Metrolink: A Light Rail Transport System for Greater Manchester

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NETLIPSE 10th Anniversary Meeting, London, 18th April 2016
• Introduction to Manchester and our Tram System

• Overview of the Phase 3 expansion which extended the Metrolink Network 3 fold

• Arrangements we have made and are revising for Operations & Maintenance

• Vision for the Future
Greater Manchester

- One of the fastest growing cities in Europe
- 40% of the economic output of the whole of the North of England
Metrolink Overview

First ‘Second Generation’ tramway in the UK

Opened in 1992

Conversion of heavy rail link between Bury and Altrincham

Street running link through the city centre

Extended to Eccles in 2000
Metrolink Overview

- £1.85 billion investment
  - Tripling the size of the network
  - Tripling Park & Ride facilities
  - Brand new fleet of trams
  - New ticketing systems
- Significantly improving reliability and capacity
- Now the largest Light Rail system in the UK
- 34 million passengers per annum and growing
<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet</td>
<td>Fleet of 32 T68 trams</td>
<td>120 M5000 trams ordered</td>
</tr>
<tr>
<td>stops</td>
<td>37 stops</td>
<td>93 stops</td>
</tr>
<tr>
<td>track</td>
<td>37 km of track</td>
<td>96 km of track</td>
</tr>
<tr>
<td>parking</td>
<td>1146 parking spaces</td>
<td>3302 parking spaces</td>
</tr>
</tbody>
</table>
Operations & Maintenance

• Current Arrangements:
  – Asset Manager & Infrastructure Manager - TfGM,
  – Operator - MRDL (RATP),
  – Infrastructure Maintainer - MRDL & Phase 3 DCM Contractor
  – Tram Maintainer – MRDL (RATP) & Manufacturer
  – Plus a number of smaller specialist service arrangements
• New Franchise 2017 – single Operator & Maintainer
Challenges and Achievements

**Challenges**

- Metrolink stations ‘to boost two Greater Manchester areas’
- Metrolink from Manchester to Droylsden opens following delays

**Achievements**

- Rochdale extension to Metrolink tram network opens
- Metrolink line to Manchester Airport opens a year early
- Metrolink extension to East Didsbury opens three months early

*Transport for Greater Manchester*
Recognition by the Industry

2014 & 2015 Awards

- Light Rail Industry
- National Rail Industry
- National Transport Industry
- Chartered Institution of Highways & Transportation
Vision for the Future
• Programme Management Model for Delivering Phase 3

• Evolution of the Metrolink Integrated Delivery Team (IDT)

• Other Project Examples
Metrolink Extension Programme (MEP) Delivery

Triple the size of the Metrolink network

104 new M5000 Trams

New Ticket Vending Machines

Stop upgrades

Track renewals

New Tram Management System (TMS)

New Depot & Control Centre

Park and Ride Schemes

£1.6 billion capital spend between 2008 and 2017
MEP Delivery Challenges

- **The UK’s largest tram system**
  - 60km of linear construction
  - £125m utility diversions
  - Conversion of Heavy Rail
  - Refurbishment of approximately 250 structures
  - Construction of major new structures
  - Concentrated residential areas and town centres
  - Environmentally sensitive areas
  - Bespoke signalling

- **Complex stakeholder interfaces**
TfGM’s Contract Strategy

Transport for Greater Manchester Committee (TfGMC) Policy Setting

Transport for Greater Manchester (TfGM) Executive Body. Owns & manages Metrolink

Parsons Brinckerhoff Delivery Partner

M-Pact Thales Design Construct & Maintain Contractor

Thales TMS Contractor

SUC’s Utility Diversions

Bombardier Light Rail Vehicles

Metrolink RATP Dev Ltd (MRDL) Operator
Delivery Partner Role

Comprehensive Programme Management Service

Master Planning and Strategic Development

Procurement Strategy

Systems Assurance

Project Controls: Risk Management & Cost Management

Contract Management

Delivery through to Operation & Maintenance

Stakeholder Engagement and Communications

Benefits Realisation

Fully integrated team with TfGM
Delivery Partner Remit

• PTE Requirement
  • The Delivery Partner is required to orchestrate, by managing an integrated team, the intelligent, effective and efficient delivery and operation of ….. a DBM Contract for the Phase 3 works;
    • Orchestrate:- to organise or arrange (elements of a plan or a situation, etc) so as to get the desired or best result

• The PB Offer (part)
  • Effective management of construction schedules begins by creating a project culture that demands on-time performance. This applies to all participants on the Metrolink Programme. The Construction Manager will demand on time performance from the contractor at every opportunity, and will insist on mitigative actions / solutions for any missed dates.
Evolution of the Delivery Partner Model

Sharper commercial focus

- Delays to achievement of RCD dates.
- Requests for significant extensions to time.
- Increasingly commercial stance being adopted.

Enhanced technical review

- Closer attention to assurance of system-wide deliverables on site.

Greater attention to the needs of the Operator

- More detailed review of testing and commissioning plans
- Close co-operation with the Operator
Procurement

Relationships

- TfGM Central Procurement – ensures VfM and best practice
- Delivery Partner – leads integrated team to deliver direct procurement with remit to deliver VE opportunities
- Designer / Contractor – to deliver the schemes working in collaboration to identify VE with benefit sharing

Phase 3B extensions

- Pricing proposals included in Phase 3A contract
- Phase 3A rates adjusted for VE and market dynamics
- Benchmarked against similar projects
- Benchmarked improvements in baseline costs
- Maximises learning from Phase 3A
- Optimises procurement timescales
Stakeholder Engagement and Communications

Reputational Risk Management

- Promote the capital programme – maintain political and stakeholder support
- Support the approvals process
- Early marketing to support the long term success of the investment programme
- Embedded within the IDT – finger on the pulse
- Support the construction programme

Close relationships with all Contractors
Delivery Partner FTE Staff Profile

- Commercial
- Stakeholder
- Delivery
Key Success Factors – Providing the Right People

COMMUNICATION
The impact of change

OWNERSHIP
Anticipating problems

EXPERIENCE

KNOW-HOW

CAPABILITY

INNOVATION
Key Success Factors – Stakeholder Outcomes

Reputational Risk Management

On Time – Public expectations met

Under Budget – TfGM governance satisfied

Efficient Operations – Customer satisfaction achieved

Benefits Realised – **Further Investment in the Future**

**Pride in Greater Manchester**
Other Projects

Experience of Alternative PMO Arrangements – Challenges & Lessons Learned

• Light Rail – Edinburgh, Denmark

• Metro /Heavy Rail – ELLP, Crossrail, Denmark

• Other Industries – Alternative PMOs
Building on Successful Delivery

- Primary focus on meeting the customer expectation
- Secure an enhanced reputation for TfGM
- Promote a strong integrated team ethic
- Agree a clear division of responsibility
- Be flexible
- Deliver value for money through effective resource management – across the combined team
- Do not insist on a perfect requirements specification that may incur significantly higher costs than the ‘off-the-shelf’ offering
- Enforce the contract
Phase 3 Lessons Learned

- Ensure Programme Integration
- Optimise Contract Arrangements
- Rigorous Assurance Processes
- Avoid Untried Solutions
- Watch Out for Obsolescence
- Welcome Innovations
Innovative Methodologies & Technologies

- Go-live Readiness Tracker
- Driver Training Simulator
Building a Strong Team

• Integrated Delivery Team
  - Transport for Greater Manchester (TfGM)
  - WSP | Parsons Brinkerhoff (WSP|PB)
  - Metrolink RATP Dev Limited (MRDL)
  - MPact-Thales (MPT)
  - Thales Transportation

• Co-location

• Integrated Delivery Programme
City Centre Programme (CCP)

• Improved co-ordination / integration of signalling
• Intensive Stakeholder Management process
• Early identification of complex risks
• Consideration and management of events
A New Extension to Trafford Park

Trafford Park Line (TPL) Project
£350m, 5.5km, 6 Stops, 10 Trams, 12 Minute Service, 89% Public Approval
Collaborative Working using BIM

- Mandated by UK Government
- Model whole system
- Enforces collaboration
- Opportunity to link Schedule & Cost information to the Design & then Construction
Topics

• Systems Integration as a Strategy

• System, Work & Organisational Breakdown Structures (SBS, WBS, OBS)

• Integrating the Parts

• Getting it Over the Line (Operational Readiness)

• Providing Assurance

• Benefits of Using BIM
Systems Integration as a Strategy

Project Definition

Conceptual Planning & Statement of Requirements

Requirements Analysis & Front End Design

Preliminary Functional Design

Detailed Design

Build / Implementation

Integration & Test

Unit Test

System Proving - Factory

Install, Commission & Final Proving

Operation & Maintenance
Systems Integration as a Strategy

Feasibility
- Development Remit
- Functional Specification

Development
- Preliminary Design
- Detailed Design

Delivery
- Manufacture & Installation

Inception
- Development Remit
- Functional Specification

Closeout
- Operation & Maintenance
- Trial Operations
- Test Running
- Test & Commissioning

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Systems Integration as a Strategy
Systems Integration as a Strategy
NoEP Stakeholder engagement diagram

Systems Integration as a Strategy

Transport for Greater Manchester

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Systems Integration as a Strategy
System Breakdown for Metrolink

- **Metrolink Expanded Network**
  - **Metrolink Existing Network including Delivered Phase 3 Systems**
  - **Metrolink Migration Phase Systems yet to be Delivered**

- **Trams**
  - T80 Variants
  - MS2000 Variants

- **Control**
  - NMC / DRC
  - Depot
  - Stops
  - Civil & Structures
  - Utility Services
  - PWay
  - Comms
  - Traction Power
  - OLE
  - Operators & Drivers
  - Rules & Procedures
  - Infrastructure Managers

- **Infrastructure**
  - Shelters
  - TVMs
  - Validators

- **Operations**

- **Management Systems**
  - TiGM SMS
  - ProgMP
  - MRDL SMS
    - Project Controls
    - Engineering Management
    - Technical Assurance

- **Highways**
- **National Rail**
- **Operators**

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Balancing the Project Manager’s Triangle

Project Scope

cost
time

quality
Related Breakdown Structures

System Breakdown Structure (SBS)

- Level 1 - System
  - Railway
- Level 2 - System Entities
  - Infrastructure
  - Trains
- Level 3 - Sub-System
  - Track
  - Stations
  - Engine

Project Configuration Baseline

Work Breakdown Structure (WBS)

- Start
  - Mobilise
  - Planning
  - Requirements
  - IT Systems
  - Furniture
  - Establish Office

Organizational Breakdown Structure (OBS)

- Project Director
  - Project Manager
    - Engineering Manager
    - Construction Manager
    - Safety Manager
  - Quality Manager
Project Engineering Lifecycle

Validation
(What Has Been Produced Meets Requirements)

Increasing Decomposition & Detail

Increasing Integration & Scale

Verification
(Next Stage Satisfies the Intention of the Previous Stage)

Verification
(Next Stage Satisfies the Intention of the Previous Stage)
Operational (Go-Live) Readiness Process
Go-live Readiness Tracker

| MRDL 200_5 | Fire & Evacuation Plan for Airport Stop issued | Document ref - PROC 00118 | 1 | 1 | MRDL George Barrow Update 23/07 Several meetings held and document drafting commenced. MR/MAG interface. Update 07/08 plan well progressed. Update 25/09 This has been incorporated into our main Procedure 0118 - Station Evacuations. – Complete.

| MRDL 200_6 | Local Police liaison/emergency services plan approved | From: George Barrow [mailto:gbarrow@metrolink.co.uk] Sent: 09 October 2014 11:41 To: Daniel Churchman Cc: Dave Skirrow; Gary Scanlon; Alan Knott Subject: Airport Go-Live Update | 1 | 1 | MRDL George Barrow Update 23/07 Discussions with Fire Brigade liaison officer underway. Confirmation that equipment requirements for applying emergency earths have been met for local brigade. Update 16/09 - Emergency services informed of current way forward. Update 25/09 MRDL have confirmed operational planned dates). Update 9/10/14 - Plan complete

| MRDL 200_7 | Stop Appreciation Plan to include maps and training for CSRs | As per 200_6 ref | 1 | 1 | MRDL George Barrow Update 04/09 Documentation being drafted. Update 16/09 - Information gathered, draft being finalised. Update 25/09 To be finalised before 13/10/2014. Update 09/10/14 - Training material complete, training ongoing

| MRDL 200_8 | Approve Q&A customer services briefing documents from TfGM | Briefing docs in place | 1 | 1 | MRDL George Barrow Update 23/07 Agreed activity can be removed. Day job.

| MRDL 200_9 | Provide Customer Experience Officer resource for updating information e.g. Posters across system | Statement letter/email | 1 | 1 | MRDL George Barrow Update 23/07 CC commenced. Stage 2 complete. Update 04/09 Statement letter/email to be finalised. Update 10/09 - Training completed and well progressed. Update 9/10/14 - Process well advanced

| MRDL 200_10 | Operations staff (controllers) route appreciation training | Training complete, confirmation email from MRDL - As per 200_6 ref | 1 | 1 | MRDL George Barrow Update 23/07 CC commenced. Stage 2 complete. Update 04/09 Confirmation email from MRDL - As per 200_6 ref. Update 10/09 - Training completed and well progressed. Update 9/10/14 - Process well advanced

| MRDL 200_11 | MRDL Change Control process substantially complete to support passenger service operation | Agility Ref No | 1 | 1 | MRDL George Barrow Update 23/07 CC commenced. Stage 2 complete. Update 04/09 Stage 3 complete of total 5 stages. Stage 4 substantially complete. Update 9/10/14 - Process well advanced

| MRDL 200_12 | MRDL to confirm management cover in place to provide first line response on passenger service commencement day (particularly if Sunday) | Email confirmation | 1 | 1 | MRDL George Barrow Update 04/09 - MRDL committed to supporting this. Update 9/10/14 - Need details of opening.

**PSRR Stage Gate - Summary Report**

| Line Item Completion | PSRR Flight Path

- **Meeting**
  - 0.0% 02-Jul-14
  - 1.2% 09-Jul-14
  - 5.6% 23-Jul-14
  - 11.1% 01-Aug-14
  - 12.5% 07-Aug-14
  - 15.2% 11-Sep-14
  - 16.2% 18-Sep-14
  - 44.9% 25-Sep-14
  - 56.2% 02-Oct-14
  - 62.2% 09-Oct-14
  - 66.0% 16-Oct-14
  - 72.2% 23-Oct-14
  - 80.0% 30-Oct-14
  - 88.0% 06-Nov-14
  - 99.0% 13-Nov-14
  - 100.0% 09-May-14

- **Overall**
  - 0.0% 09-May-14

- **Line Item Completion**
  - 100.0% 09-May-14

- **Line Item Completion**
  - 99.0% 09-May-14

- **Line Item Completion**
  - 96.0% 09-May-14

- **Line Item Completion**
  - 90.0% 09-May-14

- **Line Item Completion**
  - 82.2% 09-May-14

- **Line Item Completion**
  - 78.2% 09-May-14

- **Line Item Completion**
  - 74.9% 09-May-14

- **Line Item Completion**
  - 71.1% 09-May-14

- **Line Item Completion**
  - 68.2% 09-May-14

- **Line Item Completion**
  - 65.3% 09-May-14

- **Line Item Completion**
  - 62.4% 09-May-14

- **Line Item Completion**
  - 59.5% 09-May-14

- **Line Item Completion**
  - 56.2% 09-May-14

- **Line Item Completion**
  - 53.0% 09-May-14

- **Line Item Completion**
  - 50.0% 09-May-14

- **Line Item Completion**
  - 46.8% 09-May-14

- **Line Item Completion**
  - 43.6% 09-May-14

- **Line Item Completion**
  - 40.4% 09-May-14

- **Line Item Completion**
  - 37.2% 09-May-14

- **Line Item Completion**
  - 34.0% 09-May-14

- **Line Item Completion**
  - 30.8% 09-May-14

- **Line Item Completion**
  - 27.6% 09-May-14

- **Line Item Completion**
  - 24.4% 09-May-14

- **Line Item Completion**
  - 21.2% 09-May-14

- **Line Item Completion**
  - 18.0% 09-May-14

- **Line Item Completion**
  - 14.8% 09-May-14

- **Line Item Completion**
  - 11.6% 09-May-14

- **Line Item Completion**
  - 8.4% 09-May-14

- **Line Item Completion**
  - 5.2% 09-May-14

- **Line Item Completion**
  - 2.0% 09-May-14

- **Line Item Completion**
  - 0.8% 09-May-14

- **Line Item Completion**
  - 0.0% 09-May-14

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Benefits of Using BIM

- Federated 3D Project Information Model
- Appropriate Level of Detail
- Automated Clash Detection
- 3D BIM
- Collaborative Design Reviews
- Audited comments and resolution
- 5D BIM
- Model Linked To Cost Items
- 4D BIM
- Model Linked To Construction Sequence
- Bill of Quantities

Federated 3D Project Information Model

- Appropriate Level of Detail
- Automated Clash Detection
- Collaborative Design Reviews
- Audited comments and resolution
- Hazards and risks identified & mitigated
- 3D BIM
- 5D BIM
- 4D BIM
- Model Linked To Construction Sequence
- Bill of Quantities

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Any Questions...?
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