NRA
An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Project Appraisal Guidelines

Unit 5.4 Zone-Based Traffic Growth Forecasting

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1 Introduction

1.1. The Project Appraisal Guidelines provide a comprehensive guidance document to scheme promoters on the methods to be used in scheme modelling and appraisal. *PAG Unit 5.2: Construction of Transport Models* provides guidance on the development of traffic models, with specific reference to the scope and functionality of traffic models. That Unit described three classes of traffic modelling:

- Static models, which reflect traffic volumes on the basis of link flows. Such models do not attempt any route assignment, and hence are only applicable for small networks where no change in traffic flows will result from a proposed scheme;
- Assignment Models which allocate demand matrices through traffic networks, thereby replicating route choice by vehicles for each origin-destination pair; and
- Variable Demand Models, which replicate demand responses where they might be expected as a result of a scheme, for example in larger towns and cities with congested road networks. These demand responses considered here comprise changes in trip rates, choice of destination and travel mode.

1.2. Table 5.3.1 of *PAG Unit 5.3: Traffic Forecasting* described the different approaches to traffic forecasting to be used with each class of traffic model. This PAG Unit sets out the methodology for application of Zone-Based growth rates for use in *Assignment* and *Variable Demand* models. This Unit of the PAG, along with *PAG Unit 5.3: Traffic Forecasting* and *PAG Unit 5.5: Link-Based Traffic Growth Forecasting*, replaces the NRA publication *"Future Year Traffic Forecasts: 2002 – 2040"*.

2. Requirements of the Traffic Model

2.1. This PAG Unit assumes that a fully validated base year model has been developed in accordance with the requirements of *PAG Unit 5.2: Construction of Transport Models*.

2.2. Ideally, Local Area Models (LAM's) for road schemes will be derived through cordoning of the National Traffic Model. Runs of the NTM with and without the scheme can be used as an initial indication of the area of influence of the scheme, and hence the geographical scope of the LAM. The actual LAM boundary would however need to be agreed with the NRA based upon a consideration of local impacts. Cordoning allows a higher level of network and zonal detail to be incorporated into the LAM and the removal of large areas of modelled network more remote from the scheme that would otherwise be retained within the NTM. This process is described in *PAG Unit 5.2: Construction of Transport Models*.

2.3. Whilst it is preferable that Local Area Models are initially developed through this cordoning process, this is not an absolute requirement. As a minimum, Local Area Models should:

- Have an internal zone system which is, where practicable, defined as subzones of the NTM zones;

- Have external zones which are connected into the LAM on national primary, secondary or regional roads (this is to allow for cordoning); and
- Be constructed, calibrated and validated to the requirements of the PAG.

3. Methodology for Preparing Future Year Traffic Forecasts

3.1. Application of zone-based growth requires a different approach for internal and external zones as follows:

Internal Zones — Trip end growth rates for the AM, PM and Inter-Peak Periods is read from the trip end data provided as an annex to this PAG Unit. These growth factors are applied to the row and column totals of the base year trip matrix to produce target trip ends for the future year matrix.

External Zones — A cordon reflecting the boundary of the LAM is extracted from the Base Year (2006) and Future Year (2025) NTM. The resulting growth factor is annualised, and then applied to the external zones in the local area model over the appropriate forecast period. The same procedure is applied to the 2040 NTM, comparing it to the 2025 cordon, to establish growth in external zones beyond 2025.

3.2. For LAM's where internal zones are smaller than NTM zones, the growth rates in the NTM should initially be applied to all LAM zones within that NTM zone. It is for this reason that it is advisable to ensure that LAM zones are defined as subzones of NTM zones to avoid any overlapping of LAM zones between adjacent NTM zones. The use of LAM zones that are larger than NTM zones is not advisable.

3.3. Within the LAM, there is some flexibility to reallocate growth between different LAM zones within a single NTM zone, although the trip end growth for the collective LAM zones that form the NTM zone should remain consistent with the zone-based trip end growth rates.

3.4. Having estimated new trip end totals for each zone, the future year trip matrix can then be derived through furnessing, which manipulates matrix cells to match defined row and column totals. In undertaking this process, seeding of zero cells may be required using either a gravity modelling technique or through the application of distribution from an adjacent zone.

3.5. During the furnessing procedure, the matrix totals must be constrained to the NTM trip ends. Even where it is appropriate to include the impact of known developments in particular zones, and where a gravity model or furness method is used to distribute new trips going to or from any particular zone, the total number of trips within the local matrices must be constrained to the NTM totals for the same area.

3.6. Any assumptions about the nature and location of specific developments should be clearly explained in the Traffic Modelling Report and a rationale provided for their inclusion. The resulting impact on growth factors for the remaining zones within the

model should also be reported and any unexpected results explained.

3.7. This traffic forecasting process is outlined below in Figure 5.4.1.

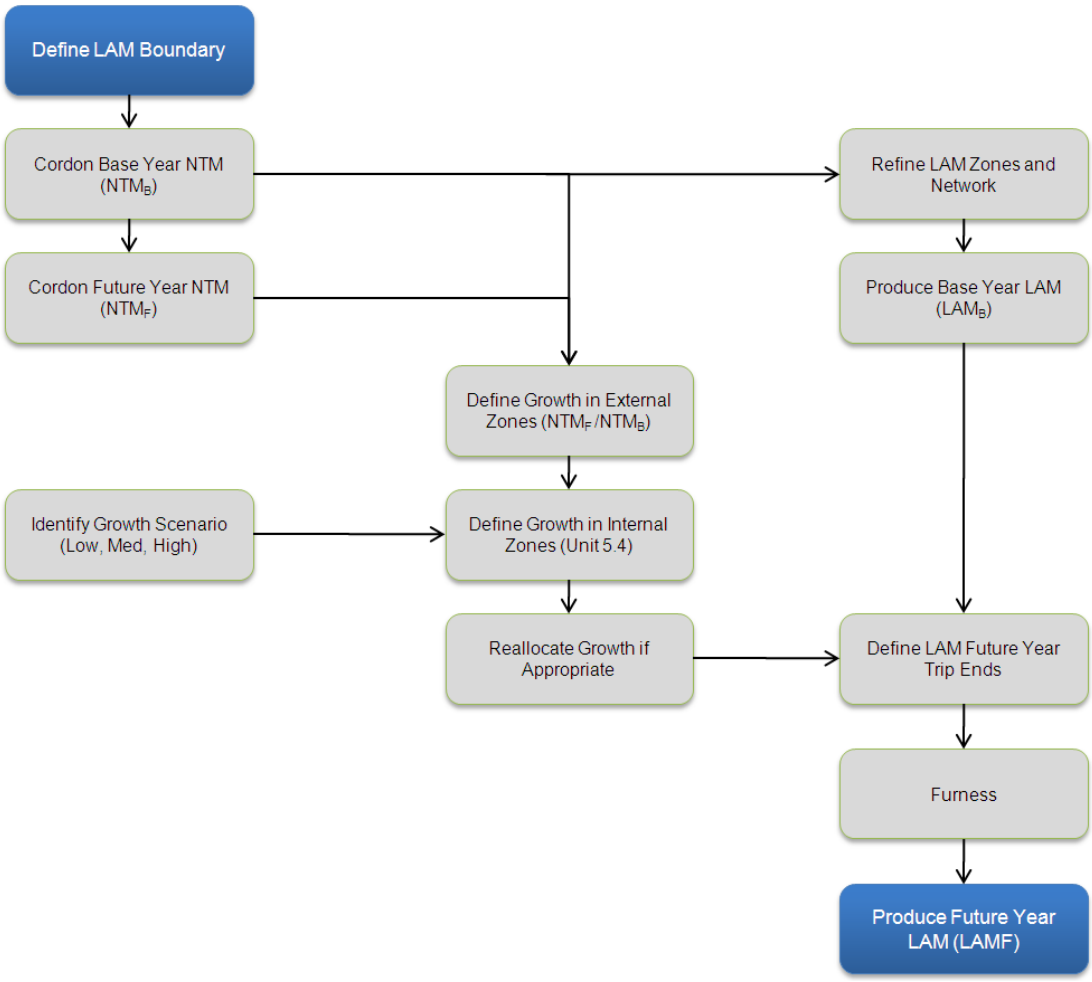

Figure 5.4.1: Traffic Forecasting Methodology for Assignment Models

3.8. An analysis of the impact of the forecasting procedure on trip length distribution should be undertaken and reported in the Traffic Forecasting Report. The report should also demonstrate the difference in net growth that occurs as a result of the furnessing procedure, both at zonal level and through the full LAM matrix.

3.9. Variable Demand Models will use zone-based growth rates to produce the initial demand forecasts for the Do-Minimum and Do-Something scenarios in the future year model. VDM techniques can then be used to adjust the demand matrices to reflect the demand responses associated with the scheme proposal.

3.10. The application of growth to other travel modes requires forecasts for public transport growth in order to allow a future year Production Attraction (PA) matrix to be developed. Further guidance on the preparation of growth forecasts for use in multi-modal models should be sought from the NRA.

4. Zone-Based Traffic Growth Data

4.1. All data necessary for undertaking the traffic forecasting is contained within a shapefile provided as an annex to this PAG Unit. The shapefile provides demographic and geographic information for each zone, in addition to annual growth rates for origin and destination trip ends. The shapefile uses a standard naming convention to identify all variables in the data. A description of this data is provided below in Table 5.4.1.

Table 5.4.1: Schedule of data contained in Shapefile

Category	Parameter	Description
Demographic	Pop/Emp/CO	Population/Employment/Car Ownership
	06/25/40	Year of Forecast (2006/2025/2040)
	L/M/H	Scenario (Low/Medium/High)
Growth Factors	AM/IP/PM	Period of Assessment
	L/H	Vehicle Class (Light/Heavy)
	1/2	Period of Forecast – (1 denotes 2006 to 2025, 2 denotes 2026 to 2040)
	O/D	Origin /Destination Trip End Factor
	L/M/H	Scenario (Low/Medium/High)

Example 1		
Demographic	Emp_25H	Employment forecast in 2025 for High Growth Scenario

Example 2		
Demographic	CO_06	Car Ownership in 2006

Example 3		
Growth Factor	PML_1_OL	PM Peak period growth factor for Light Vehicles during period 2006-2025. Applies to Origin Trip Ends for Low Growth Scenario

Example 4		
Growth Factor	AMH_2_DM	AM Peak period growth factor for Heavy Vehicles during period 2026-2040. Applies to Destination Trip Ends for Medium Growth Scenario

This information is contained within the downloadable file *ntmshapefile2010.zip* from the NRA PAG portal (*www.nra.ie/publications/projectappraisal*).

5. Application to Economic Appraisal

5.1. The main use of forecasts in local models is for the calculation of costs and benefits over the lifetime of the proposal and the calculation of the design parameters for the proposal. Cost and benefit calculations are used to derive the value for money a proposal may have when compared with other ways in which investment funding could be utilised. *PAG Unit 6.1: Guidance on Conducting CBA* provides guidance on the need for and use of cost-benefits analysis for road schemes.

5.2. The current methodology for assessing the costs and benefits set out in these Units requires the use of COBA (Cost-Benefit Analysis) or TUBA (Transport User Benefit Analysis) to calculate the Net Present Value (NPV) and Benefit-Cost Ratio (BCR). The use of COBA and TUBA requires the preparation of the following traffic forecasts which use the growth forecasting methodology set out in this Unit:

- Base Year;
- Opening Year;
- Design Year (Opening Year +15 years); and
- Forecast Year (Opening Year +30 years).

5.3. The application of forecast growth rates in COBA/TUBA has traditionally used national growth rates which are set out in the COBA Parameter Value Sheet. These growth rates represent anticipated traffic growth at a national level, and were originally based on the TRL forecasts produced for the NRA in 2002.

5.4. As with traffic modelling, the use of these generic growth rates does not allow representation of different growth rates that might be expected throughout the transport network, and hence represents crude means of assessing the future increase in benefits that could result from traffic growth.

5.5. The traffic growth rates to be used in the economic appraisal should be extracted from the LAM as aggregate growth rates. It is important to note that the growth rate obtained through the calculation of matrix totals does not represent true increases in traffic growth, as it does not account for changes in trip length which contribute equally to growth. Instead, the increase in vehicle kilometres should be used as a measure of traffic growth in the LAM. This can be calculated manually in the case of spreadsheet models, or through matrix calculations in the case of assignment models.

5.6. The resulting growth rate should be input to the COBA or TUBA input decks to describe total traffic growth between the Opening, Design and Forecast Years. No traffic growth beyond 2040 should be assumed in scheme appraisal.

5.7. Further guidance on application of growth rates in economic appraisal is provided in *PAG Unit 6.2: Guidance on Using COBA*.