NRA
An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Project Appraisal Guidelines

Unit 5.3 Traffic Forecasting

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1 Introduction

Overview

1.1. *PAG Unit 5.2: Construction of Transport Models* provides guidance on the development of traffic models for use in the appraisal of transport infrastructure. The guidance addresses the scoping and construction of transport models which reflect transport demand and supply in a 'Base Year'.

1.2. This Unit of the PAG provides detailed guidance on the preparation of future year traffic models for use in scheme modelling and appraisal. This Unit examines different methodologies for preparing future year traffic forecasts which reflect the functionality of the models being used.

1.3. The guidance set out in this Unit is to be followed for the modelling and appraisal of all National Road schemes, although the guidance is equally applicable to traffic forecasting on local roads. Where there are localised factors which may dictate the use of different growth forecasts they may be produced as a sensitivity test to supplement the standard methodology.

The Role of National Forecasts

1.4. Accurate traffic forecasts are a critical input in ensuring that capacity for transport infrastructure is neither too large nor too small to meet the future demand. Furthermore, traffic forecasts inform the economic appraisal of transport schemes and therefore play a fundamental role in deciding whether a scheme is to progress.

1.5. At a national level, the Government has finite resources to commit to transport infrastructure improvements. In order to ensure that funding is provided to those proposals which provide the best value for money, comparable assessments are required. This includes ensuring that forecasts of future usage (and the benefits which flow from that usage) are undertaken consistently.

1.6. This accuracy and consistency is achieved by the use of common predictions of growth in transport demand which are based on national and local forecasts of population, car ownership and economic factors. The procedures outlined in this PAG Unit outline the application of such growth forecasts to scheme modelling and appraisal. It is a requirement of the National Roads Authority that scheme promoters use the procedures set out in this Unit to forecast future traffic demand for all road proposals for which it has responsibility

Traffic Growth Assumptions and Transport Policy

1.7. This accuracy and consistency is achieved by the use of common predictions of growth in transport demand which are based on national and local forecasts of population, car ownership and economic factors. The procedures outlined in this PAG Unit outline the application of such growth forecasts to scheme modelling and appraisal. It is a requirement of the National Roads Authority that scheme promoters use the procedures set out in this Unit to forecast future traffic demand for all road proposals for which it has responsibility

1.8. Concerns about climate change and sustainability have caused a significant policy shift in favour of sustainable transport policies. *Smarter Travel – A Sustainable Future for Ireland* aims at addressing growth in unsustainable transport and travel patterns and reduwcing adverse health and environmental impacts. It recognises that economic growth prospects are now substantially reduced and the national population could reach 4.8m by 2020, rather than the previous project of 5.1m.

1.9. Despite the reduced economic and demographic prospects, the Smarter Travel Policy is concerned that car numbers could reach 2.47m by 2020. Against this background, the Smarter Travel Policy sets out a target of no significant increase in total kilometres travelled by the car fleet between 2008 and 2020, and that work-related commuting by car should reduce from 65 per cent to 45 per cent of all such trips.

1.10. The Policy recognises that achieving sustainable transport will require a suite of measures including sustainable land use and employment policies, fiscal measures to dis-incentivise unnecessary car travel and improvements to public transport. The cost of the Policy is estimated at €4.5bn and a phased approach to its implementation is envisaged, with significant progress being sought by 2015. The Policy document notes that funding the required measures will be a matter for Government in light of the prevailing economic and budgetary situation.

1.11. The traffic forecasting methodologies set out in this Unit of the Project Appraisal Guidelines take account of these new policies and prospects by:

- Incorporating reduced economic growth prospects [and higher oil prices];
- Adopting a central population forecast in line with the reduced Smarter Travel target of 4.8m by 2020;
- Recognising the additional impact of economic growth and saturation effects on car ownership and predicting a car fleet of 2.1m by 2020, thus almost halving the growth in car numbers envisaged in the Smarter Travel Policy (medium scenario); and
- Providing a low scenario forecast that facilitates the testing of the robustness of projects to even more pessimistic assumptions

1.12. The adoption of this approach means that traffic forecasts are realistic in the light of current policies and prospects. Nevertheless, they should be regarded as constituting a set of Baseline Forecasts that will need some revision, as the measures under the Smarter Travel Policy are fully defined and successfully implemented.

2. A New Approach to Traffic Forecasting

2.1. The National Roads Authority Advice Note "Future Year Traffic Forecasts: 2002 – 2040" was published in 2003 and provided a standard set of national forecasts of traffic growth for different vehicle classes and road types. These forecasts were based on an aggregate assessment of potential growth in vehicle kilometres across the network, incorporating assumptions of growth in population, employment, and car ownership. The resulting growth rates were used to estimate the traffic growth that might occur on different link types across the network.

2.2. In updating the existing traffic forecasts provided in the 2003 Report, it is acknowledged that the application of generic forecasts does not allow local and regional variations in population, employment, car ownership or economic growth to be considered. The importance of Spatial Planning has been recognised by the *National Spatial Strategy* which sets out a number of designated hubs and gateways within which future economic growth will be concentrated. The new approach to traffic forecasting will ensure this strategy can be fully reflected.

2.3. In responding to this, the approach to traffic forecasting has been revised, such that the anticipated geographical variations in local and regional land use and demographic patterns can be accounted for. This has been achieved through the implementation of growth forecasts on the basis of zonal trip-ends, which in turn defines growth throughout a trip matrix. This replaces the previous methodology of defining traffic growth by applying global growth factors to a trip matrix.

3. The Development of National Traffic Growth Forecasts

3.1. The National Traffic Model (NTM) was developed by the National Roads Authority in 2008 and is currently maintained as a central analysis tool for the assessment of the future needs of the network at a strategic level. The development of the model has used Census Journey to Work information, supported by a comprehensive programme of Roadside Interview Surveys, Automatic Traffic Counts and Journey Time Surveys across the network. The modelled network includes all National Primary, Secondary and Regional Roads, plus other local roads of significance, and demand is represented by 874 zones which are based on aggregations of District Electoral Divisions (DED). The model is constructed to represent a 2006 Base Year, and has a forecast year of 2025 and 2040.

3.2. The future year traffic forecasts for the NTM are based on demographic and economic projections which have been prepared at a zonal level. The medium growth projections are consistent with aggregate forecasts prepared by the Central Statistics Office scenario M0F1 which assumes zero net-migration. High and Low projections represent upper and lower bounds on anticipated growth over the same period. The NTM uses a Trip Attraction Generation Model (TAGM) to convert these demographic and economic indicators into trip ends for each NTM zone.

3.3. The derivation of the demographic and economic forecasts for the NTM is outlined in a Technical Paper entitled *"Demographic and Economic Forecasting for the National Traffic Model"*, presented as *PAG Unit 20.1: Demographic and Economic Forecasting for the National Traffic Model*.

4. Traffic Forecasting Methodologies

4.1. As outlined in *PAG Unit 5.2: Construction of Transport Models*, it is neither practicable nor efficient to develop highly complex models for low levels of investment where limited changes to travel patterns would be expected. Likewise, it is important that larger investments which will lead to significant changes in travel patterns are based on a detailed understanding of user responses to inform the economic and environmental impacts of the scheme. The Project Appraisal Guidelines describe three levels of transport model functionality as follows:

- 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.

4.2. The application of traffic forecasts will differ for each of these model types. Forecasting can be undertaken by applying growth factors to link flows (Link Based Forecasts) or by applying trip end growth to demand matrices (Zone-Based Forecasts). Table 5.3.1 sets out the traffic growth forecasting methodology to be used in the three transport model categories defined.

Table 5.3.1: Criteria for Forecasting Traffic Growth

Category	Static Models	Assignment Models	Variable Demand Models
Description	Manual assignment calculations using fixed demand flows. Can comprise spreadsheet modelling, junction modelling or static microsimulation modelling	Models which use a fixed traffic demand matrix, and assess impacts of reassignment only.	Models which include consideration of demand responses (Trip Generation, Distribution and Mode Share)
Nature of Scheme	• Minor schemes (<€30m) • Road safety schemes • Localised improvement	• Major schemes (>€30m) • New roads • Significant upgrades to existing roads • Rural areas • Small urban areas	• Major schemes (>€30m) • New roads • Significant upgrades to existing roads • Major urban areas
Likely Impacts of Scheme	• Rural road networks with no route-switching • Single or multiple junctions in urban areas with no route-switching	• Schemes which will lead to changes in routing • Areas with limited public transport • Areas where induction or suppression of traffic is not anticipated • May use microsimulation models to model complex merging/shockwaves	• Schemes which will generate traffic impact • Major urban areas where congestion will exist • Schemes which lead to large reductions in journey time • Areas where induction or suppression of traffic is anticipated • Schemes which will increase competition with public transport
Forecasting Methodology	**Link-based growth rates**	**Zone-based growth rates**	**Zone-based growth rates**

Link-Based Growth Rates

4.3. Where traffic forecasting uses manual methods, traffic flows are generally represented as vehicular traffic flows on links, with limited information on origin, destination or trip length. In such cases, future year traffic growth is forecast using growth rates which describe likely traffic growth that will occur on specific road types over the appraisal period.

4.4. The derivation of link based growth rates is based on an aggregate projection of growth in vehicle kilometres within a defined area, with appropriate classifications by road type, road classification, year and geographical location. This allows the specification of a series of factors which can be applied directly to traffic flows on simple networks to generate a best estimate of future traffic flows.

4.5. Link-based growth rates have been developed based on interrogation of the National Traffic Model which incorporates the demographic and economic indicators set out earlier in this section. The derivation and application of link-based growth rates which cover the forecasting period from 2010 to 2040 is presented in *PAG Unit 5.5: Link-Based Traffic Growth Forecasting*.

Zone-Based Growth Rates

4.6. For larger schemes which are supported by assignment models, demand is input in the form of a matrix which allocates demand based on defined trips between geographical zones. In such cases, growth rates should be applied as increases in trip ends at a zonal level. The factoring of origins and destinations at a zonal level leads to the definition of Target Trip Ends. This is then translated into a future year matrix through furnessing, which adjusts the demand matrix such that row and column totals match the target trip ends.

4.7. The derivation of zone-based growth rates and their application in assignment models is outlined in *PAG Unit 5.4: Zone-Based Traffic Growth Forecasting*.

Variable Demand Modelling

4.8. With Variable Demand Modelling (VDM), the preparation of future growth is initially concerned with the Do-Minimum scenario, which does not account for the impact of the proposed intervention. Changes in trip generation, destination or mode share may result as a consequence of changes in travel costs through the network due to traffic growth over the forecast period. The use of 'initial' forecasts is nevertheless required to allow these impacts to be estimated for the Do-Minimum, and subsequently the Do-Something. The growth forecasting methodology outlined in *PAG Unit 5.4: Zone-Based Traffic Growth Forecasting* provides the initial forecasts which can be adjusted based on the full VDM processes.

4.9. Modelling changes in trip timing is a particularly complex task and advice should be sought from the NRA before embarking on such a course. Where mode shift effects are required from the Variable Demand Modelling, future growth forecasts will be required for those other travel modes. Further guidance on the preparation of growth forecasts for use in multi-modal models should be sought from the NRA.