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file note

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From	SDG		
Project	Leeds NGT	Project No.	207595

Subject Application of TUBA for scheme appraisal

Introduction

This note outlines how TUBA was used in the appraisal of the Leeds New Generation Transport (NGT) scheme.

Appraisal process

TUBA formed one element of an appraisal that brought together inputs from a range of sources. Separate TUBA runs were used to estimate benefits or disbenefits to public transport, highway and Park & Ride users. These elements were combined with cost information in a spreadsheet to calculate an NPV and BCR for each option. This approach was partly dictated by the complexity of the models and the size/number of output files – a combined TUBA file containing all PT and Highway inputs and cost information simply could not have been run or assured. The approach offers further advantages over a combined TUBA run, including allowing flexibility to undertake many of the required sensitivity tests without requiring additional TUBA runs.

The results of each TUBA run was output as a '.csv' file using the 'detailed results' facility and these files loaded into the appraisal spreadsheet as discounted cash flows allowing factors accounting for the build up of demand to be applied.

TUBA was used to calculate journey time benefits (for public transport, highway and Park & Ride), user charge benefits (for public transport and Park & Ride), change in vehicle operating costs (for highway), and change in indirect tax revenue (for highway only).

TUBA Inputs

Economics file

The economics file issued with TUBA v1.7b was amended as follows:

- Additional 'no pay' journey purpose added with value of time information as per 'other' journey purpose to match demand model segmentation
- Custom LGV journey purpose splits coded: 88% business, 0% commuting, 12% other, 0% no pay, taken from WebTAG 3.5.6, Table 7

Public transport run scheme file

Public transport run inputs were taken from the Public Transport demand model. Input matrices were specified as follows:

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- 2 modelled years: 2016, 2031
- 4 user classes: Business, Commuter, Other, No pay
- 2 scenarios: Do Minimum, Do Something
- 2 time periods: Morning peak, Inter-peak

Four classes of output were produced by the demand model, on an OD basis:

- Perceived generalised journey time (hours)
- Unweighted journey time (hours) – for business user journey time benefits
- User charge (£fare, 2007 prices)
- Demand (total trips over 60 minutes)

Other scheme file parameters were set as follows:

- First year 2015 (for 2015/16)
- Horizon year 2074
- Current year 2008
- Annualisation factors As detailed elsewhere in this MSBC submission
- Four user classes, one for each journey purpose

Park & Ride run scheme file

Park & Ride run inputs were taken from the Public Transport demand model and the Park & Ride demand model. These runs represented the benefits of the Public Transport portion of the journey – the impact of Park & Ride site access trip legs on the highway model were included direct via the transfer matrix. Input matrices were specified as follows:

- 2 modelled years: 2016, 2031
- 2 user classes: Commuter, Other[1]
- 2 scenarios: Do Minimum, Do Something
- 2 time periods: Morning peak, Inter-peak

Three classes of outputs[2] were produced by the models, on an OD basis:

- Perceived generalised journey time (hours)
- User charge (£fare, 2007 prices)
- Demand (total trips over 60 minutes)

Other scheme file parameters were set as follows:

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[1] Business bus passengers do not form a material proportion of the existing market – and were not in sufficient numbers to allow RP analysis to estimate an acceptable highway vs public transport model for this segment. The omission of business to PT transfer is considered to be a reasonable assumption and a prudent one for the NGT proposals.

[2] Unweighted business time benefits were not required for Park & Ride as there was no business mode shift represented.

- First year 2015 (for 2015/16)
- Horizon year 2074
- Current year 2008
- Annualisation factors As detailed elsewhere in this MSBC submission
- Two user classes, one for each journey purpose

Highway run scheme file

Highway run inputs were taken from the Highway demand model. Input matrices were specified as follows:

- 2 modelled years: 2016, 2031
- 3 user classes: Business, Commuter, Other
- 2 scenarios: Do Minimum, Do Something
- 2 time periods: Morning peak, Inter-peak
- 3 vehicle types: Car, Light Goods Vehicle, Other Goods Vehicle

Four classes of outputs were produced by the demand model, on an OD basis:

- Journey time (hours)
- Distance (km)
- Demand (total trips over 60 minutes)

Other scheme file parameters were set as follows:

- First year 2015 (for 2015/16)
- Horizon year 2074
- Current year 2008
- Annualisation factors As detailed elsewhere in this MSBC submission
- Five user classes, 3 for cars (1 for each journey purpose), 1 for LGVs (with journey purpose splits set by the Economics file), 1 for OGVs (business journey purpose only)

The 'New Mode Problem'

The Leeds NGT project elected to model NGT services as a separate mode from the existing bus service – to obtain the considerable advantages in the specification of the demand model from this approach. This presents a challenge for appraisal because no costs exist for an NGT mode in the do minimum situation. The approach taken to dealing with this has been to appraise scheme benefits at an aggregate public transport level by calculating composite costs prior to output from the demand model – consistent with the application of the highway vs PT demand model. This approach does not allow benefits to be disaggregated subsequently between NGT and existing buses. As only minor changes are assumed to be made to the existing bus service supply, it is a reasonable approximation to assume that most or all of the benefits can be assigned to NGT. The impact of the anticipated rationalisation of the existing bus network has been assessed by undertaking runs of the models with and without these changes.

Appraising Park & Ride

As Park & Ride is a mixture of highway and public transport modes, the information requirements for appraisal can be high, requiring journey times for the car leg and public transport legs of each trip. The approach adopted took public transport journey time savings only as specific to Park & Ride. The impacts of the reallocation of car journey destinations from the city centre (eg) to Park & Ride sites are included within the highway assignment model and therefore within the highway appraisal. Do minimum public transport costs are used, consistent with TUBA and WebTAG guidance (Unit 3.5.3) that the calculation of benefits should consider the change in costs for the 'destination' mode only.

TUBA Files

TUBA economics, scheme and output files for the three main MSBC options are provided with this appendix as a separate CD.

Calculations External to TUBA

Capital and Revenue Costs

Capital, renewal and operating costs are included directly within the appraisal spreadsheet rather than being specified in the TUBA scheme file. The adjustments made to these costs within the spreadsheet to obtain appraisal values are fully WebTAG compliant. The main advantages of this approach are: that cost inputs can be directly linked to the derivation of those costs, removing the need to manually enter them into the TUBA scheme file; and that factors representing year-on-year changes in these costs can be specified, rather than having to enter different values for each appraisal year. As previously stated in this note the use of this method also considerably simplifies sensitivity testing.

Revenues (and PT Indirect Taxation)

As specified earlier in this note, the TUBA approach taken was to calculate combined impacts for public transport passengers, rather than separately for existing buses and NGT. While this approach is justifiable for passenger time/economic impacts it isn't acceptable for revenues where the interaction of NGT and bus is critical to the interpretation of results. It should also be noted that PT model revenue matrix outputs are not directly equivalent to the service revenue calculations employed by the assignment model. Therefore revenue outputs from the PT assignment were included directly within the appraisal spreadsheet. These revenues were adjusted to appraisal values in a WebTAG compliant manner. A further advantage of the approach taken was the financial sustainability analysis was considerably simplified as the detailed results (including by NGT service) were directly available, rather than these calculations partially replicating TUBA functionality and potentially not being consistent.

Accidents

The impacts of changes in highway flows on accidents were derived using a spreadsheet model based on DMRB/COBA formulae and parameters. A road type split of: 40% older S2 A Roads; 40% Other S2 Roads; 20% Older D2 Roads; was adopted to represent the NGT

corridors where the majority of abstraction from highway is seen. It is noted that the results are not sensitive to this assumption. Changes in highway km assigned between do minimum and do something were taken from the relevant highway models for 2016 and 2031. Changes in bus km operated were taken from the operating cost models – buses are represented in the highway models as fixed flows and therefore not included in assigned distance totals. It was assumed that bus km would have an impact on standard highway accident numbers where they were running in general traffic lanes – therefore changes in bus km operated were adjusted by the different proportions of segregation in the do minimum and do something situations.

Carbon Emissions

TUBA outputs represent the change in carbon emissions resulting from the impacts of NGT for assigned traffic only – ie not for buses. The assumed bus network rationalisation would materially decrease the distance operated by diesel vehicles and therefore reduce the amount of carbon generated in Leeds. The appraisal value of this carbon saving was calculated in a spreadsheet model based on standard WebTAG/TUBA formulae and assumptions.

Reliability

Reliability benefits were calculated in part using TUBA. This process is described in a separate note and is therefore not included here.