

# Three ULTra Case Studies

examples of the performance of the system in three different environments

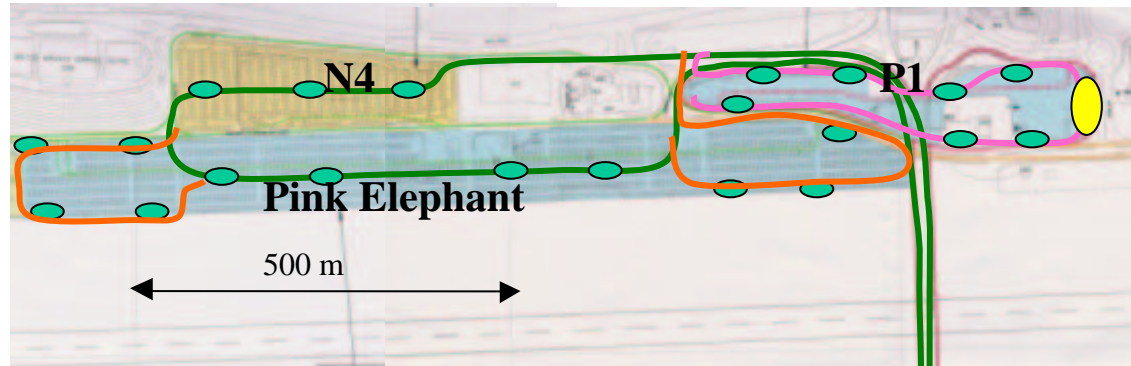
- **airport application: London Heathrow** : linking business and staff car parks through the access tunnel into a redeveloped Central Terminal Area, replacing the existing shuttle buses. 8,000 passengers per day, cost (including capital) £0.80 per passenger trip, saves 8.4 minutes per trip
- **urban application: Cardiff**: links city centre with newly developing Bay Area. 15,000 passengers per day at £1 fare. Revenues likely to cover operating costs and capital costs at 6%
- **greenfield site application: Corby**: links extensive greenfield development to existing town centre. 37,000 passengers per day. Direct comparison with alternative LRT network. ULTra attracts 70% more passengers than LRT, and 17% of current car users. Covers capital costs at 6%, while LRT falls far short.

# ULTra for Heathrow

## LHR Objectives

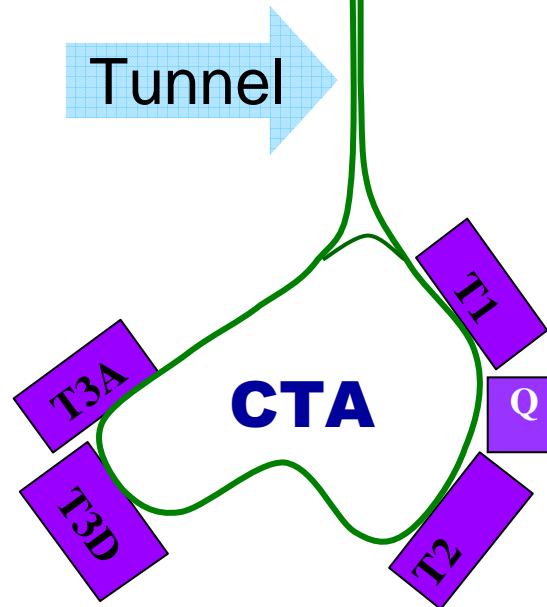
- solve critical problems of congestion in tunnel access to Central Terminal Area (CTA) - both for staff and air passengers
- alternative to the Kiss and Fly drop off in the CTA
- transport solutions that minimize impact during construction and operation
- high availability operation
- highly resistant to disruption of service

# Heathrow



ULTra connects three northside passenger and staff car parks to Central Terminal Area (Terminals 1, 2 and 3)

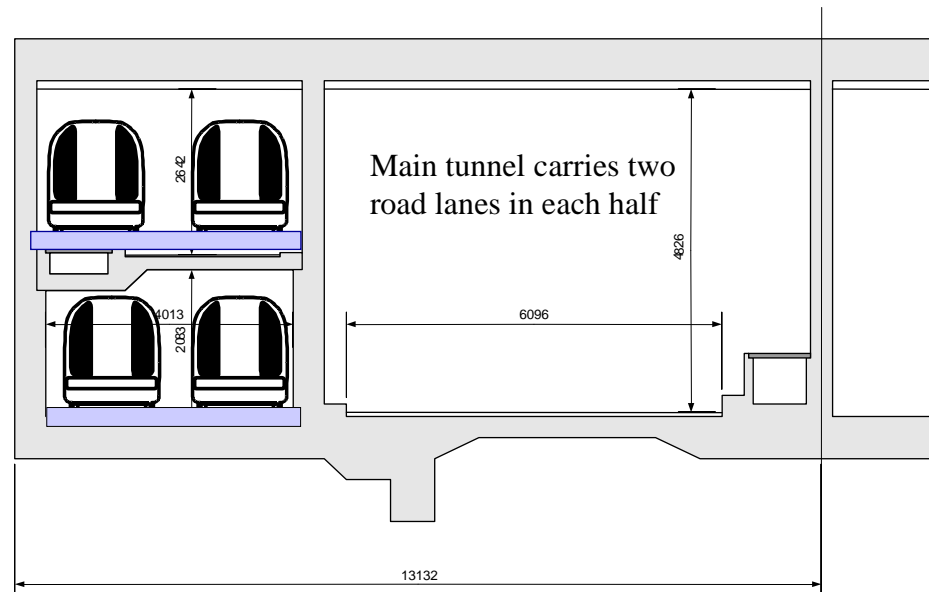
PRT guideways carried in existing sidebores alongside main road access tunnel



*7.6 kms guideway, 2.4 kms elevated, 27 stations (simple berths in car parks), 78 vehicles*

# Tunnel Links

- Existing sidebore tunnels are well matched to ULTra
- Up to four tracks per sidebore
- Full use of sidebore offers considerable excess capacity over north side connectivity requirements
- Outline Safety case approved by HMRI



# Car Park & Terminal Connections

## Results of Initial Studies

- Excellent service to car parks can be provided
- Service to stops at Terminals 1, 2, 3 with stations inside buildings where appropriate
- Unexpectedly simple integration with complex CTA site
- Small scale infrastructure permits service at high or low level floors
- Low interference during construction
- Simulation results confirm practicability

# Travel Times\* by ULTra vs Bus

Car Park	Users per Day	Time Shuttle Buses	Time ULTra	Time Saving minutes	Time Saving %
Pink Elephant	3590	16.0	6.8	9.2	58%
Park 1	532	6.4	4.0	4.0	38%
Staff N1/N2	3014	18.0	6.9	11.1	62%
Staff N4	2034	15.0	5.0	10.0	67%
Average	9170	16	6.3	9.7	60%

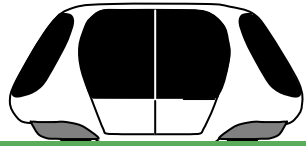
*\*Time in minutes includes sum of walking, waiting and trip*

# Cost Benefit Analysis

**Results** based on detailed costing, reported car-park demand, travel time measurements and simulation of network

- User benefits (time saved) £5 million p.a.
- Operating costs £0.7 million p.a. less than shuttle buses
- Capital cost (incl. vehicles) £3M per kilometre
- First year rate of return 25%
- 30-year Net Present Values at 6% discount:
  - £88M user benefits; £12.5M operator benefits
  - overall NPV after investment £73M

*(some of user benefit could be converted to higher charges if required)*
- Reduced emissions by 2.9 tonnes CO, 0.9t VOC, 12.9t NO<sub>x</sub>, 1.7t PM<sub>10</sub>, 311t CO<sub>2</sub>
- Noise much lower than background



# Conclusions for LHR

- ULTra is excellent solution to landside transport needs of LHR
- Excellent value for money, especially compared to APM: 30-year NPV of +£73M at 6% discount
- Saving in operating cost of 40% over current bus service
- Typical passenger time saving of 60%
- Premium service for passengers
- Valuable reduction in emissions
- Risks of introduction are manageable

## Benefits to BAA

- *Reductions in emissions*
- *Improved passenger service*
- *Efficient use of space*
- *Value for money*



# BAA Position (October 2005)

- ULTra selected as preferred PRT system for Heathrow
- Contract Awarded for Detail Route Design Studies
- Installation 2007
- Expanded installations 2009 and on against 20 year framework contract

# ULTra for Cardiff

## Cardiff Objectives

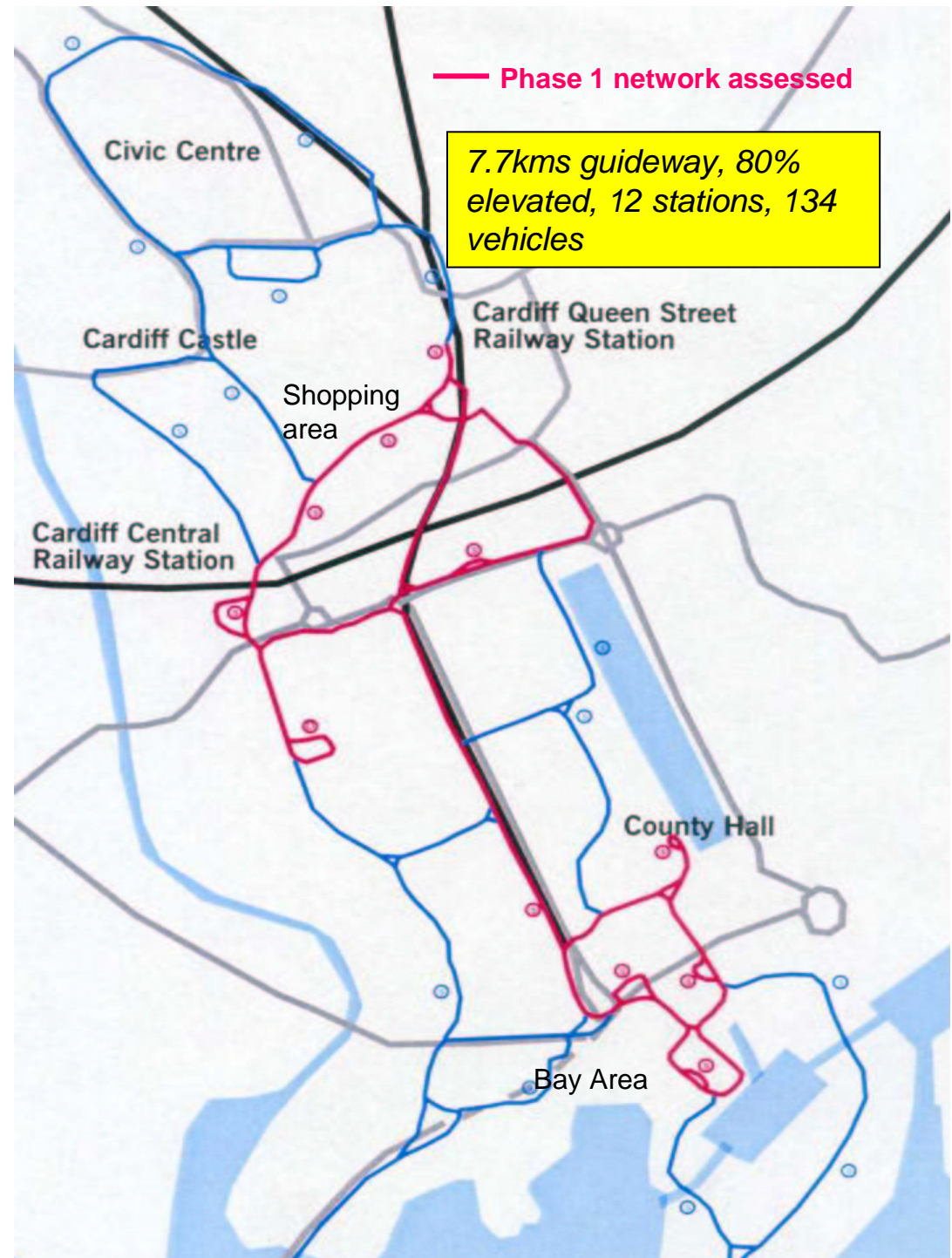
- improve public transport connections between city centre and rapidly developing Bay Area
- support Cardiff's development as a thriving and attractive European Capital City, serving commercial, retail and leisure activities in the Bay
- protect and enhance the new environment, encouraging transfer from car to public transport and reducing air pollution from traffic
- address the needs of those people who are most disadvantaged

# Cardiff

capital city of Wales, is rapidly redeveloping its old docklands with shops, leisure facilities, offices and homes. PRT provides high quality access to the Bay Area, with fast, non-stop, no-waiting and private access direct to the major attractions.

Phase 1 network (red) assessed in detail – blue shows envisaged future expansion.

Transit time from Central Station to the Bay Area is about 5 minutes. £1 fare assumed



# System performance

**DEMAND** for Phase 1 predicted by logit modal split modelling calibrated on Stated Preference surveys:

- 5.7 million passenger per year
- cost of £0.72 per trip
- attracts 8% commuters from car, 60% bus users, 9% from short walks
- average waiting time 0.3 minutes – most passengers don't wait at all
- **PLUS** attitude surveys of riders on prototype vehicle show very positive acceptance
- and disability audit shows system is more accessible to disabled and elderly people than conventional public transport

# Benefits of the system

**BENEFITS** assessed using standard social cost-benefit methodology:

- saves 900 hours of passenger travel time per day (average 3.5 minutes/passenger)
- saves 65,500 car-kms per day
- transfer from car saves congestion worth £1.7M per year
- reduced road traffic casualties (mainly pedestrian) saves £0.5M per year
- saving in energy equivalent to 3M litres of fuel per year
- net reduction in pollutants of 45 tonnes of CO, 3.5 tonnes VOCs, 5.7 tonnes NO<sub>x</sub>, 0.3 tonnes particulates, 3750 tonnes of CO<sub>2</sub>

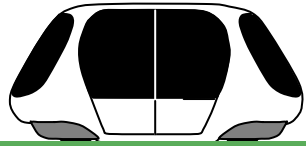
# Financial prediction

## Costs:

- total capital cost (including vehicles) £4.5M per guideway km
- annual operating cost £2.05M
- revenue £4.30M
- system not only covers operating costs but
- returns about 6% on capital investment

**Net Present Value** over 30-year life of benefits plus revenue less operating and capital costs:

- +£142M if discounted at standard 6%



# Conclusions for Cardiff

- ULTra easily covers its operating costs
- comes very close to covering capital costs at standard public sector 6% discount factor even at the low £1 fare assumed (and in practice is likely to do so completely as travel patterns adapt to make more use of PRT).
- Surveys of passengers riding the prototype show they are willing to pay several times this fare, and are very enthusiastic about all aspects of the system.
- Commuters transferring from car to public transport plus PRT increase bus and rail use by 5%.
- Large social benefits give a very good rate of return:  
+£133M NPV, benefit/cost ratio 392%, first year rate of return 27%

Conventional public transport cannot meet this performance.

# ULTra for Corby

## Objectives

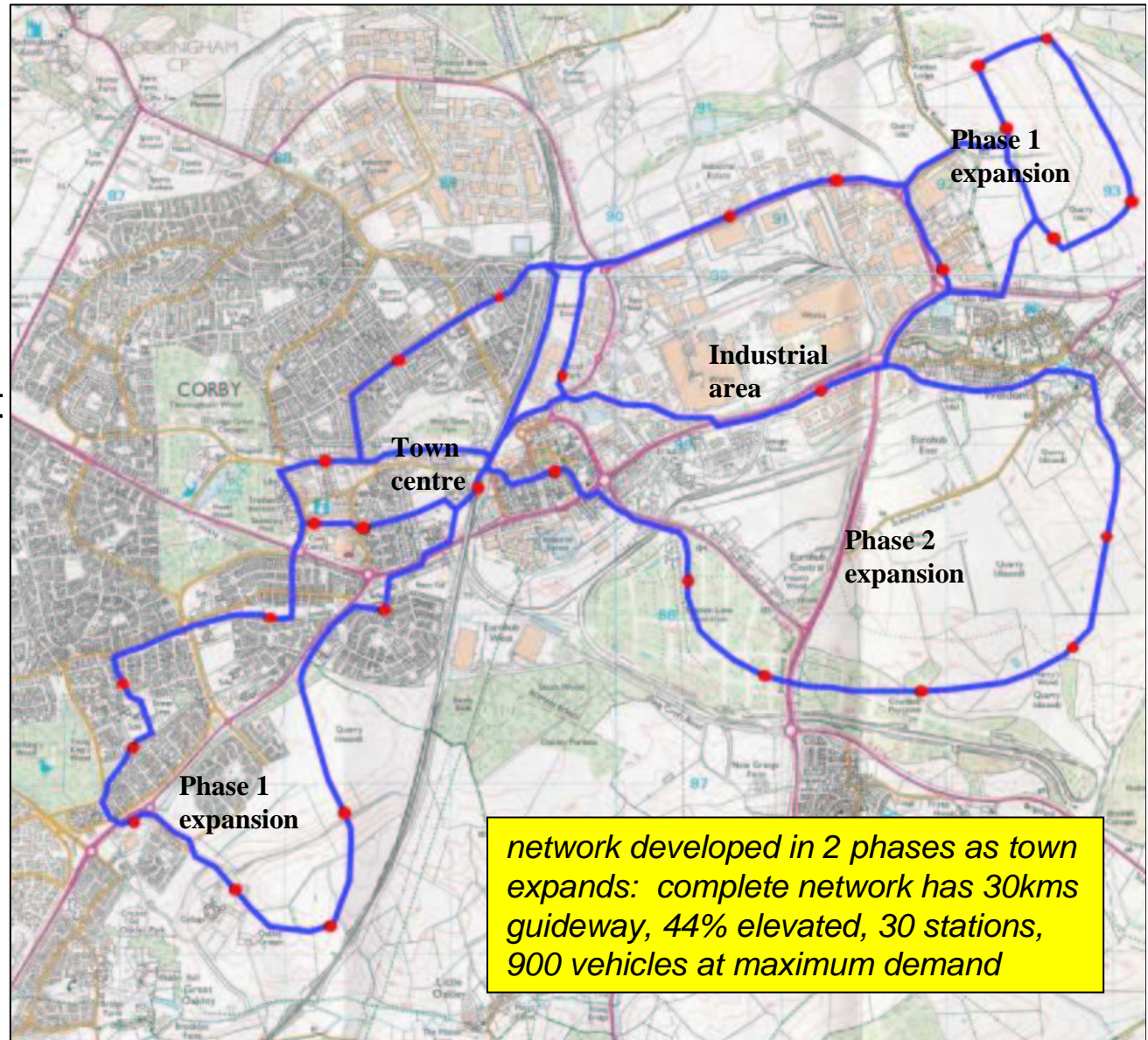
- link rapidly expanding new development on greenfield sites to a modernised town centre
- make the centre attractive by bringing passengers directly into the shops and facilities
- increase the use of public transport in the town (currently very low)
- contribute to an environmentally sustainable transport policy
- provide a direct comparison with LRT as an alternative



# CORBY

has seen much of its traditional industry vanish, but is rapidly modernising. It plans much new development on greenfield sites, and the town centre is to be renewed.

A recent study evaluated a proposal for conventional LRT, giving opportunity for direct comparison of PRT with LRT

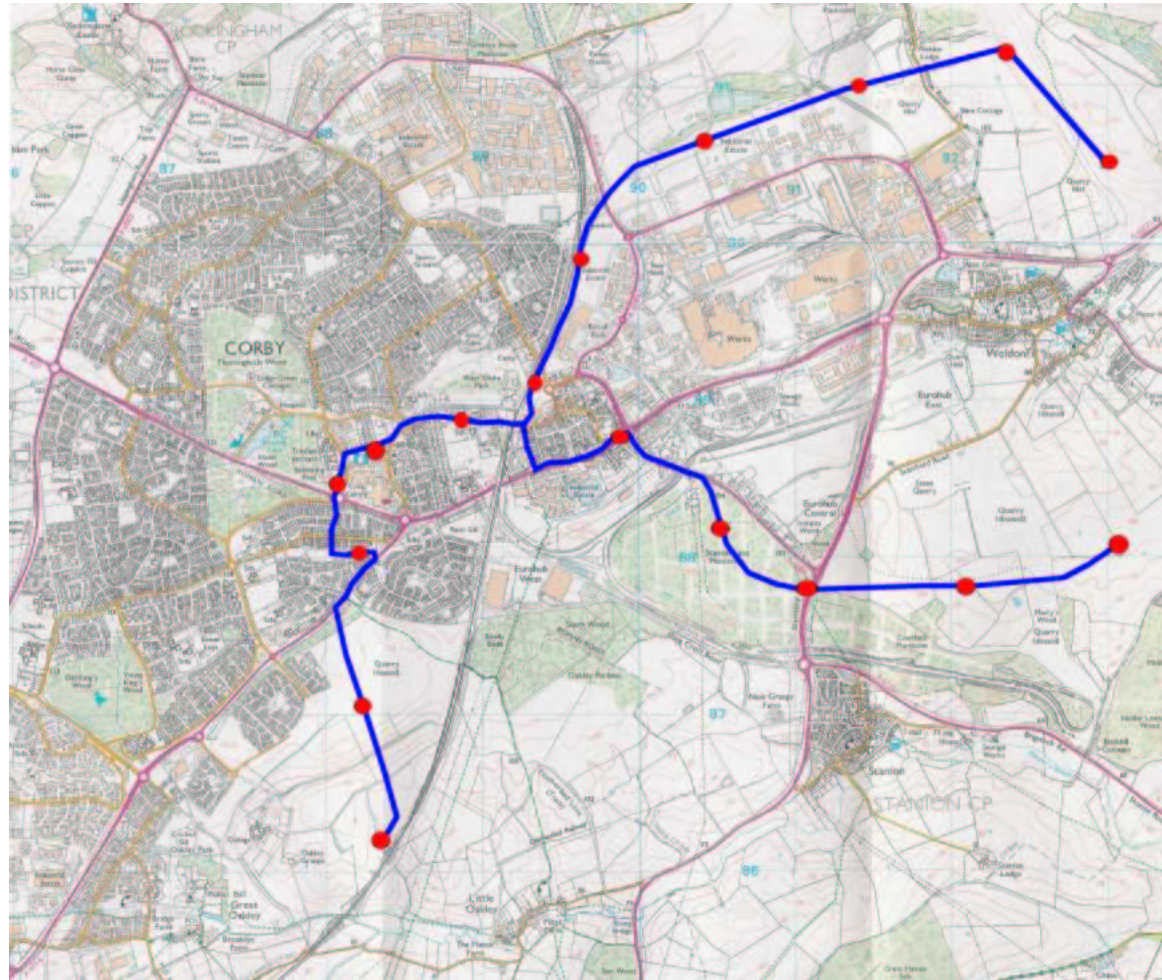




# PRT vs LRT serving the same areas

Colin Buchanan & Partners had recently analysed a proposed LRT system for Corby. The same trip matrices and modal split model were used to provide comparison on exactly the same basis.

Developed in two phases, the full system has 28.4 kms of track



# Demand

Both PRT and LRT serve same catchment area, but ULTra's loops improve access for passengers on edges of area compared with corridor LRT.

**DEMAND** predicted in first year of operation of full system (both phases) :

## ULTra

13.4 million passengers  
17% transfer from car  
19.3% of all trips in area  
£15.1M revenue  
@ £1.13 average fare

## LRT

7.8 million passengers  
10% transfer from car  
11.4% of all trips in area  
£8.5M revenue  
@ £1.09 average fare

# Costs

	<b>ULTra</b>	<b>LRT</b>
Total capital cost per track km	£3.2M	£3.3M
Operating cost p.a.	£5.1M	£5.8M

Although the guideway costs of ULTra are much less than those of LRT, PRT attracts almost twice as many riders as LRT and therefore requires much higher vehicle capacity. The requirement for 895 vehicles makes the overall investment similar to that for LRT, but the performance is much superior.

# COST-BENEFIT ASSESSMENT

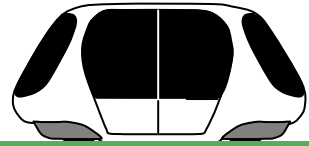
- **30-year financial NPV** (revenue less operating and capital costs)

+£4M ULTra

-£69M LRT

ie both systems cover their operating costs, but LRT falls far short of covering its capital costs (at 6%) while ULTra covers both operating and capital

- **30-year NPV of social benefits less costs** is +£188M with a benefit/cost ratio of 260%
- **Social benefits** include £16.9M in passenger time and money savings, accident cost savings at £0.2M, energy savings at £0.4M per year. Mean passenger waiting time is 0.3 minutes
- **Reductions in air pollution** of 62 tonnes CO, 5 tonnes VOCs, 10 tonnes NO<sub>x</sub>, 1 tonne particulates, and 3600 tonnes CO<sub>2</sub> per year. Noise is below background.



# Conclusions for Corby

- very strong case for ULTra in Corby, both financially and socially
- covers both operating costs and capital
- attracts over 70% more passengers than LRT, 17% transfer from car: high socio-economic NPV
- PRT offers an excellent modern underpinning to the new development, can be integrated architecturally, and run within new stores in the town centre.
- even in the older parts of town, roads are wide enough to offer many practicable and aesthetically acceptable routes
- in the new developments it can be designed integrally to offer maximum accessibility with minimum severance, and enhance the attractiveness of both residential and commercial areas.