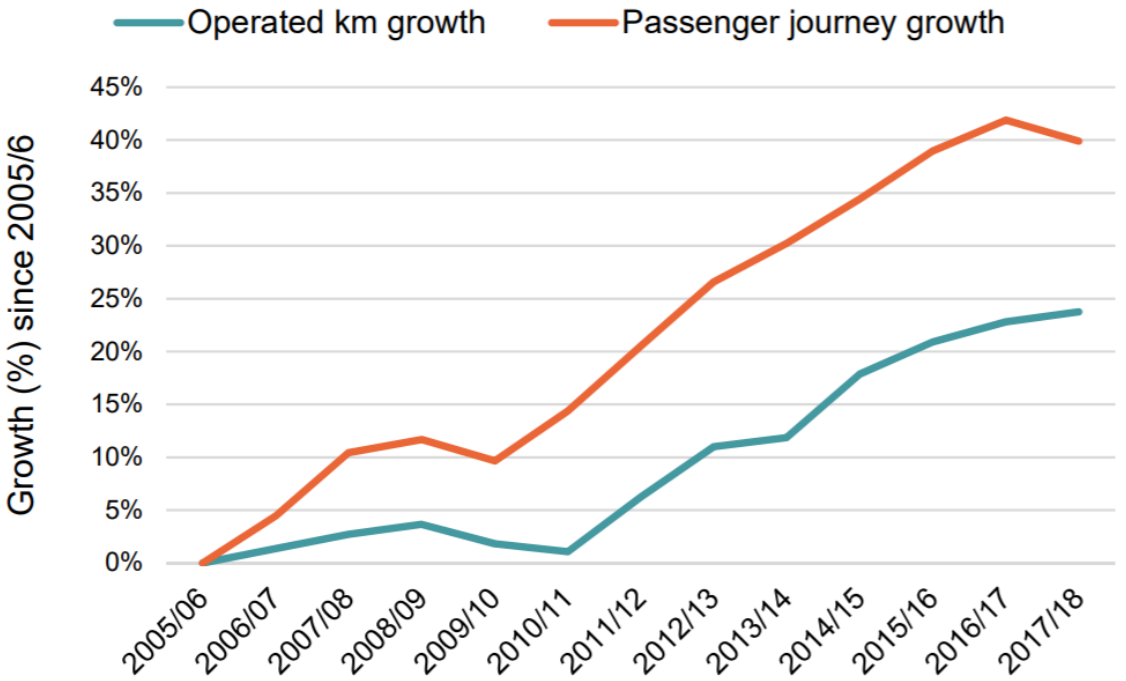
Reliability Improvement Methodology for Signalling Implementations on Brownfield Metros

Ian Thompson

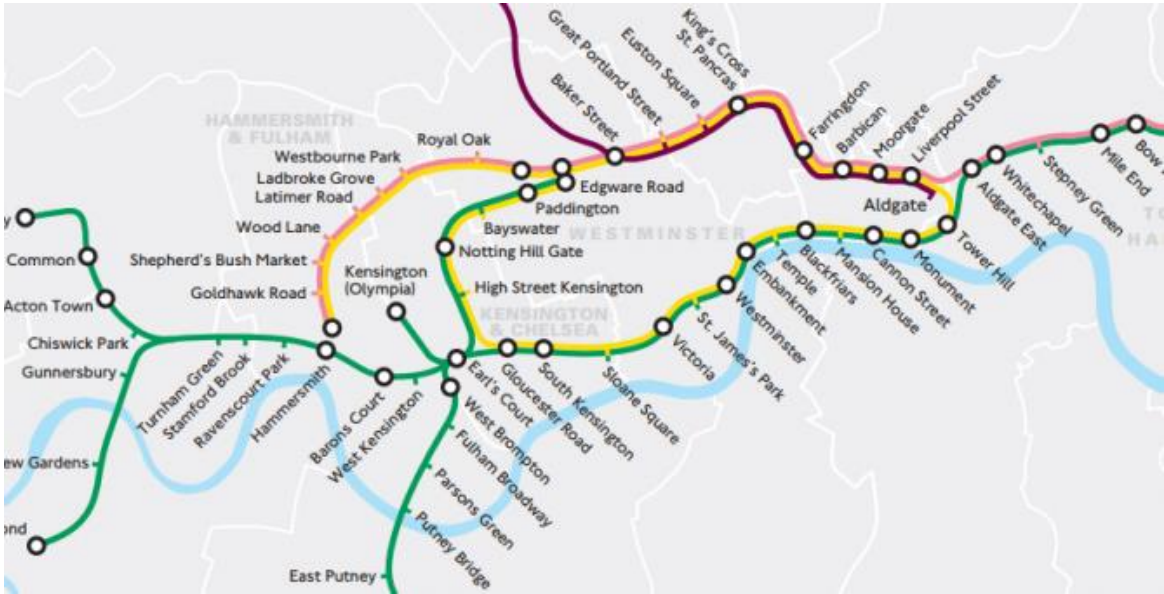
London Underground

- Population of London increasing to 10.5 million by 2030
- Mayor's Transport Strategy - More frequent services
- Annual ridership 1.35 billion

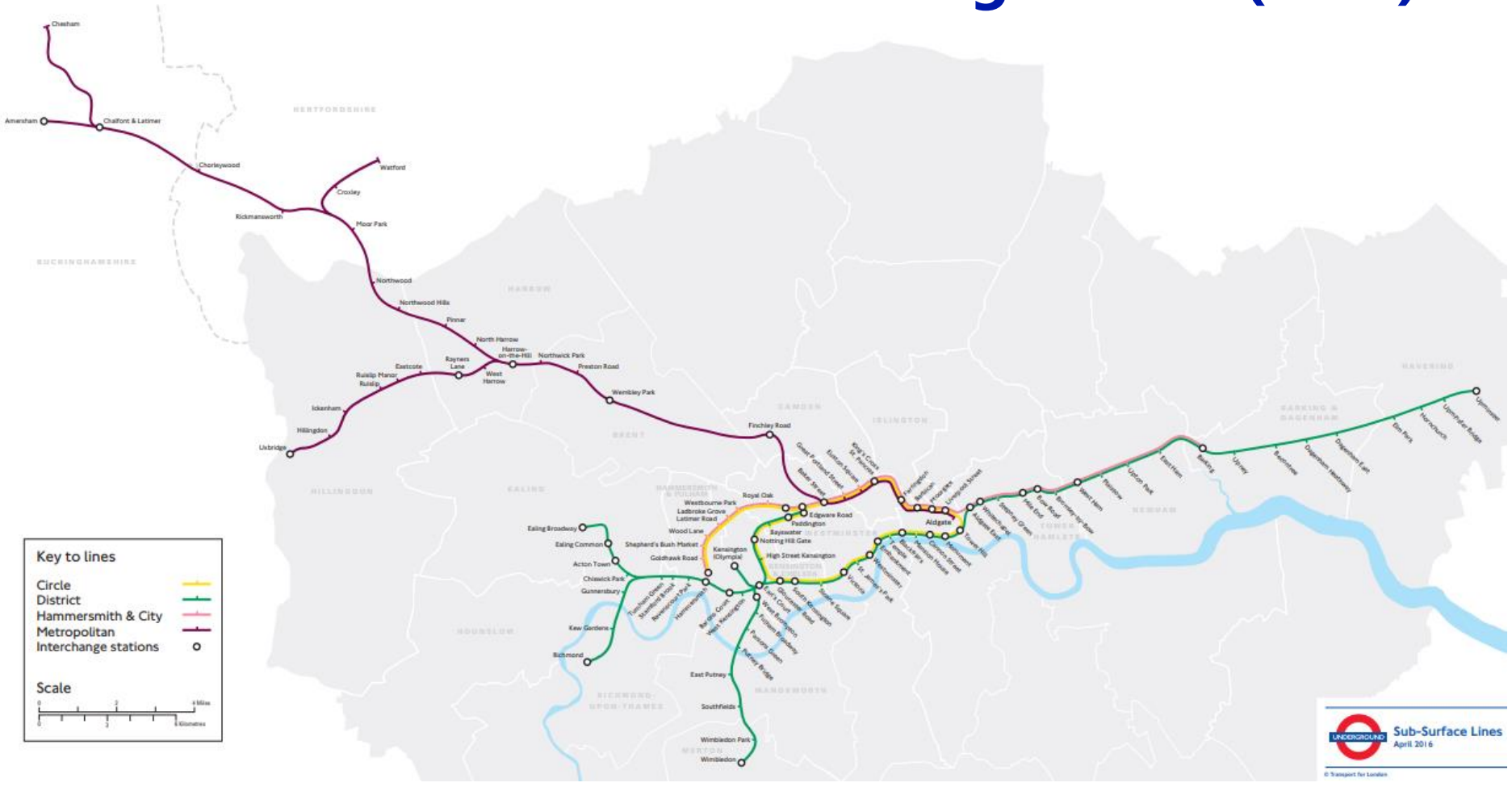


Four Line Modernisation Programme

- Circle, District, Hammersmith & City and Metropolitan
- 40% of the network
- 1.3 million passengers per day
- £5.4 billion upgrade programme



Four Line Modernisation Programme (4LM)



4LM Programme Benefits

Faster journeys times

Fewer delays

Full benefits of new rolling stock

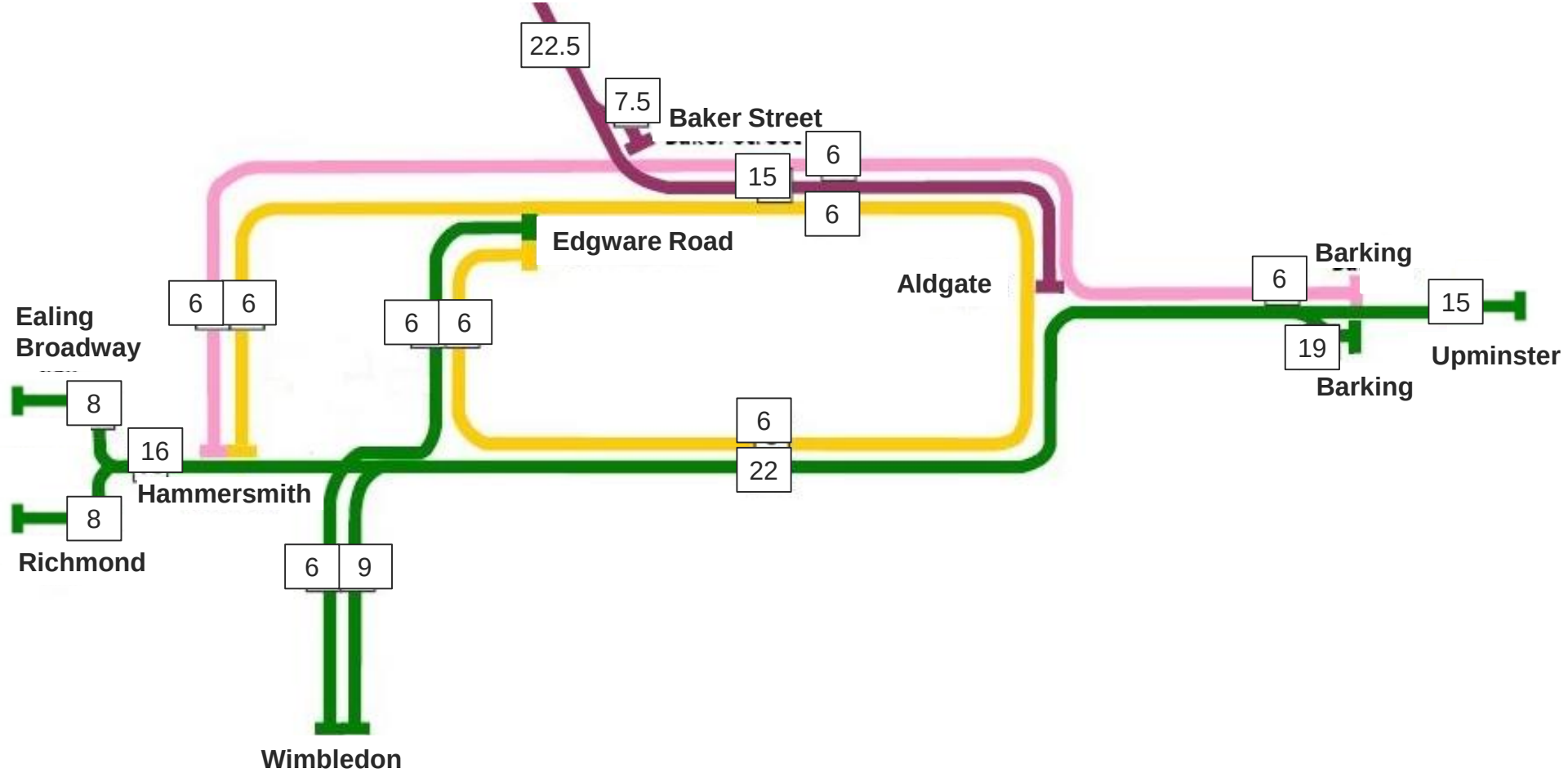
28 to 32 trains per hour

Better live customer information

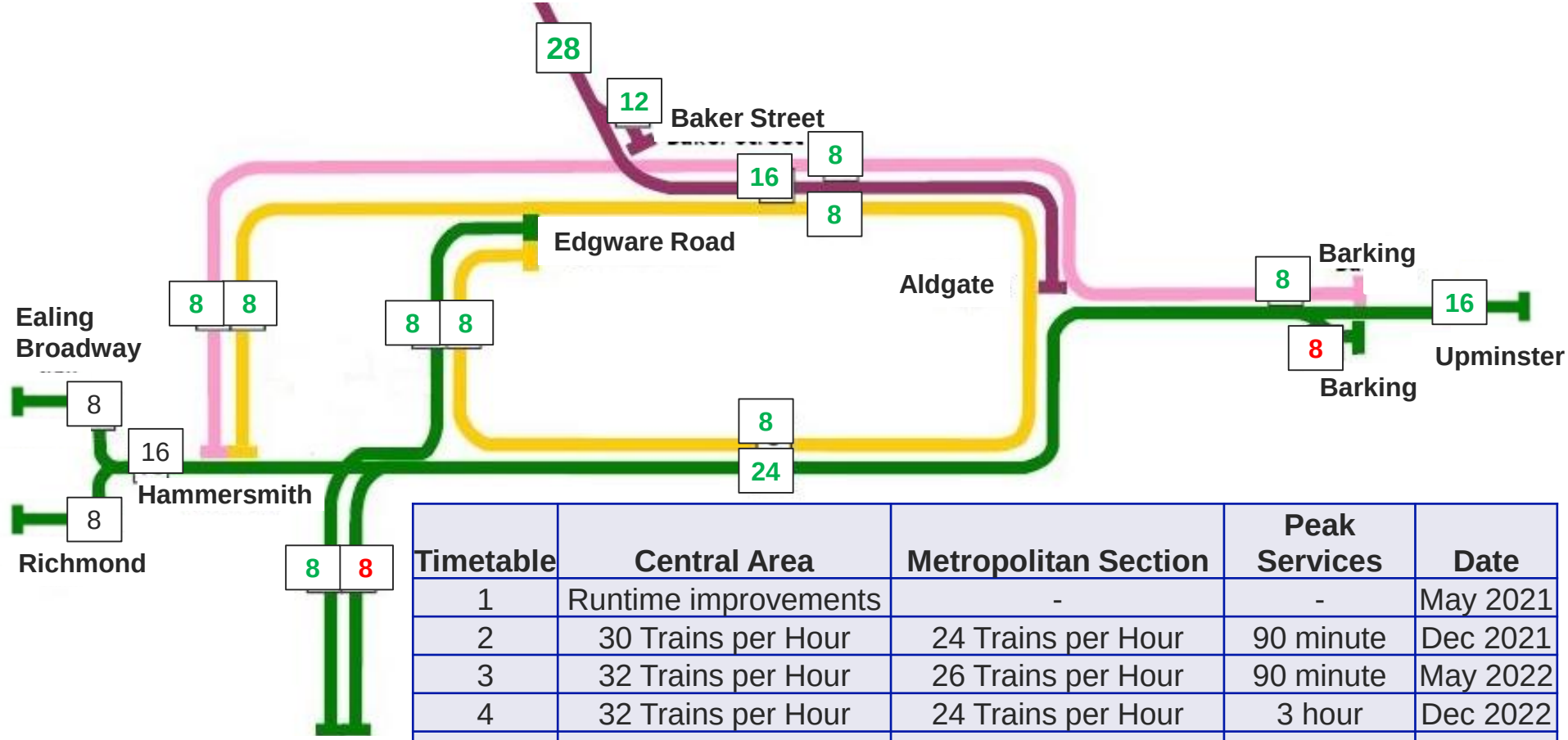
33% increase in service frequency

Improved and more integrated service management

Current Trains per Hour



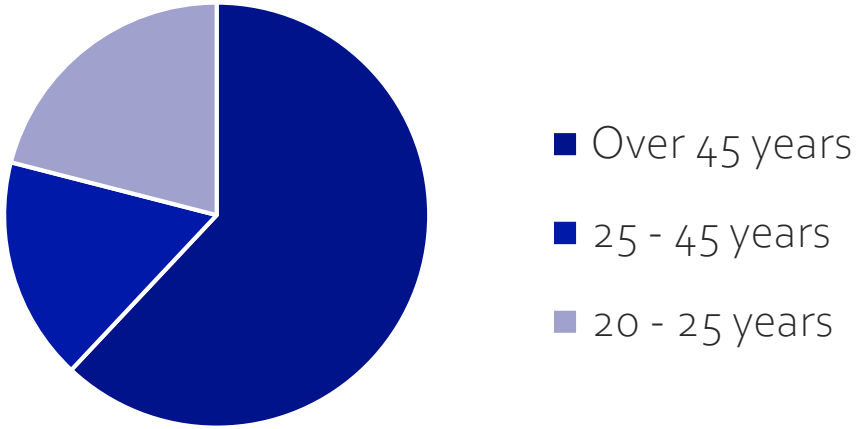
4LM Planned Trains per Hour



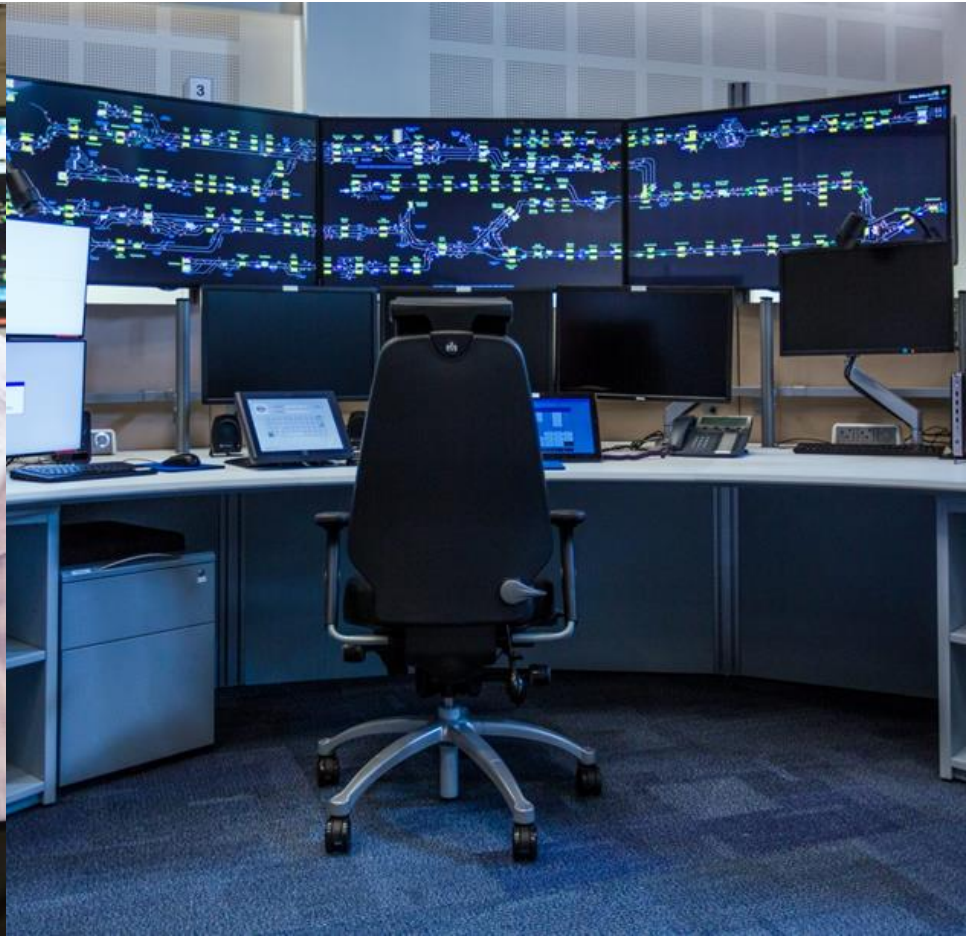
Timetable	Central Area	Metropolitan Section	Peak Services	Date
1	Runtime improvements	-	-	May 2021
2	30 Trains per Hour	24 Trains per Hour	90 minute	Dec 2021
3	32 Trains per Hour	26 Trains per Hour	90 minute	May 2022
4	32 Trains per Hour	24 Trains per Hour	3 hour	Dec 2022
5	32 Trains per Hour	24 Trains per Hour	3 hour	May 2023
6	Off peak enhancements	Off peak enhancements	3 hour	Dec 2023

4LM Project Environment

- Complex brownfield environment
- Limited site access
- Signalling technology from 1960s and earlier
- Time-expired assets
- 9 existing service control locations relocated to a new service control centre
- Age of the existing 4LM assets



4LM Technical Challenges



4LM Technical Challenges

- Integration required with other lines and National Rail
- ‘Overlay system’ - Network Rail signals will remain in place and CBTC will take information from them
- ‘Underlay system’ - CBTC will control new lineside signals in compliance with Network Rail
- Track runs alongside a Network Rail line fitted with 25kV AC overhead line equipment
- New equipment has to be proofed against EMC
- Integration of nine existing service control centres
- Mixed train operations
- Both moving block and fixed block signalling systems

4LM Signalling Upgrade Project

- Peak service frequency increased by 33%
- Thales SELTRAC CBTC - £760 million contract
- Upgraded system as used on DLR, Northern and Jubilee
- Wi-Fi and sleeper mounted transponders every 25m
- 14 Signalling Commissioning Areas (SMAs)

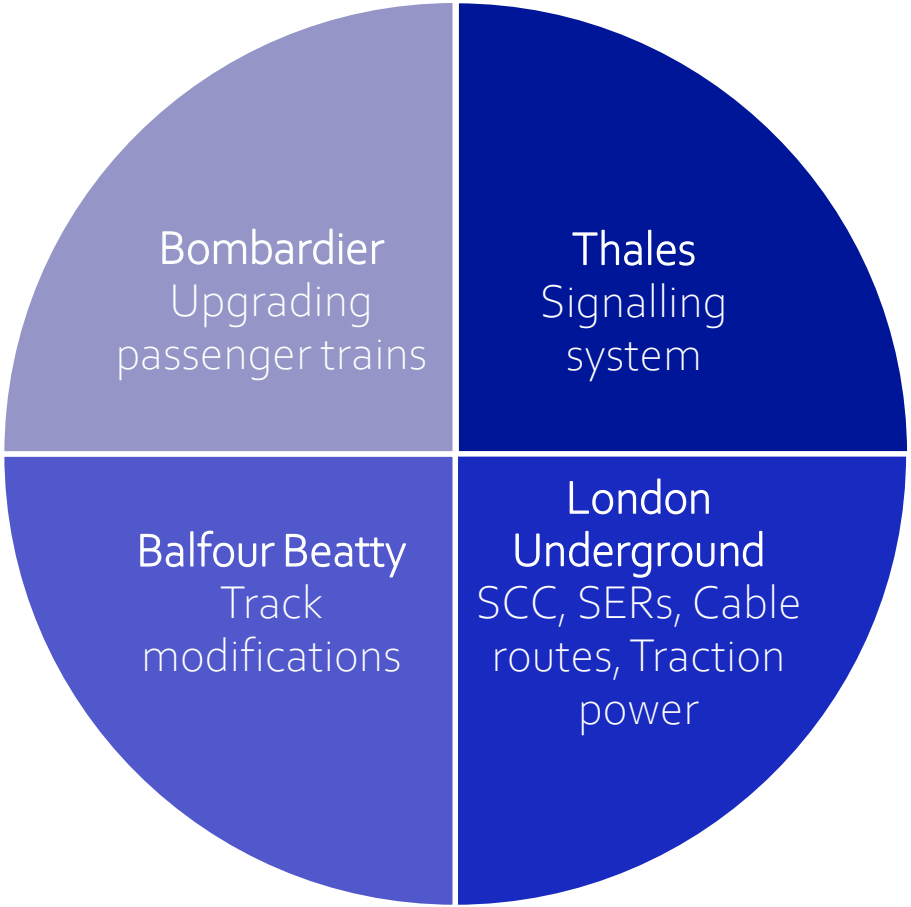
2015
Contract awarded

2017
Installation began

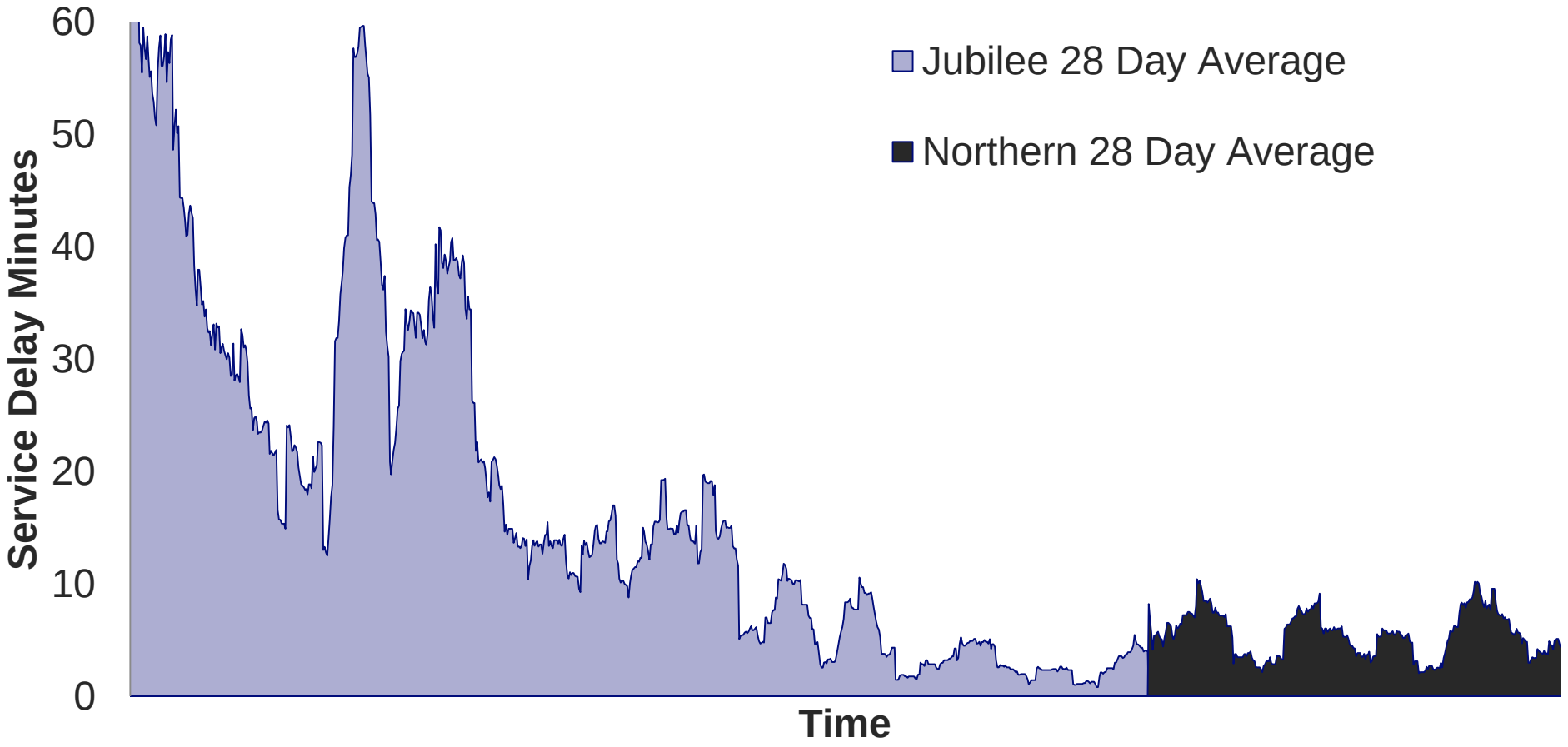
2019
First commissioning

2023
Complete

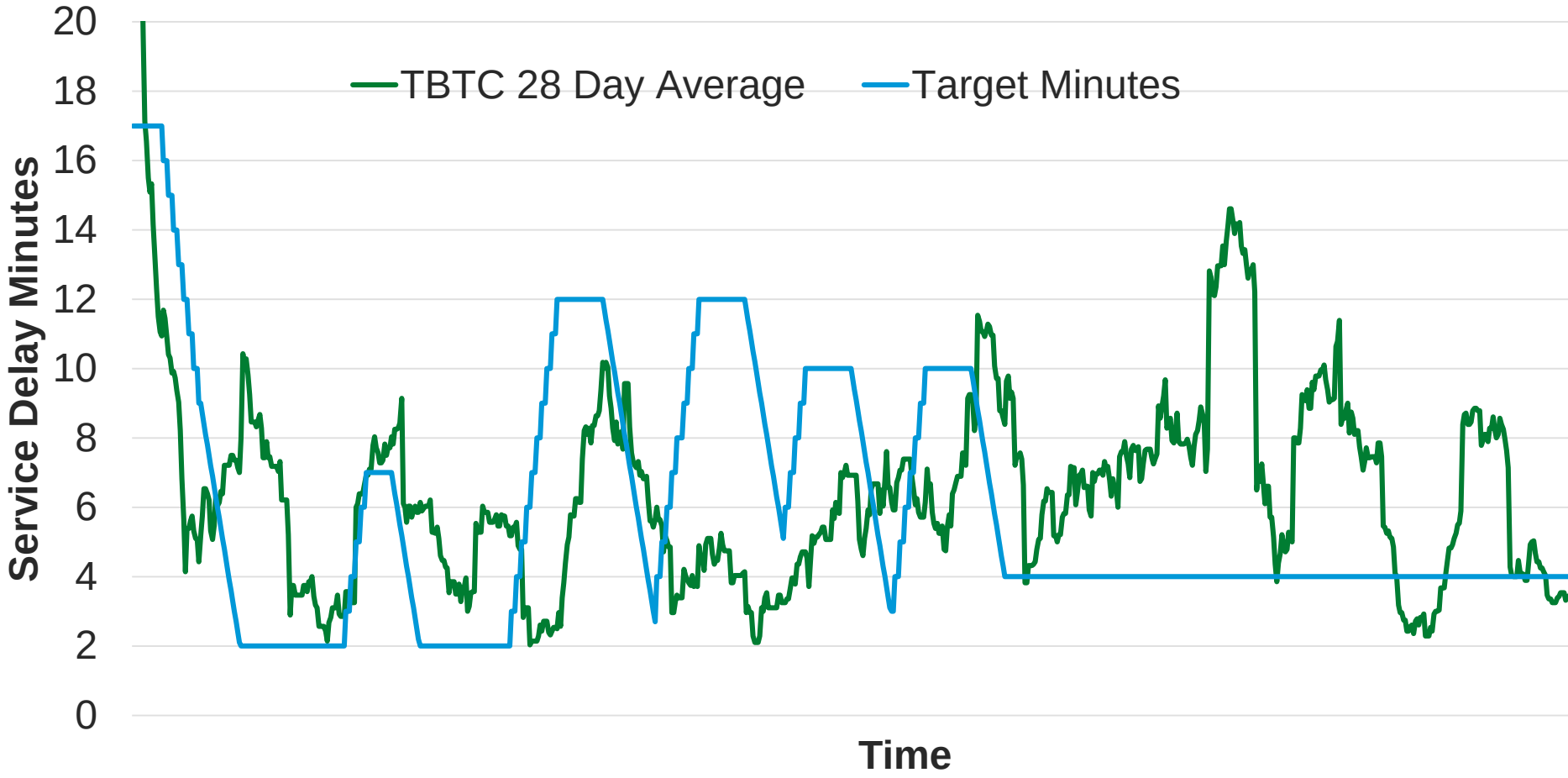
Cooperative Working



Unified Reliability Metric

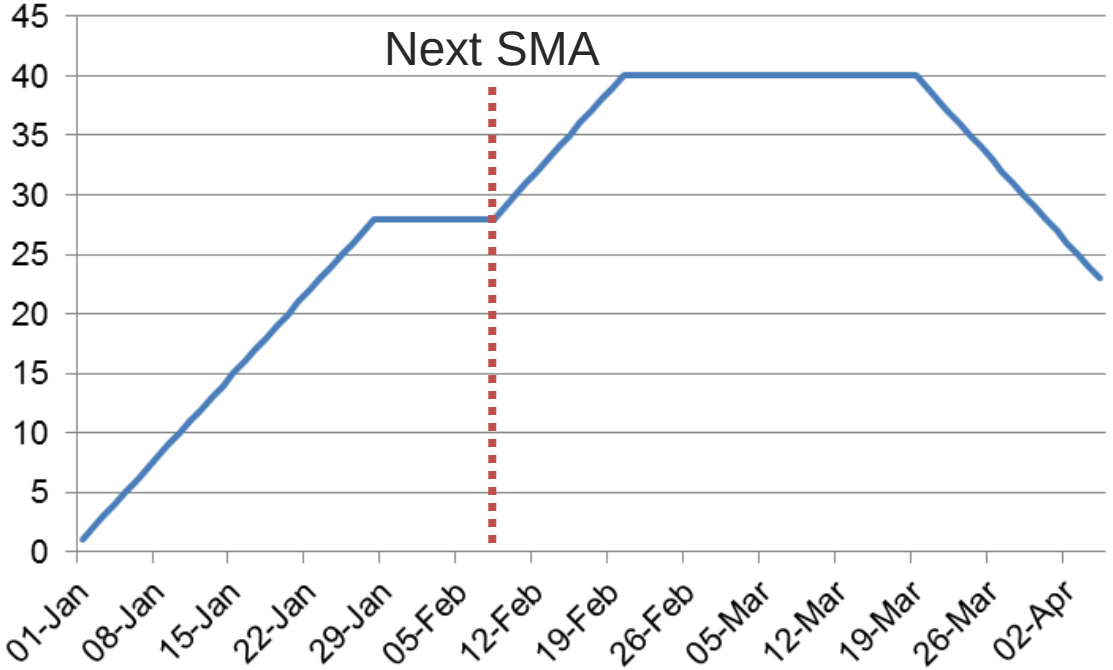


Previous Reliability Predictions



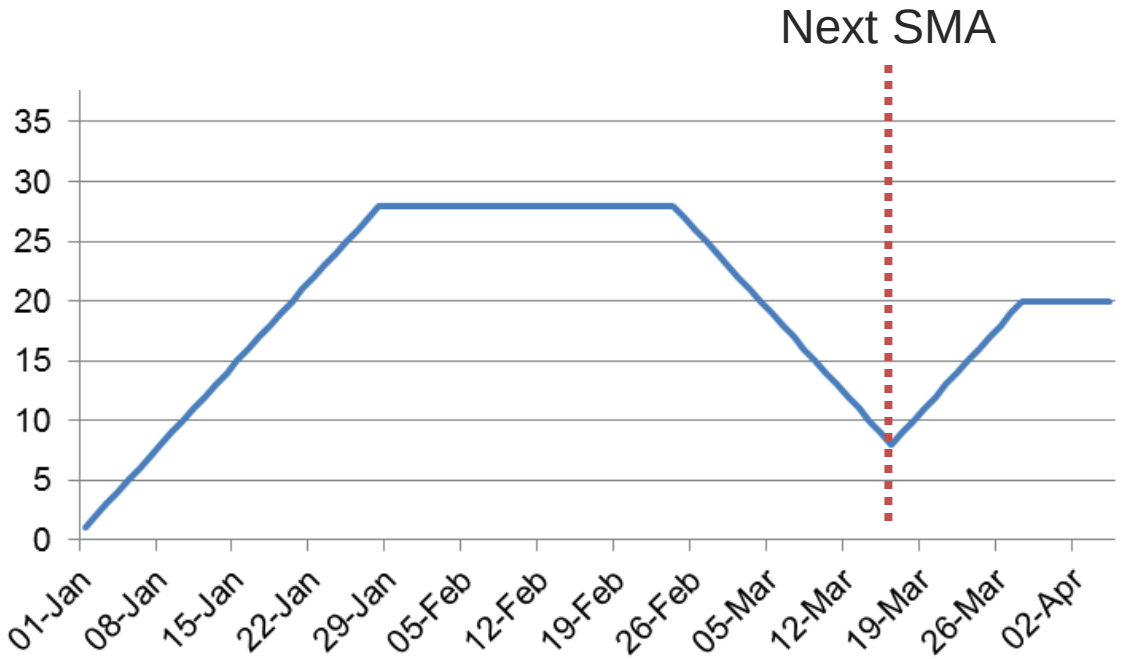
Phased Project Migration

- Reduce size and complexity of migration area
- Used to manage reliability

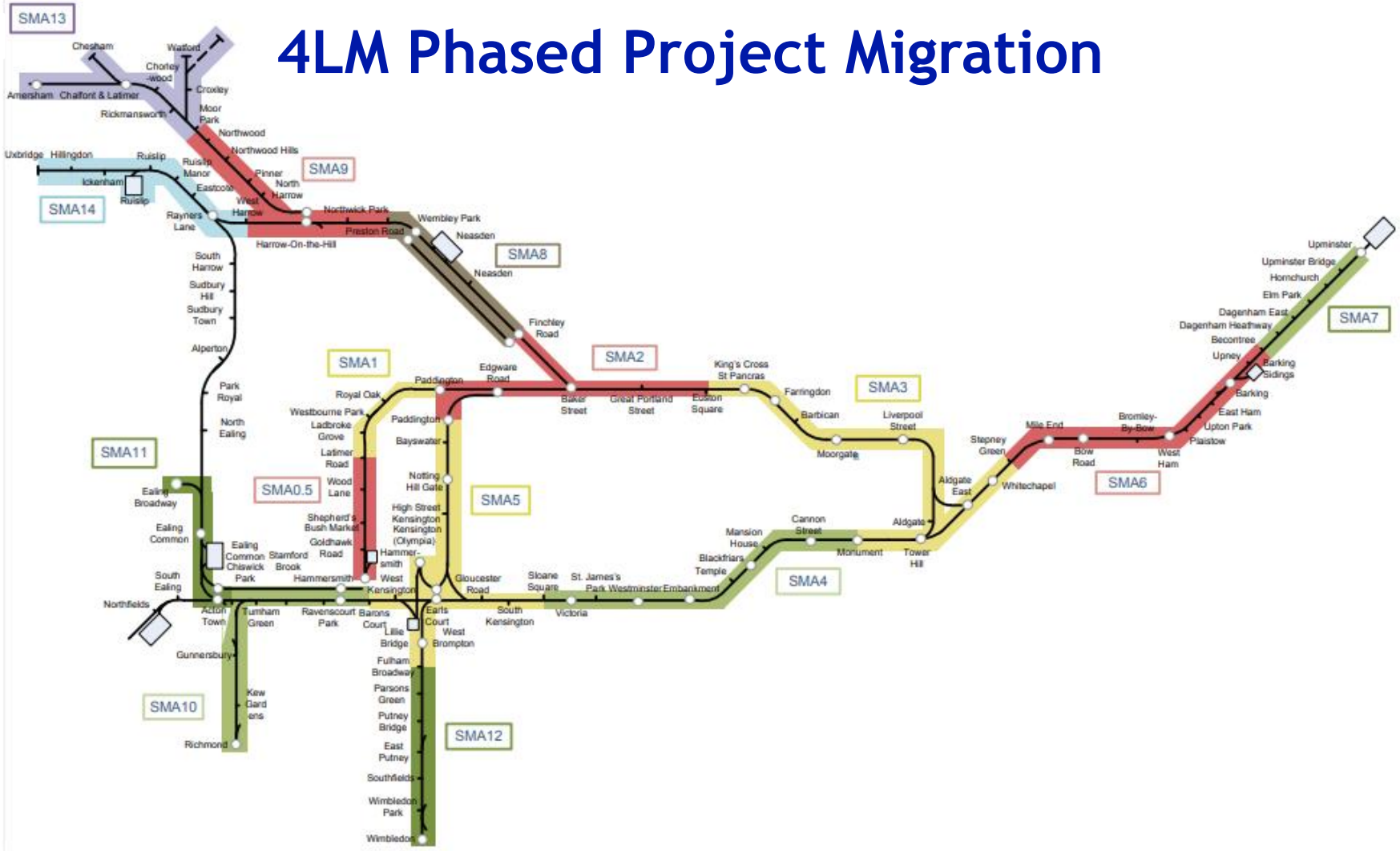


Phased Project Migration

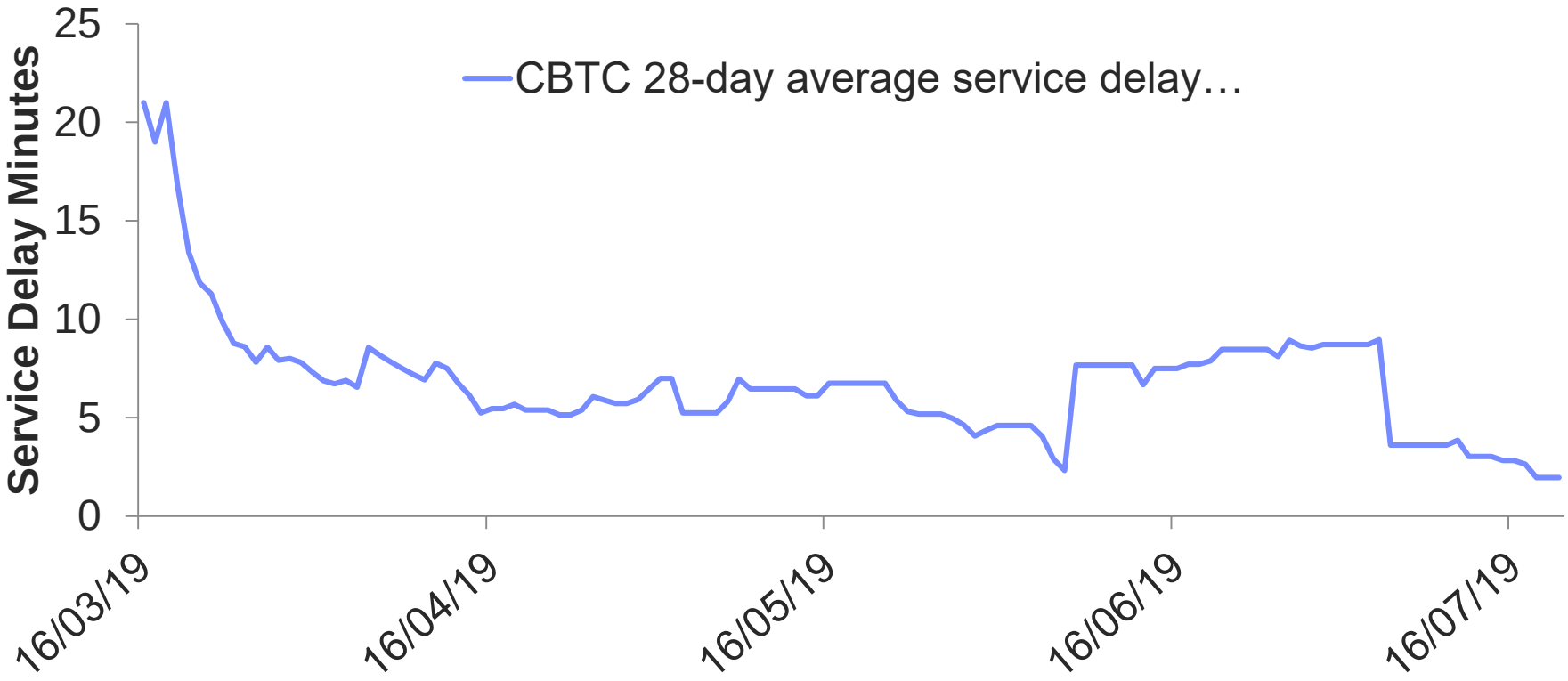
- Calculations based on previous experience
- Used to develop project planning
- Go/No-go decisions



4LM Phased Project Migration

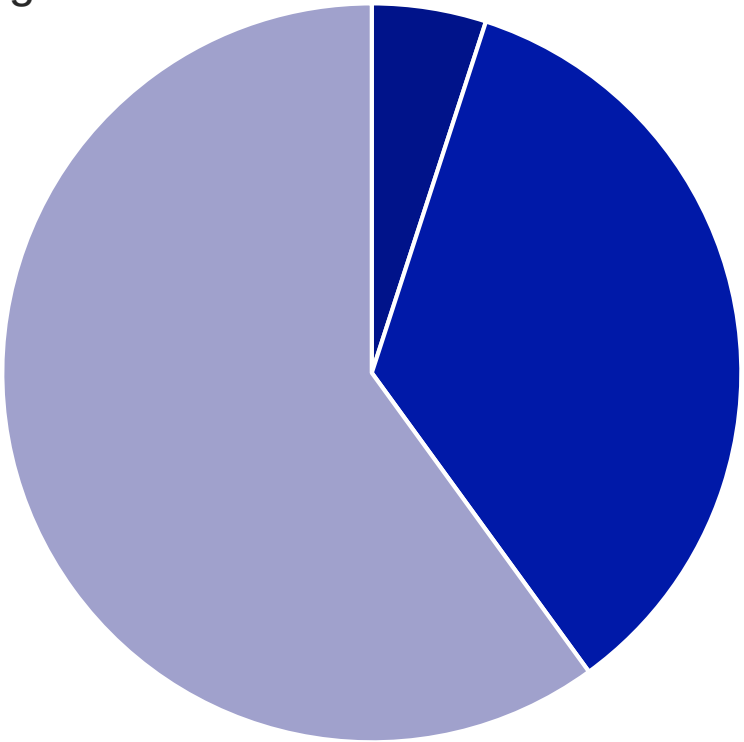


4LM Reliability



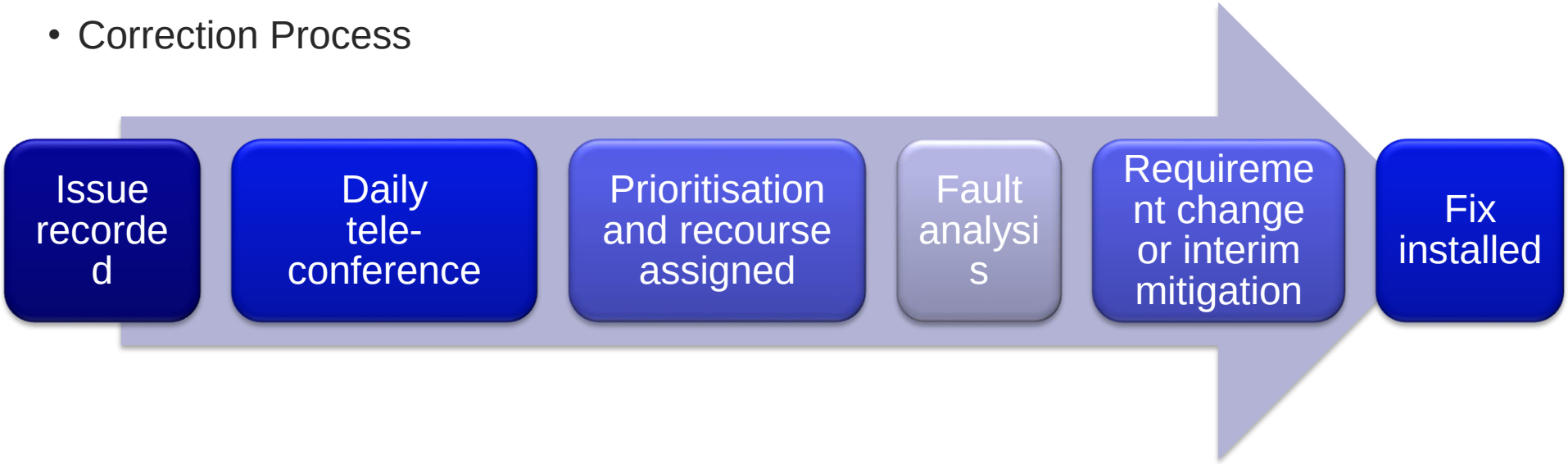
Data Analysis Methodology

- Northern Line Signalling System Delay Minutes Categorisation



Data Collection Analysis Methodology

- Daily call
- Critical issues process
- Collaborative approach
- Correction implementation
- Types of solutions; temporary, technical or training
- Correction Process



Conclusions

- Added complexity with Brownfield projects
- Clear reliability strategy should drive project
- Common metric for reporting and goal setting
- Defined go/no go decision stages
- Practical reliability predictions and assessments
- Extensive data collection strategy
- Suitable resources to review all available data
- Collocative effort required for reliability analysis, investigations and solutions

Thank you

Ian Thompson