

**INTERIM ADVICE NOTE 107 /08**

**VARIABLE DEMAND MODELLING  
TECHNIQUES AS PART OF A TRANSPORT  
ASSESSMENT FOR THE HIGHWAYS  
AGENCY**

**Summary**

This document provides guidance to those involved in, or considering, the use of Variable Demand Modelling as part of a Transport Assessment for the Highways Agency.

**Instructions for Use**

This is a new document which should be read in conjunction with those documents referred to in the text. The document will be updated from time to time as necessary.

## Executive Summary

This Interim Advice Note is provided to assist HA staff in dealing with developers and their consultants who may be determining whether Variable Demand Modelling (VDM) is the preferable methodology to use in modelling the likely transport effects of a proposed development.

The note provides guidance on the use of VDM, and on the issues HA wishes to see covered.

After briefly discussing the history of VDM, it discusses, but avoids repeating, the guidance available elsewhere. It then describes various possible approaches and some key areas to be considered. It describes the type of information HA wishes to see reported and discusses the provision of mitigation measures.

The note also discusses briefly the possible application of VDM in Local and Regional Planning.

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## **VARIABLE DEMAND MODELLING TECHNIQUES AS PART OF A TRANSPORT ASSESSMENT FOR THE HIGHWAYS AGENCY**

### **1 Purpose of Document**

- 1.1 This note is intended to guide HA staff and consultants in dealing with developers and their consultants who may be determining:
- i) whether Variable Demand Modelling (VDM) techniques are appropriate as part of a Transport Assessment (TA) to show the HA the likely transport impacts of a proposed development; and if so;
  - ii) how to carry out an appropriate level of assessment.
- 1.2 The note highlights issues that the HA wishes to see considered and explains their importance. The note complements the advice on modelling available in the Design Manual for Roads and Bridges (DMRB), Volume 12, and in the Department for Transport's (DfT) Web Based Transport Analysis Guidance (WebTAG). Although these were written for assessment of Trunk Road schemes and appraisal of public sector transport projects respectively, they do contain guidance useful in the appraisal of the transport effects of proposed developments.
- 1.3 This document also complements but does not replace any part of 'Guidance on Transport Assessment' issued jointly by Communities and Local Government and the Department for Transport in March 2007.
- 1.4 The use of VDM techniques in the production of TAs is not mandatory and is not expected to occur in the majority of cases. However, if VDM is found to be appropriate, then whether or not it is used, the developer will need to satisfy HA that their assessment of the development's transport effects is robust.
- 1.5 Copies of this note may be provided to developers and consultants to assist them in ensuring that the impacts described in their TAs are supported by adequate methods and are robust.

### **2 Introduction**

- 2.1 In order to ensure the safe and efficient operation of the trunk road network, the HA, on behalf of the Secretary of State for Transport, considers the effects of those planning applications referred to it by local planning authorities under the statutory requirements of the Town and Country Planning Act (General Development Procedure Order) 1995. The HA also needs to ensure that its network complies with all relevant environmental legislation, particularly that regarding air quality. Often these considerations will result in developers being required to provide mitigating works, even if they have done all that they reasonably can to limit motorised travel to/from the developments.
- 2.2 Where area wide traffic models have been used to assess the effects of additional traffic generated by proposed development, the traditional practice has been to use a fixed trip matrix approach. Where the volume of new traffic is relatively small and the road network is relatively uncongested and likely to remain so then this approach will be adequate. However, where this is not the case, the additional congestion resulting from the additional trips, and its impact on existing trips, eg from trip suppression, redistribution, mode and/or time shifts, will not be modelled adequately. Such effects

are now taken into account for the vast majority of HA's major improvement schemes and developers will often need to incorporate the VDM techniques in any area wide modelling supporting applications for major developments. Current guidance in the HA's DMRB and DfT's WebTAG is centred on the needs of transport scheme appraisal rather than Development Control (DC). This note provides guidance on use of VDM techniques in a DC context so as to provide outputs appropriate to HA's consideration of a planning application.

### **3 Brief History of VDM**

- 3.1 The Standing Advisory Committee on Trunk Road Assessment (SACTRA) report of 1994 led to DfT publishing in June 2006, after considerable study and consultation, its Variable Demand Modelling (VDM) Advice as part of WebTAG at [www.webtag.org.uk](http://www.webtag.org.uk).
- 3.2 The WebTAG guidance requires that the HA considers the use of VDM techniques for all of its major highway improvement schemes (ie those in, or being considered for, the Programme of Major Schemes). It is likely that VDM will, as a result, become the norm, rather than the exception, for all HA financed major schemes.

### **4 Impact of VDM for Developments**

- 4.1 In a Fixed Trip appraisal of a development's transport impact, it is assumed that any additional traffic resulting from the development has no effect on the travel patterns of the existing 'background' traffic. This could, in some cases, result in forecasts of considerable congestion in the absence of mitigating works.
- 4.2 In the real world, it is likely that there would be changes, such as drivers amending their journey mode, destinations, journey times and/or frequency. These changes would tend to result in lower congestion than forecast but a possible spread of traffic effects over a wider area. Some effects, such as redistribution and trip suppression, despite their limiting effects on congestion, do impose some cost on the affected users. The HA takes these effects and associated costs into account whilst formulating its response to any planning application. A Variable Demand appraisal would therefore allow the provision of more appropriate mitigating measures.

### **5 Current DfT and HA Guidance**

#### **5.1 HA**

The HA's principal guidance of relevance is in the Design Manual for Roads and Bridges (DMRB), Volume 12: [www.standardsforhighways.co.uk/dmr/index.htm](http://www.standardsforhighways.co.uk/dmr/index.htm)  
The above link is likely to change during 2007/8, after which DMRB will be available via [www.highways.gov.uk](http://www.highways.gov.uk)

#### **5.2 DfT**

DfT's Variable Demand Guidance is in WebTAG [www.webtag.org.uk](http://www.webtag.org.uk) units 2.9.1, 2.9.2 and 3.10.1 - 3.10.5. Many other WebTAG units are relevant to both Fixed Trip and Variable Demand Modelling.

In March 2007, DfT and Communities & Local Government (CLG) published their 'Guidance on Transport Assessment' (GTA):  
[www.dft.gov.uk/pgr/regional/transportassessments/](http://www.dft.gov.uk/pgr/regional/transportassessments/)

5.3 This note is consistent with the above guidance.

## 6 Level of modelling

6.1 In determining whether or not VDM is preferable, the following alternatives should be considered:

### 6.2 No VDM (ie Fixed Trip Modelling)

This method is suitable where:

- The road network in the vicinity of the development is uncongested and is expected to remain uncongested in the 'without development' scenario
- The development is small enough that its traffic generation does not have a significant impact on 'background' traffic; i.e. the 'with development' scenario will also be uncongested.

### 6.3 Use of existing forecasts

This method is suitable where an existing variable demand model has already been produced; e.g. for a Local Authority's own transport scheme. If the model has produced suitable forecasts for the 'without development' case, then it may be possible to use these forecasts as 'background traffic' alongside an assumption that the development traffic would not cause further variable demand effects. This approach is only suitable where:

- the forecasts are relevant, up to date and fit for purpose,
- the development is small enough not to have a significant impact on background traffic; and,
- the forecasts are sufficiently detailed in the vicinity of the development.

### 6.4 Simple elasticity approach

WebTAG Unit 3.10.1 states that '*...An elastic assignment procedure can give an initial indication of the effects. This procedure should only be used to ascertain whether variable demand modelling is required and for nothing else.*' The elastic assignment procedure may be acceptable to the HA for scheme option testing before carrying out full VDM on the favoured option but is unlikely to be acceptable for assessment of the favoured option.

Section 1.2 of WebTAG Unit 3.10.3 provides more guidance on this method.

### 6.5 Full Variable Demand Modelling (VDM)

At its most complex, this involves modelling the effects of changing travel costs on each individual demand response. However, the commonly modelled responses are redistribution, mode choice, time period choice and trip frequency. Specific advice on the modelling of the effects of developments, as opposed to road schemes, is given in 7 and 8 below.

## 7 Requirements for using VDM for Transport Assessments

7.1 The scale of modelling required should take account of the scale of the proposed development. In many cases the models that would have been used for Fixed Trip appraisals may be used with slight modifications provided that there is sufficient data on the origins and destinations of trips such that the 'whole trip' is reasonably modelled.

## 7.2 General Objectives

- The various components of the model should be described clearly so that the HA and its consultants can have an effective understanding of its characteristics and any limitations.
- The model should be consistent with DMRB and WebTAG principles.

## 7.3 Functionality

- Trip redistribution due to congestion and due to the development may be particularly important for larger developments. The impact will vary considerably depending on the type of development.
- The network model should be adequate to represent delays at and diversions around junctions likely to be affected by the development.

## 7.4 Demand Segmentation

For some development types (e.g. goods distribution depot, airport) the trip making patterns will be very different from the background traffic and it may be necessary to model specific trip purposes in addition to those already modelled.

## 7.5 Development Trip Rates

- In general, the forecasting of travel using the network in the 'without development' scenario will be as for any non-development related highway scheme.
- However, the forecast of development related traffic will generally be derived using data from similar sites elsewhere, often using commercially available databases such as TRICS. Care will be needed to ensure that the data is used appropriately: e.g.
  - Sites considered should be as similar as possible in terms of size, type, location, availability of public transport, local traffic conditions and other relevant criteria.
  - Trip rates for some trip types will be very sensitive to changes in travel costs.
  - Changes in consumer preferences can also affect the forecast trip rates.
  - The trip rates in the database may already be suppressed by congestion effects; there may be a need to avoid double counting of suppression.

(Further useful guidance on using TRICS is available in the TRICS 'Good Practice Guide' available at: [www.trics.org/bestpractice.htm](http://www.trics.org/bestpractice.htm))

## 7.6 Effectiveness of measures to limit vehicular traffic

Current advice on Transport Assessments (TAs) requires that measures to encourage non-car modes are considered before any TA is carried out. Although this suggests that the VDM of development trips could be undertaken without a mode choice component, a preferable approach would be to carry out a further test, or tests, with the proposed measures to encourage non-car use modelled explicitly so that their likely effectiveness can be quantified.

## 7.7 Development Traffic

- It will be necessary to justify any decisions regarding changes in the development traffic over the assessment period. Often, development trips are taken as fixed but this is not always appropriate; e.g. because of severe congestion, phased development or other considerations.
- The modelling of the impacts of the development and mitigating measures should ideally show that journey times for a representative sample of background traffic are better, or at least no worse, than without the development.

## 8 The HA's Reporting Requirements

8.1 These will generally be as described in DMRB and WebTAG, however, the following additions must be taken into account:

### 8.2 Traffic Modelling/Forecasting

Full details should be given on how the traffic model and the forecasts of traffic (background traffic and traffic to/from the development) have been derived. Much of this would be required whether or not VDM techniques are being used.

DMRB Volume 12 and WebTAG provide much useful guidance that would assist in the preparation of the above, but these details should include at least:

- How the trip-rates for the development were estimated and, where other sites were used as a source of data, the criteria for choosing such sites should be stated,
- How non-motorised travel associated with the development was estimated. This information will be required as part of the Transport Assessment if a FTM, or other basic, assessment has been undertaken, but it has added importance if VDM techniques are used to assess the development traffic,
- How the trips to/from the development would be distributed and how they were modelled (as new, pass-by, linked, diverted, transferred or some combination),
- How, in the reference case, the development relates to the TEMPRO forecasts for the local authority and region, and details of any corresponding adjustments to the TEMPRO defined forecast growth for the area.
- How the forecasts for the development will change over time, including the main forecast years.
- Tabular and graphical representations of the forecast flows for the relevant scenarios and years

### 8.3 Operational and Economic Appraisal

Whilst the above will provide information on the traffic forecasts and their derivation, it is also necessary to show the effects of the changed flows on travellers on the affected parts of the network, whether or not they continue to use that network in the 'with development' scenario.

For the opening year and each forecast year, for the following two scenarios:

- without development, its traffic and its mitigation works
- with development, its traffic and its mitigation works

detailed outputs should be produced to satisfy the HA that any traffic and travel issues have been correctly identified, and proposed mitigation measures are

appropriate. The extent of these details, including which forecast years should be modelled, should be agreed between the developer, the HA and the relevant local authority. These items should include:

- An analysis of an agreed set of link flows.
- Junction capacity assessments for an agreed set of junctions, including, at least, all those junctions where any arm will see a Reference Flow/Capacity (RFC) ratio of more than 0.85 either with or without the development in the base year or any forecast year.
- Operational performance statistics such as:
  - Reference Flow/Capacity (RFC) at affected junctions,
  - queue lengths and delays at affected junctions; and,
  - changes in Journey Times and Travel Costs and the numbers of trips affected for an agreed set of journeys through the network.
- Operational assessment and performance statistics for affected highway links.
- Quantification of the travel costs of road users in the 'without development' scenario together with quantification for the same road users in the 'with development' scenario. This will include the costs to road users whatever their responses; e.g. reassignment, time shifting, mode change, suppression, redistribution, etc.

Understanding of the above would be assisted by measures of the numbers of trips which have been affected and by quantification of the effect together with details of their origins and destinations. This again should include all responses. In some cases the traffic model will be able to provide suitable information but in other cases, use of TUBA may be necessary.

It will be necessary for HA to consider the results for the above in determining whether the impact of the development on HA's network is acceptable; i.e. resulting in 'nil detriment'.

#### **8.4 Potential mitigation schemes**

If, despite the inclusion of measures to encourage non-car use, the traffic modelling shows that the development has a significant impact on the background traffic, the HA may ask for mitigating measures to be provided. Such measures, involving capacity enhancement and/or traffic management measures, should be worked up in sufficient detail to convince the HA that they are viable and effective. If VDM has been used to produce 'without development' forecasts then VDM should be used to estimate the impact of the mitigating measures except where the approach in paragraph 6.2 has been agreed with the HA. In the latter case, reasons why this approach was considered suitable should be given along with traditional FTM model results.

In some circumstances it may not be practicable or desirable to provide mitigating measures aimed solely at the transport effects of the proposed development. It may be that there would be benefits in HA developing wider ranging proposals in the area and these could provide the required mitigation. This allows for the possibility of a developer contributing to a larger scheme, instead of directly providing mitigation for the effects of their development.

## 9 Local and Regional Planning

9.1 Although this document primarily deals with VDM issues for specific development proposals, it may also be used to inform modelling to assist the Local Development Framework (LDF) process; e.g. for Local Development Documents, Regional Strategy Reviews, etc.

9.2 The use of VDM may be appropriate for any area where there is:

- likely to be congestion now, in the near future, and/or within the plan period, either with or without the transport and other developments considered in the plan,
- major transport and/or other developments are being considered in, and/or near, the plan area; or,
- travellers in the area are likely to be sensitive to changing travel costs.

## 10 Queries

If you have any queries about this Guidance Note, they should be addressed in the first instance to :

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