

Barry Island Viaduct

Risk Reduction and Value Engineering through Design

Presentation Overview

- Introductions & Summary
- Description of the Structure
- Value Engineering
- Design Optimisation
- Benefits – Risk, Cost, Time & Carbon Footprint
- Sustainable Delivery
- Approach, Behaviour & Culture
- Any Questions?

Presenters

- John Hannah – Operations Director – Centregreat Rail
- Julian Howe – Managing Director – Crouch Waterfall
- Jarrod Richards – Contracts Manager – Centregreat Rail

Summary:

This session will focus on using design as a tool for reducing risk and realising value engineering opportunities. We will map out the journey from challenging ourselves during the design phase, to gaining efficiency benefits in relation to risk, cost, time & carbon footprint during the delivery phase.

Description of the Structure & Scope

- 18-span steel structure
- Built circa 1887
- Carries a single track of the BRY line and a single track of the Barry tourist railway
- Simply supported on steel trestles and masonry abutments
- 4 main longitudinal girders with 3 sets of cross bracing per span
- Steel deck with longitudinal rail timbers



Before works

Description of the Structure & Scope

- The deterioration of the structure was such that the residual loading capacity did not meet the route availability of the line.
- Design & Build Contract
- The following works were undertaken to address the deficiency:
 - Surface preparation and painting
 - Steel work strengthening
 - Steel work repair



During works

Value Engineering

- Alternative assessment model:
 - re-directed the longitudinal forces away from the steel double trestles
 - removed the requirement for significant strengthening works to the steel trestles and their foundations
- Further advanced studies of the bending forces within the main girders also removed the requirement to over plate all the four main girder bottom flanges across the 18 spans



During works

Value Engineering

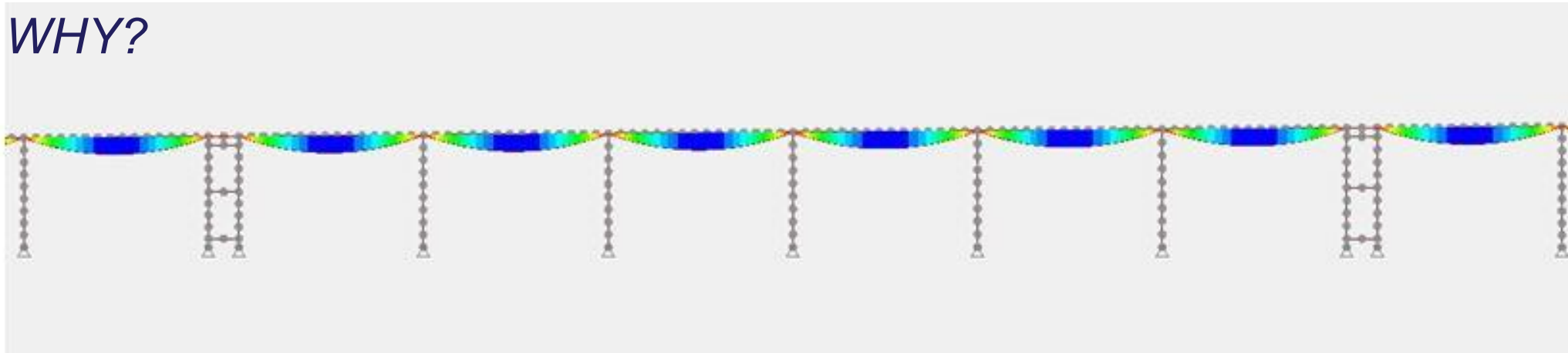
- Smart detailing of repairs & strengthening:
 - Maximise normal hours working with 'live' loading
- Innovative temporary works designs:
 - Allowed significant repair & strengthening works to be completed during RoR possessions & mid-week line blockages with additional protection
- Emergent Defects:
 - Our knowledge & understanding of steel structures allowed early & timely identification, detailing and repair



After works

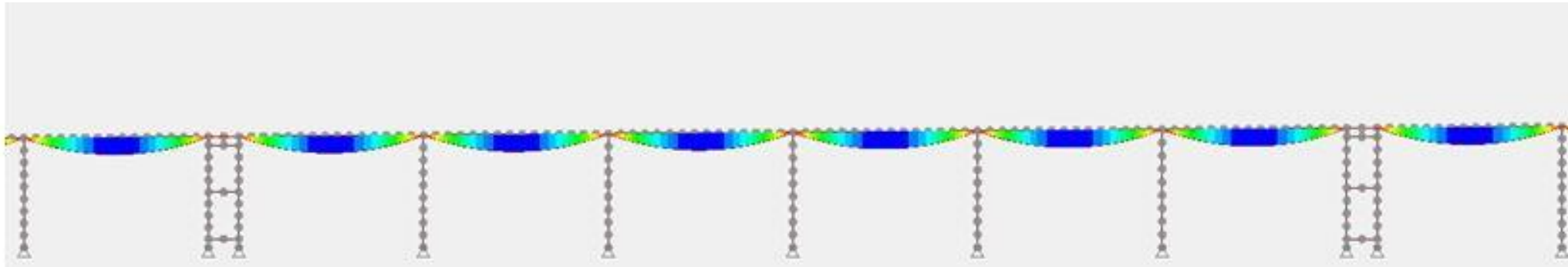
Design Optimisation

WHY?



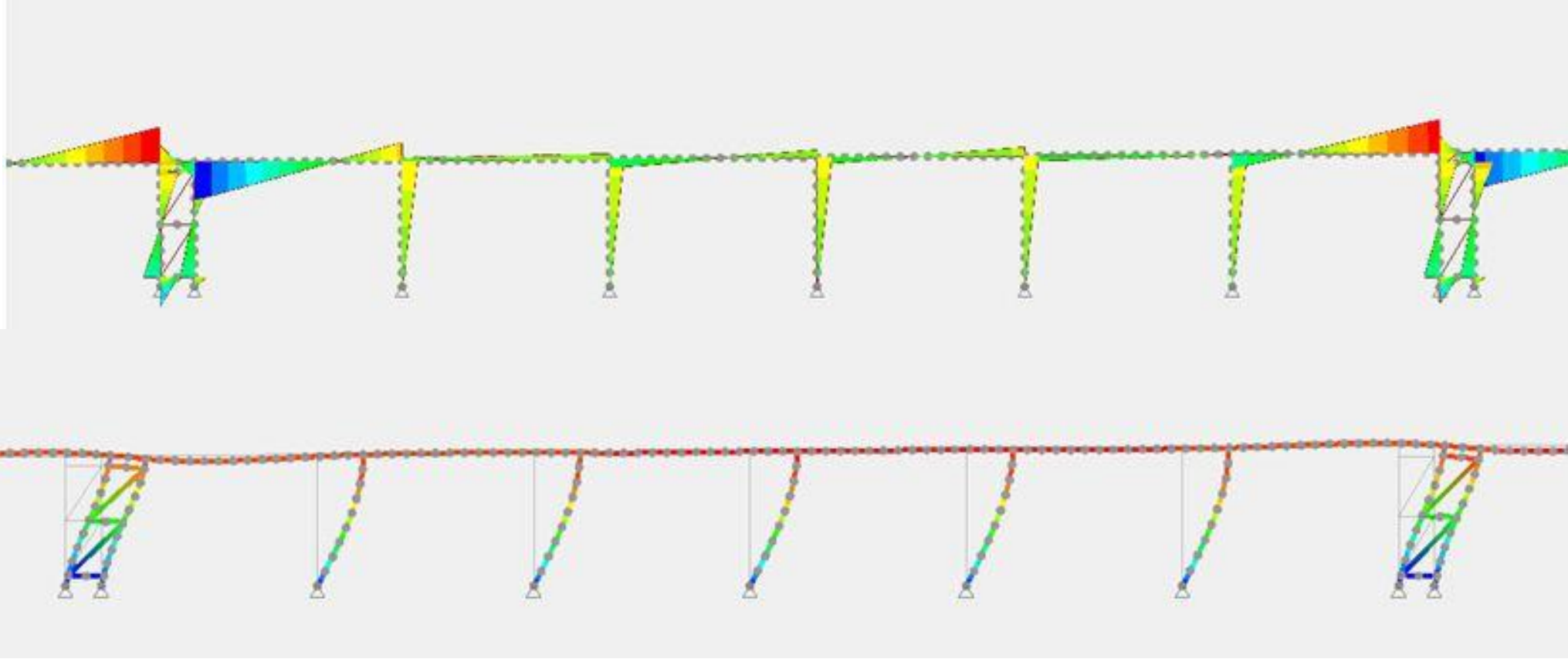
- The initial assessment was conservative in its findings.
- However, after 130 years of use, there were no significant signs of distress.
- The assessment in 2015 showed that the foundations would be failing spectacularly.

Design Optimisation



Element	Assumptions	
	Previous Assessment Sept 2015	Crouch Waterfall
Main Girder	Simply supported	Simply supported
Single trestles to Main Girders	Pinned	Pinned under vertical loads and fixed under longitudinal loads
Single trestles to foundations	Pinned	Pinned
Double trestles to main girder	Pinned	Pinned under vertical loads and fixed under longitudinal loads
Double trestles to foundations	Pinned	Pinned
Abutment bearings	Free longitudinally	Free longitudinally
Deck	Full lateral restraint to comp. flange but no composite action	Full lateral restraint to comp. flange but no composite action
Assumed corrosion loss	10% - 20%	20%

Design Optimisation



Benefits – Risk Reduction

- Requirement to strengthen double trestle foundations removed:
 - Ground conditions & significant excavation & piling
 - Structure stability, track geometry & monitoring
- Innovative temporary works:
 - Ensured possessions & line blockages could be handed back if repairs not completed
- Dynamic & efficient remedy of emergent defects:
 - Cost
 - Programme



Double Trestle

Benefits – Cost

- Alternative assessment model and subsequent design solution offered a 27% cost saving
- Emergent defects identified, detailed and remedied in a timely manner such that there was no down-time between contracted works & emergent defects:
 - No non-productive costs
 - Prelim / time-related impacts minimised
- Even with a 50% increase in repairs following blasting operations and the associated programme impact – final account within original authority / funding budget



Benefits – Time

- Alternative assessment model and subsequent design solution offered:
 - 4 month programme saving
 - Removed the requirement for 4 week blockade
- Even with a 50% increase in repairs following blasting operations works still handed back within Network Rail financial / funded year



Benefits – Carbon Footprint

- Reduced programme – time related fuel requirements
- Reduced out of hours / night time working - time related fuel requirements
- No requirement for 4 week blockade – no bus replacement service
- No double trestle foundation strengthening – significant reduction in heavy plant usage



Sustainable Delivery

- Apprentice scheme – directly employed local workforce - *A prosperous Wales*
- Litter Pick Barry Island Beach – *A resilient Wales*
- Mental Health Awareness Programme – Mates in Mind – *A healthier Wales*
- Diverse Workforce – *A more equal Wales*
- Future proof the railway asset – *A Wales of cohesive communities*
- Welsh Language Signage & Drop in Sessions at the Local Heritage Centre – *A Wales of vibrant culture & thriving Welsh Language*
- Local supply chain – Economic Multiplier's – *A globally responsible Wales*

Approach, Behaviour & Culture

- Deliver outstanding value for money to the taxpayer and our customers
- Make a lasting positive contribution to our lineside neighbours and communities in which we operate
- Ensure everyone returns home safe from work every day
- Invest in our people and develop their skills & talent within a culture of diversity, inclusion & mutual respect
- ‘Be the Best’ attitude
- Strive for continuous improvement – goal to be ‘World Class’





centred
around great
service...