# Introduction to the Rail Sector Bill Free – Rail Director, CECA

CECA NW'S FOUNDATIONS GROUP AND LJMU CIVIL & STRUCTURAL ENGINEERING DEPARTMENT

12 February 2020

# Contents:

- How I got here
- Building Railways
  - Historically & Now
- The Railway Today
  - Earthworks
  - Structures
  - Track
  - Signalling
  - Electrification
  - Stations
- UK Rail Structure
  - Organisation
  - Unintended consequences
  - Railway re-openings
- Case studies



# How I got here - 1

My (gap year)connection to Liverpool

- Seaforth Dock, Liverpool opened in 1971
- Bristol West Dock in 1974







# How I got here - 2



1980s Motorways & Highways
1990s General civil engineering
1998 – 2018 Railways

Site Engineer to Site Agent Estimator, Planner, Bid Manager Business Development







# **Building Railways - Historical:**



- First proper railway opened in 1830 most of the GB network built by 1899
- Largely built by hand with horse power & temporary rail tracks
- Didn't always go to plan!



# **Building Railways - Now:**



- New railways generally high speed or metro
- Similar to motorway construction but with tighter tolerances and (much) less deviation
- Longer sections tunnelled than in the early railways







# The Railway Today:

- "Putting Passengers First"

   quite a change in thinking
- A record level of renewal work
- Targeted enhancement work
- Restricted access for work
- Environmental restraints
- Safety concerns





# Earthworks:





- Cross sections not unlike highways
- Cuttings deeper & embankments higher than historic roads
- Issues with:
  - Buried services
  - Inadequate & neglected drainage
  - Vegetation
  - Over steep slopes

## Structures:





- Repairing / replacing failed structures bridges & retaining walls
- Increasing clearances for electrification and larger gauge trains
- Structures designed for rapid installation during railway possessions



# Track

- Alignment is critical
- A lot of subgrade issues, due to age of assets
- Ballast and rails deteriorate reasonably quickly / slab track very critical wrt subgrade
- High tech solutions for track laying and maintenance
- Modern track has a very carefully prepared subgrade











# Signalling







- A control system for trains using principles established in the earliest days of the railway
- Now mostly colour light signals, but still some semaphore systems surviving
- "Digital Rail" will bring in cab signalling and closer / faster running and "Traffic Management"





# Electrification

- Used on all types of systems:
  - 30 kph light rail (750v DC)
  - 100 kph metro generally third rail (750v DC)
  - 200 kph heavy rail (25kv AC)
  - 320 kph high speed rail (25kv AC)

• Depending on source of power – generally lower carbon emissions

Ceo

 UK build has, recently, been prohibitively expensive – but recent schemes have been built to budget



## **Stations**



- Most innovative area for new build Blackfriars Station being an example
- A lot of work is carried out on the refurb / improvement of existing stations
- Both work types generally carried out by Civil Engineering Contractors!





## **UK Rail Structure**





# **Octopus of Confusion**





# **Funnel of Complexity**





Process	Involvement
Build / Handback	Delivery
DRRD Detailed Route Requirements Document	Development
CRT Contract Requirements Technical	Contract
RRD Route Requirements Document	Stakeholders
CRD Client Requirements Document	Scope
What passengers want	Outcome wanted

# **Misalignment of Stakeholders**



**Description in Contract Documents** 



What was really required – and built



# Railway re-openings



- In the news now re-openings in England. Blythe, Skipton etc
- Not new in Scotland, lines include Borders, Airdie Bathgate, Stirling Alloah and Larkhall.
- In England, only the East London Line (so far)
- Standard required is higher than what you would find on similar lines that have remained open
- All reopened lines have exceeded their ridership predictions
- This is good work for civil engineers rail work without the need for possessions / blockades



# Case Study: Worksop Station Refurb



- Work by Network Rail and "Commercial & Marine"
- Refurbishment of station, dating from 1849
- Historic livery from the LNER era (1930s)
- Original station features recreated from scratch
- Category winner at the National Rail Heritage Awards (NRHA)





# Case Study: Dulwich staircases





- Work by Network Rail / BAM
- Existing stairs were suffering from "wet rot" and needed replacement

- New stairs manufactured, off site, from Accoya timber
- Worked with local conservation officer







#### **Case Study**

#### **Southampton Tunnel – Gauge Enhancement**

#### **Original Proposal:**

- Carry out the work in two distinct
   Christmas Blockades:
  - 2009 for Up Line
  - 2010 for Down Line
- 18 month programme with two mobilisations
- Two Christmas' worth of disruption
- Benefits available in 2011
- Overall budget, inc Schedule 4 etc: £29m

#### Alternative – developed via ECI

- By Carillion & TSO via civils framework
- Based on experience from HS 1 slab track
- Alternative agreed with TOCs & FOCs:
  - ALO / Single Line working for much of the construction period
  - Freight Trains diverted
- Track prefabricated in DB yard and delivered to site by train
- Work completed over Christmas 2009 / Jan 2010
- Benefits available in 2010
- Contract value circa £9m
- Overall cost, inc Schedule 4 etc: £25m
- Remaining £4m used to fund additional gauge clearance on diversionary route

**NetworkRail** 

# Case Study: Lincoln – River Witham Bridge

- Work by Network Rail / AMCO
- The River Witham Bridge was built in 1848 and used the Fairbairn tubular box edge girder system for the main span, over the river
- Important route, to Immingham, carries a lot of freight trains
- The new structure uses the existing piers together with a "standard" composite steel / concrete prefabricated deck unit
- They were able to reposition the, refurbished, original box girders either side of the new deck
- Commended at the NRHA





# Case Study: North London Line - 1



- Work by Network Rail & Carillion
- Railway in artificial "canyon" opened in the 1850s
- Unstable walls & leaking sewer
- Upgraded to four tracks with overhead line
- Needed increased headroom – so lowered track, but:





## Case Study: North London Line - 2



## Case Study: North London Line - 3







# Any questions?

