RPA
Railway Procurement Agency

METRO NORTH ORAL HEARING

PROOF OF EVIDENCE TRANSPORT MODEL

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Metro North Oral Hearing
Proof of Evidence
Transport Model
David King

1.0 INTRODUCTION

1.1 My name is David King and I currently hold the position of Transport Planning Manager within the RPA.

1.2 I have five years' experience in transport planning and have been employed by the RPA for the past six years.

1.3 I hold a first class honours degree in Engineering and a Masters Degree in Engineering. I am a qualified Project Manager and I am also a member of Engineers Ireland.

1.4 My experience includes the examination of the demand and revenue and for light rail and Metro systems in Dublin.

1.5 My evidence is concerned with the Transport Model used to forecast demand for Metro North.

1.6 In my evidence I will:

- 1.6.1 First, describe how demand is forecast;
- 1.6.2 Secondly, describe the demand model tests undertaken including assumptions made;
- 1.6.3 Thirdly, summarise model outputs and the demand forecast results;
- 1.6.4 Fourthly, Discuss Capacity versus Forecast Demand;
- 1.6.5 Fifthly, The Airport Stop, and;
- 1.6.6 Finally, discuss the conclusions that can be drawn from the Transport Model.

2.0 HOW DEMAND IS FORECAST

2.1 Future Year Demand is forecasted using a multi-modal transport model, in the case of Metro North using a transport model that was built specifically for RPA and which has been independently validated.

2.2 The purpose of these forecasts is to assess the likely demand on Metro North in the future.

2.3 A model is a simplified representation of a system. Transport demand models are used to represent the key elements of the travel demand process using mathematical equations.

2.4 In 2001, on publication of the Dublin Transportation Office (DTO) strategy document 'A Platform for Change' it became apparent to RPA that a robust methodology for forecasting Luas, Metro and other transport initiatives in Dublin was required to support the study and introduction of new projects.

2.5 In order to prove the transport feasibility of any RPA project, RPA develop forecasts of patronage and revenue. The forecasting methodology used must be robust enough to ensure confidence in our patronage and revenue estimates.

2.6 It was decided by RPA, on advice from consultants, that a transport forecasting model be developed so that RPA can forecast project patronage and revenue with confidence.

2.7 This model was developed by consultants Steer Davies Gleave in 2002 and 2003 and was independently audited by consultants MVA in 2003.

2.8 Since then the model has been successfully applied to the following projects.

- Luas Red and Green Line Patronage and Revenue Forecasts;
- Luas Fare Structure;
- Metro North OBC (Outline Business Case), Route Selection and EIA (Environmental Impact Assessment);
- Irish Rail interconnector Feasibiltiy Report 2003;
- Department of Transport (DoT) integrated Fares Strategy 2004;
- Luas Line B1 Route Selection, OBC, EIS, Evidence at Public inquiry and Final Business Case;
- Luas Line C1 Route Selection, OBC, EIS, Evidence at Public inquiry and Final Business Case;
- Luas Line A1 Route Selection, OBC, EIS, Evidence at Public inquiry and Final Business Case;
- Metro West Route Selection;
- Luas Line F, Feasibility and Route Selection;
- Integrated Ticketing Project Feasibility and OBC;

- Luas Capacity Enhancement Projects;
- Various RPA feasibility studies.

2.9 The application of the model results in the projects has also been subject to numerous, successful, independent audits.

2.10 In summary the primary functionality of the RPA model is to allow RPA to forecast Luas, Metro and other transport demand with confidence into the future:

2.10.1 To enable RPA to robustly demonstrate the case for new projects and investment;

2.10.2 To allow RPA to prove the feasibility of new lines and take forward the development of the proposed network in greater confidence;

2.10.3 To assist assessment of future demand and capacity requirements on existing lines; and

2.10.4 To forecast future revenue on existing and new projects.

2.11 The RPA model predicts demand for an average hour within the am peak period of 7:30 to 9:30.

2.12 The RPA model predicts demand for an average off peak hour within a period of 13:30 to 15:30.

2.13 The current RPA model is designed to produce demand and revenue forecasts for the base year (2000) and one forecast year (2016). The year 2016 was adopted as it represented the end of plan period covered by the DTO “A Platform for Change” strategy.

2.14 There are two basic data system inputs to the model that are interrelated. These are:

2.14.1 Demographic data for the base and future years. Forecasts of future population and employment throughout the region and;

2.14.2 A public transport network and highway network that allow the travellers in the model to move from zone to zone.

2.15 The demographic data for the base and future year use a zonal system to represent the geographic extent of the model. The RPA model is divided into over 700 zones and covers the Dublin Area and hinterland.

2.16 The zone structure used is largely based on EDs (Electoral Divisions) with disaggregation of the zones around the Metro North Alignment and other public transport.

2.17 The highway and public transport are represented using a network. The two systems are interrelated through the use of centroids. Each zone is portrayed on the network by a point (centroid) which holds all the demographic data for that zone. The centroid is connected to the adjacent network through links. Every zone is connected to the network so it is possible for trips from each zone to reach every other zone by way of a number of paths though the network.

2.18 Land use forecasts have been supplied to the RPA by the Dublin Transportation Office (DTO) and the local authorities. The land use forecasts used in our model are based on the current projections from the local authorities.

3.0 DEMAND FORECASTING TESTS UNDERTAKEN FOR METRO NORTH

3.1 The purpose of these forecasts is to assess the likely demand for Metro North in the future year.

3.2 The methodology involves the use of future year demand forecasts which seek to represent how people will travel in the Greater Dublin Area. As land becomes developed trips are generated from it and attracted to it.

3.3 The forecasting methodology seeks to represent how choices are likely to be made between different modes of transport (public and private transport) and the particular routes and services which are likely to be chosen.

3.4 The land use data have been utilised by RPA to develop passenger forecast demand in both the morning and off peak periods using the RPA transport model.

3.5 In order to assess the effect of the proposed Metro North scheme the transport model is run with two different scenarios.

3.6 The first scenario is called the Do-Minimum. This scenario assumes that the projected land use forecasts are met without Metro North included.

3.7 A second scenario is then run where Metro North is included. This is called the Do-Something scenario and this scenario includes all the assumptions of the Do-Minimum scenario plus Metro North.

3.8 The difference between one scenario and the other gives us an indication of the effect of the Metro North scheme.

3.9 Metro North was specified for the demand modelling work with a morning peak hour headway of 4 minutes.

3.10 The demand forecasts for Metro North also assume that future year bus proposals as outlined in the DTO strategy document 'A Platform for Change' are in place. This envisages an extensive network of quality bus services in the region and throughout the study area.

3.11 For the model tests conducted for Metro North the assumed transport network reflected included:

- Line BX Preferred Route;
- Metro West Preferred Route;
- Line B2 Preferred Route;
- Luas Line D;
- Luas Line F;
- Interconnector Services as defined by Irish Rail.

4.0 MODEL OUTPUTS AND FORECAST DEMAND RESULTS

4.1 The outputs from the model are as follows:

4.1.1 Line Flows. The line flows show the number of passengers per peak or off-peak hour who board and alight the tramway and metro at each stop, and give the respective loading at each stop;

4.1.2 Demand by Mode, for example, Rail, Bus, Luas and Metro.

4.1.3 The outputs from the RPA transport model results can be applied to estimate the benefits resulting from Metro North

4.2 The demand forecasts indicate that the introduction of Metro North will produce in excess of 40 million trips per annum in 2016.

4.3 The maximum forecast passenger demand (lineflow) in the morning peak hour is approximately 6,000 passengers per direction per hour. Metro North will operate initially with a capacity of 10,000 passengers per direction per hour. (See table)

4.4 This peak lineflow occurs at DCU on the Metro North Southbound service

5.0 DEMAND, CAPACITY AND FUTURE GROWTH

5.1 Metro North will be designed and constructed so that it can provide adequate capacity in a cost effective manner for the projected levels of initial demand and also be capable of being expanded to provide additional capacity as demand increases over time;

5.2 Services will be regular and frequent to ensure that passengers do not have long waiting times at Metro stops. Initially, at peak times, Metro services will operate every four minutes. As demand grows, the frequency of services will be increased to every two minutes;

5.3 Metro North will operate initially with a capacity of 10,000 passengers per hour per direction. Demand will grow over time with growth in population and employment along the Metro North catchment. Metro North has been designed so that its capacity can be increased incrementally to 20,000 ppdph over time to meet this growing demand;

5.4 Capacity greater than 20,000 ppdph is typically only provided in high density cities (>4,000 persons per km^2). Dublin has a density of 1,300 persons per km^2. (See table of comparable cities)

5.5 Demand

5.5.1 Demand is the actual number of people travelling on a railway past a certain point, over a given period of time;

5.5.2 Maximum demand is the actual number of people travelling on the busiest section of a railway, over a given period of time;

5.5.3 Demand varies along a route and over time;

5.5.4 Demand is measured in passengers per direction per hour.

5.6 Capacity

5.6.1 The capacity of a railway is the maximum number of passengers it can carry at any particular point on the line, over a given period of time;

5.6.2 The capacity of a railway is the capacity of the vehicle operating on that railway multiplied by the number of services per hour;

5.6.3 Capacity is fixed for a given service pattern;

5.6.4 Capacity is also measured in passengers per direction per hour;

5.7 As mentioned above initial capacity of Metro North is 10,000 persons per direction per hour (ppdph). This initial capacity will be provided by running 90m plus vehicles every 4 minutes in the peak period. The system is being designed to be easily upgraded to at least 20,000 ppdph by lowering the peak headway to 2 minutes. It is not expected that a further capacity increase will be required within the 30 year appraisal period;

5.8 In addition to estimating total Metro North patronage, the demand modelling is used to inform the appropriate system size;

5.9 But how may peak hour demand grow over time? RPA have examined the possible effects of changes to transport policy, expansion of the public transport network for example in order to ascertain how they might affect the sizing of the system: These include: Full Public Transport integration (fares and bus services), Demand Management measures (e.g. No free employee parking; cordon charging), Development of the public transport network beyond Transport 21 (A Platform for Change), and growth in peak trip demand per annum linked to economic factors and increasing population size

5.10 Forecast peak hour demand on Metro North in 2040 was determined based on all growth assumptions outlined above being realised;

5.11 The maximum forecast passenger demand (lineflow) in the morning peak hour is approximately 18,000 passengers per direction per hour in 2040 which is below the future Metro Capacity of 20,000 passengers per direction per hour. (See table)

6.0 DUBLIN AIRPORT

6.1 The total forecast passenger use at the Airport Stop (passengers boarding and alighting metro both northbound and southbound) in 2016 is approximately 3,700 during the AM peak hour.

6.2 The Airport Stop is designed to cater for over 13,000 boarders and alighters per hour, and thus has significant reserve capacity to cater for long term growth at the Airport. (See table)

6.3 Our forecast demand for Metro North suggests that Metro has significant spare capacity arriving at Airport from Swords in a.m. peak (see graph). Our modelling suggests that in the AM peak hour there is demand for 500 boarders on Metro North Southbound. This results in a peak hour directional lineflow at the airport in the order of 5,700. This implies that there is spare capacity at the airport of 4,300 in the AM peak hour. (See graph)

6.4 The peak hour for the airport occurs before the traditional AM peak hour of 8.00 – 9.00. This implies that there will be additional spare capacity at the airport stop during their peak hour.

7.0 CONCLUDING REMARKS

7.1 The demand forecasts indicate that the introduction of Metro North will produce in excess of 40 million trips per annum in 2016.

7.2 The maximum forecast passenger demand (lineflow) in the morning peak hour is approximately 6,000 passengers per hour per direction. Metro North will operate initially with a capacity of 10,000 passengers per hour per direction.

7.3 Forecasts also suggest that the demand on Metro north will be within the capacity capability of Metro north with upgrades up to and beyond 2040.

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