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TATA

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ICE Build Offsite

Presented by: **Niall McCreanor**

Director, Tata Steel Projects

Tata Steel Projects (TSP)

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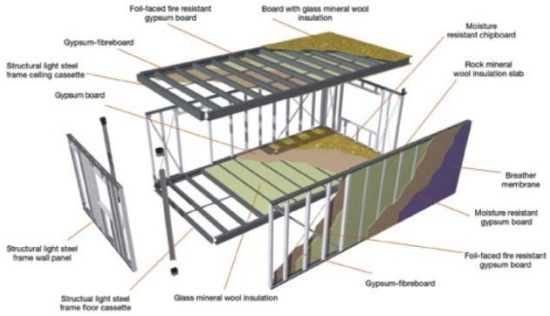
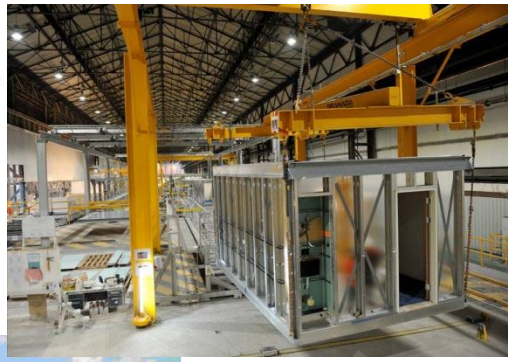
TSP - Off Site and Modular Experience

Modular buildings for the MOD





TSP - Off Site and Modular Experience

Modular buildings for the MOD

Lift shafts, Building Cores and Footbridges

TSP - Off Site and Modular Experience

Modular buildings for the MOD

Lift shafts and building cores

Modular Stations, Platforms, & Canopies

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Modular Stations, Platforms, & Canopies

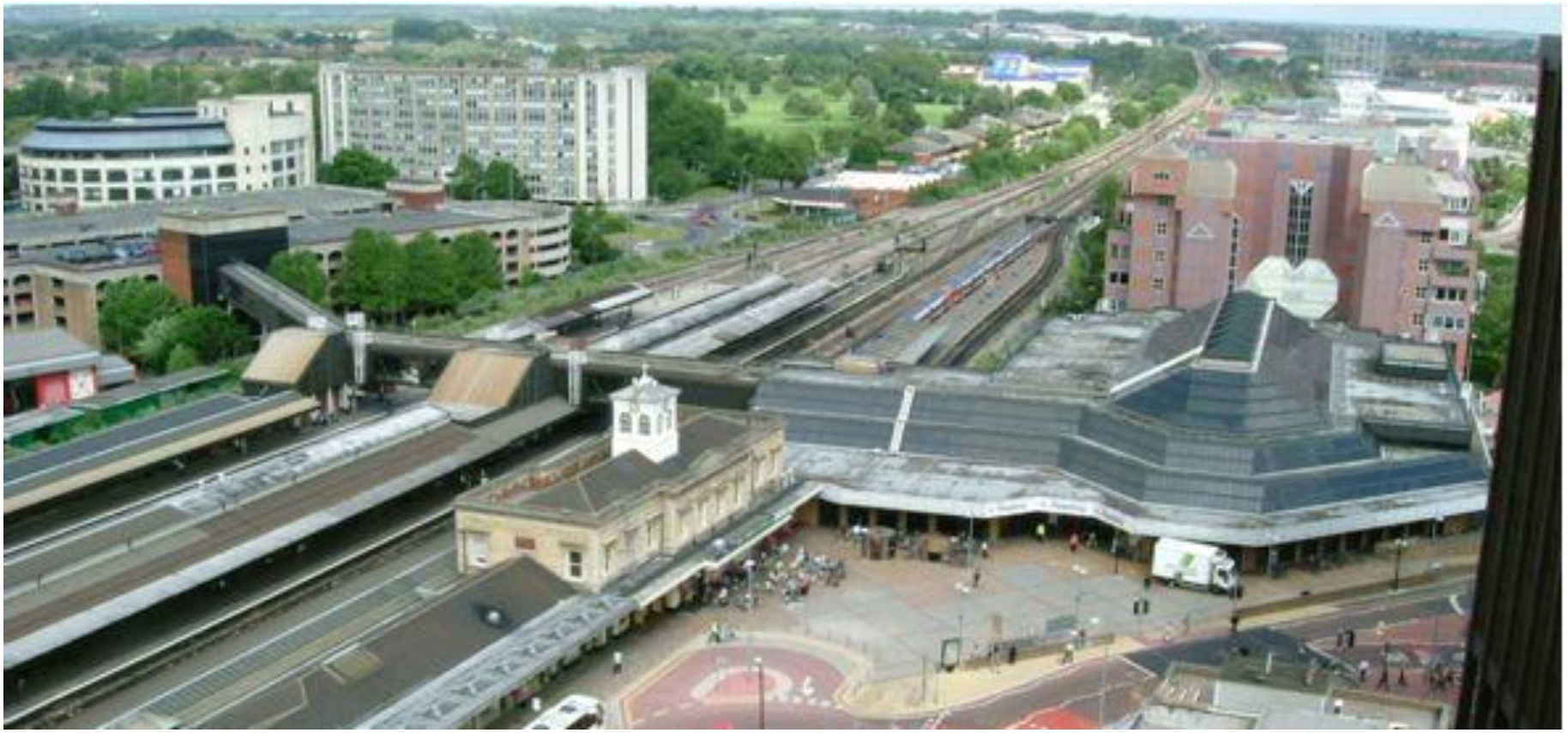
Modular Switches and Crossings

Offsite Construction and Rail

- UK Rail Sector – significant investment in infrastructure enhancement during current consecutive Control Periods
- Enhancements require interventions impacting the operational railway and passenger experience
- Heavily regulated industry demanding increasing efficiencies with minimum disruption
- Innovation necessary to change the norm and meet these demands

- Offsite offers opportunity for reduced access and possession requirements - safety, quality, cost and schedule efficiency in controlled environments

Reading Station



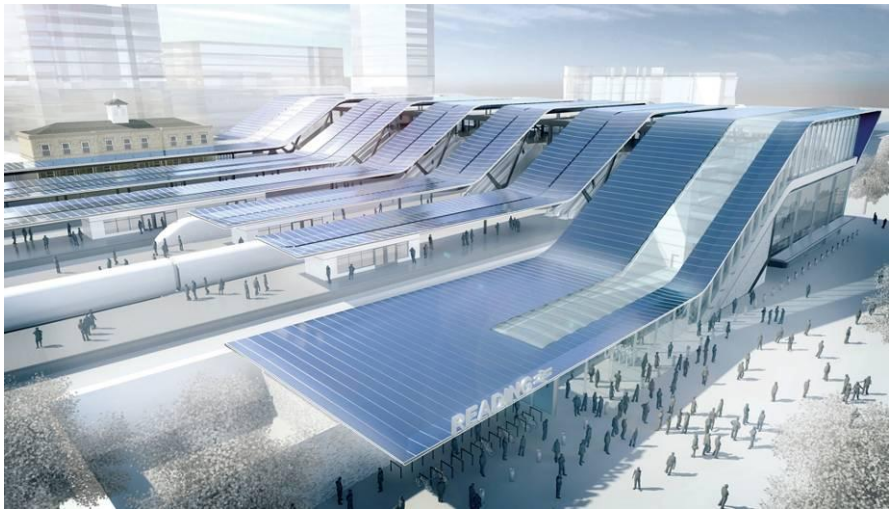
Reading Station

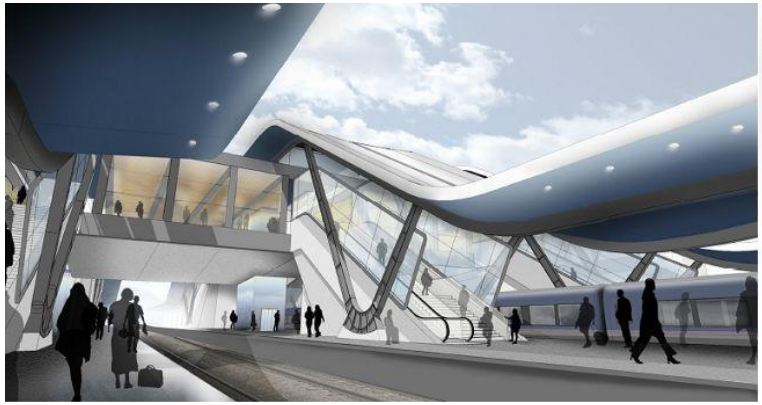
- Original Station built in 1840 with major works in 1898, 1965 and 1989
- 14.5M entry/exit passengers per annum (2011)
- 3M passengers changing trains (highest outside London)
- “Shuttle service” to London with trains every 5 minutes on average
- Station capacity and infrastructure layout providing operational constraint
- Current station is: dated, congested, poor disabled access, a constraint for predicted passenger and freight growth
- Network Rail identified £850M capital investment in infrastructure remodelling and station build

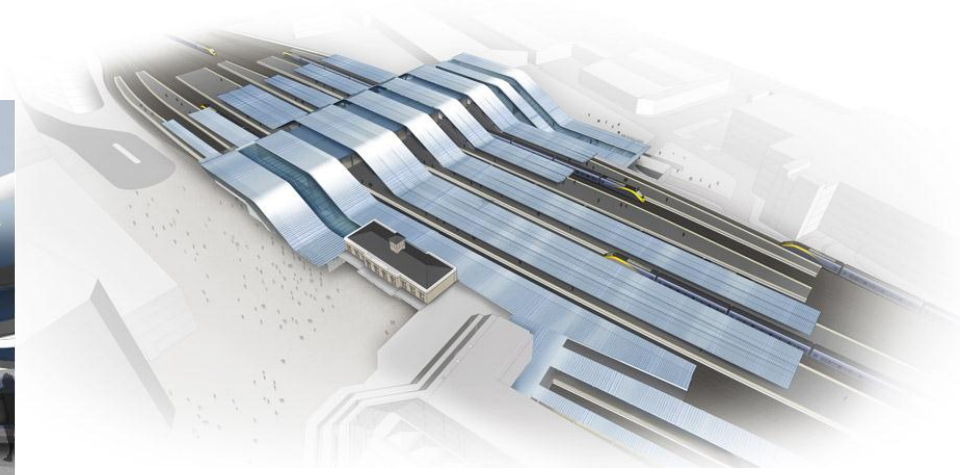
Reading Station Area Redevelopment – Transfer Deck

Proposed Station Works

- Proposed Station Works
  - Platforms
  - Western Gateline Building
  - Northern Entrance Building
  - Transfer Deck
  - Station Canopies
  - North Retaining Wall
  - Station Subway



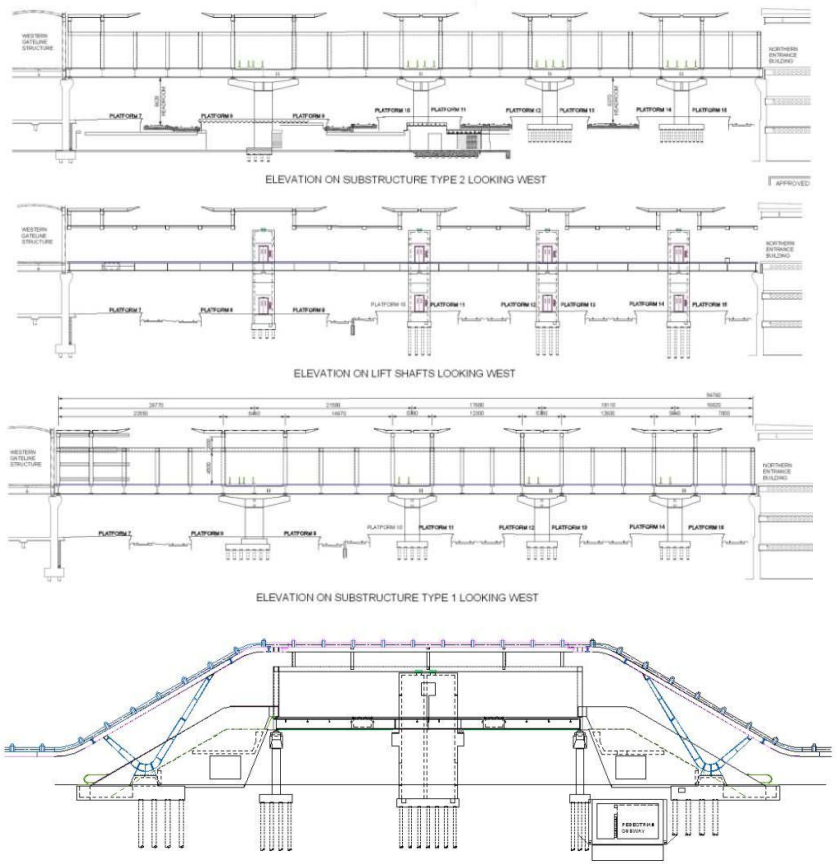




Reading Station Area Redevelopment – Transfer Deck

Transfer Deck

- Link between new entrances
- Access to platforms
- 95m long x 30m wide
- 5 spans
- Steel frame
- RC substructure
- 6.2m headroom for OLE
- Combined V column foundations
- Fabrication off site
- Installation staging key



Reading Station Area Redevelopment – Transfer Deck

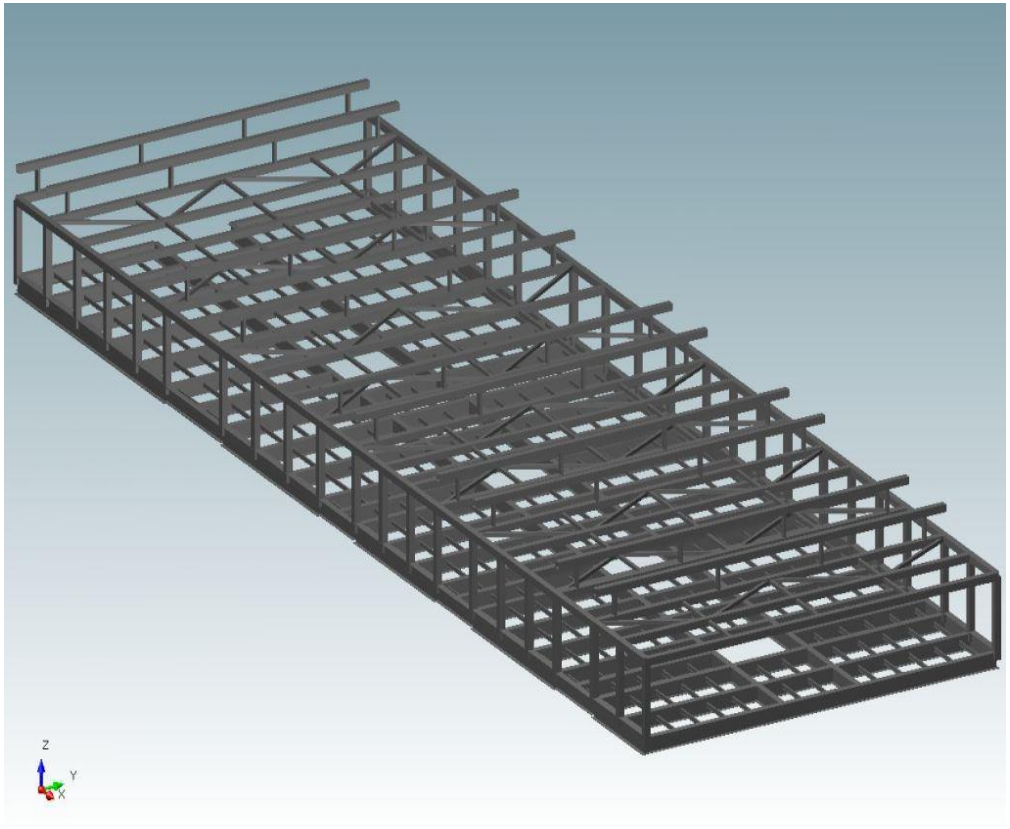
Superstructure Arrangement

Design Considerations

- Construction Strategy
- Fire rating
- Progressive collapse
- Service route
- Passenger flow
- Disabled access
- Natural ventilated unconditioned space

- BS5400 – Design of Bridges
- Analysed using SuperSTRESS
- Calculated utilisation of each member
- Natural Frequency
- Cat 3 check

- Strategy for launching the deck determined early in design

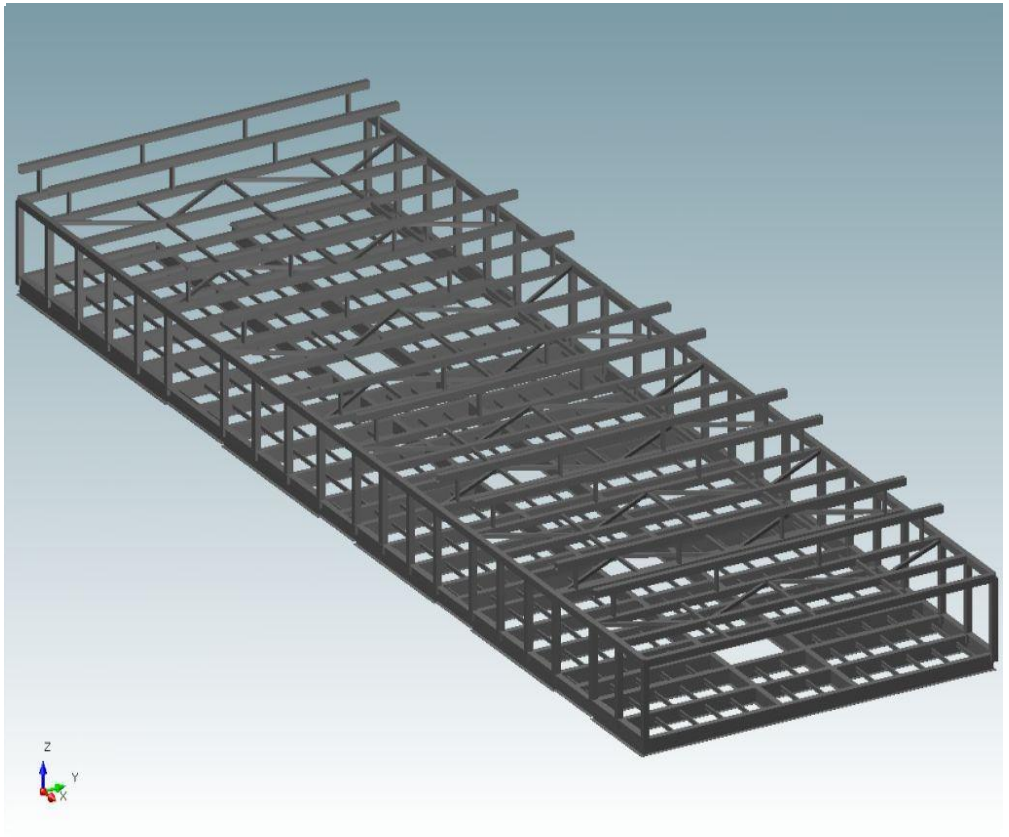


Reading Station Area Redevelopment – Transfer Deck

Superstructure Arrangement

Structural Steelwork

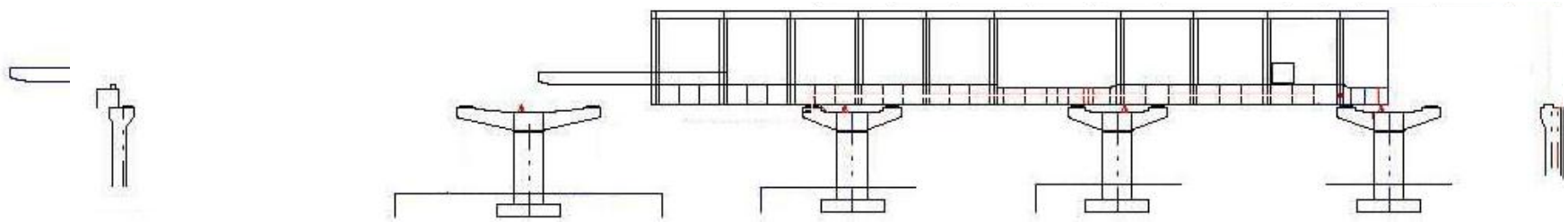
- Vierendeel Truss required
- Bottom Chords formed from 1.3m x 0.55m wide plate girders
- Inner longitudinal girders formed from 1.025m x 0.5m wide plate girders
- Cross girders formed from 1.025m x 0.5m wide plate girders
- Verticals and top chords of trusses and transverse roof members formed from 0.5m x 0.5m SHS



Reading Station Area Redevelopment – Transfer Deck

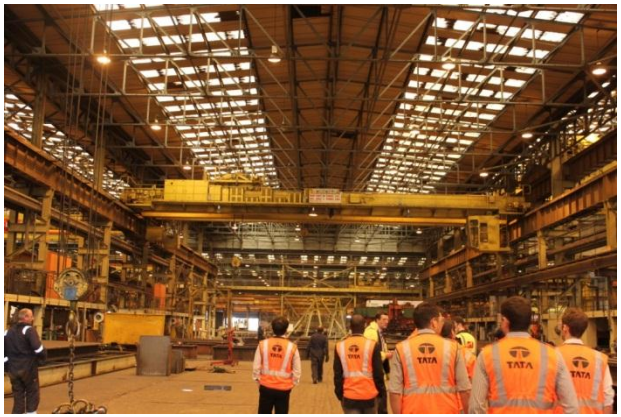
Superstructure Installation methodology

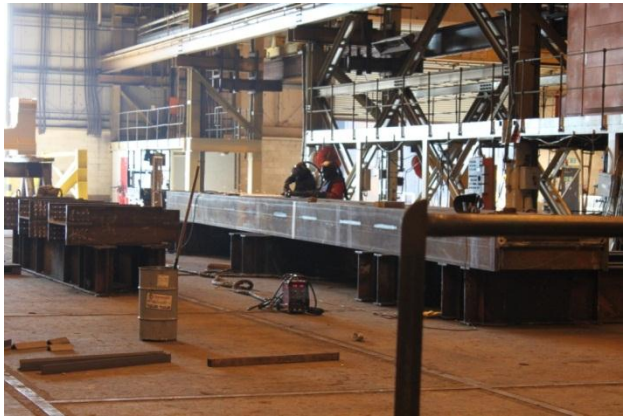
- Installation and construction sequence
  - Concept developed early in design
  - Detailed design led by Tata Steel Projects; Cat 3 Check by Cass Hayward
  - Heavy lifting specialist input from Dorman Long Technology
  - Superstructure constructed on North side of station launched into position using strand jack system in 3 phases
    - 1st phase – Construct 49m length launch 29m
    - 2nd phase – Construct another 23m length launch 18m
    - 3rd phase – Construct remainder of deck
  - Construction methodology adopted by Contractor Costain-Hochtief using specialist fabricator Cleveland Bridge



Reading Station Area Redevelopment – Transfer Deck

Fabrication – Cleveland Bridge Darlington





Costain Hochtief - On-Site Assembly and Erection

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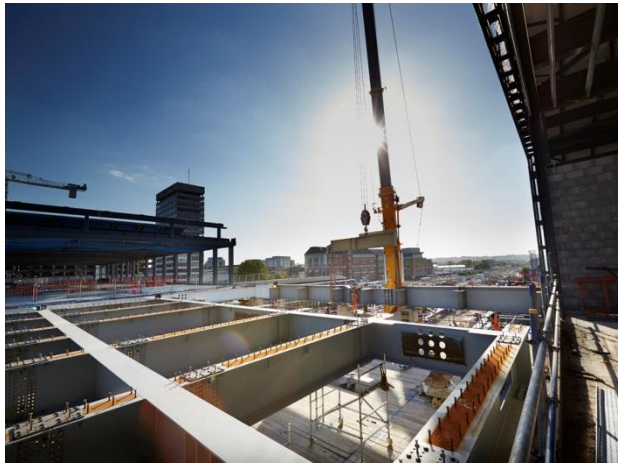
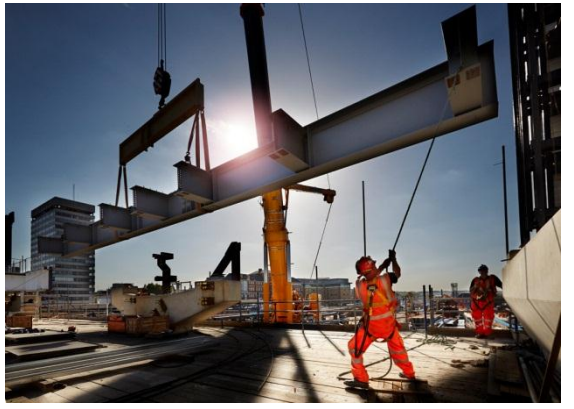
Costain Hochtief - On-Site Assembly and Erection





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Reading Station Area Redevelopment – Transfer Deck

Phase 1 Superstructure Construction – Costain Hochtief






Reading Station Area Redevelopment – Transfer Deck
Bridge Launch Temporary Works and Equipment

- Strand jacks and strands
- Temporary bearings
- Fabricated steel arms
- Lateral guides
- Pier props

Reading Station Area Redevelopment – Transfer Deck

Bridge Launch Temporary Works and Equipment

- 30Te Counterweight
- Nose girders
- Hydraulic rams

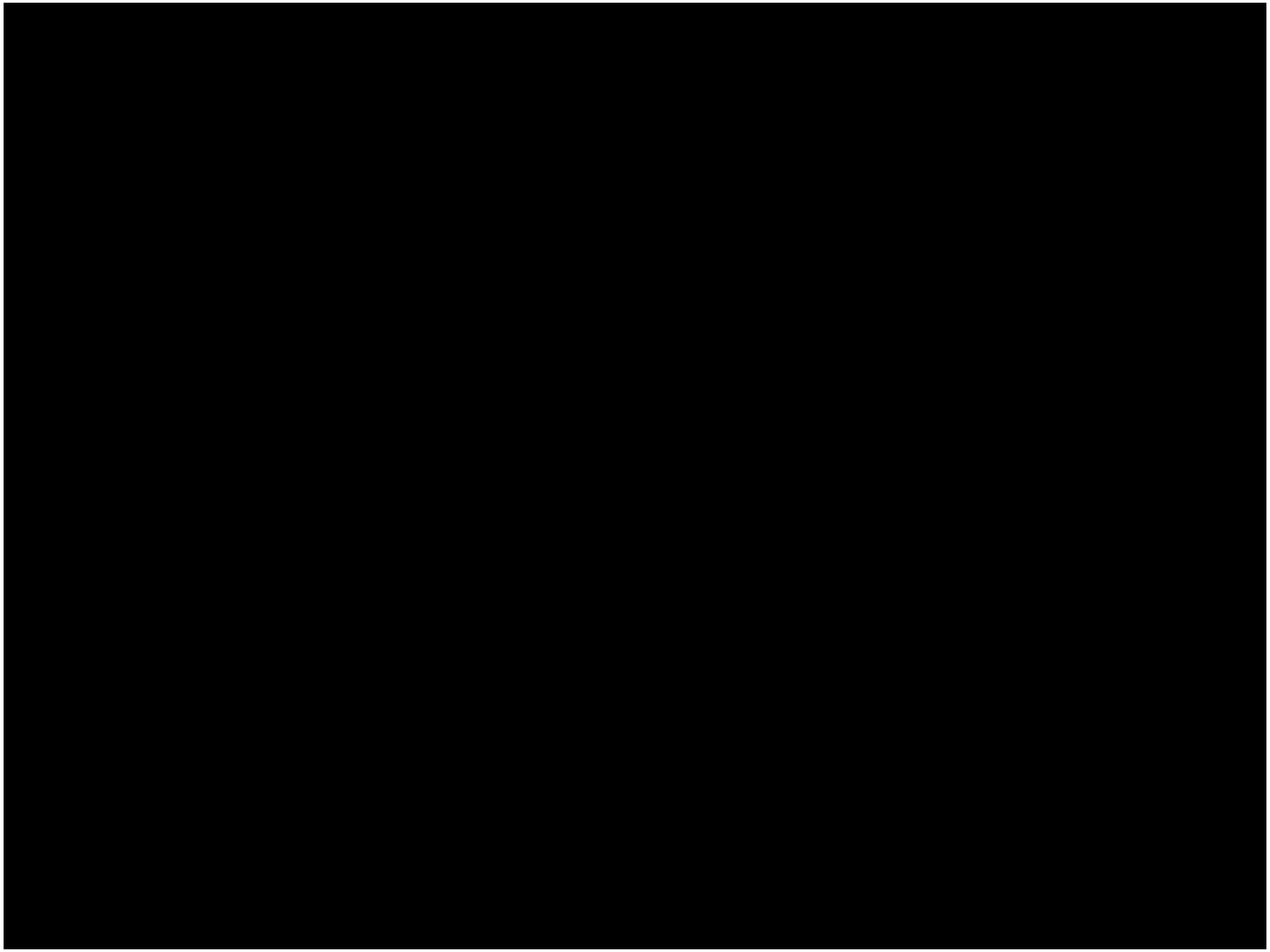
Reading Station Area Redevelopment – Transfer Deck

Phase 1 Launch

- Bridge launched in July 2012 prior to the Olympics
- No track blockades during Olympic period
- Bridge weighed 728Te
- Trial slide - 30Te required – 4%
- Design allowed for 120Te – 60Te either side

Reading Station Area Redevelopment – Transfer Deck

Phase 1 Launch



Reading Station Area Redevelopment – Transfer Deck

Phase 1 Launch

Reading Station Area Redevelopment – Transfer Deck

Phase 2 Launch

- Launched over live tracks
- Bridge weighed 900Te
- Large front cantilever – 150mm deflection

Reading Station Area Redevelopment – Transfer Deck

Phase 3 Erected

Reading Station Area Redevelopment – Transfer Deck

Phase 3 Erected

Lessons Learned

- The use of BIM would have greatly assisted design development
- The use of BIM would have assisted the Contractor in managing his construction sequencing, safe working access etc
- Early and open discussion and collaboration between Client, Designer, Fabricator and Contractor essential in setting design strategy
- Offsite and modular can give rise to a different set of risks which need to be accepted and managed
- The use of offsite and modular construction techniques requires Engineers to step out of their “comfort zone”
- Offsite and modular competency is an essential attribute to today’s Engineers

Acknowledgements

- Network Rail – Reading Station Area Redevelopment Team
- First Great Western
- Tata Steel Projects
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- Costain
- Hochtief
- Dorman Long Technology
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