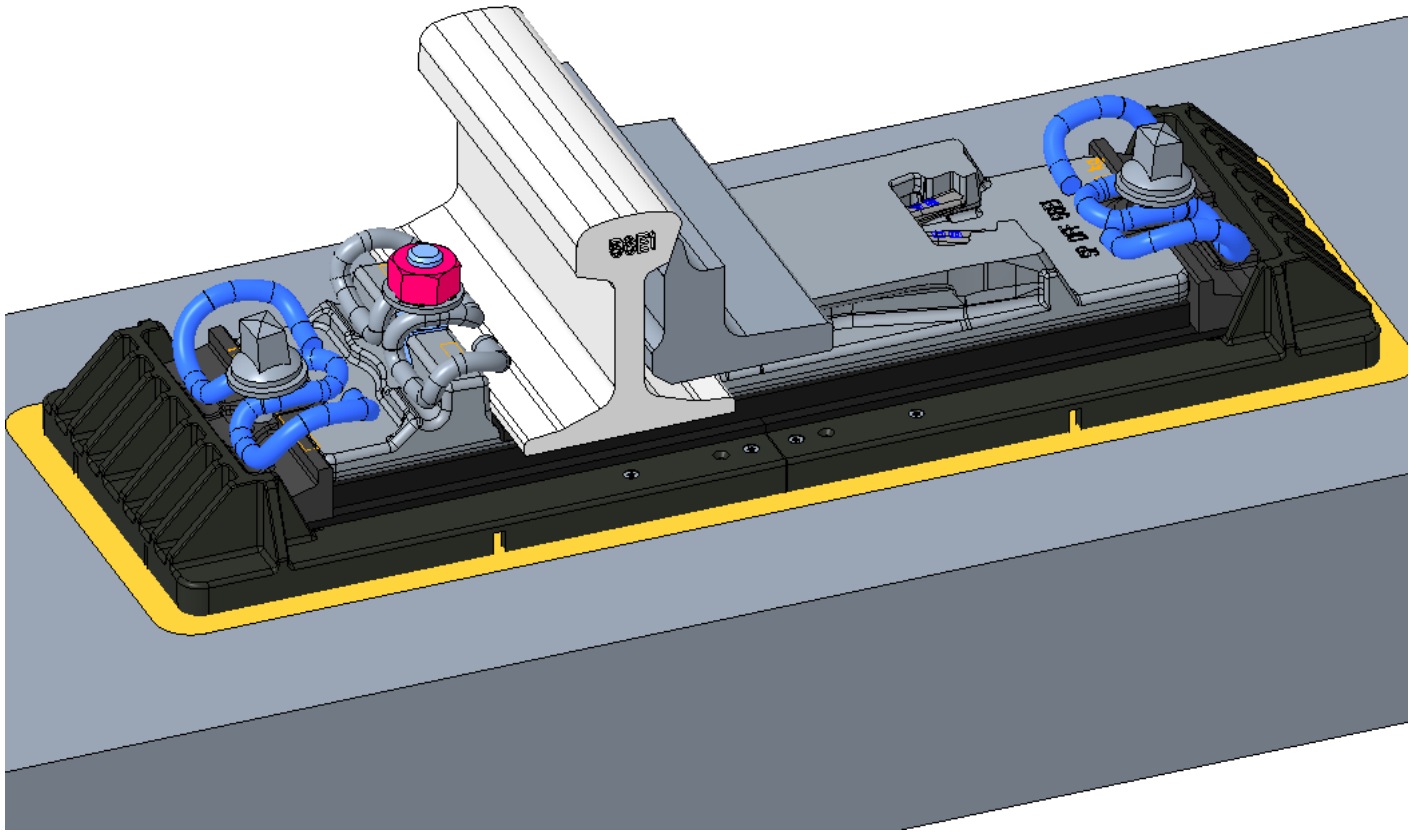
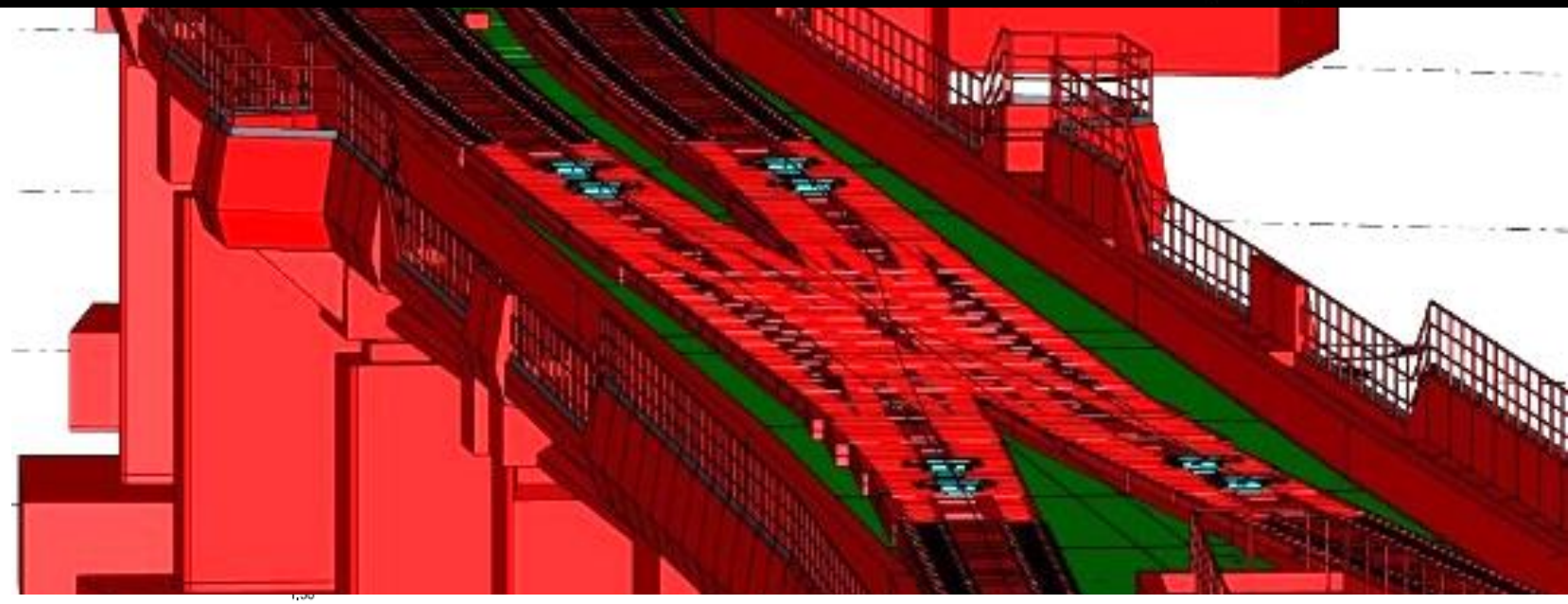
THE ELASTIC RAIL SUPPORTS – SCHWIHAG DFF-SW

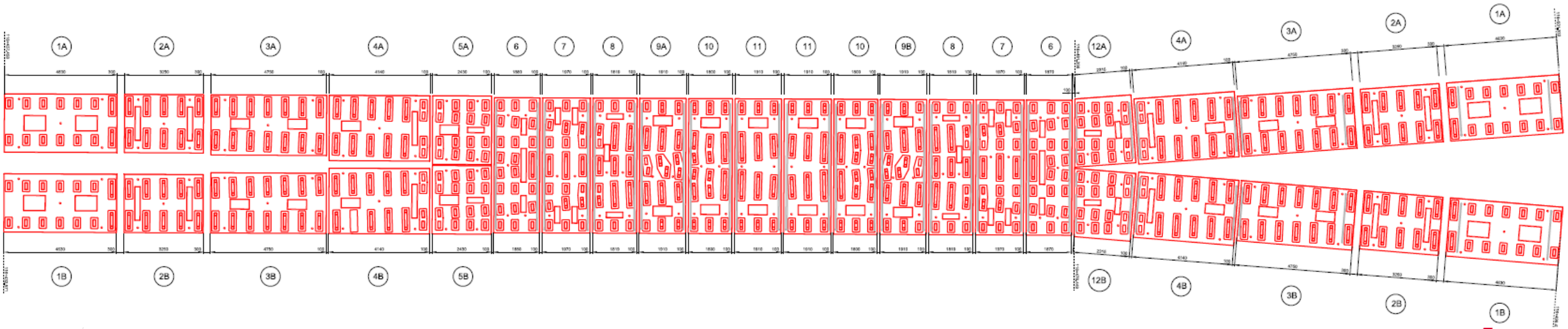
- Schwihag developed the SW set of components to suit cast in-situ S&C with improved interlock to the concrete
- Here we had to decide between something cast in-factory and cast in a pocket in the precast
- The pocket approach suited the viaduct scenario
- Tolerances dealt with both below and above the precast slabs
- Solution preferred by NR to suit modern application,



THE DESIGN
1 – THE LAYOUT

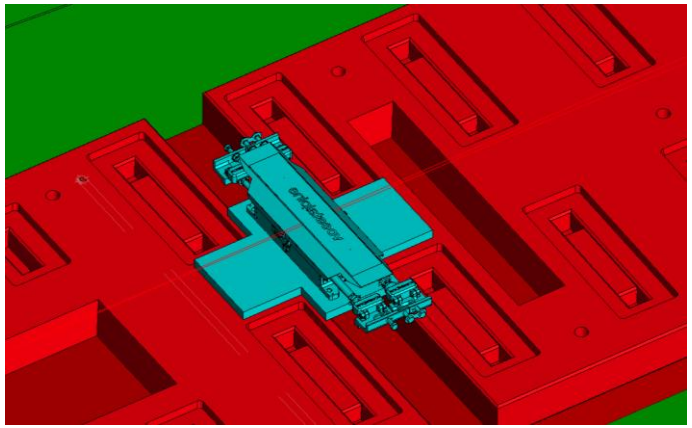
- Precast layout integrated in 3D model
- Alignment with structure
- Configured to 1:50 S&C design
- Near symmetry helped
- Pocket concept allowed tolerances

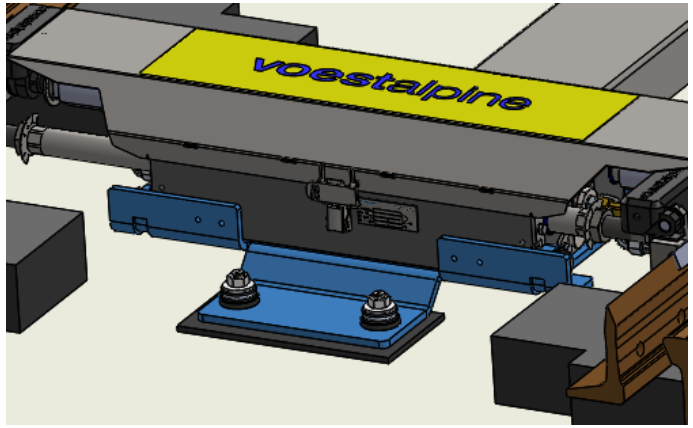


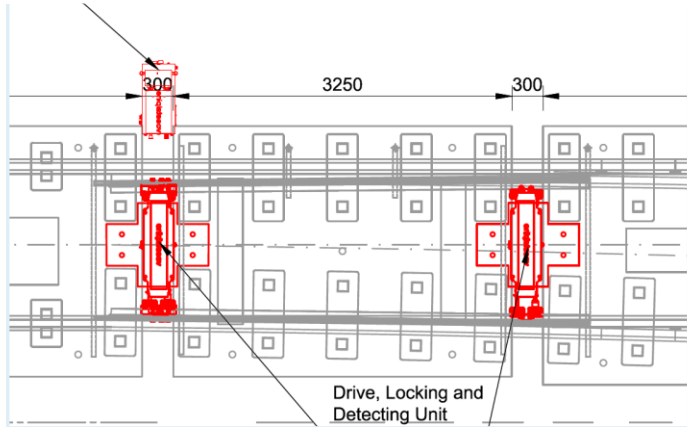


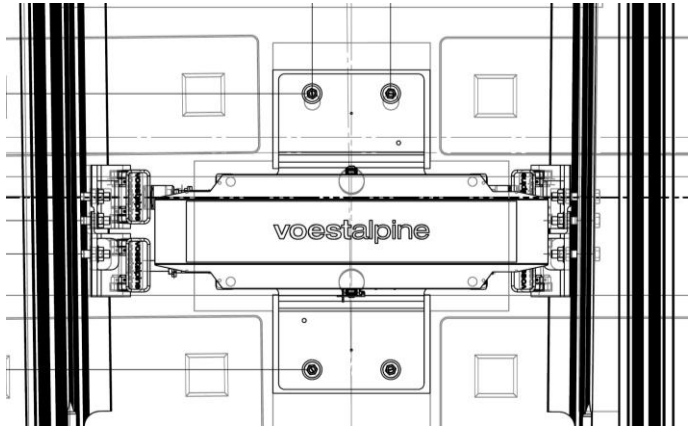
THE DESIGN
2 – UNISTAR HR POE AND SLABS

- Wider gap allowed between slabs for cable feed
- Drilling space allowed in precast concrete
- Shimming and adjustability retained
- End result is a secure, accessible support, fully compatible with REPW, the platework and the slabs



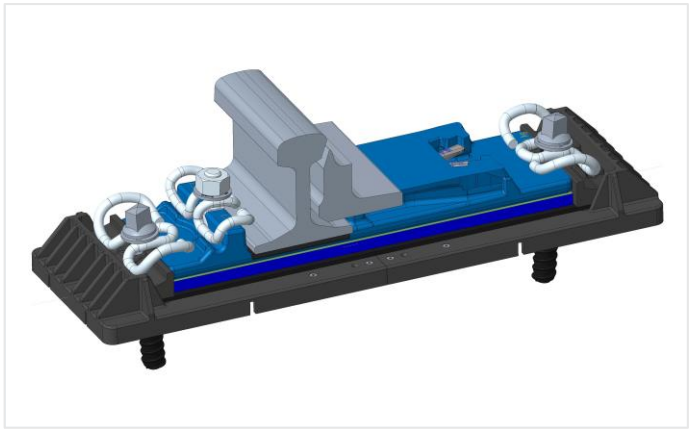


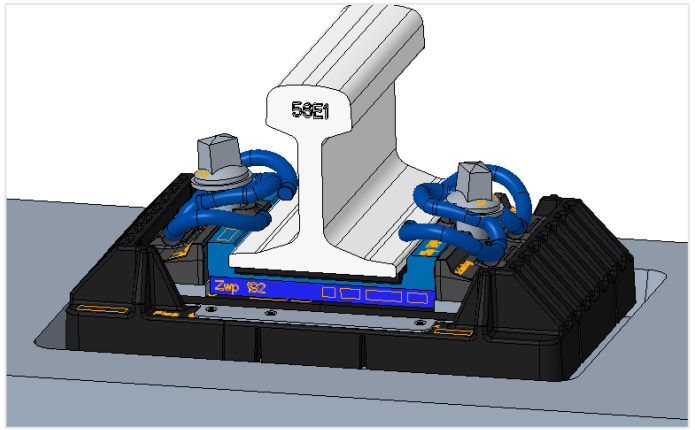


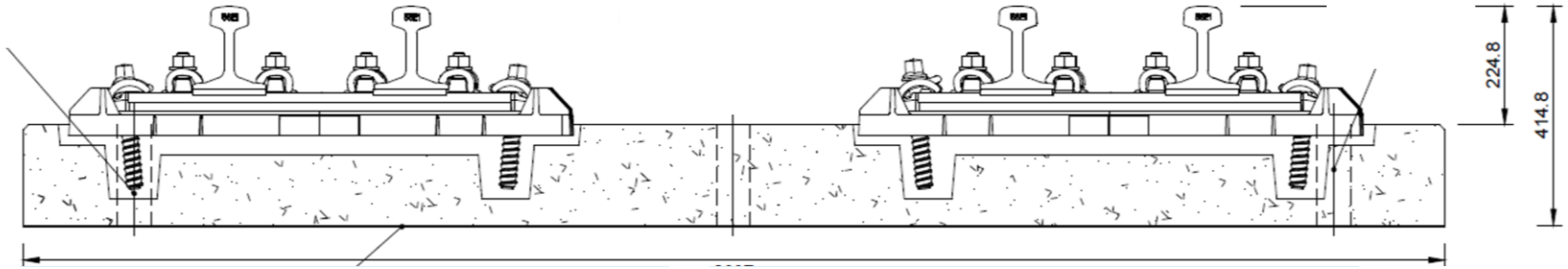


THE DESIGN
3 – THE DFF-SW BASEPLATES AND SLABS

- Modular plastic baseplate allows for all lengths required
- Stiffness design accounts for surface area and load applied
- Corrosion protection provided
- High performance grout from Fosroc
- Precast slab pocket with exposed aggregate finish
- Height under rail suitable for adjustment and welding





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CONSTRUCTION PHASE:
1 - PREPARATION

- First, some practice!
- At ground level
- Also grout tests

- Assembly of baseplates…
- and crossing panels

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CONSTRUCTION PHASE:
2 - LIFT AND POSITION PRECAST ELEMENTS

- Hybrid Approach (Bottom Up then Top Down)
- Both slabs and S&C fully built prior to placement of concrete
- 32 pocketed slabs positioned
- Infill concrete up to ~300mm due to longitudinal drainage of viaduct
- Reinforcement laid prior to slabs
- Crane access to viaduct sides

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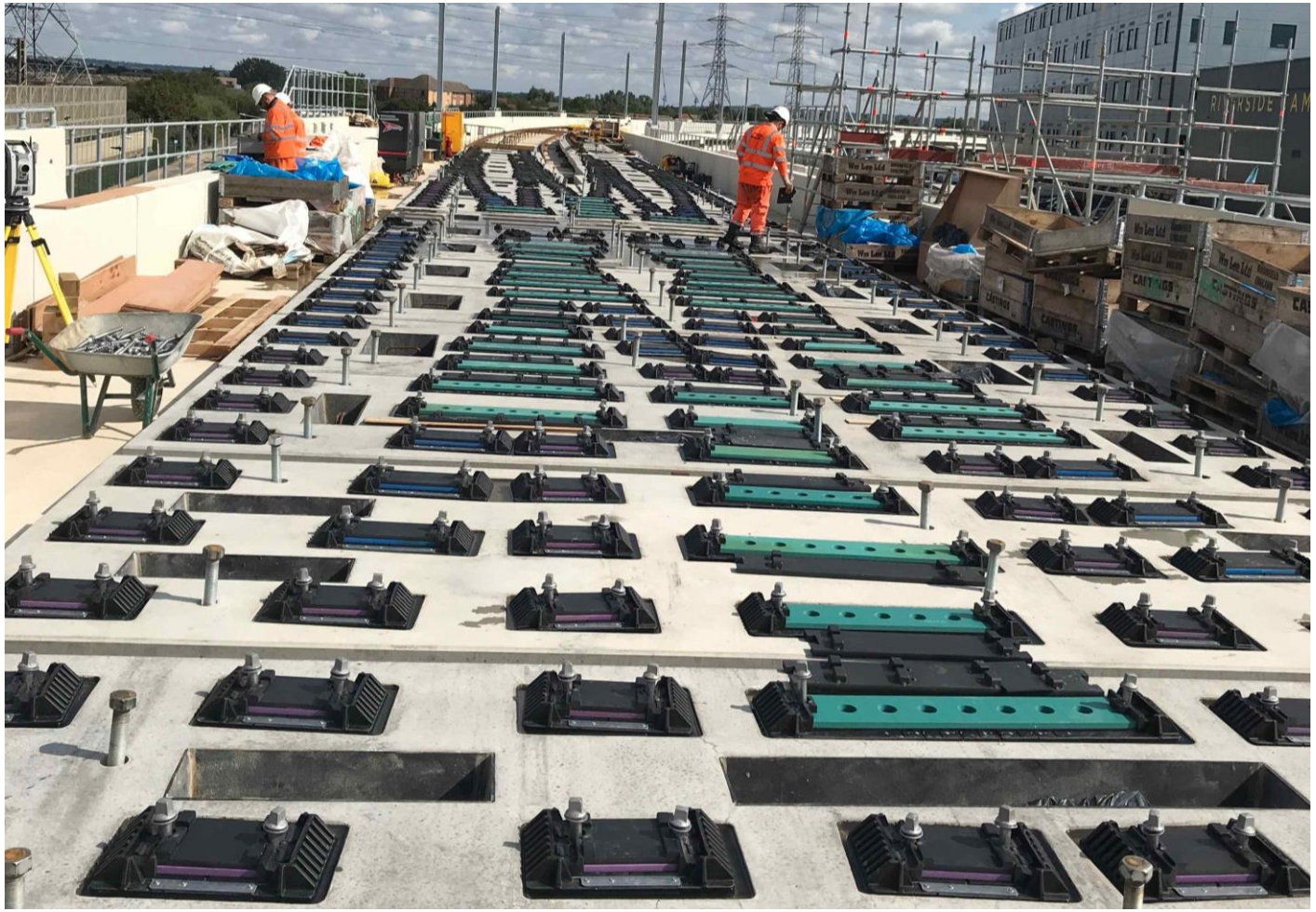
CONSTRUCTION PHASE:
3 – DFF-SW BASEPLATE ASSEMBLY

- Delivery in coded pallets per slab type
- Baseplates built up in pockets
- 486 supports in total across 32 slabs
- ~40 variants to suit layout configuration



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CONSTRUCTION PHASE:
4 – LIFT AND PLACE SWITCH AND CROSSING ELEMENTS

- With slabs positioned to sub 5mm accuracy
- Rails landed on timbers, clear of baseplates
- Joints fish-plated
- Baseplates lifted and clipped

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CONSTRUCTION PHASE:
4 – POSITIONING SUPPORTS

- Whole crossover built up on RhoSAS
- With temporary tie bars
- Then load taken and timbers removed

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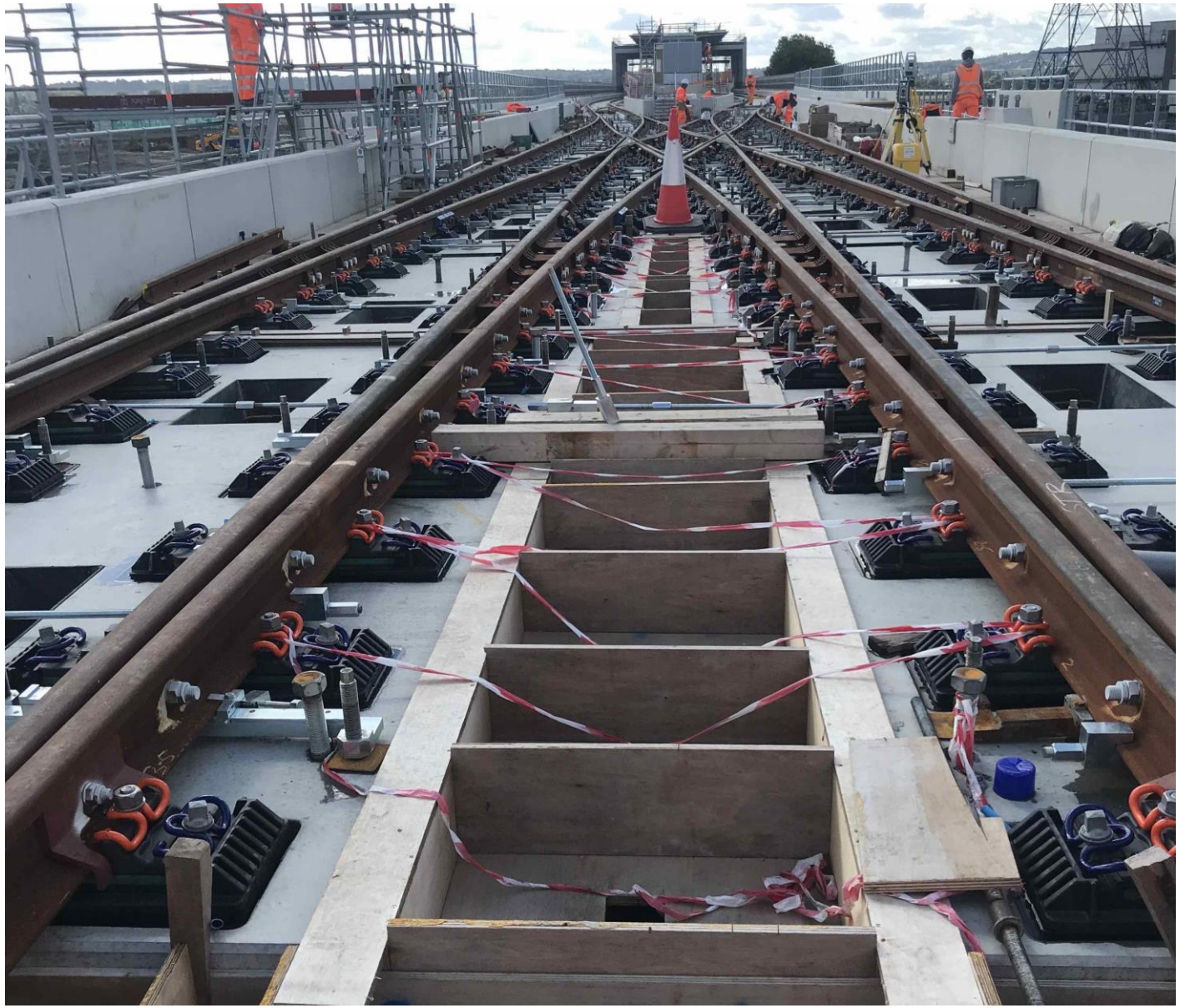
Trimble
GEDO CE

CONSTRUCTION PHASE: 5 – INITIAL ALIGNMENT

- Slab level confirmed
- Baseplate positioning tweaked where necessary
- Check of tie-ins
- Shuttering and concrete preparation work



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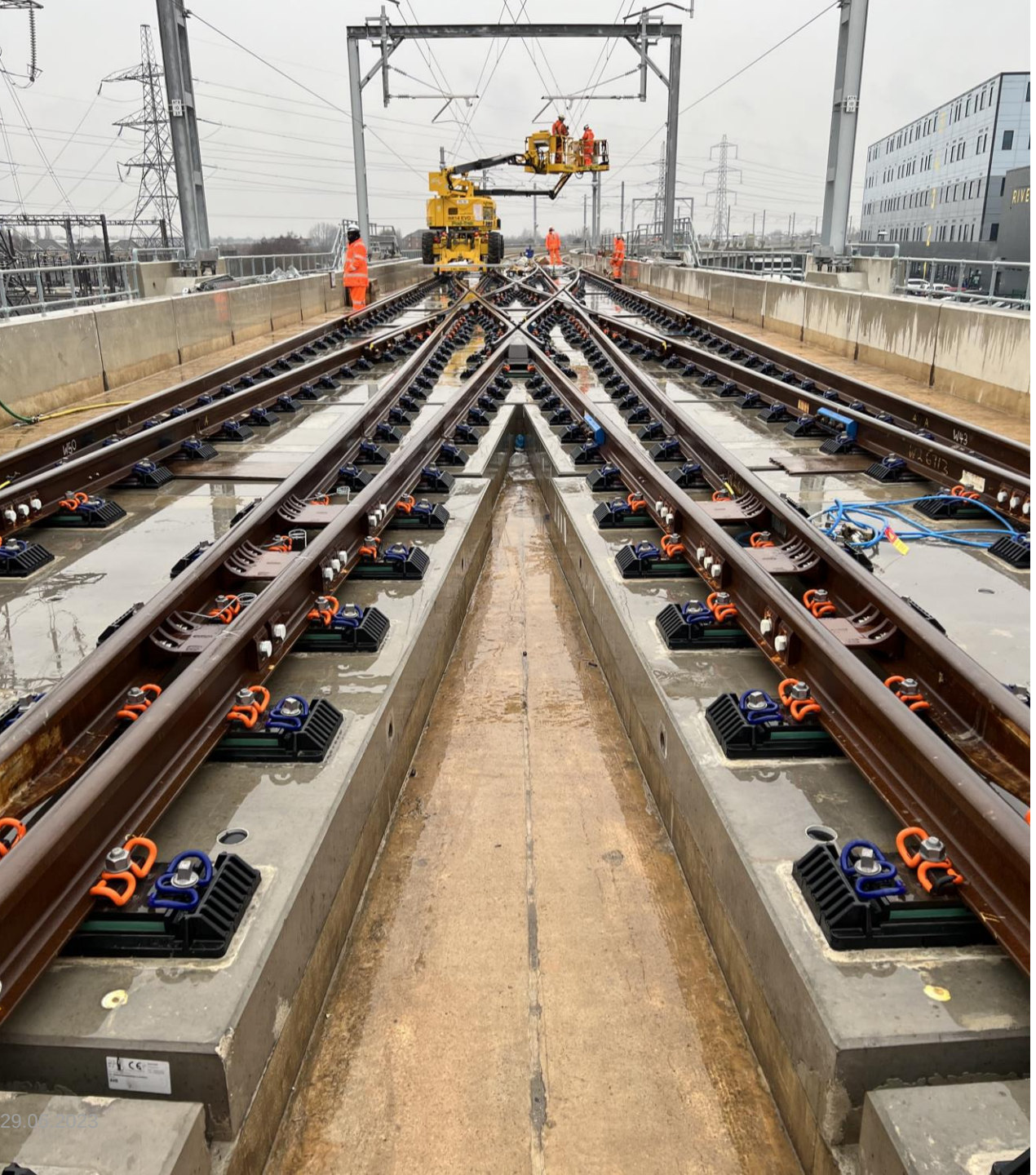
CONSTRUCTION PHASE:
6 – SELF-COMPACTING CONCRETE

- Once alignment confirmed slabs fixed into position
- Concrete placement and curing
- Removal of shuttering

CONSTRUCTION PHASE:
7 – GROUTING TO FINAL POSITION

- Further alignment checks and slight adjustments
- Grouting of DFF-SW baseplates

- Ready for POE installation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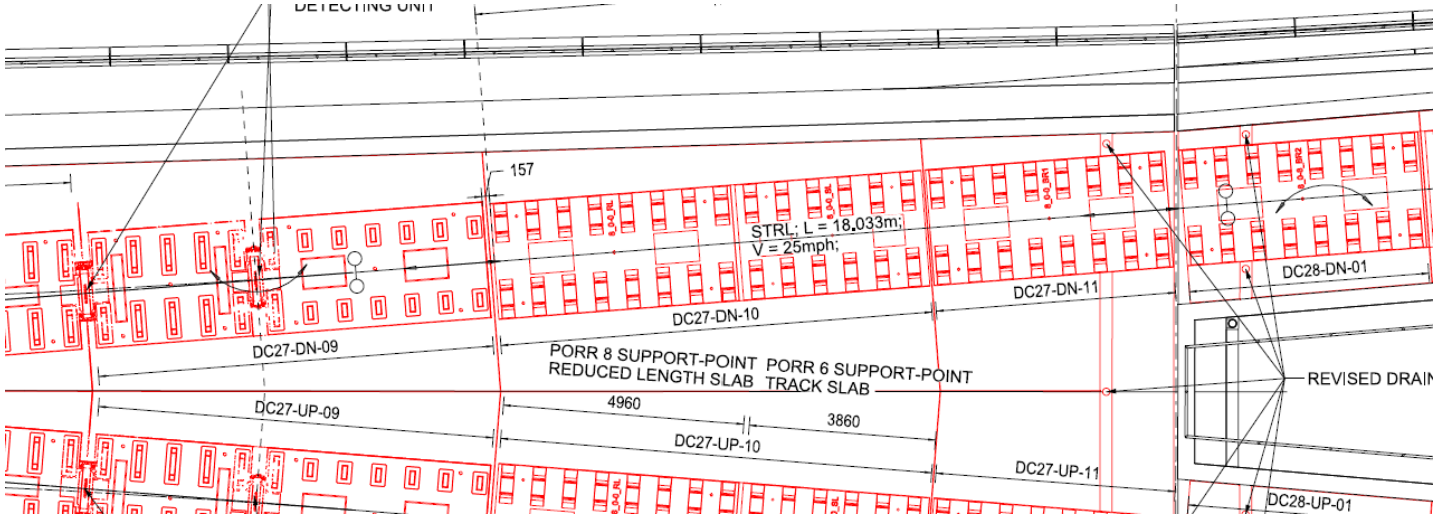
CHALLENGES AND ISSUES

- Late check on insulation path required a change to 2 plates and resulted in one slab type having a variant for the handing (9A/(9B)
- **Caught in time for IDR and slab production schedule**

- Discrepancy between 1:50 and alignment Form B – caught on site and resolved



LESSONS – NATURALLY!

- Application of BIM, taking S&C from 2D to 3D
- Joining up the assurance process integrating ALL parties
- Bridges/viaducts are even more complicated (temperature change, deflections)
- A full pre-build offline could be advantageous and save time

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THANKS AND ACKNOWLEDGEMENTS TO:

Transport for London

Network Rail

Morgan Sindall – Volker Fitzpatrick Joint Venture

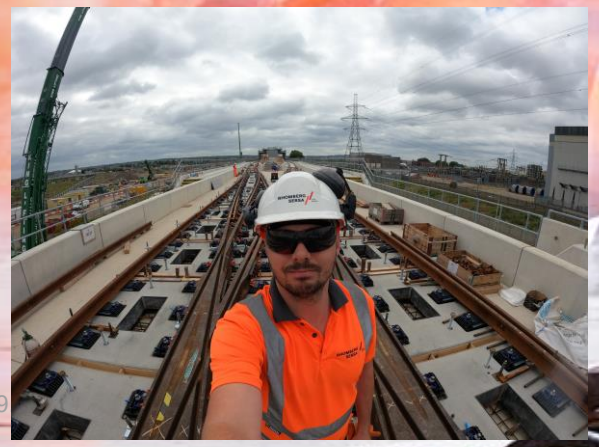
Schwihag

Voestalpine

Porr

Fritsch Chiari & Partners (FCP/VCE)

Dr Chris Hardwick (RSRG)



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