

Development of Light Rail Dublin- Luas

- High level overview
 - Involvement in all phases from 1997 to 2017- development, design, funding, statutory approval, tender, construction, commissioning, operations
 - Outline of presentation
 - What is light rail/modern tramway?
 - Brief description of the Dublin LRT
 - Dublin experience
 - Developments following opening of initial lines
 - Lessons learned
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What is Light Rail Transit (LRT)

- Rail based urban public transport system mainly using street space.
 - Intended to achieve 70% to 80% of the benefits of a metro type system for a fraction of the cost
 - Three fundamental requirements to deliver the required quality and level of service.
 1. Segregated alignment - not sharing lanes with other road vehicles- similar to bus lanes
 2. Priority for LRT vehicles at traffic lights-get a proceed aspect as a tram approaches a junction.
 3. Carrying capacity of the system is compatible with the demand on a chosen corridor.
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Dedicated Lanes

- Success requires a commitment to dedicate the necessary road space exclusively to trams- space is often a scarce and valuable resource in city streets
 - Tram makes efficient use of space for movements in city streets when compared to cars
 - Tram lane – medium capacity of say 5000 people per direction per hour
 - Tram passes every three minutes which improves the overall environment and it is not a major barrier to pedestrians
 - Car lane in an urban environment has a capacity of say 1300 people per direction per hour
 - Car passes say every 4 seconds on average.
 - Space required for parking
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Urban Insertion

- LRT can make urban space more attractive yet maintain accessibility
 - Enhanced image of a city
 - LRT can accommodate various surfacing types - grass, paving, black top, timber
 - Electrically driven, environmentally friendly
 - Careful design of LRT components- stops, equipment cubicles, OCS supports.
 - Vehicle design- interior and exterior
 - Minimum curve radius of 25m facilitates integration-relatively sharp curves
 - Gradient up to 6%
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Luas Surfacing



Preservation of Historic Fabric



Mayor Square Stop



Grass Track



LRT Vehicles

- Most visible element of modern LRT system
 - Low floor development (100%, 70%) - easier to insert into cities
 - Attractive interior and exterior
 - Good braking capabilities in an emergency - magnetic brake
 - Multiple doors to facilitate entry and exit and reduce dwell times
 - Cabs at both ends
 - Easy to access given the low gaps that can be achieved with the platforms
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Tram



Luas Vehicle - platform interface



Tracks and Depot

- Double track rail line
 - Normally top of rail is level with the road surface
 - Can accommodate parallel and cross traffic movements
 - Use of grooved rail
 - Depot -store trams, maintenance functions, administration.
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Luas street tracks



Aerial view of Depot on Red line



Traction System

- System is electrically driven
 - Need to provide a cable staggered over the track centre line energised at a nominal voltage of 750V
 - Current is taken from the grid and is transformed and rectified to normally provide an DC 750 V output supply
 - Substations are required to house the necessary electrical equipment and control systems.
 - Apart from the single overhead cable over each track the remainder of the power cables are located in ducting underground in order to reduce the visual clutter
 - Overhead wire can be supported by poles or fixing to buildings
 - Regenerative braking and on board storage of energy
 - System without catenary are in use but not in Dublin
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Tram wire overhead system



Catenaryless power supply in Bordeaux



Pont de Pierre, Bordeaux

Control System

- Central Control System (CCS)
 - Automatic Vehicle Location System (AVLS)
 - Fixed Equipment SCADA System
 - Power Supply SCADA System
 - Stop Passenger Information Display (PID) System
 - Stop Public Address (PA) System
 - Radio Transmission System
 - Cable Transmission Network (CTN) System
 - Telephone System
 - Emergency Telephone System
 - Video Monitoring System (CCTV)
 - Timing System
 - Line Signalling System (LSS)
 - Depot Control System (DCS)
 - Automatic Fare Collection (AFC) System
 - Fire detection and ventilation
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Control Room



Passenger information displays



Utilities

- Any new LRT in a street environment will have a major interface with utilities
 - Need to move them in order to avoid construction clashes and to avoid disrupting operations in order to repair or make connections to them.
 - There is often no reliable record of where they all are
 - Investigate records, survey, slit trenches.
 - Finding space for the diversions can be a challenge
 - Co-ordination with the myriad of utility providers is challenging
 - The problems are often underestimated in new LRT proposals
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Utility Works



Project Phases

- **Feasibility Study** -route options, demand analysis, high level cost, public consultation, funding sources, decision to proceed
 - **Creation of Project Team**
 - **Approval**- surveys, design of selected route, environmental impact assessment report, public consultation, property acquisition if required, more detailed costing, application to relevant body, approval to proceed..
 - **Procurement**-procurement strategy, funding mechanism, tender documents, tender evaluation, contract(s) award.
 - **Construction**-contract management, detailed liaison with stakeholders
 - **Commissioning**- testing, staff training, safety approval
 - **Operations**
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Dublin City Centre

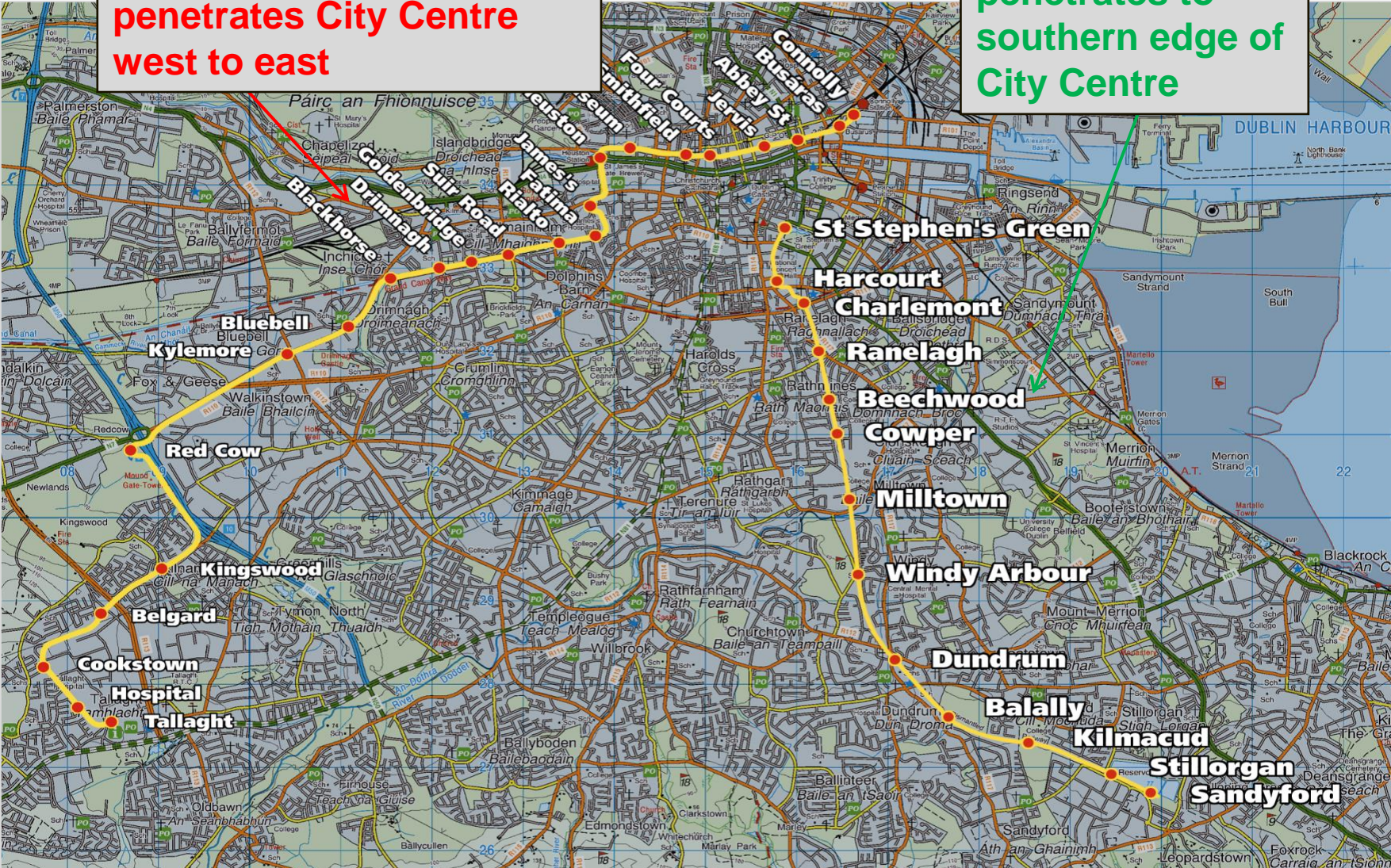


- Relatively narrow streets
- Space constraints
- Use of busy city centre streets for Luas alignment

Lines opened in 2004

Red line 15 km penetrates City Centre west to east

Green Line 9 km penetrates to southern edge of City Centre



Construction works City Centre



Construction works City Centre



Procurement strategy-Dublin

- Enabling works contracts such as utility diversions, depot, bridge works
 - Separate contract for rolling stock including maintenance
 - Main contract for trackworks, power and systems, surfacing, stops, traffic control system
 - Fixed assets and rolling stock owned by the state.
 - Separate contract for operation which also included infrastructure and rolling stock maintenance.
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Dublin Experience

- Public debate in relation to light rail/metro
 - Prediction that proposed patronage would not be realised.
 - Lack of understanding of a modern LRT system
 - Concern re disruption during construction
 - Political decision to create two separate lines
 - Negative press coverage in relation to disruption
 - Lines were successfully constructed in the City Centre
 - Green line opened in June 2004 and the Red line in September 2004
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Dublin Experience

- Extremely positive reaction on opening- opinion practically changed overnight
 - Queues of up to 400m to travel on the system which was free for three days
 - Patronage higher than expected
 - Predicted positive cost to benefit ratio was confirmed.
 - High off peak usage
 - System made an operating profit
 - Proposals to increase capacity
 - Proposals to extend the system
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Further network enhancements

- 30 m trams on the Red line extended to 40 m
 - Purchase of extra 40 m trams
 - Extension to depots
 - Extension of Red line eastwards opened in 2009
 - Extension of Green line southwards opened in 2010
 - Spur to City West off the Red line opened in 2011
 - Extension of Green line across the city centre making a connection with the Red line and continuing further North opened in 2017
 - Trams operating on Green line extended to 50m
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Bridge on Red line extension



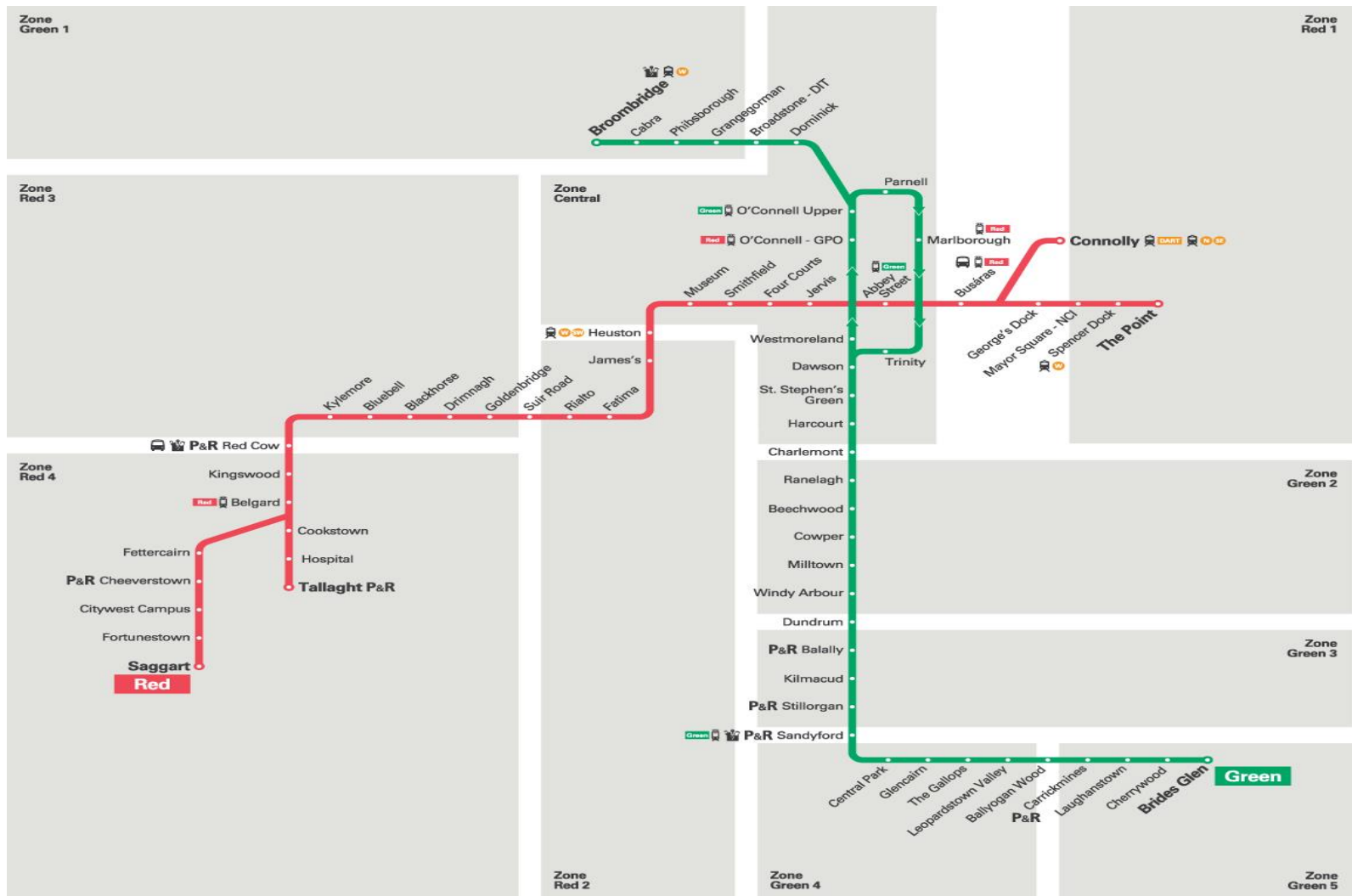
Stop on Red line extension



Tram on Green line



Current Luas Network



Initial operating results

Patronage (Passenger Trips) and Commercial Results Since Inauguration



Luas Operational Surplus/Deficit*:

€'000

- 2004 – €1.453-
- 2005 – €0.228
- 2006 – €5.646
- 2007 – €6.868
- 2008 – €6.174
- 2009 – €2.744
- 2010 – €1.130
- 2011 – €3.303-

* before interest and tax

Lessons learned

- Public concerns always present at the planning and construction stage of projects
 - Need to fully explain the concept of LRT and its advantages
 - Set a competent project management structure to deliver the project
 - Set backs are inevitable at some stage
 - Travel to other systems in operation can be very helpful in understanding the concept
 - Need to engage constructively with stakeholders at all stages in the process
 - Need to consider and address issues related to the effect on business along the route during the construction period
 - Have realistic time lines.
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Lessons learned

- Have detailed requirements in contract documents in relation to managing disruption, site hoardings, signage-priced at tender stage
 - Maintain a good information process in relation to the project especially during the construction stage
 - Have some unique features in the design that reflect your city
 - Ensure there is an operating input into relevant parts of the design
 - Allow sufficient time at the commissioning stage to successfully introduce the new LRT system
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Funding of LRT Dublin

- Initial lines were largely funded by the exchequer with a limited amount of EU funding
 - EIB loan
 - Significant private sector funding for extensions of up to 50% of the capital cost by way of
 - Provision of some infrastructure by developers.
 - Land at less than market value
 - Integrating stops into development
 - Planning levies
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Medium sized French cities with LRT

Name	Opened	Length
Angers	2011	12.3 km
Brest	2012	14.3 km
Dijon	2012	19.0 km
Le Harve	2012	13.0 km
Reims	2011	11.2 km

Success of Luas

- Shift from private transport modes
- Improved perception of public transport
- Increased land values (20%+)
- Urban regeneration
- Increased retail footfall (30%)
- Increased opportunities (social inclusion)
- Private sector contributions to projects
- High quality service results in rapid changeover to public transport
- System makes an operating profit
- Very positive public attitude to the Luas

