

STAG Technical Database

Section 17

Additional Information

27 May 2008

Transport Scotland

Version History

Changes since STAG Refresh, May 2008

Change number	Section updated	Date
1	Table 17.8 Classification of accessibility models by category	September 2008
2	CO ₂ Monetisation Spreadsheet in Section 17.5 updated	December 2009

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17. Additional Information

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17.1.1 STAG Transport Appraisal

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17.2 National Data Sources

There are currently a number of data sources available, both nationally and specific to Scotland, which may be of use to planners during the appraisal of transport proposals. The most significant are summarised in this section.

17.2.1 Summary

In general, all the UK data sources are held by the Department for Transport (DfT) and all the Scottish sources by the Scottish Government.

United Kingdom Transport and Travel Databases

The DfT has a number of national data sources including:

- TEMPRO Planning Data - National Trip End Model (NTEM);
- National Travel Survey (NTS);
- Census Journey To Work (JTW) trip matrices;
- Rail Passenger Trip Matrices (station to station) from LENNON; and
- National Index and Depository of Roadside Interview Survey Data;
- Traffic counts (see SRTDb summary for details).

Summaries of these national data sources are included in this Appendix.

Scottish Transport and Travel Databases

In addition to the national data sources outlined above, there are also a number of Scottish Government data sources and other Scottish based data sources available. These can be categorised under the following headings:

- Network (Supply) Data;
- Travel (Demand) Data; and
- Combined Network/Travel Data.

Network (Supply) Data

Network (Supply) Data includes:

- Road Network descriptions (links, junctions, tolls);
- Public Transport Services (routes, frequencies, capacities);
- Parking data (on/off street, short/long term, spaces by location); and
- Zones — land-use areas (e.g. shopping/employment centres, residential estates).

Sources of Scottish Network (Supply) Data include:

- Road Accidents Scotland;
- TREAD - Trunk Road Economic Assessment Database; and
- Public Transport timetables - Traveline Scotland.

Travel (Demand) Data

Travel (Demand) Data includes:

- Trip End data (based on car ownership/land-use planning data);
- Trip Distribution data (private/public transport origins to destinations); and
- Traffic/Passenger Count data (traffic flows by vehicle type, public transport passenger volumes by service / location).

Sources of Scottish Travel (Demand) Data include:

- SRTDb - Scottish Road Traffic Database, maintained by Transport Scotland;
- Scottish Household Survey (SHS);
- Scottish Transport Statistics (STS);
- Bus & Coach Statistics; and
- Public Transport Survey & Ticket Data.

Network/Travel Data Combined

In addition to the above sources comprising Network or Travel Data, there are sources which contain both, including:

- TMfS - Transport Model for Scotland; and
- SITM - Strathclyde Integrated Transport Model.

Land Use and Services Databases

To allow transport supply and demand to be considered in relation to the spatial pattern of land uses and services, for example in the accessibility analysis, national and local data may be needed. These include:

- Locations where jobs, education and training are available;
- Locations where health services are provided;
- Locations of shops; and
- Other opportunities which may be of local significance such as post offices, chemists, leisure opportunities, banks and building societies.

Table 17.1 summarises the transport data contained within the various sources detailed in this section.

Table 17.1: Summary of Transport Data Sources

Data Source	See section	Data Content		Network (Supply) Data				Travel (Demand) Data		Additional Data i.e. Costs, Economics
		National	Scottish	Highway	Public Transport	Accidents	Structures	Highway	Public Transport	
TEMPRO/NTEM	17.2.2	X						X		X
National Travel Survey	17.2.3	X						X	X	X
National Rail Travel Survey	17.2.4	X							X	
Census Journey to Work Trip Matrices	17.2.5	X						X	X	X
LENNON trip data	17.2.6	X			X				X	
National Rail Trends	17.2.7	X			X			X		X
RSI Database	17.2.8	X						X		X
Road Accidents Scotland	17.2.9		X			X				X
TREAD	17.2.10		X			X				X
Traveline	17.2.11		X		X					X
SRTDb	17.2.12		X					X		
Scottish Household Survey	17.2.13		X					X	X	X
Scottish Transport Statistics	17.2.14		X		X	X		X	X	
Transport Statistics GB	17.2.14	X			X	X		X	X	
Bus & Coach Statistics	17.2.15		X		X				X	
TMfS	17.2.16		X	X	X			X	X	X
SITM4	17.2.17		X	X	X			X	X	X

17.2.2 TEMPRO and the National Trip End Model (NTEM)

TEMPRO is a computer program used to access the National Trip End Model forecasts of growth in all modes of surface transport, and the underlying car ownership and planning data projections. TEMPRO enables the user to retrieve data for any year from 1991 through to 2041, and calculate the growth rate between a selected base and future years.

The 'NTEM zoning system' divides Great Britain into around 1200 zones. In Scotland (region) the zoning system is broken down into local authority areas and zones. Settlements under 10,000 population are generally not distinguished as separate zones but are included within the rural area (if any) of each Local Authority.

Sources:

The main sources of information contained within TEMPRO are:

- Census 2001;
- Mid-year population estimate and Office for National Statistics (ONS) population projections;
- Office of the Deputy Prime Minister (ODPM) housing projections; and
- Inter Departmental Business Register and Annual Business Inquiry (ABI) employment data.

Data Availability:

Data can be output from TEMPRO/NTEM at a Great Britain, local authority and zonal level. In addition, data can be output for a user defined study area, made up of one or more counties and/or zones.

The following base and forecast data can be output:

- Total Trip Ends;
- Trip Ends split by Purpose (Home based work, non-home based work, employer's business, personal business, education, shopping, recreational/social, visiting and holidays/day trips);
- Trip Ends split by Time Period (weekday am peak, inter-peak, PM-peak, off-peak, Saturday, Sunday, average weekday and average day);
- Trip Ends split by Mode (walking, cycling, car driver, car passenger, bus/coach, rail/underground);
- Trip Ends split by Car Availability;
- Number of Households with 0, 1, 2, 3+ cars;
- Total Households;
- Total Cars;
- Population;
- Workforce; and
- Jobs.

The format of trip end forecast data is available as:

- Growth Factors (= future year data/base year data);
- Future Year — Base Year (= growth expressed in terms of the absolute increase/decrease in the displayed data values);
- Base Year Data (= absolute data for the selected base year); and
- Future Year Data (= absolute data for the selected future year).

Format of the data:

TEMPRO is a WINDOWS based program. Exported data is in comma separated variable (csv) format.

Data Use:

Detailed applications of TEMPRO and NTEM can be found in Section 5 of the TEMPRO guidance note, which can be downloaded from the TEMPRO website .

Accessing Data:

Full details of the TEMPRO program and the National Trip End Model are available in the TEMPRO guidance note which can be downloaded from the TEMPRO website.

The TEMPRO software and NTEM files, together with the TEMPRO guidance note, can be downloaded from: www.tempro.org.uk

Cost:

Access to TEMPRO is free of charge.

Contacts:

The main contact for TEMPRO and the NTEM is the ITEA Division within the DfT.
Email tempro@dft.gsi.gov.uk

17.2.3 National Travel Survey (NTS)

The National Travel Survey (NTS) is an annual household survey of travel covering residents of Great Britain.

Every household member in the sample is asked to keep a seven-day travel diary of all personal travel within Great Britain. Parents are asked to keep the diary for young children. Diary details include the purpose of each journey made, the modes of transport used, the timing of the journey, and the origin and destination.

The household members are also interviewed (using CAPI- Computer Assisted Personal Interviewing) to provide background demographic data, such as age, sex, income and employment status, and other information relevant to travel such as ownership of cars and other vehicles, details of driving licences, the availability of local public transport, and disabilities affecting transport use.

Only travel within Great Britain, by British residents living in private households is included. Most personal travel over 50 yards is included, including walking. Walking, cycling and other travel off the public highway are not included in the survey, although activities such as jogging and walking the dog along a road or cycling on cycleways are included.

Travel in the course of work by people whose work is to travel (such as bus drivers, postmen and deliverymen) is excluded, but travel in the course of other work is included. For example, this includes a business person travelling to a meeting, a doctor or health visitor on their rounds, or a plumber fetching materials to complete a job.

Sources

A sample of households is taken throughout Great Britain. In 2006, the achieved sample just under 8,300 'fully responding' households. From 2002, the sample size has been increased sufficiently to allow more single year statistics to be presented, rather than the combined 3-year average as previously used.

Data Availability:

Various data associated with people's travel patterns throughout Britain are available at a regional level, including:

- Distance travelled each year;
- Time spent travelling;
- Number of trips made;
- Mode of trips; and
- Purpose of trips.
- Format of the Data

Data from the National Travel Survey is available as a series of tables and graphs which can be broken down to a regional level. Although it is possible to identify residents of a particular local authority area, results at this level are not necessarily representative, and sample sizes are too small to give more than minimal information about their travel. From 2002, the sample is representative at sub-regional level allowing some analysis at greater geographic detail.

In addition to geographic information on administrative areas, such as Government Office Regions, the NTS can identify residents of urban (in different population bands) and rural regions.

Accessing Data:

Output and results from the National Travel Survey can be accessed via the DfT web site at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/personal/>

The main analysis of the 2005 National Travel Survey is contained in Focus on Personal Travel available from the DfT's website at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/personal/focuspt/>

Seven Personal Travel Factsheets are also available on a number of topics such as Travel to School, Travel to Work, Travel in Urban and Rural Areas also from the DfT website at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/personal/factsheets/>

Data is generally available by mode, sex, age group and other variables. Customised tables using unpublished NTS data may be obtained from the DfT.

Cost:

Extracts and data from the National Travel Survey obtained from the DfT web page are free. The Transport Statistics Bulletin and Personal Travel Factsheets are available free from the DfT. For customised tables, obtainable from the DfT, there may be a charge.

Contacts:

The Department for Transport is responsible for the National Travel Survey. For all enquiries telephone 020 7944 3097 or Email national.travelsurvey@dft.gsi.gov.uk.

17.2.4 National Rail Travel Survey (NRTS)

The National Rail Travel Survey (NRTS) is a survey of passenger trips on the National Rail system. It was designed to fill a gap in our knowledge about who uses the rail network, where, when and for what purposes.

Sources:

All stations in Great Britain have been surveyed on weekdays outside school holiday periods during the period 2000-2005. Data is collected from passengers by self-completion questionnaire, and passenger counts are carried out at the same time to give details of the volume of people using each station. This enables the survey responses to be weighted up to represent all rail passengers. About 430,000 questionnaires were collected in total.

Data Availability:

The following information is available:

- Rail stations used;
- Time of travel;
- Access and egress modes;
- Origin and destination addresses;
- Trip purposes;
- Ticketing information; and
- Demographic information.

Format of the Data:

Data from the National Rail Travel Survey is available as a series of tables and graphs which can be broken down to a regional level.

Accessing Data:

The full results of the NRTS have not yet been published. Provisional output and results from can be accessed via the DfT web site at:

<http://www.dft.gov.uk/pgr/statistics/datatablespublications/railways/>

Full access to the data set is available for the use of local government for rail planning details. Transport Scotland can provide access to the data.

Other users wishing to gain access to the database will be able to receive non-disclosive subsets of the database, in accordance with confidentiality. Transport Scotland should be contacted for access.

Data use:

The data can be useful for modelling of both multi-modal travel choices and assessing the impact of rail service options and infrastructure schemes across not only Scotland but the whole of Great Britain. It is an important data source for most analysis functions including franchise specification, the bidding process, Route Utilisation Strategies, model updates, scheme assessments, station catchment analysis and provides information required to undertake other policy analysis - for example in respect to social inclusion.

Cost:

Extracts and data from the National Rail Travel Survey obtained from the DfT web page are free. Customised tables, obtainable from Transport Scotland, are also free of charge.

Contacts:

Transport Scotland is the contact for National Rail Travel Survey data in Scotland. For all enquiries email info@transportscotland.gsi.gov.uk

17.2.5 Census Journey to Work Trip Matrices

The DfT has developed software to produce Census Journey-to-Work matrix extracts for use in base year matrix building. The software produces trips by mode in a production and attraction format suitable for transport modelling. The users define their zoning system, specifying each zone in terms of one or more 2001 Census regions, counties, districts or wards. Appropriate factors are applied to convert from the 'usual journey to work' in the Census to an estimated number of trips by each mode in the selected year, split by household car ownership if required.

Sources:

The main source of data is currently the 2001 Census data and the National Travel Survey

Accessing Data:

The Census Journey to Work Trip Matrices can be accessed from Peter Davidson Consultancy.

Cost:

The software is maintained and distributed by [Peter Davidson Consultancy](#) and is available to all public authorities. Private sector users will need to negotiate royalty payments with ONS. The full software package costs about £450 (including telephone support). Price for small enquiries on application.

Contacts:

The DfT can be contacted regarding the Census Journey to Work Trip Matrices by email at itea@dft.gsi.gov.uk or via their web site at www.dft.gov.uk

Peter Davidson Consultancy can be contacted by email at mail@peter-davidson.com

17.2.6 LENNON Rail Passenger Trip Data

LENNON (formerly CAPRI) is the rail industry's central ticketing system. It provides information on passenger kilometres, journey data, and ticket sales.

Sources:

Daily ticket sales. System captures and stores sales of tickets on each flow nationally.

Data Availability:

- The following data is available:
- Ticket sales by origin-destination; and
- Implied flows by origin-destination.

Accessing Data:

Summaries published in various formats, including National Rail Trends, and DfT publication of international traffic figures.

Data is owned by Train Operating Companies (TOCs) and availability is subject to commercial confidentiality restrictions. Those wishing to use the data should in the first instance contact Transport Scotland

Cost:

Price on application.

Contacts:

Transport Scotland can be contacted regarding the LENNON data by emailing: steven.mcmahon@transportscotland.gsi.gov.uk

17.2.7 National Rail Trends (ORR)

The Office of the Rail Regulation's (ORR) National Rail Trends is published quarterly and brings together a wide range of information on the rail industry. It is split into sections covering:

- Rail markets, passenger and freight;
- Quality, performance and perceptions;
- Health and safety; and
- Other current issues.

Sources:

The main sources of information contained within the National Rail Trends are:

- The Train Operating Companies (TOCs);
- Network Rail; and
- Department for Transport.

In addition, use is made of the rail industry's central ticketing system, LENNON, as the basis for passenger kilometres and journeys data.

Data Availability:

Various information and data are available from the National Rail Trends, including:

- Passenger kilometres;
- Passenger journeys;
- Passenger revenues;
- Timetable train kilometres;
- Public performance measure;
- Rail complaints;
- National Rail Enquiry System;
- Fares price index;
- Freight moved;
- Freight lifted; and
- Average age of rolling stock.

In addition, as its role as monitor of Network Rail, the Office of the Rail Regulation provides information on:

- Government support;
- Investment; and
- Infrastructure on National Railways.

Format of the Data:

The National Rail Trends presents data in tabular and graphical format for each topic and includes summaries of key results. Where possible the information presented is broken down by ticket type, sector, or Train Operating Company etc. The analysis of trends in some cases dates back to 1948.

Data Use:

The data from the National Rail Trends can help to provide information on sub-national rail statistics and can provide a more comprehensive picture of the service being provided. The data can be used for analytical purposes such as modelling. The data also provides a useful source of historic trends.

Accessing Data:

The National Rail Trends can be accessed through the ORR via their website at <http://www.rail-reg.gov.uk/>

A more detailed breakdown of the information contained within the National Rail Trends can be obtained from the ORR. The ORR will consider each request and generally consult with the Association of Train Operating Companies (ATOC) to ensure that the request would involve no disclosure of commercially confidential information. As a rule, this is much less likely to be the case where requests are for journeys/passenger kilometres data than for revenue data.

Where detailed data is being sought for analytical purposes such as modelling, the ORR can offer advice and data subject to confidentiality agreements.

Cost:

The National Rail Trends can be downloaded free from the ORR website. Detailed data requests to the ORR may incur a charge which should be discussed with them.

Contacts:

The ORR contact for rail data is:
Brian Hatfield Tel. 020 7282 2073
Email brian.hatfield@orr.gsi.gov.uk

17.2.8 National Origin-Destination Transport Survey Databank

The National Origin-Destination Transport Survey Project has been developed by the DfT to assist organisations involved in the identification, selection and use of appropriate origin-destination transport data. Collection of this type of data is often expensive. For this reason, whenever possible, transport modellers should ensure that they make the best use of existing survey data. However, it is often time-consuming identifying potential sources of movement data and can cause duplication of effort.

In recognition of the need for a consolidated source of information, the National Origin-Destination Transport Survey project was developed by the DfT in association with the Highways Agency. The project originally began in 1997 and has undergone a number of changes since then.

Sources:

The National Origin-Destination Databank now contains information about transport origin-destination surveys for:

- Roadside interviews;
- Public Transport; and
- Home interviews.

The resultant database contains information collected from questionnaire returns sent to local authorities and consultants covering England, Scotland and Wales. The database contains information on the location and type of data available, including organisation central contact details.

Data Availability:

The database provides a list of site locations for existing RSI datasets held by UK public authorities, including summary data (contact name, telephone number, date of survey etc.).

Public transport survey sites are represented in the mapping application as location-based, route-based or area-based, depending on the surveying methods.

Home interview surveys are represented on an administrative boundary level so when a user selects an area they are presented with a listing of all surveys taken.

Format of the Data:

Outputs from the datasets can be spreadsheet listings, printouts of GIS maps, or a GIS point dataset. Detailed maps showing site locations are also available.

Data Use:

The National Origin-Destination Databank contains details of what RSIs have been carried out to date, along with their locations and date of survey etc. The information can be used to augment local RSI survey data during matrix building.

Accessing Data:

The Database File, Index Files and Survey questionnaires can be downloaded from the DfT website:

<http://www.dft.gov.uk/pgr/economics/ntm/ntmdatasources/nationalorigindestinationtra3012>

The mapping information can be viewed graphically at: www.ods.dft.gov.uk

Cost:

Access to the data depository is free of charge.

Contacts:

The ITEA division of DfT can be contacted for any further information regarding the National Databank by emailing odsatabank@dft.gsi.gov.uk

17.2.9 Road Accidents Scotland

Road Accidents Scotland is produced annually by the Scottish Government, Analytical Services Division, Transport Statistics Branch. It presents statistics of the numbers of injury road accidents which were recorded by the police in Scotland. The data presented relates to the most recent year available (currently 2006). The more detailed tables provide data in the form of 5-year annual averages (for the years 2002-2006) in line with the UK casualty reduction targets for 2010. They also present information over the last ten individual years. Some of the lesser detailed trend analysis goes back as far as 1953. Similar statistics are available on a Great Britain wide basis in the publication 'Road Accidents Great Britain'.

Sources:

The main source of accident data is Police STATS 19 Forms.

STATS 19 forms are completed by the police for all injury accidents reported to them. They include details of:

- Attendant circumstances — date, location (OSGRs), road conditions, weather;
- Vehicles involved; and
- Casualties recorded.

All this information is coded into the Road Accidents Statistical Database.

Data Availability:

Road Accidents Scotland contains over 40 tables of information relating to injury accidents in Scotland. Examples of these tables include:

- Accidents by road and junction type and area;
- Accidents rates and costs; and
- Casualties and vehicles involved.

The database of accidents contains details of all injury accidents recorded.

Format of the Data:

Road Accidents Scotland is produced annually as a stand-alone document/report. A summary bulletin giving provisional high level figures is also produced. Full accident details are held on the database.

Accident data from the database can be extracted for specific roads throughout Scotland (both trunk and non-trunk).

Data Use:

The data from Road Accident Scotland and the Road Accidents Statistical Database can be used to determine the overall effects of scheme improvements i.e. the changes in accident rates and costs associated with different schemes. Data can also be extracted from the database to provide local historic accident rates and costs.

Data Access:

Copies of Road Accidents Scotland are available online at <http://www.scotland.gov.uk/Topics/Statistics/Browse/Transport-Travel/PubRoadAcc>.

Extracts from the Road Accidents Statistical Database can be obtained from the SG Transport Statistics Branch and the SG Accident Investigation Unit (trunk road accidents only). Local information should however be obtained from the appropriate Police force or Local Authority.

Road Casualties Great Britain can be accessed via the DfT website at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/accidents/>.

Cost:

Road Accidents Scotland is available free of charge online.

Data from the Road Accidents Statistical Database is usually supplied free of charge to Local Authorities. However, a charge may be made depending upon the amount of staff time required.

Contacts:

The Scottish Government contact for accident data is:
Charlie Lewis, Email: transtat@scotland.gsi.gov.uk.

17.2.10 Trunk Road Economic Assessment Database (TREAD)

The Trunk Road Economic Assessment Database (TREAD) contains details of trunk road scheme economic assessments at different stages of the assessment process. It contains links to all current Traffic and Economic Evaluation Report (TEER) forms which give detailed information associated with the economic assessment such as Net Present Values (NPVs) and Benefit Cost Ratios (BCRs).

In addition, TREAD contains copies of Transport Scotland's TRIPS Design & Construction Division's Quarterly Scheme Progress Reports which detail the status and progress of all the schemes within DCD's trunk road programme. TREAD also contains summary details from DCD's Annual Before and After Monitoring Reports.

Sources:

The main sources of information contained within TREAD are:

- TEER forms;
- Quarterly Scheme Progress Reports; and
- Annual Before and After Monitoring Reports.

Data Availability:

The following information and data is available from TREAD:

- Scheme details i.e. carriageway standard, length, construction start date & construction period etc.
- Scheme economics including costs, NPV, BCR etc.; and
- Before and After Monitoring data including traffic flows, accident details, environmental mitigation measures, etc.

Format of the Data:

TREAD is a Microsoft Access database. Extracts from the database are supplied either on paper or in electronic format suitable for input to spreadsheets.

Data Use:

The data from TREAD can be used to:

- Determine what trunk road schemes may be planned within an area of interest and their current status;
- Examine the economic assessments of schemes at different stages i.e. pre-feasibility; pre-order publication; pre-tender; and post tender, including the current and previous quarter's total scheme costs; and
- Examine the accident savings associated with different schemes.

Data Access:

TREAD can be accessed through Transport Scotland.

Cost:

There is no charge to Local Authorities for data extracted from TREAD.

Contacts:

The contact for TREAD is:

Gerard McPhillips, Transport Scotland, MTRIPS, Standards, Traffic & Economics Branch.

Email gerard.mcphillips@scotland.gsi.gov.uk

17.2.11 Traveline Scotland

Traveline Scotland is one of 12 regional partnerships across the UK which together deliver the National Traveline traveller information service. Information is available by telephone (0871 200 22 33) and the internet (www.traveline.org.uk) for journeys by all modes of public transport — bus, train, air, ferry, coach and underground, plus walking links.

Traveline Scotland provides traveller information through a journey planner about all public transport services in Scotland and currently for trunk journeys in the UK. Enhancements to regional planner communication protocols through Journey Web allow complete journey details anywhere in the UK to be provided at one point of contact.

Traveline Scotland holds a database of every bus stop and public transport access point within Scotland. This includes the name of that stop, its local authority identity code and its Ordnance Survey grid references (OSGRs - six digits each giving one metre resolution).

Sources:

Information is provided by bus and train operators and local authorities on these services. Information on other modes is collected by Traveline from a number of public sources for use within the journey planner.

Data Availability:

Base data about each mode is available in the form of timetables which typically contain:

- Service identifier;
- Route description;
- Service frequency or times; and
- Daily or holiday variations.

Format of the Data:

Data can be output in the form of a specific journey itinerary, a listing of departures for any given stop by operator, by service or by time, and a list of departures for any given stop by chronological time order. Bus stop geographical codes and names can be supplied on excel spreadsheets.

Data Use:

The data provides a central source of information about travel opportunities and can be used to investigate trends and possibilities for changes in public transport use and evolution. It may be used to help identify travel needs for new planning and development proposals. OSGRs of all stops, along with the listing of service provision from these stops, may be used to develop accessibility analysis routines.

Data Access:

Data can be requested from Traveline Scotland, and can be made available on CD.

Cost:

A small charge may be made for the time involved in extracting the required data, and details will be provided by Traveline Scotland at the time of request.

Contacts:

Enquiries should be made to the Chief Executive of Traveline Scotland, John Elliot. Tel. 07771 647034 or email john.elliott2@btopenworld.com

17.2.12 Scottish Road Traffic Database (SRTDb)

The Scottish Roads Traffic Database (SRTDb) is a system which collects, validates, stores and disseminates traffic count data for the trunk road network and limited parts of the non-trunk network. The SRTDb is operated and maintained by Transport Scotland.

Sources:

There are over 1,500 traffic count sites in the system at present, with more likely as additional non-trunk sites are brought into the system. Data is collected via automatic traffic counters located (mainly) throughout the trunk road network.

Most automatic sites are continuously monitored but the extent of available data can vary depending upon the reliability of the count equipment and the data retrieval process. The more modern sites include power and telemetry and as a result data from these sites are in general the most comprehensive and reliable. Whenever a new trunk road scheme is constructed, or maintenance work is undertaken on an existing part of a route, the opportunity is taken to install or upgrade automatic counters as required.

Data Availability:

The earliest data available dates back to 1984. At the earlier automatic sites, data is downloaded and retrieved manually and sent to SRTDb on a monthly basis, whereas at the more modern automatic sites data is sent by telemetry on a daily basis to SRTDb. The available data includes:

- 12 hour manual counts classified by vehicle type for a single day;
- Automatic volumetric (i.e. no class) — on an hourly and daily basis;
- Automatic classified counts — on an hourly and daily basis; and
- Local growth rates (can be calculated).

Format of the Data:

A variety of data formats are available including printouts and electronic files which can be imported into spreadsheets.

Data Use:

The data available from SRTDb can be used to:

- Validate modelled flows;
- Update matrices;
- Estimate local traffic growth;
- Estimate local flow profile data; and
- Factor RSI data.

Data Access:

Access to the data is via the Transport Scotland's traffic count site at: <http://www.transportscotland.gov.uk/road/traffic-count>

Cost:

General traffic count data is provided free of charge. Specific requests for data to Transport Scotland may incur a fee.

Contacts:

Contacts at Transport Scotland are:
Email: info@transportscotland.gsi.gov.uk

Additional Information:

The DfT has an extensive database of traffic counts similar to that held by SRTDb. Traffic information is available from <http://www.dft.gov.uk/pgr/statistics/datatablespublications/roadstraffic/traffic/>

In addition, the Highways Agency also has a large amount of traffic data, available from <http://www.highways.gov.uk>.

The DfT can be contacted regarding traffic count information by emailing: roadtraff.stats@dft.gov.uk

17.2.13 Scottish Household Survey (SHS)

The Scottish Household Survey provides the Scottish Government with accurate information about the composition, characteristics and behaviour of Scottish households at both a national and local authority level.

The survey is designed to provide up-to-date information about the characteristics, attitudes and behaviour of Scottish households on a range of issues. It focuses on the areas of transport and social inclusion issues such as housing, health and neighbourhood.

Sources:

The survey began in 1999 and is currently funded until 2009. Interviews are carried out in approximately 15,500 randomly selected households each year.

Data Availability:

The Scottish Household Survey contains details on the following topics/areas:

- Household composition including number of children;
- Property;
- Transport and amenities;
- Health, disabilities and care;
- Working status of highest income householder;
- Economic activity;
- Household income and expenditure inc. housing costs;
- Assets savings, credit and debt;
- Local area/community safety;
- Education;
- Services and local government;
- Internet access;
- Homelessness;
- Childcare;
- Recycling; and
- Volunteering.

Format of the Data:

The results of the survey are available from SHS Annual Reports, and various Scottish Government Statistical Bulletins. These can be obtained in either paper format or electronically via the internet.

Data Use:

The Scottish Household Survey will provide the Scottish Government and other interested parties with accurate, up-to-date information on the impact on households and individuals of key services and policies which the Parliament is now responsible. This will assist in the effective evaluation of policy and the development of policy advice.

Data Access:

Copies of The Scottish Household Survey Annual and Technical Reports, Quarterly Bulletins and other related publications are available from The Stationery Office Bookshop and also on the survey's website at <http://www.scotland.gov.uk/shs>

Cost:

Survey bulletins are priced at between £5.00 and £20.00 whereas information via the internet is available free.

Contacts:

The main contact for the Scottish Household Survey is:
The Project Manager, Tel 0131 244 8420; Fax. 0131 244 7573
Email: shs@scotland.gsi.gov.uk

17.2.14 Scottish Transport Statistics (STS)/Transport Statistics GB

Scottish Transport Statistics contains numerous key statistics associated with transport in Scotland and is published annually by the Scottish Government. Similar statistics are available on a Great Britain wide basis in the publication Transport Statistics Great Britain.

Sources:

Various sources contribute to the Scottish Transport Statistics including:

- Bus & Coach Statistics — Statistical Bulletin;
- Travel by Scottish Residents: Some National Travel Survey Results — Statistical Bulletin;
- Road Accidents Scotland; and
- Department for Transport Maritime Statistics.

Data Availability:

Scottish Transport Statistics contains chapters on:

- Road transport vehicles;
- Bus and coach travel;
- Road freight;
- Toll bridges;
- Road network;
- Road traffic;
- Injury road accidents;
- Rail services;
- Air transport;
- Water transport;
- Finance; and
- Personal and cross-modal travel.

In addition, there are tables which provide a summary of the trends in passenger and freight transport in Scotland since 1960. Transport Statistics GB contains similar data on a GB wide basis.

Format of the Data:

Scottish Transport Statistics presents data in tabular format for each topic together with commentary on points shown in the tables.

Data Use:

The data contained within the Scottish Transport Statistics (and Transport Statistics GB) can be used to examine and update travel demand. The data provides a useful source of historic trends.

Data Access:

Scottish Transport Statistics (together with all its source documents and bulletins) can be found on the Scottish Government website: www.scotland.gov.uk and may be purchased from The Stationery Office Bookshop.

Transport Statistics Great Britain can be accessed via the DfT website on: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsgb/> and may be purchased from The Stationery Office Bookshop.

Cost:

Scottish Transport Statistics costs £10. Information obtained via the internet is available free of charge.

Transport Statistics Great Britain costs £33, but is available via the internet free of charge.

Contacts

The Scottish Government contact for Scottish Transport Statistics is:
Andrew Knight, Transport Statistics Branch; Tel. 0131 244 7256; Fax. 0131 244 7281;
Email: transtat@scotland.gsi.gov.uk.

The DfT can be contacted regarding Transport Statistics Great Britain by emailing publicationgeneral.enq@dft.gsi.gov.uk

17.2.15 Bus and Coach Statistics

Bus and Coach Statistics is a biennial Statistics Bulletin which describes the trends in Scottish bus and coach services over the past 10 years. The data focuses on the latest year and compares it with the previous year, and also with trends over the past ten years. Trends for Scotland are also compared with those for Great Britain as a whole (and for Great Britain outwith London).

Sources:

The data is collected from Scottish operators.

Statistics for the Bus and Coach Statistics Bulletin are provided by the Department for Transport.

Data Availability:

The bulletin provides estimates of the level of provision and trends in the provision of local bus services and patronage of such services for Scotland, and in some cases by local authority area. These include:

- Distance travelled;
- Passenger numbers;
- Number of buses, coaches & services;
- Fares & receipts;
- Public transport support & subsidies;
- Operating costs;
- Staff employed;
- Estimates of vehicle kilometres and passenger journeys; and
- Long term trends.

Format of the Data:

The statistics contained with the Bus and Coach Statistics Bulletin are presented in tabular format supported by textual commentary. The bulletin is available in paper format and electronically via the internet.

Data Use:

The information and statistics contained within with the Bus and Coach Statistics bulletin can be used to examine the current and historic levels and trends in the provision and patronage of bus and coach services throughout Scotland. These can then be compared against similar data for Great Britain as a whole (with and without the inclusion of services in London).

Data Access:

Copies of the Bus and Coach Statistics Bulletin is available from The Stationery Office Bookshop and on the Scottish Executive website at www.scotland.gov.uk.

Cost:

The Bus and Coach Statistics Bulletin is priced at £2.00. Information obtained via the internet is available free of charge.

Contacts:

The Scottish Government contact for Bus and Coach statistics is:

Email: transtat@scotland.gsi.gov.uk

The DfT can be contacted regarding national bus and coach statistics by emailing bus.statistics@dft.gsi.gov.uk

17.2.16 Transport Model for Scotland (TMfS)

The Transport Model for Scotland (TMfS) is an enhanced four-stage multi-modal model with detailed link and junction assignments and an interactive land-use model. The model is an enhanced version of the Central Scotland Traffic Model (Version 3) and has a base year of 2005. TMfS covers the entirety of Scotland, including the highlands and islands. It contains detailed road and public transport networks and travel demand defined by mode, purpose and car availability.

Further information regarding TMfS can be found in Section 17.3.

Sources:

TMfS makes use of data from other such models as Strathclyde Integrated Transport Model (SITM — see section A.22), CSTM3 and CSTM3A. The development process involves a programme of roadside interviews, traffic surveys and public transport surveys.

Data Availability:

TMfS is able to provide traffic forecasts on all Trunk Roads within the modelled area up to 2022. Information from different modelling stages within TMfS can be extracted for use in more detailed scheme appraisal processes.

Various data is collected and input to the model. These include:

- Planning and Forecast data;
- Roadside Interview data;
- Public Transport data;
- Journey Time data; and
- Junction Turning Count data.

Information from these various datasets can be obtained from TMfS.

Format of the Data:

TMfS is based on the Citilabs TP+ modelling suite (which requires a licence). Output from the model can however be produced in text or spreadsheet format.

Data Use:

TMfS can be used to test different major road and public transport schemes or policy initiatives as well as local transport strategies. In addition, the model can be used to analyse the transport demand consequences of different land-use and economic growth assumptions.

TMfS can also be used at a strategic level feeding traffic data etc. into local area models for more detailed scheme appraisal.

Data Access:

TMfS is available to Local Authorities from Transport Scotland. A Cube TP+ licence will be required to be able to operate the software. The model will be able to be operated by consultants on behalf of Local Authorities on a 'bureau service basis'.

Cost:

TMfS is available free of charge to Local Authorities. A fee may be charged to private sector bodies. The Scottish Government will impose a charge (based on their consultant's agreed rates) for the extraction of data from TMfS.

Contacts:

The Transport Scotland contact for the TMfS is:
Hugh Gillies, Strategy and Investment, Tel. 0141 272 7571; Fax. 0141 272 7560
Email hugh.gillies@transportscotland.gsi.gov.uk.

17.2.17 Strathclyde Integrated Transport Model (SITM)

The Strathclyde Integrated Transport Model (SITM) is a four-stage multi-modal model with detailed link and junction assignments which has been developed over a number of years by Strathclyde Passenger Transport (SPT). The current version, SITM4, has been developed from earlier versions and has a base year of 2001. SITM4 covers the west central Scotland area encompassing East & West Dunbartonshire, North & South Lanarkshire, Glasgow, East Renfrewshire & Renfrewshire, Inverclyde, North, South and East Ayrshire and part of Argyle & Bute.

SITM uses TUBA for economic evaluation of road and public transport scenarios having either fixed or variable matrices. The model encompasses the strategic road network and extensive public transport network, with all rail and most bus services represented. It has a comprehensive network of walk links associated with the transport network to ensure accurate modelling of modal split. Travel demand is defined by purpose and car availability, with park & ride and crowding effects via optional sub-modules. The effects of changes in land use and economic growth rates on transport demand can also be analysed through interaction with the DELTA model that has been developed by the David Simmonds Consultancy.

Sources:

SITM has been developed from an extensive database of survey material including origin/destination interviews, counts, household interviews and behavioural surveys, covering all transport modes and journey types. The zoning system and networks for SITM have been used as the basic building blocks for other models such as the Transport Model for Scotland (TMfS, see Section 17.2.16) and for other local models, ensuring compatibility and easy transfer of information.

Data Availability:

SITM can provide traffic forecasts on all principal routes on the public transport network throughout the SPT area for a twenty year forecast period. Information from different modelling stages within SITM can be extracted for use in more detailed scheme appraisal processes. The model incorporates 1,059 zones, 20,000 links and 1,000 modelled junctions.

Data sources utilised in development of the model include:

- Planning and Forecast data;
- Roadside Interview data;
- Public Transport data;
- Journey Time data; and
- Junction Turning Count data.

Information from these various datasets is available.

Format of the Data:

SITM is based on the SATURN suite for modelling the road network and the TRIPS suite for the public transport network. Output from the model can be produced in a variety of ways, including text or spreadsheet format.

Data Use:

SITM has been developed primarily to assist the analysis and planning of developments in the Public Transport network. To enable this, however, a robust road network and

modal split model are key elements of the model, together with modules to take account of parking, park & ride and crowding. SITM can be used to test different road and public transport schemes or policy initiatives as well as local transport strategies. In addition, the model can be used to analyse the transport demand consequences of different land-use and economic growth assumptions, particularly in combination with other modelling systems in SPT.

SITM can be used at a strategic level feeding traffic data etc. into local area models for more detailed scheme appraisal.

Data Access:

SITM is operated by SPT and is primarily a transport planning tool. SPT, however, can provide data from the modelling process or commission specific tests for other organisations. Requests, however, have to be part of the managed process within SPT and any data requirements or modelling work required should be discussed with SPT at the earliest stage, in order that they can be scheduled into the work programme.

Cost:

Modelling work or data provision will be costed on an individual basis. Exchange of data with other local authorities will normally be free of charge, but where staff time is required to undertake work for a specific local project, or provision of data or a service for a commercial company is requested, there will be a charge made. Charges may be discussed directly with SPT.

Contacts:

The SPT contact for the Strathclyde Integrated Transport Model is:
Neil Sturrock, Transport Planning & Integration Department, Strathclyde Passenger Transport, Tel. 0141 333 3745; Fax 0141 333 3284
Email neil.sturrock@spt.co.uk

17.2.18 Land Uses and Services

There are many potential sources of data at a small area level. Most local authorities now hold spatially referenced local data on GIS systems. In the absence of these locally validated data sources national data sets can be used.

Some of the most useful land use data sets are summarised in Table 17.2.

Table 17.2: Summary of Land Use and Service Data

Data Source	Data Content		Pop'n	Work	Training	Health	Shops	Other
	National	Scottish						
Census		X	X					
YellowPages	X			X	X	X	X	X
PointX	X			X	X	X	X	X
NOMIS	X			X				
IDBR	X			X				
NHS Scotland		X				X		
SEGIS		X	X			X	X	X
OS Mastermap	X				X	X	X	X

Census 2001 (www.scrol.gov.uk)

The 2001 census of population results can be obtained from the above web site at a ward level. The data are held by GRO down to output area level and within confidentiality restrictions it may be possible to obtain information on population groups at various spatial levels down to output area level. Most local authorities have access to this data at its most detailed level but other requests can be made directly to GRO via the web site.

YellowPages Business Database (www.yell.com)

A number of commercial datasets are potential sources for mapping local services by sector. These would need to be purchased but prices can be quite reasonable providing certain conditions of use are guaranteed. Yellow pages recommend use of their business database in combination with YellowPoint which uses Ordnance Survey data to locate records geographically with nothings and eastings for use with GIS, but assure that other map bases are also compatible.

PointX Location Based Database (www.pointx.co.uk)

This database is a new product that is very useful in identifying local services. It includes the names and address of all GPs and dentists, educational establishments and other public services that do not appear in the YellowPages Business Database. Locations are identified by combining the Thompson's Local Directory database with Ordnance Survey mapping data. The classification system has three levels. There are 18 data fields: record type, unique reference, supplier reference, common record number, topographic identifier (TOID), TOID version, name, address, address detail, street name, locality, postcode, PointX classification code, Easting, Northing, Name of data supplier, date of supply, Positional accuracy code, supplier link. Level 1 data has ten groups, e.g. accommodation, commercial services, attractions, sport and entertainment, education and health, public infrastructure, manufacturing and production, wholesale, retail, transport. Level 2 then sub-divides into further 56 sub-categories e.g. hotel, bed and breakfasts, etc, Level 3 has 750 sub-divisions of these. The cost of obtaining this data can be considerable.

NOMIS (www.nomisweb.co.uk)

Nomis provides access to a wide range of national and local labour market statistics data free of charge:

- Labour Force Survey (LFS);
- New Earnings Survey;
- Annual Business Inquiry (ABI);
- Claimant Count; and
- Job centre vacancies.

All data sets available through Nomis are open access except for the Annual Business Inquiry series. To access these it is necessary to obtain authorisation from the Office for National Statistics.

Inter Departmental Business Register (IDBR)

Information on the location of business is recorded by the IDBR. New business start-ups and existing businesses are recorded by:

- SIC;
- Number of employees (male and female full and part-time);
- Turnover on an annual basis;
- Ward code;
- Ward name;
- Trading name and address; and
- Full post-code (in most instances).

The data is only allowed to be shared by government departments. If local authorities want to use the data they would have to request why they want the data and what they are going to use it for. Contact the Office of National Statistics (ONS).

Previous experience of using IDBR for GIS mapping is that the post code information is sometimes inaccurate or incomplete and that considerable time is needed to geo-code.

NHS Scotland (<http://www.isdscotland.org/>)

The NHS ISD provides information on patient care delivered by the NHS in Scotland by location. This is used to provide wide ranging analysis for the NHS, Government and many other organisations and individuals who have an interest in health and healthcare administration. ISD publishes tables that can be downloaded free of charge from the web site. There can be confidentiality problems sourcing this data at a small area level but these issues can be resolved for accessibility modelling by contacting ISD.

Rural Services Data from the Scottish Executive GIS Unit

The Scottish Executive GIS unit (SEGIS) has developed a database of rural services including post offices, banks, chemists, petrol stations, shops, job centres and other facilities. Requests for data from this source should be made through Transport Scotland since SEGIS cannot respond to all direct requests from local authorities.

Ordnance Survey (OS) Mastermap data (www.ordnancesurvey.gov.uk)

OS data identifies existing land-uses in sufficient detail for the purposes of GIS mapping of key local services. All local authorities have free web based access to this GIS mapping data under the government's service level agreement. It identifies all land use

development and identifies, hospitals, schools, colleges, supermarkets and other major buildings. It will not identify the activity use of smaller buildings e.g. in a row of local shops. The data is continuously updated and new developments and use changes should be recorded within 6 months in most instances. Authorities can overlay their own local data in GIS.

17.3 Modelling and Assessment Software

The development and application of models and software are important to many project appraisals for the following reasons:

- They provide an analytical framework to assess existing demands on the transport system, and to project these demands into the future to test the impact of transport and land-use options on a systematic basis; and
- They enable quantitative measures to be generated that act as key indicators in the appraisal process.

Some of these indicators can only be derived in a sufficiently robust, disaggregate manner by using a model.

At their most complex, models include:

- A road traffic assignment model;
- A public transport passenger assignment model;
- A mode choice model;
- Trip generation and trip distribution assumptions based on trip end data; and
- Modelling of transport and land-use interactions.

Demand models are most common and range from assignment only, to more sophisticated approaches involving the four main stages of generation, distribution, mode choice and assignment. Demand models come in two main forms:

- The operational form where the networks and systems are represented in detail; and
- Policy sensitive forms where the trip ends are represented in greater detail.

For many appraisals, the pattern of travel demand is unlikely to differ significantly for the transport options under consideration. In these circumstances, travel demands can be assumed to be fixed for each option and the assessment undertaken using only an assignment model.

Accessibility models represent the transport supply in relation to the spatial distribution of land-uses. It is often assumed that road network supply is available to all locations so the modelling is regularly restricted to public transport supply. However in some circumstances it is helpful to compare the standard of transport supply for road and public transport users so in these cases travel times and costs using the road network are also modelled.

Land-use/transport interaction (LUTI) models cover a wide range of types of model representing aspects of the interaction in different levels of detail. At their simplest level they are sometimes taken to include policy sensitive demand models or accessibility models as described above, but in true LUTI models patterns of land-use are modelled rather than simply represented as a data input.

17.3.1 Modelling and Assessment Software Appendix Structure

This Appendix consists of six sections. Following this introductory section, 17.3.2 Transport Demand Modelling Software summarises the range of transport modelling software available and discusses its application. Typical data requirements, model outputs and functionality of the various program packages are also presented. For information on demand modelling and land-use/transport interaction models, the reader is referred to WebTAG (www.webtag.org.uk).

Assessment software that could be used for economic or environmental appraisals is summarised in 17.3.3 Economic Assessment Software and 17.3.4 Environmental Assessment Software. In particular, these sections describe the different types of assessment and discuss the capabilities and application of each program. Accessibility Modelling is discussed in 17.3.5 Accessibility Modelling.

Summary information on various Scottish transport models is contained in 17.3.6 Summary of Existing Scottish Transport Models.

17.3.2 Transport Demand Modelling Software

There is a variety of software packages available for modelling transport networks. The software applications range from local junction assessments of road traffic to strategic road traffic and public transport assignment modelling as well as pedestrian interaction modelling.

The choice of which software package to use will depend on many factors, including the application, available data and the type of assessment to be carried out.

17.3.2.1 Assignment Methods

A number of assignment techniques exist and generally, each package will differ in terms of the methods available. The choice of which assignment method to use will depend on a number of factors, including study purpose, study area, the range of alternative routes, the zoning system and the detail and quality of the available data. The assignment methods in common use are as follows:

- All-or-nothing – Single route assignment;
- Multi-routeing – Using stochastic methods;
- Capacity restraint – Drivers long-term knowledge of congestion utilised; and
- Dynamic – Drivers short-term knowledge of congestion utilised.

The majority of packages covered in this guidance contain one or more of the above assignment methods. The choice of which package is best suited to a study will be significantly influenced by the assignment methods inherent within it. For example, a package which only accommodates all-or-nothing routeing may be suitable for a route corridor study covering several kilometres, but would be insufficiently detailed to model a much smaller urban area where multiple alternative routes are available.

17.3.2.2 Model Types

There are a large number of software packages used in the UK for modelling transport networks. The software packages available have been categorised under the following model type headings to simplify presentation:

- Road Traffic Assignment;
- Public Transport Passenger Assignment;
- Traffic Microsimulation;
- Junction Models; and
- Pedestrian Models.

Road Traffic Assignment

Road traffic assignment models allocate vehicle trip matrices to a road network to reproduce or estimate traffic flows on links. This is done by determining traffic routes using the cost of travel between zone pairs. For the base year, the model calibration and validation process enables the level of fit to be verified by comparison against observed traffic flows and journey times. Traditional road traffic assignment models operate on the basis of traffic flow being considered as a single entity flowing through the road network, analogous to fluid flowing through a pipe.

Generally, in congested assignment routines, it is assumed that some form of equilibrium – whereby drivers cannot reduce their travel cost by changing route – involving a number of iterations, has to be achieved before the assignment process is complete. These capacity restraint techniques involve feasible routes being considered at each iteration based upon current network conditions. Convergence or equilibrium is

reached when changes in route cost (and hence the likelihood of alternative routes being used in successive iterations) reach negligible levels, based upon pre-defined criteria. This type of assignment method is particularly useful for reflecting drivers' learning effects of congested network conditions over long periods and is therefore suitable for modelling average traffic conditions in congested areas.

Less congested networks can be modelled using simpler methods such as all-or-nothing or stochastic assignment where the prescribed cost, and/or individual drivers' perception of the cost, determines route choice. Stochastic methods are used to produce a more realistic spread of traffic across competing routes where all-or-nothing methods are too simplistic. Congestion effects are not accounted for in these assignment routines and, therefore, their application is more suitable for situations where route choice is not significantly affected by congestion.

Traditional road traffic assignment models are often referred to as macroscopic since they operate on the principle of aggregate traffic flow. Broadly, the macroscopic approach assumes that average conditions are modelled and that all drivers making the same trip will experience the same conditions and will therefore have the same journey cost. Some models attempt to break down this flow into smaller elements by assigning the travel demand in smaller increments throughout the simulation period. These models may be categorised as mesoscopic, as they still represent aggregate traffic flow and not individual vehicles, but do take some account of the variations in traffic demand and network conditions.

Public Transport Passenger Assignment

Public transport passenger assignment models involve the assignment of individual passenger trips to the network as opposed to the public transport vehicles themselves, which will generally be incorporated in the road traffic assignment process. This can involve both road and non-road based public transport trips, and will generally be encompassed in the wider context of modelling all person/vehicle movements within a study area. The demand response of mode choice can therefore be incorporated in the modelling process to forecast the effects of transport proposals across all modes.

Traffic Microsimulation

Traffic Microsimulation models have become more widely used during the last few years. Their application ranges from large-scale urban and inter-urban assessments to operational models of a single junction. Key strengths of this type of software include the modelling and visual representation of individual vehicles together with a comprehensive range of model outputs.

The more sophisticated microsimulation models incorporate road traffic assignment algorithms for wide area or strategic studies. Microsimulation models also use all-or-nothing and stochastic assignment methods. For congested conditions, some microsimulation models have dynamic assignment capabilities whereby drivers can alter their route as they travel through the network, based upon current levels of congestion or delay. Generally, these techniques do not assume equilibrium, but rely on the feedback of delay information to a proportion of the driving population at intervals defined by the user. These techniques are particularly suited to the detailed simulation of congested traffic networks to represent in-day variations of traffic flow resulting from the build up of queuing and delay.

Junction Models

Junction models are generally used to evaluate the operation of a single junction or localised group of junctions. Key strengths of these packages are their ease of use and

limited data requirements. These models are based upon empirical capacity, queuing and delay formulae, and in common with macroscopic assignment models, consider traffic as a fluid flow or platoon of vehicles travelling through the network.

Pedestrian Models

Pedestrian models can be used to assess the design and operation of walking infrastructure such as transfer (e.g. rail/bus) stations, airports, shopping malls and sports stadiums. As well as assessing the pedestrian flow through known thoroughfares in buildings, such models can also be used to examine the relationship between pedestrian flow and transport service timetables. Additionally, evacuation scenarios can be examined in the design process.

17.3.2.3 Model Applications

The types of study and assessment which would utilise the network assignment and junction software described above can be categorised as follows:

- Transport Corridor Studies;
- Strategic/Trunk Road Assessments;
- Public Transport Assessments;
- Local Transport Strategies;
- Local Area Development Studies;
- Local Junction Assessments; and
- Pedestrian Assessments.

Transport Corridor Studies

Transport Corridor studies are specifically targeted at investigating problems on or with all modes of transport. In particular, they are expected to focus on problems on the road, rail and bus systems, including access to ports and airports. Transport Corridor studies can also include analysis of problems of air transport, coastal shipping and inland waterways. Generally, such studies consider strategic scenarios and plans by assessing the impact on modal transfer, the demand for travel and major public transport and roads schemes. These studies therefore, require the ability to model a wide range of demand responses (e.g. re-distribution, modal transfer and trip re-timing) in addition to the routing of vehicle or person trip movements.

Examples of Transport Corridor Studies include the Central Scotland Transport Corridor Studies which examines the A8, A80 and M74 corridors.

Strategic/Trunk Road Assessments

The assessment of strategic roads schemes can be undertaken using a number of software packages. In addition to modelling operational effects, there will be a requirement to undertake economic and environmental assessments. Typical schemes can range from major infrastructure improvements on a corridor or junction (e.g. grade-separation or on-line widening/upgrading) to new major roads or re-alignments designed to improve current route standards (e.g. rural motorway, bypass etc.). Whilst these schemes may be significant in terms of scale and cost, their impact on travel demand would not justify modelling demand responses other than re-assignment.

Examples of Strategic/Trunk Road Assessments include the A90 grade separation between Perth and Dundee, the A90 climbing lanes and the A92 Preston to Balfarg improvements.

Public Transport Assessments

A public transport assessment is necessary for any scheme or proposal designed to improve public transport services or infrastructure. This would apply to new Light Rail systems and quality bus corridors. The operational assessment for such schemes would encompass the changes in cost associated with public transport operators and users as well as general road traffic. This could involve public transport passenger and/or road traffic assignments.

Local Transport Strategies

Local transport strategies prepared by local authorities provide a framework for meeting wider policy objectives. A strategy will typically encompass the full spectrum of transport issues in the local area including freight movements, local public transport services, local road infrastructure, cycling and pedestrian facilities, set in the context of both central and local government policy objectives. Hence, studies related to the development of a local transport strategy may consider single or multi-modal issues in the local context.

Local Area Development Studies

Local area development studies typically investigate the operational impact on existing infrastructure of traffic generated by the opening of new developments. These studies often involve a localised assessment of operational conditions at a limited number of junctions in the vicinity of the development (i.e. traditional traffic impact assessment). Larger studies could involve assessing the operational impact of proposed developments along a strategic corridor or within the wider context of a town or city.

Local Junction Assessments

Local junction assessments generally concentrate on operational issues associated with single junctions or small groups of junctions. Applications could include assessment of existing problems and their solutions such as geometric improvements or traffic signal optimisation. The impact of proposed capacity alterations at junctions, such as bus or cycle priority measures, could also be assessed.

Pedestrian Assessments

Pedestrian assessments generally concentrate on operational issues associated with pedestrian thoroughfares or pedestrian infrastructure such as rail stations and airport terminals. Applications could include assessment of existing infrastructure and potential measures to improve pedestrian flow (e.g. increased number/changed location of ticketing facilities etc.). Additionally, evacuation facilities for emergency situations can be assessed.

Table 17.3 shows the model types that could be applied to each of these assessments.

Table 17.3: Model Applications

Model Types	Multi-Modal Studies	Strategic / Trunk Road Assessments	Public Transport Assessments	Local Transport Strategies	Local Area Development Studies	Local Junction Assessments	Pedestrian Assessments
Road Traffic Assignment (With Capacity Restraint)	✓✓✓	✓✓✓	✓	✓✓	✓	-	-
Road Traffic Assignment (Without Capacity Restraint)	-	✓✓✓	✓	✓✓	✓	-	-
Public Transport Passenger Assignment	✓✓✓	-	✓✓✓	✓✓	-	-	-
Traffic Microsimulation	✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	-
Junction Model	-	-	-	-	✓✓	✓✓✓	-
Pedestrian Model	-	-	-	-	-	-	✓✓✓

Key: ✓✓✓ Ideally Suitable ✓✓ Suitable ✓ Acceptable - Unsuitable

17.3.2.4 Model Review

The type of model chosen, and the level of detail modelled, will vary by application. The following sections summarise the main functions, inputs and outputs for the various model types. These are key factors to be considered when selecting a software package to meet the objectives of the study in question. The suppliers should be contacted for a more comprehensive list of individual software functionality.

The model types outlined in Table 17.3 (see previous section) will be defined in terms of:

- Purpose;
- Software Packages;
- Inputs;
- Outputs;
- Applications.

Road Traffic Assignment Models

Assignment models with capacity restraint have been used extensively to represent traffic conditions across relatively large road networks. These models have been used for towns and cities where the effects of congestion are prevalent. The assignment facilities within these models have also been utilised in more strategic studies where route choice decisions over a wider area are a principal element of the modelling process.

Assignment models with capacity restraint in general use within the UK include:

- CONTRAM;
- EMME/2;
- SATURN;
- CUBE Voyager
- VISUM.

These models typically require the following data inputs:

- Physical network description – link length, link travel speed, junction details;
- Operational network description – signal timings, lane markings, saturation flow/capacity;
- Demand matrix;
- Public transport routes and frequencies.

Model outputs can include:

- Assigned link and turning flows;
- Demand link and turning flows;
- Junction capacity indicators;
- Junction delays, queue lengths – maximum, average;
- Link travel times, speeds;
- Network summary statistics – vehicle kilometres, hours.

Table 17.3 (see previous section) provides an overview of the application of assignment models with capacity restraint. These models are ideally suited to the assessment of transport strategies or schemes in congested urban and peri-urban areas.

Some of the modelling packages outlined above (e.g. EMME/2, SATURN and CUBE Voyager) can also utilise simpler assignment methods which do not explicitly account for the possible effects of traffic congestion on drivers' route choice. These simpler methods

would include all-or-nothing assignment and multi-routing methods using stochastic techniques. The principal applications of such techniques would be for operational, economic and environmental appraisal of schemes which primarily influence road traffic and do not have significant impacts on travel demand across modes.

Along with the software packages outlined above, single and multi-routing facilities are also available in NESA. This program was developed specifically to perform a cost benefit analysis of new or improved road schemes in Scotland and incorporates the modelling and assessment routines within a single package. This package includes a traffic assignment model which can apply single or multi-route options. Link travel times are calculated from speed-flow curves and junction delays from TRL junction capacity formulae.

Public Transport Passenger Assignment Models

The assignment of public transport passenger trips (i.e. a person trip as opposed to a vehicle trip assignment) is an essential component of any model which is specifically developed to assess public transport schemes or modal responses. The operational interactions of public transport schemes may be assessed using road traffic assignment models. However, if the modelling of demand responses such as mode shift and re-distribution are to be investigated, then a public transport passenger assignment would normally be required.

The packages with public transport passenger assignment capabilities most widely used in the UK are:

- EMME/2;
- CUBE Voyager
- VISUM.

The use of public transport passenger assignments may be as part of a wider multi-modal study where demand responses across all transport modes are modelled. Alternatively, this element may be used to look at schemes affecting public transport in isolation.

The public transport information required as input to this type of model is significantly more detailed than would be necessary for the assignment of public transport vehicles alone. Data inputs include:

- Person trip matrix for public transport (possibly derived from a multi-modal model);
- Detailed information on public transport routes, services, fares, frequency and capacity;
- Interchange times between modes or services.

Model outputs are broadly similar to the road traffic assignment models, including passenger volumes, travel times and costs. These outputs however will often be supplemented by additional data on public transport operating costs, fare revenues and overcrowding.

Traffic Microsimulation Models

Traffic Microsimulation models have been used commercially in the UK since the mid-1990s. These models simulate individual vehicles travelling through a transport network. Microsimulation models offer the ability to simulate at a greater level of detail compared to macro-models. This increased level of sophistication can be advantageous, particularly in congested situations.

Microsimulation packages currently in use in the UK include:

- AIMSUN;
- CUBE Dynasim;
- Dracula;
- Paramics;
- SISTM;
- VISSIM.

The underlying simulation models and data inputs are relatively similar and generally car following, lane changing and gap acceptance models combine to allow individual vehicles to travel through the network. See the *Interim Advice Note IAN/36/01* (ref. <http://www.standardsforhighways.co.uk/ians/pdfs/ian36.pdf>) for key differences between the software packages.

As for traditional modelling packages, there is a wide range in the level of functionality and assignment methods available across the various microsimulation packages. The choice of which package is most suitable will depend on the scope and purpose of the study. All microsimulation modelling packages enable individual or groups of junctions to be modelled. The more sophisticated packages include dynamic assignment routines and are also capable of accommodating wide area or strategic studies covering several hundred junctions.

Whilst all microsimulation packages focus on representing and visualising individual vehicles, the simulation methods and range of applications vary greatly between packages. For example, Dracula is an ancillary program that performs an animation of an assignment previously undertaken using the SATURN macroscopic program. SISTM was developed explicitly to model the operation of motorway traffic and is therefore inapplicable for urban road networks.

The other more advanced packages (e.g. AIMSUN, Paramics and VISSIM) are applicable to a wide range of network conditions and undertake the simulation/assignment at an individual vehicle level without using macro or mesoscopic models in part or as a starting point. The assignment procedures in these microsimulation models vary from all-or-nothing to stochastic multi-routeing and dynamic (in-day) assignment.

A microsimulation model requires the following data inputs:

- Physical network description – junction details, link characteristics;
- Operational network description – signal timings, lane markings;
- Demand matrix;
- Public transport routes and schedule;
- Driver behaviour characteristics.

Microsimulation models can provide similar outputs to macroscopic models. A range of additional model outputs is available, although this varies between packages. Additional model outputs can include:

- Visualisation captured on movie file;
- Detailed operational output by individual trip or route;
- Pollution emissions.

Microsimulation models offer significant benefits in providing graphical outputs of the vehicles being modelled. Current computer hardware means that this can be achieved for networks of significant scale representing city areas or major inter-urban routes. Applications and key features of microsimulation models include:

- Blocking back effects on congested networks;
- Detailed operational design;
- Public consultation;
- Visualisation of output from macro and mesoscopic models.

Junction Models

Software for modelling single junctions has been widely used throughout the UK for the past 25 years. Each software package models traffic queues and delays at either a signal controlled intersection, a roundabout or a priority controlled junction.

- Signalised Junction
- LINSIG
- OSCADY
- TRANSYT
- Roundabout
- ARCADY
- RODEL
- Priority Junction
- PICADY

These packages use empirically derived formulae to determine junction capacity, queue length and queuing delay. The signal junction software can also optimise traffic signal settings for a given set of traffic flows.

A junction model typically requires the following data inputs:

- Turning counts;
- Physical network description – geometry, visibility;
- Signal staging and saturation flows (signalised junction only).

Model outputs can include:

- Junction capacity;
- Approach capacity – degree of saturation or RFC;
- Maximum and average queue lengths;
- Queuing delay;
- Optimum cycle time and signal settings (signalised junction software only).

Junction models are generally used to evaluate the operation of individual junctions in detail. The software can be used as part of the design process or to test small-scale improvement measures at an existing junction or a localised group of junctions.

Pedestrian Models

Specialised software for modelling pedestrian flows and interaction is available in the UK and overseas. This is a developing field and consequently, only a small number of alternative packages are available. Examples of software available in the UK are:

- FATHOM;
- PEDROUTE/ PAXPORT;
- PEDFLOW.

These packages use a simulation module, similar to a traffic microsimulation model, to simulate the interaction of pedestrians in stations and other buildings and on pavements. Other pedestrian modelling packages are in development overseas such as SIMVOET and NOMAD.

A pedestrian model typically requires the following data inputs:

- Network description (i.e. station/terminal layout, location of stairs/escalators, location of obstacles etc.);
- Walking behaviour parameters (e.g. speed, size, age, sex, impatience, grouping etc.);
- Activity scheduling and route choice parameters (e.g. location of doors, ticketing/waiting areas etc.);
- Evacuation/emergency parameters.

Model outputs can include:

- Graphical animation of pedestrian simulation;
- Service levels/pedestrian densities;
- Delays;
- Pedestrian flows;
- Pedestrian characteristics;
- Visibility;
- Accessibility.

Pedestrian models are generally used to evaluate the design of existing or influence the design of proposed pedestrian infrastructure. This type of model can be used to influence the layout of stations/airports, the location of ticketing facilities and pedestrian barriers/access routes. Additionally, the effectiveness of evacuation facilities during emergency situations, can be assessed.

17.3.2.5 Summary

In summary, the assignment model software available offers a wide range of features and has a diverse range of data requirements and model outputs. To assist in the selection of a suitable software package, the following tables summarise the outputs and functionality of the model types.

Typical model outputs for each category of model are shown in Table 17.4.

Table 17.4: Model Outputs

Model Types	Flows, Journey Times, Queue Lengths etc.	Classified Output	Routing Paths / Costs	OD Based Output	Link Based Output	Pollution Emissions	Pedestrian Visualisation
Road Traffic Assignment	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓	-
Public Transport Passenger Assignment	✓✓	✓✓	✓✓✓	✓✓	✓✓✓	-	-
Traffic Microsimulation	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓
Junction Model	✓✓✓	-	-	✓	✓	✓	-
Pedestrian Model	✓✓	✓	✓✓	✓✓	-	-	✓✓✓
Key:	✓✓✓ Full Range of Output	✓✓ Selected Outputs	✓ Little Output	- No Output			

Typical assignment methods available with each model type are shown in Table 17.5.

Table 17.5: Assignment Methods

Model Types	Dynamic (In-Day)	Equilibrium	Stochastic	All or Nothing
Road Traffic Assignment (With Capacity Restraint)	No	Yes	Yes	Yes
Road Traffic Assignment (Without Capacity Restraint)	No	No	Yes	Yes
Public Transport Passenger Assignment	No	Yes	N/A	Yes
Traffic Microsimulation	Yes	Not Standard	Yes	Yes
Junction Models	No	No	No	No
Pedestrian Models	Yes	No	Yes	Yes

The extent to which public transport is represented in each model type is summarised in Table 17.6.

Table 17.6: Public Transport Capability

Model Types	PT Modes / Routes	Bus / LRT Priority	Passenger Loading / Vehicle Occupancy	Impact of Dwell Times, Vehicles Manoeuvres	Response to Overcrowding
Road Traffic Assignment	Yes	Yes	No	No	No
Public Transport Passenger Assignment	No	Yes	Yes	No	Yes
Traffic Microsimulation	Yes	Yes	Yes	Yes	No
Junction Models	No	No	No	No	No
Pedestrian Models*	Yes	No	Yes	Yes	No

*Note: Detail and application of PT information likely to be station / terminal specific for pedestrian modelling

17.3.3 Economic Assessment Software

17.3.3.1 Assessment Categories and Applications

There are a variety of software packages available for undertaking the economic assessment of transport schemes. The software applications range from separate modules to assess outputs from other transport models to fully integrated economic assessment transport models. The choice of software package will depend on many factors, including the type of assessment and the nature of the scheme to be assessed.

Assessments are required across the full spectrum of transport schemes and hence, the nature and complexity of the assessment can vary greatly between schemes. The capabilities of the different assessment software packages also vary and hence different packages will be suited to different types of assessment. The types of assessment can be categorised in accordance with the recommendations in the SACTRA report *Trunk Roads and the Generation of Traffic* (HMSO, 1994) as follows:

- Complex scheme assessments;
- Intermediate scheme assessments;
- Simple scheme assessments.

Schemes are classified into the above categories and assessed against the following criteria:

- Are the existing roads in the study area operating close to capacity, or are they expected to do so within the design life of the scheme? In these circumstances, congestion is likely to lead to suppression of traffic effects, and schemes may result in the release of some of the suppressed traffic;
- Is the potential change in overall traffic flows high with respect to changes in travel times or costs? This is likely to be the case where there are good alternatives available for the movements affected by the proposed scheme, e.g. other routes or public transport alternatives; and
- Will the implementation of the proposed scheme cause large changes in travel costs, road capacity or both? These conditions are likely to occur where the scheme or improvement bypasses extended lengths of low standard or congested network, or where new road links or public transport systems cause major changes in accessibility (e.g. estuarial crossings, LRT network).

This systematic approach to scheme/assessment classification is intended to identify the nature of transport proposals in terms of their effects arising from changes in traffic flow, journey times/travel costs and road capacity compared to existing conditions. The assessment of these criteria involves both qualitative and quantitative factors and schemes are designated a low, medium or high ranking in terms of the above criteria which in turn defines the scheme classification and hence, the assessment requirements. Advice on the classification of schemes is contained in 'Induced Traffic Appraisal' (ref. DMRB 12.2.2), however a brief summary is provided below.

Complex schemes are those where a high marking is merited in more than one of the criteria outlined above. Generally, a variable trip matrix assessment is appropriate for this type of scheme, however, a fixed trip matrix assessment should be undertaken for comparison purposes.

Intermediate schemes are those where one of the criteria merits a high marking or more than one merits a medium marking. Variable trip matrices may be appropriate for these schemes but may only be necessary for sensitivity testing on a fixed trip matrix analysis.

Simple schemes are those where low markings are given for all criteria. Fixed trip matrices are sufficient for these types of schemes since the pattern of travel demand is unlikely to differ significantly between the base and improved networks.

The following paragraphs provide an overview of the scheme classifications within which different study and assessment types can be considered.

Complex Scheme Assessments

Complex scheme assessments encompass multi-modal studies, certain public transport assessments and some aspects of local transport strategies. By their nature, multi-modal studies will invariably involve an investigation of a range of responses which ensures that they justify a complex classification. Certain public transport assessments may require consideration of impacts across transport modes (e.g. major public transport improvements or new LRT schemes) and would therefore be classified as complex. Local transport strategies consider policy measures across all modes of transport. Studies aimed at meeting the objectives of the local transport strategy may therefore be required to consider sufficient variables to justify a complex classification.

Intermediate Scheme Assessments

Intermediate scheme assessments could be either strategic/trunk road assessments or those related to local transport strategies. Strategic/trunk road assessments generally consider the benefits of operational improvements due to road schemes, where the main focus is on savings in journey times, vehicle operating costs and accidents. The demand responses of such schemes would not be expected to have a significant impact on mode choice, but may justify a variable trip matrix method due to the improvements themselves, hence the justification of an intermediate classification.

Simple Scheme Assessments

Simple scheme assessments relate to all other schemes which are not expected to have significant effects in terms of modal shift or other demand responses and hence, a fixed matrix is suitable in all cases. This may apply to strategic/trunk road assessments such as on-line improvements or grade separation where mode or demand responses are marginal. Equally, specific public transport assessments, local development studies or small elements of local transport strategies could be classified as simple. Local junction assessments will rarely require a full appraisal and would generally be considered as simple in such circumstances.

17.3.3.2 Overview of Economic Assessment Software

The assessment programs outlined in this appendix can be used to provide economic inputs to the Part 2 AST detailed in Section 6 of this Guidance.

A number of assessment packages are available for assessing the performance of schemes in economic terms. These packages analyse output from an operational assessment and produce various measures that can be used to compare or rank the economic and sometimes operational aspect of projects against each other on a consistent basis. Some packages contain both the operational and economic analysis routines within a single module, whilst others are designed to interface with outputs from separate operational models.

The following sections provide an overview of available economic assessment programs and their application.

17.3.3.3 Economic Assessment Programs

Economic assessment programs have been used extensively in the UK to quantify the costs and benefits associated with a range of transport strategies and schemes. Applications include infrastructure improvements, public transport schemes and assessment of roadworks. The economic assessment programs in use in the UK are as follows:

- COBA (DfT)
- QUADRO (DfT)
- TUBA (DfT)
- NESAs (Transport Scotland)
- PEARS (Transport Scotland/SIAS)
- TREVAL/PTEVAL (Transport Scotland/MVA)

The capabilities and outputs of these programs vary and, hence, certain applications will be better suited to individual programs. Table 17.7 provides an overview of the capabilities of each program. All the programs listed in Table 17.7, use the methodologies and parameters outlined in WebTAG.

Table 17.7: Economic Assessment Program Capabilities

Assessment Program	Integral or Ancillary	Travel Time Benefits	Vehicle Operating Cost Benefits	Accident Benefits	Maintenance Costs	Variable Trip Matrix Assessments	Link or Matrix Based Assessments
COBA	Ancillary	Yes	No	Yes	Yes	Yes	Link
QUADRO	Integral	Yes	Yes	Yes	Yes	No	Link
TUBA	Ancillary	Yes	Yes	No	No	Yes	Link/Matrix
NESA	Integral	Yes	Yes	Yes	Yes	No	Link
REVS	Integral	Yes	Yes	Yes	Yes	No	Link
TREVAL / PTEVAL	Ancillary	Yes	Yes	Yes	No	Yes	Link/Matrix
PEARS	Ancillary	Yes	Yes	No	Yes	No	Link/Matrix

Note: Integral denotes operational / economic assessment is undertaken using the same program, ancillary implies that economic assessment is undertaken by the program using output from a separate operational assessment program.

COBA was developed specifically to undertake economic evaluations of road based infrastructure improvement schemes and is applicable to inter-urban and rural scheme assessments. COBA is suitable only for fixed trip matrix (FTM) analysis and is therefore generally restricted to 'simple' scheme assessments. COBA can however also be used to carryout sensitivity tests on 'intermediate' schemes using a FTM analysis and can also be used to undertake the accident analysis for variable trip matrix schemes.

QUADRO was developed specifically to undertake assessments of the impact of roadworks using similar economic concepts to COBA and NESAs. This program assumes a fixed matrix approach and is only suitable for use on 'simple' schemes. The application of QUADRO is also limited by the fact that junctions are not explicitly modelled and that diversion routes are crudely represented.

TUBA (Transport User Benefit Appraisal) is a multi-modal, variable trip matrix (VTM) economic appraisal package which was developed by DETR (now DfT) to undertake the economic appraisal of multi-modal transport projects. TUBA is capable of appraising highway and/or public transport, fixed or variable matrix projects. TUBA does not carry out any analysis of accident benefits and generally an accident only COBA or an accident only NESAs will need to be run to obtain these.

NESAs is effectively the Scottish equivalent of COBA and is primarily focussed on assessing inter-urban and rural road schemes. The economic concepts are the same in both COBA and NESAs but NESAs uses Scottish based traffic and economic parameters where appropriate. Like COBA, NESAs is suitable only for fixed trip matrix (FTM) analysis and is therefore generally restricted to 'simple' scheme assessments. NESAs can however also be used to carryout sensitivity tests on 'intermediate' schemes using a FTM analysis. It can also be used to undertake the accident analysis for variable trip matrix schemes.

PEARS (Program for the Economic Assessment of Road Schemes) is an economic assessment module which is designed to interface with outputs from microsimulation software. The economic concepts in PEARs are consistent with those contained in NESAs and COBA. PEARs is suitable only for fixed trip matrix (FTM) analysis and is therefore generally restricted to 'simple' scheme assessments. It can however be used to carryout sensitivity tests on 'intermediate' schemes using a FTM analysis. PEARs can carryout an FTM assessment using both link and matrix based outputs. PEARs does not carry out any analysis of accident benefits and generally an accident only NESAs will need to be run to obtain these.

TREVAL and PTEVAL are economic assessment packages that have been specifically developed to interface with the TRIPS software. TREVAL and PTEVAL undertake economic assessments for private and public transport users respectively. TREVAL and PTEVAL can provide fixed or variable trip matrix assessments and hence are suitable for use on schemes with 'simple', 'intermediate' or 'complex' classifications.

17.3.3.4 Summary

In summary, there is a wide range of transport assessment software available for the purpose of economic evaluation. These packages range from ancillary routines which interface with output from transport modelling software to fully integrated modelling and assessment programs. The functionality level varies by program and hence, certain packages are best suited to certain applications as outlined above.

17.3.4 Environmental Assessment Software

17.3.4.1 Overview of Environmental Assessment

Environmental assessment can incorporate a number of different elements, many of which are either physical, aesthetic or social in nature. The assessment of such elements is, to a certain extent, qualitative and beyond the scope of using mathematical and analytical models. Other factors however, can be analysed to enable quantitative assessments to be undertaken.

17.3.4.2 Environmental Assessment Programs

The principal environmental factors that can be quantified from transport models are as follows:

- Vehicle emissions and air quality;
- Noise levels; and
- Fear and intimidation.

Details of the procedures for assessing these factors are outlined in DMRB Volume 11 and webTAG. This guidance provides a broad outline of the inputs and outputs required for assessing the above environmental factors.

Environmental assessment programs make use of travel speed and traffic flow output from a transport assignment model. This data is then input to the procedures for estimating pollution levels/air quality, noise and fear and intimidation. The procedures generally make use of average speed or hourly flow information and therefore are not suitable for producing absolute values for a given time. They do however provide the mechanism to compare schemes on a consistent basis.

Most macroscopic assignment models are capable of producing output suitable for processing by an environmental assessment program albeit that the level of detail varies across the different modelling packages. For example, macroscopic or mesoscopic modelling packages will generally produce hourly flow and average speed information on a link by link basis.

The calculations used in environmental assessment are computationally simple and hence it is possible to use relatively straightforward programming routines or even spreadsheets. The ENEVAL program incorporates these routines within a single package to enable calculations for the above parameters to be undertaken. This package can output measures of local roadside air quality, regional air quality impact, noise levels and fear and intimidation factors that can be compared against pre-defined threshold levels.

Microsimulation models can provide similar outputs. However, they can also produce data on the acceleration, deceleration and idle time of individual vehicles. This more detailed information is already being used to enhance the robustness and accuracy of environmental outputs.

A screening process for environmental assessment is outlined in DMRB Vol.11 Section 3 Part 1. Formerly, a paper-based approach to the screening process (to determine whether a more detailed environmental assessment is required) was adopted. Recent amendments to DMRB have seen the production of a spreadsheet by the Highways Agency for this purpose. The reader is referred to the relevant section of DMRB (see above) for more detail on the screening process. Alternatively, the spreadsheet can be downloaded from the Highways Agency website at: <http://www.highways.gov.uk/business/238.aspx>

17.3.4.3 Summary

Environmental factors are by their nature, less easily quantifiable than economic elements. The environmental assessment programs in existence generally use standard transport model outputs to calculate environmental factors such as emissions, air quality, noise and intimidation and fear using empirical formulae. These formulae are described in DMRB Volume 11 and, whilst not providing accurate representations of absolute environmental impacts, do enable schemes to be compared on a consistent basis.

17.3.5 Accessibility Modelling

Accessibility modelling can be categorised in many ways. For the purposes of developing the STAG indicators of public transport network coverage and local access by walking and cycling (and their distribution), there are three main categories of model:

- Category 1 - Accessibility models which analyse walk times to different tiers of public transport systems or to local facilities. In these models the PT systems are classified by mode, frequency, time of day, and types of destinations served and local facilities classified according to their function.
- Category 2 - Accessibility models which analyse travel times using PT systems. In these models PT networks are defined using journey planning techniques and destinations are described in terms of activities, opportunities or places (e.g. town centres)
- Category 3 - Models not primarily designed to calculate accessibility but which are used as part of the accessibility modelling process. These include: demand models which calculate accessibility change for input to economic appraisal; land-use models which explain the spatial relationships in terms of accessibility; and activity based models which estimate behaviour based on accessibility opportunities.

Most models are developed using standard GIS, spreadsheet, database, and journey planner packages and customisation for the purposes of accessibility analysis can be helpful in some instances. However it is also important to recognise that one of the strengths of accessibility analysis is its flexibility and custom solutions can sometimes hinder rather than help the accessibility analysis process.

Table 17.8 identifies a few of the well-known models under each category.

Table 17.8: Classification of Models by Category

Model Type	Examples
Category 1	PTALS Models (e.g. Hammersmith and Fulham), Glasgow City Council Bus Network Coverage Model, Accession (Citilabs Ltd), etc
Category 2	Accession (Citilabs Ltd), SONATA (Steer Davis Gleave), ABRA (Colin Buchanan and Partners), APTT (Halcrow)
Category 3	Land-use transport interaction models: e.g. DELTA, MEPLAN, LILT, TRANUS, etc. Four stage models used in conjunction with accessibility analysis processors - e.g. TMfS or SITM used in conjunction with the SPT accessibility model, ACCALC (Derek Halden Consultancy)

Some of the main features of each category of model are described below.

Category 1 - Local Accessibility by Walking and Cycling

Local walking and cycling opportunities are usually considered by distance. In their simplest form "crow fly" distances are used, and services are represented by some simple measure of availability. However most models refine the assumptions about: the characteristics of the PT networks or services, including frequency, reliability, destinations served, wait times, and time of day; and the definition of the walking networks to access the services.

Computerised road network data can be used to define walking routes on footpaths following the road network. GIS data sets can be purchased from various companies and custom approaches can be devised to define travel times using these networks. Alternatively custom drive time software packages can be used to calculate times by setting speeds to suitable walking and cycling speeds. In addition many of the category 2 models can also undertake these simple calculations.

Category 2 - Models which Analyse Transport Network Accessibility

Where transport network accessibility is being considered there are several main variants in modelling structure including:

The Transport System

- Representing the geography of the networks as a cost surface derived from public transport information data;
- Representing travel time through the network as routes between zones based on journey planning algorithms or derived from other transport modelling.

People and Places

- Representing origins and destinations in terms of people and activities;
- Representing origins and destinations as types of places e.g. town centre.

In their most highly developed form they can consider not just travel time through networks, but the scheduling of transport services and activities at trip destinations within time windows. This level of complexity in scheduling has only been applied to date in rural situations.

The main disadvantage of these models is that their ability to represent supply/demand relationships is weak or non-existent, and they cannot assist with forecasting future changes in land-use or transport.

Category 3 - Models Designed for some other Purpose but which can be used in the Derivation of Accessibility Indicators

Demand Models

Most demand models can output some form of accessibility index. Using time and cost skims between zones, accessibility indicators can be calculated by linking the land-use and transport data (generally using a logarithmic scale for the travel time/cost and readily available data on the land-uses and other activities available in each zone).

SPT have developed software to automate the links with the four-stage demand model SITM. Alternatively these calculations can be undertaken on a spreadsheet/database or using proprietary software (Table 17.8)

Land-use Transport Interaction Models

Land-use transport interaction models seek to represent the most essential processes of spatial development including relevant land-uses. A number of systems are in use and there are significant variations amongst the different models regarding overall structure, comprehensiveness, theoretical foundations, modelling techniques, dynamics, data requirements and model calibration.

Despite recent achievements in wider development and deployment these models, there remain some challenges to be met. The transport sub-models used do not apply activity

based modelling techniques but rather the traditional four-step travel demand model sequence. They therefore have many limitations for modelling behavioural responses.

The derivation of the accessibility measures is therefore no more sophisticated than can be achieved with the four stage models but the models can output accessibility measures directly.

17.3.6 Summary of Existing Scottish Transport Models

There are a number of existing Scottish transport models. These range from large scale models covering very large areas such as the Transport Model for Scotland (TMfS), to relatively small single junction models such as the Paramics model of the A720 Sherrifhall Roundabout signalisation.

Given the number and range of models available only summaries of the large scale Scottish models are provided in this section. Readers should contact local authorities for summary details of local models available within their areas.

Within Scotland there are two large scale demand models, namely:

- Transport Model for Scotland (TMfS);
- Strathclyde Integrated Transport Model (SITM).

Full summaries of these models are included Tables 17.7, and 17.8. These summaries contain contact details for each of the models and these people should be contacted for more detailed information on the models.

Both these models have also been used in the development of accessibility models. However other simpler forms of accessibility modelling are also practical.

Land-use transport interaction models are the most sophisticated approaches and DELTA models are now available for both Glasgow and Edinburgh. They are however limited in terms of the number of trip purposes which can be included.

Table 17.9: Transport Model for Scotland (TMfS) Summary

Title	TRANSPORT MODEL FOR SCOTLAND (TMfS)
Description	Transport Model for Scotland (TMfS) is a multi-modal transport demand and assignment model with an interactive Land-Use model. See www.tmfS.org.uk for further information
Study Area or Route	The model currently covers 95% of the population of Scotland and all of the principal urban centres except Inverness. The modelled area covers all Trunk Roads and a large proportion of non Trunk principal roads..
Commissioned & Developed By	TMfS was commissioned Transport Scotland and developed by MVA.
Objectives	<ol style="list-style-type: none"> 1. To provide robust traffic forecasts on all Trunk Roads within modelled area over a twenty year period; 2. To enable traffic & economic assessments of any proposed major inter-urban road schemes at assessment Stages 1 (corridor assessment) and 2 (route option assessment) of the roads design process; 3. To test the effect of and/or interaction between major inter-urban road and PT schemes & major transport policy options; 4. To provide consistent information and a framework for local scheme models, as a basis for the development of Local Transport Strategies or with a view to testing potential strategies.
Type of Model	Enhanced Four Stage, multi-modal CUBE TRIPS + DELTA model.
Model Base	Base Year: 2005 Time Periods: 1 hour AM, OP, PM (neutral month)Flow Units: Car in Work, Car Non Work, LGV&OGV; PT Trips.
Size of Model	No. Zones: 1,200 (approx.) No. Links: 25,000 (approx.) No. Modelled Junctions: 1,800 (approx.)
Assignment Method	Equilibrium / Congested Assignment.
Modes Modelled	Car / LGV & OGV; Buses & Trains.
Traffic Growth / Forecast Used	Locally derived forecasts based on LA planning data for 2012, 2017 and 2022. Consistent with TEMPRO / NRITF sub-models (car-ownership model etc).
Other Information	CUBE TRIPS+ licence will be required to run TMfS.
Contact	Transport Scotland: Hugh Gillies. Tel: 0141 272 7571; email: hugh.gillies@transportscotland.gsi.gov.uk

Table 17.10: Strathclyde Integrated Transport Model (SITM) Summary

Title	STRATHCLYDE INTEGRATED TRANSPORT MODEL (SITM)
Description	The SITM is a multi-modal model comprising of trip end synthesis, distribution, modal split (includes Glasgow city centre parking model), highway and public transport assignment models. The revised model (SITM4) will be available from September 2003. SITM4 uses TUBA for economic evaluation of road and public transport scenarios having fixed or variable matrices. Travel demand is defined by purpose and car availability, with park & ride and crowding effects via optional sub-models.
Study Area or Route	SITM4 covers the west central Scotland area encompassing East & West Dunbartonshire, North & South Lanarkshire, Glasgow, East Renfrewshire, Inverclyde, North, South and East Ayrshire and part of Argyle and Bute.
Commissioned & Developed By	The SITM4 has been expanded and developed by Jacobs Consultancy, on behalf of SPT, from the original SRC/SPTE model.
Objectives	<ol style="list-style-type: none"> 1. To provide robust traffic forecasts on all Trunk Roads within modelled area over a twenty year period; 2. To assist transport planning and development of an integrated Public Transport network through the generation, testing and development of new, robust proposals; 3. To test the effects of and/or interaction between transport schemes; 4. To enable traffic and economic appraisal of proposed transport schemes.
Type of Model	Conventional Four Stage, multi-modal model. SATURN Highways model and TRIPS Public Transport Model.
Model Base	Base Year: 2001 Time Periods: 1 hour AM, OP, PM (spring weekday)Flow Units: Car by trip purpose and Goods Vehicles.
Size of Model	No. Zones: 1,059 No. Links: 20,144 No. Nodes: 6,775 No. Modelled Junctions: 1,000
Assignment Method	Highways: Wardrop Equilibrium Public Transport: Multi-path Logit choice with facility for new modes.
Modes Modelled	Car, Goods Vehicles, Buses, Trains and Glasgow Underground and New Modes.
Traffic Growth / Forecast Used	Locally derived forecasts based on LA planning data for 2006, 2011 and 2021.
Other Information	
Contact	SPT: Neil Sturrock Tel. 0141 333 3745; Fax: 0141 333 3284; email: neil.sturrock@spt.co.uk

17.4 Useful Links

This section provides links to information that may be useful to practitioners conducting a STAG Appraisal.

Construction Price Indices

A set of construction price indices is published in the Department for Business, Enterprise & Regulatory Reform [Construction Statistics Annual](#).

Department for Transport Appraisal Guidance (WebTAG)

The UK Department for Transport maintain online Transport Appraisal Guidance ([WebTAG](#)). STAG is similar but not identical to this guidance, but it may prove a useful reference, particularly on the theory underlying the economics of transport appraisal.

Design Manual for Roads and Bridges (DMRB)

The Design Manual for Roads and Bridges ([DMRB](#)) provides guidance on how to conduct economic and environmental assessments. Although it is primarily road focussed, the principles it outlines are of use in all transport appraisals.

HM Treasury's The Green Book

The [Green Book](#) lays out the Treasury guidance to be followed in assessing all government spending.

National Passenger Survey

The National Passenger Survey of rail travellers is conducted annually by [Passenger Focus](#)

Planning Guidance

Practitioners should take account of any relevant Scottish Planning Policy and Planning Advice Notes. These are published by the Scottish Government and are available at <http://www.scotland.gov.uk/Topics/built-environment/planning>

Scot-TAG

As well as STAG, [Scot-TAG](#) serves as the gateway to a range of transport assessment resources:

[*Transport Model for Scotland \(TMfS\)*](#)

Transport Model for Scotland (TMfS) is a multi-modal transport demand and assignment model that incorporates an integrated Transport and Economic Land Use Model. It contains an extensive dataset of both transport and land use data within Scotland and has a capability of forecasting the transport and land-use changes resulting from major infrastructure and/or policy initiatives.

Transport Assessment

Information on relevant Scottish Government guidance on planning assessment, including Scottish Planning Policy (SPP) 17 and Planning Advice Note (PAN) 75.

Network Evaluation from Survey and Assignment (NESA)

NESA is a computer program developed and maintained by Transport Scotland to assess proposed road schemes. The **NESA Manual** is the counterpart to DMRB in Scotland.

Program for the Economic Evaluation of Road Schemes (PEARS)

PEARS is an economic assessment package, developed and maintained by Transport Scotland, that has been specifically designed for use with the output from traffic microsimulation models to assess the economic impacts of proposed road schemes.

Transport Scotland

Transport Scotland can provide information on ongoing transport infrastructure works and traffic counts. www.transportscotland.gov.uk.

17.5 Downloads and Worksheets

This section contains links to the worksheets and tables which practitioners may need during the course of a STAG Appraisal.

Appraisal Summary Tables

[Part 1 Appraisal Summary Tables](#)

[Part 2 Appraisal Summary Tables](#)

Option Summary Table

[Option Summary Table](#)

Worksheets

[Economy Worksheets - Economic Activity and Location Impacts](#)

[Environment Worksheets](#)

Excel Spreadsheets

[CO₂ Monetisation Spreadsheet](#)

[Agglomeration Spreadsheet](#)

A copy of the DMRB Air Quality Screening spreadsheet can be downloaded from the Highways Agency website [here](#). Note that the latest version of this spreadsheet gives outputs in terms of tonnes of carbon, which must be converted to tonnes CO₂ for reporting purposes in STAG.

A copy of the LAQ Excel spreadsheet produced by the Department for Transport is available from WebTAG [here](#).

17.6 Specific Applications of STAG

Transport Scotland is keen to promote the use of STAG, and that it be used in a proportionate manner. Examples of studies that exemplify the following of STAG will be provided here over time.

17.7 Key Contacts

Practitioners requiring further advice on the information contained within the STAG Technical Database, can submit enquiries via scot-tag@transportscotland.gsi.gov.uk.