
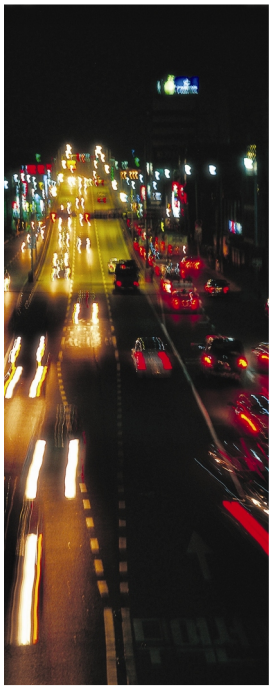


# TUBA User Manual

Version 1.8

May 2010
Department for Transport

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Mott MacDonald

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# Content

# 1 Introduction

## 1.1 Overview

TUBA (Transport Users Benefit Appraisal) is a computer program developed for DfT to undertake an economic appraisal for a multi-modal transport study.

The aim of TUBA is to carry out economic appraisal in accordance with the DfT's Transport Analysis Guidance (http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3.5.4.pdf). This implements elements of the Sugden method. Details of the method, as implemented in TUBA can be found in Section 3.5.3 of WebTAG[1].

TUBA undertakes a matrix-based appraisal with either fixed or variable trip matrices. It takes trip, time, distance and charge matrices from a transport model. These matrices may be disaggregated by vehicle type, purpose, and person type. The user also inputs other costs associated with the do-minimum and do-something schemes. TUBA will then calculate the user benefits in time, fuel vehicle operating costs (VOC), non-fuel VOC and charge; operator and government revenues; and the scheme costs, discounted to the present value year. Values calculated from input model data will be interpolated and extrapolated to cover the full appraisal period as necessary. The output file contains all these results for various degrees of disaggregation and also presents the data in a series of summary tables showing the economic efficiency of the transport system, known as TEE tables. Results are reported as perceived costs and market prices.

TUBA does not calculate benefits that are due to changes in accident costs.

## 1.2 Contacts

News of latest developments and updates for TUBA can be found on website:

http://www.dft.gov.uk/tuba/

Contacts for support on the application of TUBA are:

Principles of TUBA:

Integrated Transport Economics and Appraisal division
Department for Transport
Zone 3/04
Great Minster House
76 Marsham Street
London
SW1P 4DR

tel: 020 7944 6179
fax: 020 7944 2198
e-mail: itea@dft.gsi.gov.uk

[1] http://www.dft.gov.uk/webtag/documents/Expert/pdf/unit3.5.3.pdf

Running TUBA:

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The rest of this manual is laid out as follows:

- Chapter 2: Information on installing TUBA
- Chapter 3: An overview of the operation of TUBA
- Chapters 4 & 5: Detailed information on setting up the scheme and economics files
- Chapters 6: Explanation of TUBA output
- Appendices A-F: Format specifications for input and output files

# 2. Installation

The TUBA installation file is supplied on CD, via email or by download from the TUBA website. It has a file name of the form TUBA_18a.EXE. If you receive the software on CD the installation process should start automatically on inserting the CD into the drive. If this does not happen, or you have received the software through a different medium you will need to run the installation program manually.

By default the files will be stored on the C drive on the computer in the 'Program Files' directory in the sub-directory 'TUBA'. To uninstall the program, use Add/Remove Programs from the Control Panel.

The standard economics data file, which is consistent with WebTAG Unit 3.5.6 will be copied to an \economics\ subdirectory.

The TUBA manual (this document), the TUBA guidance note (which provides guidance on producing data for TUBA from a transport model), a description of the demonstration data, a list of frequently asked questions (FAQs) and a guidance note on checking results will be placed in a 'manuals' subdirectory.

A 'papers' subdirectory contains two TUBA-related papers from the 2001 European Transport Conference.

Documentation and papers are in pdf format which can be read using Adobe Acrobat Reader (available free from www.adobe.com/reader).

Demonstration data will be installed into the directory c:\TUBAdemo\.

Approximately 10Mb of disk space is required for the installation.

## 2.1 System requirements

To run TUBA we recommend the following as a minimum specification;

- Windows XP/Vista
- 256Mb RAM (although large problems will benefit from extra RAM)
- 10Mb Hard Disk space (for installation)

The amount of disk space required for storing results will depend on the number of zones in the transport model and the level of disaggregation of the input data. For TUBA runs with large data sets extra RAM can give significant improvements in run time.

# 3. Running TUBA

## 3.1 Overview

TUBA is controlled via two main input files and outputs two files. Data from the transport model, in the form of matrices of trip numbers, distances, times and charges are also required.

The two main input files are:

- Economic parameters file: This contains data such as values of time, VOC coefficients, tax rates and economic growth. It also contains standard categories for mode, vehicle type, trip purpose etc. A standard file is supplied by ITEA division of DfT. Users may edit this file to suit the needs of their study.

- Scheme-specific file: This contains data specific to the scheme being modelled, such as the scheme costs. It is also used to specify the trip and cost matrices generated by the transport model.

Both these input files can be created and edited via the user interface. Alternatively a text editor program can be used.

A standard output file (.out) is produced containing the following information:
- List of errors and warnings during the program execution
- Summary of input information
- Tabulations of scheme costs
- Tabulations of user benefits, government and operator revenues by various categories
- Summary information in TEE (Economic Efficiency of the Transport System) format

A second output file (.tbn) presents time benefits broken down by the change in travel time and trip numbers for each OD.

In addition there is an option to produce a detailed results file in binary format containing fully disaggregate results which can be interrogated via the user interface.

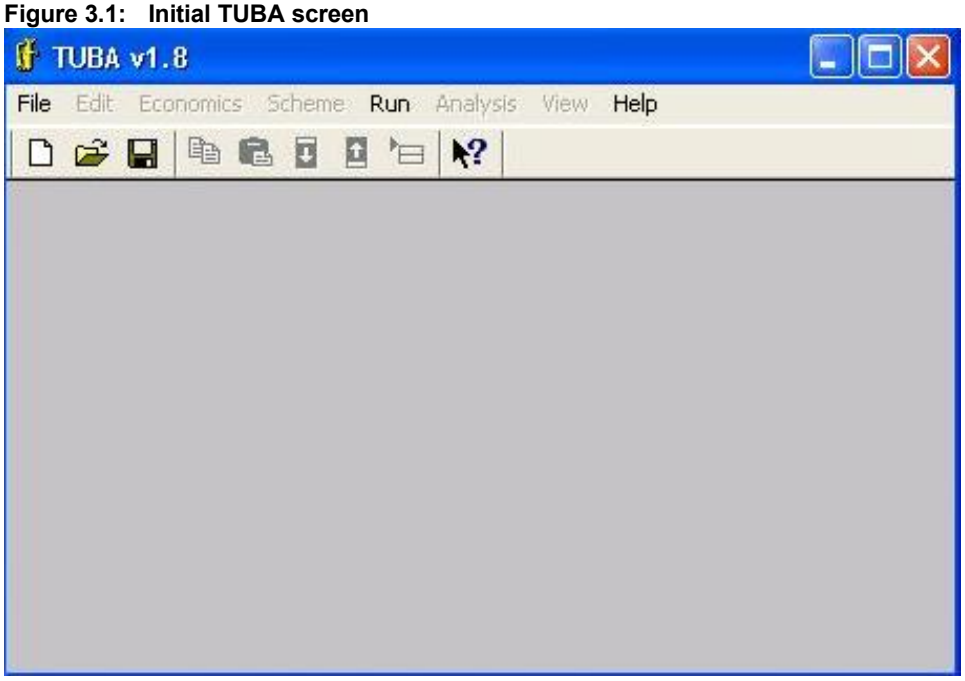
The names of the input and output files are defined via batch files with a .BAT extension. The contents of these batch files are edited in the user interface via the Run->Settings menu (see Section 3.5).

## 3.2 Starting TUBA

The TUBA installation process automatically creates a shortcut to TUBA on the Windows desktop. Alternatively, TUBA can be started from the Start menu, Start->Programs->TUBA.

On starting TUBA the user is presented with the screen shown in Figure 3.1 below:

**Figure 3.1: Initial TUBA screen**




This is a standard Windows interface with a menu bar and toolbar buttons for the most common operations. Placing the cursor over a button will display an explanation of its operation.

## 3.3 File menu

Under File are the usual options found with Windows software:

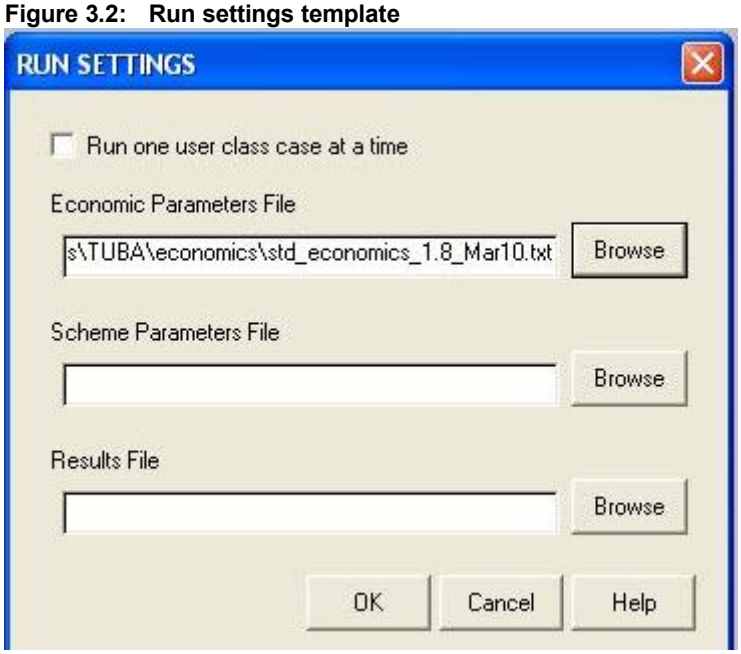
- New
- Open
- Close
- Save
- Save As
- Exit

plus a most recently used file list. Save and Save As apply separately to each of the batch, scheme and economics files.

This menu is used to create, open and save TUBA batch files and to exit the program.

Selecting File->New brings up the following Run Settings template:

**Figure 3.2: Run settings template**




This is used to define the input and output file names, which may be typed directly or selected using the standard Windows 'Browse' dialogue. By default the standard economics file supplied with the software will be defined in the 'Economic Parameters File' box.

The economics and/or scheme file names can be left blank if either is to be created from scratch. After editing these they should be saved using the File->Save As options. A results file must be specified before TUBA can carry out its calculations.

Once these filenames have been defined and after clicking OK they can be saved to a batch file using File->Save Batch or File->Save Batch As. Saved batch files can be re-opened and edited.

File->Save All saves the batch file and any changes to the scheme or economics files. The batch, scheme or economics files can be saved under different file names using the File->Save As command.

When opening a batch file, or changing the scheme or economics file, the files are checked for errors. A message will be displayed if there are any problems. Details can be viewed from the View >Warnings menu.

The option 'Run one user class at a time' can be used to reduce memory requirements and should be selected in cases where there is insufficient RAM and Windows is using a lot of virtual memory. In cases where there is sufficient RAM using this option will slow down the software slightly.

The Run Settings template is also accessed from the Run->Run Settings menu.

## 3.4 Data entry and editing

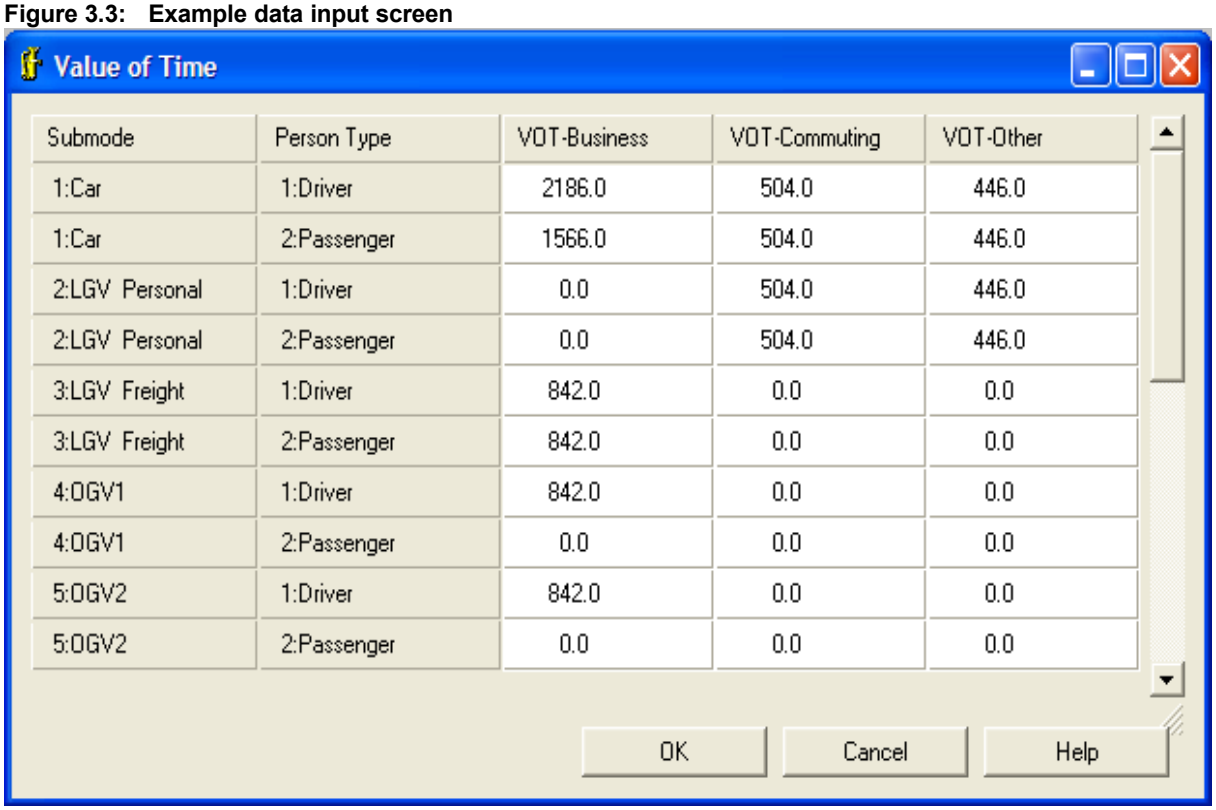
Economics data can be edited by selecting 'Economics' on the menu bar and then selecting an appropriate sub menu. A full description of the different types of economic data can be found in Chapter 4. Similarly, scheme data is edited by selecting 'Scheme' from the menu bar. Full details are given in Chapter 5.

All data input screens have a similar format. The example in Figure 3.3 shows the value of time input table. The template is like a simple spreadsheet, with the user being able to edit the white areas. Clicking the Help button will bring up information to aid completion of the current table.

Navigation between cells is via the Tab and Shift-Tab keys to move right and left and the up and down cursor keys to move up and down. In the larger tables a scroll bar is also used.

Data in individual cells can be copied and pasted via the menu brought up by right-clicking the mouse when the cursor is in the appropriate cell. Alternatively the whole table can be copied or pasted using the copy and paste buttons on the toolbar. This allows transfer of data to or from a spreadsheet.

**Figure 3.3: Example data input screen**



## 3.5 Run

The Run menu has three sub-menus:

- Run settings: to select or change the name of the input and output files

- Run now: to carry out the TUBA calculations (after input and output file names have been defined). On completion a summary of errors and warnings will be displayed. Any errors encountered will cause the program to stop and will need to be rectified. Warnings and serious warnings represent possible anomalies in the input data and warrant further investigation by the user.

- Run batch: to open a TUBA .GRP file containing a list of TUBA runs. This enables a sequence of TUBA runs to be carried out without user intervention. The 'Run Batch' option is only available if a TUBA file is not already open in the GUI. The .GRP file contains a list of individual TUBA .BAT files, e.g.:

  C:\TUBADEMO\EXAMPLE1.bat
  C:\TUBADEMO\EXAMPLE2.bat
  C:\TUBADEMO\EXAMPLE3.bat

## 3.6 Analysis

The Analysis menu gives the user the opportunity to interrogate the fully disaggregate results that are stored in the binary file (provided the option for detailed results was set in the scheme file). This facility selects the data that matches the criteria set by the user and outputs them to a CSV format file. This can be opened in any spreadsheet package for further analysis or for plotting graphs.

More details are given in 6.4.

## 3.7 View

Using the view menu it is possible to open the input and output files with the default Windows text editor. *This feature should not be used to edit the input files* - either use the user interface or close down TUBA and use your preferred text editor.

## 3.8 Help feature

The TUBA help system can be accessed in two ways. From the Help menu the entire help file is opened and can be searched for keywords. Alternatively clicking the Help button in a template will bring up context-sensitive help, giving guidance on that particular data table.

# 4. Economics data

## 4.1 General

The economics (and scheme) input file is an ASCII file consisting of a series of data tables. Each of these tables can be defined interactively via the user interface. Appendix A contains detailed data table formats for the economics file.

Certain features of data entry are common to several tables. These are explained in the following sub-sections.

### 4.1.1 Percentages

Where data is entered as percentages, for example growth rates, a value of, say, 20 is interpreted as 20%; 0.2 would be interpreted as 0.2% and not 20%.

### 4.1.2 Growth rates

Growth rates are required for a number of economic data. The common format is: start year, end year, rate (as % p.a.), e.g.:

| Start year | End year | Rate |
|---|---|---|
| 1999 | 2005 | 5 |
| 2006 | 2010 | 4 |

The interpretation of this is as follows: the 1999 value is 5% higher than the 1998 value. the 2000 value is 5% higher than the 1999 value and so on, up to the 2005 value being 5% higher than the 2004 value. Then 2006 is 4% higher than 2005 and so on. Where several periods with different growth rates are defined, they must not overlap.

Any growth defined after the appraisal horizon year will be ignored and a warning message issued.

## 4.2 Parameters

The following parameters are defined:

| | |
|---|---|
| TUBA version | The current TUBA version. This is used to identify the format of the file and should not be edited. |
| Base year | The base year for economic parameters. The standard value is 2002, meaning that VOT, value of fuel, etc. will be defined in 2002 prices and values. Outputs will be reported in base year prices. |
| Present value year | The year to which costs and benefits will be discounted |
| RPI in base year | The value of the Retail Price Index in the economic base year. This is to allow scheme costs input in a different price base to be converted to base year prices. |

| | |
|---|---|
| Average indirect tax rate | The average rate of indirect taxation in the economy. This is used to convert from factor costs to market prices. |
| Base year carbon values | The value, in pounds, of 1 tonne of carbon emissions in base year prices; low, high and central values must be provided, in that order. |

## 4.3 Category

The categories are

- Mode
- Vehicle type/submode
- Purpose
- Person type
- Fuel type

These categories serve two purposes. Firstly, the input and output data in TUBA can be disaggregated by category. Secondly, some of the economic parameters will vary by category; for example, value of time depends on person type, vehicle type and purpose.

### 4.3.1 Mode

Mode is the top level of aggregation in TUBA. It is primarily used for reporting purposes, although scheme costs are defined by mode. Results in the TEE table are disaggregated by mode.

Up to 5 modes may be defined. Each mode is given a name for reporting purposes.

### 4.3.2 Vehicle type/submode

Vehicle type/submode is a further disaggregation of mode. In TUBA separate trip and cost data have to be defined for each vehicle type/submode. Submode is a public transport equivalent of vehicle type. For example, in the standard settings ‘rail’ is a main mode with two submodes: ‘light rail’ and ‘heavy rail’.

Up to 10 vehicle types/submodes can be defined. Each vehicle type/submode is allocated to a particular mode for reporting purposes.

Any new submodes or vehicle types are identified by entering ‘Y’ in the ‘New submode?’ column. A new submode is one that does not exist in the standard DM scenario, a typical example being the introduction of a new LRT line. For these submodes it is still necessary to define so-called pseudo-DM data. For further details of how to deal with new submodes in TUBA please see the user guidance document.

Park and ride submodes are identified with a ‘Y’ in the ‘P&R?’ column. This will affect the calculation of vehicle operating costs. Please see the user guidance document for more details on appraising park and ride schemes with TUBA.

Each vehicle type/submode must be identified as being used for personal travel (‘per’) or freight travel (‘fre’). This is for reporting purposes only and does not affect the benefit calculations.

The following economic data will depend on vehicle type/submode:

- Value of time
- VOC coefficients
- Charge tax rates (i.e. taxes on fares, tolls, parking charges etc.)
- Non-fuel VOC tax rates
- Default purpose splits
- Default person type factors (i.e. vehicle occupancies)

### 4.3.3 Person type

The two person types currently defined in the standard economic parameters file are 'driver' and 'passenger'. A more disaggregate classification of person type can be used, for example to provide a more disaggregate application of values of time.

Up to 20 person types can be defined. Each person type must be identified as being either a driver (D) or a passenger (P), with the latter including both private vehicle and public transport passengers. This is to aid conversion between vehicle and person trip matrices.

For data from a public transport model it is expected that all data will be for 'passenger' person type. Data from a highway model data will probably be for 'vehicles'. In this case an 'all person' type is used and standard person type factors are used to calculate mean values of time per vehicle.

Help on dealing with bus drivers and passengers can be found in the TUBA guidance document.

The following economic data depend on person type:
- Value of time

### 4.3.4 Purpose

The disaggregation of data by purpose is important in TUBA because different formulae are used for business and consumer trips. If the transport model does not contain data disaggregated by purpose, standard purpose splits are defined in the economic parameters file which are applied to 'all purpose' data from the model.

Up to 10 purposes may be defined. In addition to being allocated a descriptive name each purpose must be identified as being business (B) purpose, consumer (C) purpose or other (O) purpose.

The following economic data depend on purpose:
- Value of time
- Default person type factors
- Non-fuel VOC coefficients

### 4.3.5 Fuel type

In the current version of TUBA only two fuel types, petrol and diesel, are defined. Since these are fixed it is not possible to change them via the user interface.

The following economic data depend on fuel type:
- Fuel costs, including tax rates
- Fuel consumption coefficients

## 4.4 Time period

The standard economic file defines 5 standard periods:
- AM peak (0700-1000)
- PM peak (1600-1900)
- Inter-peak (1000-1600)
- Off-peak (1900-0700)
- Weekend (All hours)

Up to 10 time periods can be defined. In addition to a descriptive name for reporting purposes, additional comments can be made for each period.

Time periods are a broad categorisation for reporting purposes. It is recognised that certain models will have a more detailed representation of time; this is allowed for in the Time Slices section of the scheme file.

The following economic parameters depend on time period:
- Purpose split
- Person type factors (vehicle occupancies)

## 4.5 Breakpoints for reporting of benefits

The economics file specifies some breakpoints to allow benefits to be broken down by trip length and size of time saving. The format of the table is given in Appendix section A.9.

The table has two rows specifying:

- Distance breakpoints (in kilometres) and
- Time saving breakpoints (in minutes).

## 4.6 Charges

Different types of charges can be defined. User charge benefits and operator revenues will be reported separately for each charge type. This allows the user to distinguish between, for example, the effects of inter-urban tolls, cordon charging, and car park charges.

As well as a description of each charge type it is necessary to use a three letter code to specify whether the revenues from the charge are received by the private sector ('pri'), central government ('cen') or local government ('loc').

## 4.7 Discount rate

This table defines the rate at which costs and benefits are discounted. Discount rates may vary over time. Each line of the table defines a period over which the discount rate is constant, along with the start and end years (inclusive) of the period. The start and end years are defined with reference to the current year (as defined in the scheme file), so that year '1' is the current year, year '2' is the current year plus 1 etc.

Discount rates between the present value year and the current year are assumed to be the same as in the current year.

## 4.8 Value of time

### 4.8.1 Base

The value of time (VOT) is used to convert time savings in, for example, minutes to monetary values. It depends on the submode, person type and trip purpose. These categories must have been set up before the user can enter VOT data.

VOT should be entered in pence per hour (p/hr) in perceived costs for business and consumer trips. Note that for business trips perceived costs will be the same as resource costs and are therefore not in market prices.

If VOT is not defined for a particular submode/person type combination it is assumed to be zero.

### 4.8.2 Growth

VOT growth is defined using the standard TUBA format (see Section 4.1.2). Different growth rates may be defined by purpose, but within each purpose the same rate applies to all submodes and person types.

In accordance with the Treasury's Green Book VOT growth rates for a given year are modified according to whether the discount rate for that year is different from the rate for the current year (defined in the scheme file) as follows:

$$VOTgrowth\_modified_{year} = VOTgrowth\_original_{year} \times \frac{discount\_rate_{year}}{discount\_rate_{current\_year}}$$

If the current year discount rate is zero the VOT growth rates will not be modified.

## 4.9 Taxes

Taxes are used to convert between resource and perceived costs, to adjust values to market prices and to calculate government indirect tax revenues. The user is referred to the TUBA guidance document for an explanation of these terms.

The following tax rates are defined (together with growth rates for calculating future year tax rates):

- Fuel tax (duty and VAT)
- Tax on non-fuel VOC (final and intermediate consumption)
- Tax on user charges (final and intermediate consumption) (depends on charge type)
- Average rate of indirect taxation

In general the tax rate on intermediate consumption is that paid by business trips and includes duty, but not VAT. The final consumption rate is paid by consumer trips. For fuel, duty is paid by all trips but only non-fuel trips pay VAT.

The average rate of indirect taxation is used to convert business trip benefits and scheme costs to market prices.

### 4.9.1 Average indirect tax changes

This table defines the forecast growth rates for the average indirect tax rate using the standard TUBA format (see Section 4.1.2).

### 4.9.2 Base non-fuel VOC Tax Rates

This table defines the tax rates on non-fuel vehicle operating costs.

Rates must be defined for both intermediate and final consumption.

These tax rates depend on vehicle type/submode.

All tax rates are defined as percentages.

Vehicle types must have been defined before data can be entered in this table.

### 4.9.3 Growth in non-fuel VOC Tax Rates

This table defines growth rates for non-fuel VOC tax rates using the standard TUBA format (see Section 4.1.2. Growth rates depend on vehicle type/submode.

### 4.9.4 Base Charge Tax Rates

This table defines tax rates on user charges in the base year. Tax rates may differ by charge type.

Rates must be defined for both intermediate and final consumption.

Charge types must have been defined before data can be entered in this table.

### 4.9.5 Growth in Charge Tax Rates

This table defines the change in tax rates on user charges using the standard TUBA format (see section 4.1.2). Tax growth rates may differ by charge type.

## 4.10 Fuel

### 4.10.1 Cost

This table defines the following elements of cost for each fuel type for the base year:

- Resource cost (p/litre)
- Duty (p/litre)
- VAT (%)
- Carbon emissions (grams per litre of fuel used)

### 4.10.2 Cost changes

This table defines the changes in the different cost elements (resource, duty and VAT) for each fuel type.

The last column of this table specifies percentage changes in carbon content of vehicle/fuel type combinations in order to reflect the impact of biofuels on carbon emissions.

### 4.10.3 Consumption

This table defines the a, b, c and d fuel consumption coefficients for each vehicle type and fuel type. These give fuel consumption in litres per km when applied to the following formula:

$$Fuel\ consumed = \frac{T}{D}\left(a + b\left(\frac{D}{T}\right) + c\left(\frac{D}{T}\right)^2 + d\left(\frac{D}{T}\right)^3\right)$$

where D and T are the distance in kilometres and the time in hours. The maximum value of D/T is restricted to the cut-off speed specified in the last column of the fuel consumption table for fuel consumption purposes.

For park and ride vehicle trips the fuel consumed per km is

$$Fuel\ consumed = \left(a + bV + cV^2 + dV^3\right) \Big/ V$$

where V is the park and ride speed defined in the scheme file (see section 5.1).

If no vehicles exist for a particular fuel type/vehicle type combination then no coefficients need to be defined.

For certain submodes, e.g. rail, the VOC formula will not be applicable, in which case no parameters need be defined and no VOC benefits will be calculated. Operating costs for these modes will need to be obtained from other sources.

Note that VOC benefits will not be calculated for ‘passenger’ person types.

### 4.10.4 Efficiency

This table defines the increase in fuel efficiency by vehicle type and fuel type.

Increases in fuel efficiency correspond to a reduction in fuel consumption. A 10% increase in fuel efficiency is interpreted as a 10% reduction in fuel consumption for a given journey.

## 4.11 Carbon value changes

This table defines how the cost of carbon emissions changes over time. Growth may be defined either as a rate in % per year, or in absolute terms in £ per year; it is not possible to define both for the same range of years.

The same growth is applied to the low, central and high base year values.

## 4.12 Fleet

### 4.12.1 Base

This table defines the base year fleet composition, that is, for each vehicle type, the proportion of vehicles of each fuel type. For each vehicle type the sum of the proportions across all fuel types should be 100%.

### 4.12.2 Changes

This table defines the changes in fleet composition over time. If there are N fuel types changes are only specified for the first N-1 fuel types. Changes for the Nth fuel type are calculated automatically to ensure that the fleet composition summed over all fuel types is 100% for each vehicle type.

Note that if the base year proportion of a particular fuel type is 80% and this decreases by 10% in the next year then the proportion in this second year will be 72% (not 70%).

## 4.13 Non-fuel VOC parameters

### 4.13.1 Base

This table defines the a and b resource non-fuel VOC coefficients by vehicle type for business and consumer trips. These are used to calculate non-fuel VOC resource costs using the formula:

$$Non-fuel\ VOC = aD + bT$$

where D and T are the distance in kilometres and the time in hours.

For park and ride trips the formula is

$$Non-fuel\ VOC = aD + b\left(\frac{D}{V}\right)$$

where V is the park and ride speed defined in the scheme file (see section 5.1).

Different coefficients are used for business and consumer trips.

For certain submodes, e.g. rail, the VOC formula will not be applicable, in which case no parameters need be defined and no VOC benefits will be calculated. Operating costs for these modes will need to be obtained from other sources.

Note that VOC benefits will not be calculated for ‘passenger’ person types.

### 4.13.2 Changes

This table defines types of change in non-fuel VOC costs. The same rate is applied to all coefficients.

## 4.14 Purpose splits and person type factors

It is recognised that transport models are not always disaggregate enough to output results by trip purpose and that vehicle-based highway models may not contain data on occupancies. For this reason two types of default splits/factors are defined in the economics file. Where disaggregate model data are available they should always be used in preference to these defaults. Similarly, robust local data on purpose splits and occupancies should be used in preference to these national averages, by changing the values in the file.

### 4.14.1 Purpose splits

This table defines purpose splits by time period and submode. Splits should be entered as percentages. For each time period and submode the sum of splits across all purposes must be 100.

Purpose splits are used to disaggregate input trip and cost data that has not already been disaggregated by purpose. This is necessary because of the different formulae used to calculate business and consumer trip benefits.

### 4.14.2 Person factors (Vehicle occupancies): base

Person factors are a generalisation of vehicle occupancies. They depend on vehicle type, purpose and time period.

The person factors define the number of people of each person type for each submode/purpose combination, varying by time period. For example, if the person types are driver and passenger the driver person factor should always be 1. The passenger factor is the average number of passengers per vehicle.

Person factors can be summed over person types for a particular vehicle type/purpose/period combination to give occupancies.

When input trip and cost data are not disaggregated by person type the person factors are used to calculate mean VOTs per vehicle. Results are reported as 'all person types' and are not disaggregated by person type.

### 4.14.3 Person factors: changes

This table defines the change in person factors by time period for each submode/person type/purpose combination. A default growth rate of 0% is assumed.

## 4.15 Preparation and Supervision Costs

If the user does not explicitly define preparation or supervision costs in the scheme file then these can be calculated by TUBA. This table defines preparation and supervision costs, by mode, as a percentage of the total land and construction cost. Preparation costs depend on the current stage of preparation, which is one of the following:

- SI (Scheme Identification)
- PC (Public Consultation)
- PR (Preferred Route)
- OP (Order Publication)

- WC (Works Commitment)

For further details see the COBA manual (DMRB Volume 13): 13.1.2.7 – The Preparation of Cost Data for Use in COBA.

# 5. Scheme data

Like the economics file, the scheme file is an ASCII text file consisting of a series of data tables that can be edited interactively via the user interface. Detailed format specifications for these tables can be found in Appendix B.

## 5.1 Parameters

The following parameters are defined:

| | |
|---|---|
| TUBA version | The current TUBA version. This is used to identify the format of the file and should not be edited. |
| Run name | A descriptive name for the TUBA run |
| Name of DM scenario | A descriptive name for the DM scenario |
| Name of DS scenario | A descriptive name for the DS scenario |
| First year | The first year of the appraisal period, i.e. the first year for which user benefits will be calculated |
| Horizon year | The last year of the appraisal period (normally First year +59 for a 60 year appraisal period) |
| Modelled years | A list of all the modelled years, separated by spaces. Up to 6 years may be defined. If the first year and horizon year are not the same at least 2 modelled years must be defined. Modelled years should lie between the first and horizon years (inclusive). |
| Current year | The year in which the TUBA run is being carried out. For automatic allocation of preparation costs this is the first year to which costs are allocated. It is also used to define 'year 1' for the discount rate table in the economics file. |
| Detailed results | Yes/No - whether a binary file containing fully disaggregate results should be output. This file can be interrogated via the user interface |
| No. of warnings to print | By default, this value is set to ‘All’ so that all serious warnings and error messages will be written to the outputs file. Setting this to a number will limit the number of warnings of each type that are output to that number. |
| P&R car speed | The average speed of the car leg of park and ride trips. This is used in the VOC calculations for P&R submodes instead of calculating speeds from the time and distance matrices. |

| | |
|---|---|
| Use zones as sectors | If 'Yes' then TUBA creates a sectoring system equivalent to one zone per sector. If 'No' then TUBA allocates all zones to a single sector. This does not affect the main .out output file, just the level of detail available in detailed results analysis. Note that setting 'Yes' is likely to significantly increase memory requirements and run time. This parameter has no effect for modes for which an explicit sector file has been defined. |

## 5.2 Time slices

This table describes the time slices used in the model and how these correspond to the time periods defined in the economics file. The following data are required for each time slice:

- Duration of the time slice in minutes
- Annualisation factor
- Time period to which the time slice belongs
- Description

The annualisation factor is used to convert from benefits per time slice to annual benefits. The benefits in each time slice are multiplied by the annualisation factor and then summed to give annual benefits. The annualisation factor is therefore how many of this time slice there are in a whole year.

Advice on annualisation factors can be found in the TUBA guidance document.

## 5.3 Scheme Costs

The scheme costs entered should include all allowances for optimism bias as required by the Treasury Green Book. The appropriate adjustment factors for optimism bias at the different stages of a scheme should be obtained from the Overseeing Organisation. The definition of scheme costs is the same for both the do-minimum (DM) and the do-something (DS) and has 4 components:

- Scheme details
- Total costs
- Cost profile
- Delay costs

If costs for the DM or DS scheme are zero then no costs need to be defined.

### 5.3.1 Schemes

This table defines the following scheme data for each mode:

- The first year of construction
- The scheme opening year
- The scheme stage (SI, PC, PR, OP, or WC – see Section 4.15 for explanation)

These data are used primarily for the automatic calculation and allocation of preparation and supervision costs.

### 5.3.2 Costs

This table defines the total scheme costs. For each cost item the following are required:

- A one letter code for the type of cost: construction (C), land (L), operating (O), maintenance (M), grant/subsidy (G), preparation (P), supervision (S), developer and other contributions contribution (D)
- The mode to which the cost applies
- The sector which incurs the cost: private sector (pri), central government (cen) or local government (loc)
- The total cost in £000s
- Whether the cost entered is in factor costs (F) or market prices (M)
- The RPI for the quarter used to estimate the total cost

For grant/subsidy and developer contribution costs only sectors 'cen' and 'loc' are allowed. For grant/subsidy this defines who makes the payment – it is assumed that the private sector always receives the payment. For developer contribution the interpretation is slightly different – the sector defines who receives the payment and it is assumed the private sector always makes the payment. Grant/subsidy and developer contribution costs should be entered as positive numbers.

If preparation or supervision costs are not defined for a particular mode then 'default' can be entered in the total cost column (the last two columns can be left blank) and they will be calculated automatically as a proportion of land and construction costs. Preparation costs will depend on the current stage of the scheme. Percentages for the calculation of preparation and supervision costs are defined in the economics file.

All costs will normally be entered as positive numbers.

For construction costs, account must be taken of any change in the cost of road construction relative to the general price level. This used to be done in TUBA by using the Relative Price Factor (RPF). However, the latest WebTAG guidance Unit 3.5.9 recommends the use of inflation rates relevant to the delivery of transport schemes. These should now be used in the preparation of base cost inputs for TUBA.

Updated values for RPI can be found on the National Statistics web site at http://www.statistics.gov.uk/STATBASE/tsdataset.asp?vlnk=7173 .

### 5.3.3 Profile

For each mode this table defines the percentage of the total costs for each cost type that occur in each year. Normally for a given mode and cost type the percentages should sum to 100 across all years.

For cost types preparation, supervision, land and operating there is the option of using default profiles. If '-1' appears anywhere in the cost profile for a mode and cost type then the default profile will be applied. In each case the default profile is flat, with costs allocated equally to the appropriate years as follows:

- Preparation: current year to year before construction starts (inclusive)
- Supervision: first year of construction to opening year (inclusive)
- Land: all costs in first year of construction
- Operating: scheme opening year to appraisal horizon year (inclusive)

### 5.3.4 Delay

This table defines the cost of delays during construction and maintenance. The costs are specified by year and mode and split between business, commuting, other and freight travel. They should be entered in thousands of pounds in base year market prices.

## 5.4 Benefit change

In accordance with Section 5.4 of WebTAG Unit 3.5.4[2] TUBA allows the user to define changes in the magnitude of benefits and revenues beyond the last modelled year. This is in addition to any change caused by economic factors, for instance growth in the value of time, and the standard extrapolation of benefits beyond the last modelled year (which is described in detail in the TUBA user guidance document).

This table is used to define rates of change in benefits beyond the last modelled year, by vehicle type/submode and time period. The standard TUBA conventions on defining growth rates apply. Changes should only be defined for the years from the last modelled year up to and including the horizon year.

## 5.5 User classes

Most assignment models operate with different user classes, each of which may have different generalised cost functions. For compatibility TUBA also has user classes, with each user class representing a particular combination of vehicle type (or submode), purpose and person type. The main function of user classes is to define what data each matrix contains. Up to 32 user classes can be defined.

'0' can be entered for purpose, indicating 'all purposes', i.e. the data is not disaggregated by purpose. In this case the default purpose splits defined in the economics file are used to disaggregate the data.

'0' can be entered for person type, indicating that the data is not disaggregated by person type. This will most often be applied to data from a highway model where trip data is in vehicles. In this case, the default person splits (occupancies) are used to calculate the mean VOT per vehicle.

## 5.6 Matrices

For each user class and modelled year trip and travel time matrices must be defined. Distance matrices must also be defined for user classes for which VOC benefits need to be calculated. Charge matrices, representing for example fares, tolls and parking charges, are optional and need not be defined if there are no charges. The same file can be specified more than once, for example if the same distance matrix applies to a number of different user classes.

### 5.6.1 Table format

This table provides a list of all the trip and cost matrices to be read by TUBA. For each matrix the following are defined:

- the user class(es) to which the matrix applies
- the time slice(s) to which the matrix applies

2 http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3.5.4.pdf

- the type of data, indicated by a single letter code: vehicle trips (V), person trips (P), travel time (T), distance (D), or charge (Cn)[3]
- the matrix format: 1, 2 or 3 (see Appendix C)
- the scenario: 0 for DM, 1 for DS, a b c d or e for intermediate points
- the modelled year
- a factor for converting the data to the correct units (see below)
- the filename

Matrix data is expected in the following units:

**Table 5.1: Matrix data expected units**

| Data | Units |
|---|---|
| Passenger or vehicle trips | Trips per hour |
| Distance | Kilometres |
| Time | Hours |
| Charge | Pence (perceived costs) |

A factor can be defined to convert to the correct units. For example if a distance matrix is in metres then the appropriate factor to convert to kilometres is 0.001.

Details on matrix formats can be found in Appendix C

Note that format 3 matrices can contain data for multiple user classes and time slices. In this case the user classes and time slices contained in the matrix are defined as in the following example:

1-3;5;7-8

which indicates that the matrix contains data for classes 1, 2, 3, 5, 7 and 8.

When the cursor is in the file name column of the data entry template the browse button on the toolbar can be used to select a matrix file.

### 5.6.2 Data checks

A number of checks are made on the consistency of the input matrices as follows:
- Trip matrices defined for both scenarios and for each modelled year
- Time matrix defined for each trip matrix
- Distance matrix defined for vehicle matrices
- Consistency in use of user classes between scenarios
- Maximum matrix cell values
- Ratio of DM to DS travel times and distances

3 'n' is the charge type number, as defined in the economics file. For example, define the type as C3 for a charge type 3 matrix. 'C' will be interpreted as 'C1'

The checks on the maximum values of matrix cells are as follows:

**Table 5.2: Maximum value of data cells**

| Data | Maximum |
|---|---|
| Passenger or vehicle trips | 100 000 trips/hr |
| Distance | 1000 km |
| Time | 10 hrs |
| Charge | 50 000 pence |

These checks are intended to identify possible errors in the units (e.g. minutes instead of hours) or anomalies in the source data.

The checks made on the ratio of DM to DS costs (time and distance) (r) are as follows:

**Table 5.3: Data checks**

| Value of r | Action |
|---|---|
| r<A or r>D | Serious warning |
| A<r<B or C<r<D | Warning |
| B<r<C | OK, no warning |

The values of A, B, C and D are:

**Table 5.4: Limit values**

| A | B | C | D |
|---|---|---|---|
| .33 | .67 | 1.5 | 3 |

These checks are made because in the case of large changes in cost the rule of a half which is used to calculate user benefits may not be valid.

Currently the number of matrices that can be defined is limited to 1500, although this can be increased if required – please contact technical support.

### 5.6.3 Intermediate points

Intermediate points are used when there are large cost changes between the DM and DS scenarios. For a detailed explanation of when they are needed and how to obtain suitable data please refer to the user guidance document.

Matrices for intermediate points are identified using scenarios a,b,c,d, and e. If there is just one intermediate point this must be scenario a. If there are two they must be scenarios a and b and so on.

When there is more than one intermediate point TUBA assumes that scenario a is the point closest to the DM, b the next closest and so on. This means that adding new intermediate points to a TUBA run already using intermediate points may require relabelling of the scenarios. TUBA will check that the values in the trip, time, distance and cost matrices are consistent with this ordering. For example, the number of trips in scenario a must be between the number of trips in the DM and the DS. Any intermediate points that do not follow this sequence will result in a warning and that intermediate point being ignored.

## 5.7 Sectors

Sectors are used to convert highway and public sector models, which may have different zoning systems, to a common base. They are also used to aggregate zones to simplify the analysis of the spatial distribution of benefits. The use of sectoring will reduce the memory requirements of the program and can significantly improve run times.

Sectoring has no impact on the total benefits, costs and revenues; it only affects the level of spatial detail available through the detailed results analysis option.

Each sector is an exact aggregation of one or more zones, i.e. sector boundaries cannot cut through a zone. The format of the sector definition file is given in Appendix D.

In this table the sector file for each mode is defined. The same file can be used for more than one mode. If no file is defined for a particular mode then the default sectoring method, as defined by the 'use zones as sectors' parameter in the scheme file PARAMETERS table, will be used.

The Browse button on the toolbar can be used to select sector files.

# 6. Output

## 6.1 Main output file

All runs of TUBA produce a standard text output file with the extension .OUT. This can be viewed via the View->Results->Text menu option. The file contains various types of information as described in the following sections. Detailed table formats can be found in Appendix E.

The same data is also available in html format: View->Results->html. See Section 6.2 for more information on the html output files. Advantages of viewing the html files include a menu bar for navigating between tables and easier copying and pasting of tables to other applications.

Unless stated otherwise, monetary values are reported as perceived costs in thousands of pounds in base year market prices, discounted to the present value year.

A separate guidance document on checking TUBA results is supplied with the software or can be downloaded from the web site http://www.dft.gov.uk/tuba/ .

### 6.1.1 Input summary

A brief summary of key input information including run names, input file names, details of the appraisal period and a summary of the number of modelled hours.

### 6.1.2 Errors and warnings

A full list of warnings, serious warnings and errors. Warnings and serious warnings indicate possible anomalies in the input data and should be investigated. Errors will cause the TUBA calculation to stop and will need to be resolved in order for TUBA to run to completion.

Certain warnings and serious warnings relating to matrix data can occur many times for a given set of input data. These are grouped together, with matrix cells ranked in decreasing order of seriousness, identifying the user class, time slice, year and scenario and the matrix values (after the application of any matrix factor) in question. This applies to the following warnings:

**Table 6.1: TUBA warnings and their causes**

| Warning | Likely cause |
|---|---|
| Ratio of DM to DS time or distance too high/low | Possible error in input data, otherwise large cost change which may invalidate rule of half |
| Matrix cell value too high | Error in input matrix, wrong units or incorrect matrix factor specified |
| Origin – destination speed too high/low | Error in input data (time/distance) |
| One of DM and DS (but not both) time or distance is zero | Attempting to use TUBA with a new mode. Contact technical support for advice. |

For very large data sets it is possible to receive a 'Not enough memory' error. To resolve this select the 'Run one user class at a time' option in the Run Settings template. If this fails to solve the problem then sectoring should be used with as few sectors as possible and if necessary allocating all zones to a single sector.

### 6.1.3 Economics file differences

The standard economics file is compared against the economics file in use for a TUBA run. The tables that differ between the two are output one after the other in the text output, and side by side in the HTML output.

### 6.1.4 Scheme costs

Three tables are used to report scheme costs. The tables DM_SCHEME_COSTS and DS_SCHEME_COSTS report undiscounted costs in base year market prices by mode, year and cost type. These tables can be used to check the automatic calculation of preparation and supervision costs and the use of default profiles.

The table PRESENT_VALUE_COSTS gives total investment and operating costs (i.e. excluding delays, grant or subsidy and developer contributions) by year and mode for the DM and DS schemes and reports the difference.

### 6.1.5 Trip matrix totals

The table TRIP_MATRIX_TOTALS reports the annualised trip totals by submode, time period and modelled year, for the do minimum and do something scenarios.

### 6.1.6 User costs

This table reports total user costs (time, charge, fuel and non-fuel VOC) for the DM and DS scenarios. Note that in a fixed trip matrix appraisal the user benefits will be the difference between DM and DS costs. This is not true in a variable trip matrix appraisal.

### 6.1.7 Fuel consumption

This table reports the total fuel consumption by fuel type and vehicle type for the DM and DS scenarios. The units are thousands of litres.

### 6.1.8 Carbon emissions

This table reports the total carbon emissions, in tonnes, for the DM, DS and the increase for each year and for each vehicle type. These figures are also presented monetised using the low, central and high values for carbon emissions.

### 6.1.9 Carbon emissions by time period

This table gives a break down of carbon emissions and carbon benefits by time period for each of the modelled years and for the overall totals in the appraisal period.

### 6.1.10 User benefits and government and operator revenues

A series of tables reports user benefits (time, charge, fuel and non-fuel VOC), operator revenues and government indirect tax revenues, disaggregated by the various categories:

- Mode
- Submode
- Person type
- Purpose
- Time period

Note that the results by mode are given for each year of the appraisal period. For the other categories results are given for the modelled years and a total across all years.

### 6.1.11 Benefits by distance and by time saving

The TUBA output gives six tables that provide the breakdown of benefits by time saving and a breakdown by distance. These include:

- NON_MONETISED_TIME_BENEFITS_BY_TIME_SAVING
- MONETISED_TIME_BENEFITS_BY_TIME_SAVING
- TOTAL_BENEFITS_BY_TIME_SAVING
- NON_MONETISED_TIME_BENEFITS_BY_DISTANCE
- MONETISED_TIME_BENEFITS_BY_ DISTANCE
- TOTAL_BENEFITS_BY_DISTANCE

The information can be used to analyse whether benefits are concentrated on short-distance trips or long-distance trips; and whether the scheme benefits are made up of short time savings or longer time savings.

### 6.1.12 Sensitivity

The SENSITIVITY table reports the total user benefits as a percentage of the total DM user costs for each mode and modelled year. This is calculated using data in the DM&DS_USER_COSTS and MODE tables.

The information in this table can be used to assess the sensitivity of the user benefits calculated by TUBA to the level of convergence in the transport model; this is a requirement of the latest WebTAG advice. The smaller the numbers reported in this table, the more sensitive the results. WebTAG gives guidance on determining whether model convergence is adequate, given the size of the scheme benefits.

### 6.1.13 Transport Economics and Efficiency (TEE) Table

A summary of the results in TEE table format which is consistent with the WebTAG documents released with IN DRAFT status in January 2010

### 6.1.14 Public Accounts table

A summary of the costs of the project to the public sector. This table is consistent with the WebTAG documents released with IN DRAFT status in January 2010

### 6.1.15 Analysis of Monetised Costs and Benefits

A summary of all monetised costs and benefits assessed by TUBA. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented may not provide a good measure of value for money and should not be used as a basis for decisions.

For example, accident benefits will have to be added by the user.

This table is consistent with the WebTAG documents released with IN DRAFT status in January 2010

## 6.2 html files

A total of four files are generated by TUBA for viewing the data in html format. If the main output file is called root.out then the html files will be as follows:

| | |
|---|---|
| root.html | The main html containing the frameset. Open this file in your internet browser to view the results. This file links to the following two files |
| root_menu.html | Contains the navigation menu. This file should not be opened directly; it is used by root.html |
| root_res.html | Contains all the TUBA results. This file can be opened on its own, but if you do so the navigation menu will not be available. |
| root.xml | Unformatted TUBA results in xml format. This may be useful if you wish to develop your own applications to read TUBA results. Please contact TUBA support for more information. |

If you wish to send html format results to someone else there are three options available:

- Just send root_res.html. The navigation menu will not be available.
- Send all three html files. The recipient should open root.html; the navigation menu will then be available
- While viewing root.html in your internet browser choose File-Save As and under File Type select Web Archive (*.mht). This single mht file can then be sent to the recipient. This may not work with all internet browser software.

## 6.3 .tbn file

A file with the extension .tbn is produced, with the same root file name as the main output file. This contains the time benefits for each mode and modelled year, cross-tabulated according to the change in trip numbers and travel time at OD cell level. The contents of this file can be used to decide whether it is necessary to run TUBA with intermediate points.

## 6.4 Export data option

If the scheme parameter 'Detailed results' is set to Yes then TUBA will output a binary file containing fully disaggregate results by year, submode, purpose, person type, period, origin and destination. This file can be interrogated using the Analysis->Export Data menu option.

**Figure 6.1: Export data template**

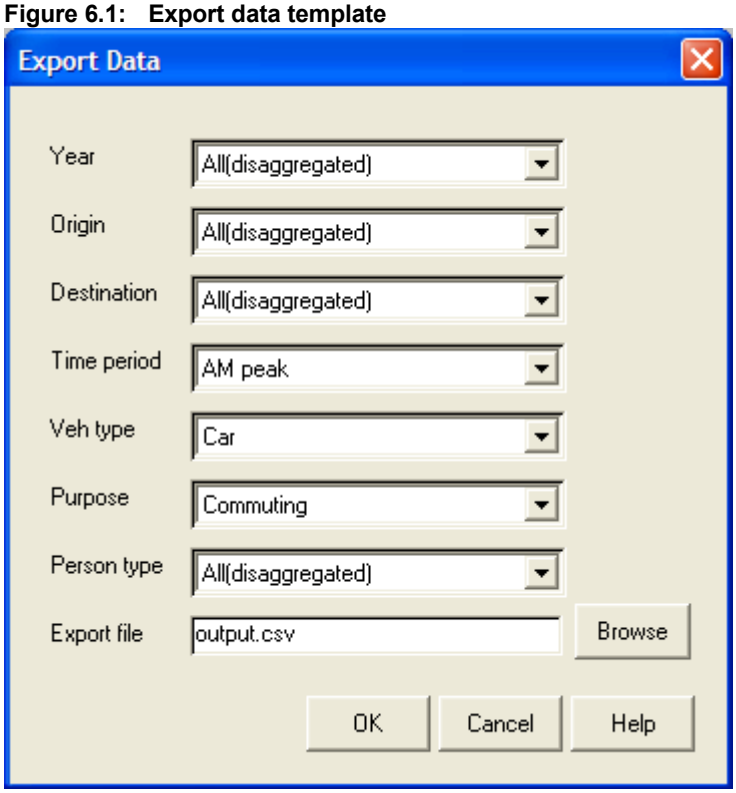



Figure 6.1 shows the export data template. A drop down box for each category is used to select a single value or 'All' data. An output file name must also be defined, using the Browse button if desired. The output file will be in CSV format for opening in a spreadsheet for further analysis or graphing.

# Appendices

# Appendix A. Economic parameters file

## A.1. General

This Appendix contains the detailed file format specification for the economic parameters file. It is intended as a guide when editing the file directly, rather than via the user interface. The user is referred back to Chapter 4 for a fuller explanation of the data items.

The two input data files are structured in a similar way, consisting of a sequence of tables each of which contains a particular type of data. Tables are identified by a title in upper case which must match the table names given below, including underscores. All lines beginning with an asterisk '*' are treated as comments. All tables are in free format, i.e. there are no fixed field widths but all fields must be separated by at least one space.

## A.2. Parameters

Table name: PARAMETERS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | Name | character | string |
| 2 | Value | (various) | integer, real, logical or character value |
| 3 | description | character | any string |

The parameters currently recognised are:

TUBA_version the current TUBA version

base_year The base year for which the parameters are defined, i.e. all reported values will be in base year prices

pres_val_year The present value year; all costs and benefits will be discounted to this year

RPI_base The value of the Retail Price Index in the economic base year

av_ind_tax The average rate of indirect taxation in the economy

carbon_values The value of one tonne of carbon emissions; three figures are required, separated by a space, representing low, high and central valuations

## A.3. Mode

Table name: MODE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | Mode number | integer | value in the range 1-5 |
| 2 | Mode name | character | any string |

Mode represents the highest level of aggregation for reporting purposes; in particular, results in the TEE table are displayed by mode. Scheme details and costs are also specified by mode.

## A.4. Vehicle type /submode

Table name: VEHICLE_TYPE/SUBMODE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type/submode number | integer | value in the range 1-10 |
| 2 | Mode number | integer | value in the range 1-5 |
| 3 | new submode? | char | Y or N |
| 4 | P&R? | char | Y or N |
| 5 | type (personal or freight) | char | per/fre |
| 6 | Name | char | any string |

## A.5. Person type

Table name: PERSON_TYPE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | person type number | int | value in the range 1-20 |
| 2 | Type | char | Driver or Passenger ( D / P ) |
| 3 | Name | char | any string |

## A.6. Purpose

Table name: PURPOSE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | purpose number | int | value in the range 1-10 |
| 2 | type (consumer or business) | char | C or B or O |
| 3 | Name | char | any string |

## A.7. Fuel type

Table name: FUEL_TYPE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | fuel type number | int | value in the range 1-2 |
| 2 | Name | char | any string |

## A.8. Time periods

Table name: TIME_PERIODS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | time period number | int | value in the range 1-10 |
| 2 | Name | char | any string |

## A.9. Benefit breakpoints table

The table has two rows.

| Field | Data type and range | Description |
|---|---|---|
| 1 | String 'Distance' or 'TimeSaving' | Identifies whether this row contains breakpoints for Distance or Time Savings |
| 2 | Real<br>>=0 for 'Distance';<br>any value for 'TimeSaving' | First breakpoint. Distance breakpoints in kms, Time saving breakpoints in minutes |
| 3 | " | Second breakpoint |
| 4 | " | … |
| 5 | … | … |
| 6 | Etc, up to 10 breakpoints | … |

Example:

* Breakpoints for breakdown of benefits by distance and time saving

| | | | | | |
|---|---|---|---|---|---|
| Distance | 5 | 10 | 15 | 20 | 30 |
| TimeSaving | -5 | -2 | 0 | 2 | 5 |

The breakpoints are open ended. So, if the breakpoint values defined are a,b,c,d then the ranges they define are:

<a
≥a, <b
≥b, <c
≥c, <d
≥d

Note that the lower end of the range is greater than or equals; the upper end strictly less than.

## A.10. Charges

Table name: CHARGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | charge type number | int | value in the range 1-10 |
| 2 | sector | char | pri, cen or loc |
| 3 | Name | char | any string |

## A.11. Discount rate

Table name: DISCOUNT_RATE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | >0 (1 = current year) |
| 2 | end year | int | >0, ≥start year |
| 3 | Rate | real | >0 |

## A.12. Value of time

Table name: VALUE_OF_TIME

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type/submode | int | value in the range 1-10 |
| 2 | person type | int | value in the range 1-20 |
| 3 | VOT purpose 1 | real | Perceived VOT (p/hr) |
| 4 | VOT purpose 2 | real | |
| n+2 | VOT purpose n | real | where n is up to 10 |

In this table values of time (VOTs) are defined by person type, purpose, and vehicle type/submode combination. The VOT for any such combination that is not explicitly defined is taken as zero.

VOTS are defined in pence per hour as perceived costs. Note that they should also be at factor cost for business purposes – TUBA will convert them to market prices.

## A.13. Value of time growth

Table name: VALUE_OF_TIME_GROWTH

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | growth rate | real | growth in % for purpose 1, default=0 |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 4 | growth rate | real | growth in % for purpose 2, default=0 |
| n+2 | growth rate | real | growth in % for purpose n, default=0 |

## A.14. Average indirect tax changes

Table name: AV_IND_TAX_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | growth | real | % increases in average indirect tax rate (% pa), |

## A.15. Charge tax rates

Table name: CHARGE_TAX_RATES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | charge type | int | value in the range 1-10 |
| 2 | charge final | real | tax on charges final consumption |
| 3 | charge intermediate | real | tax on charges intermediate consumption |

## A.16. Charge tax rate changes

Table name: CHARGE_TAX_RATES_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | charge type | int | value in the range 1-5 |
| 4 | Final | real | % p.a. change |
| 5 | intermediate | real | % p.a. change |

## A.17. Fuel costs

Table name: FUEL_COST

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | fuel type | int | value in the range 1-2 |
| 2 | resource cost | real | resource value of fuel, pence per litre |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 3 | Duty | real | duty, pence per litre |
| 4 | VAT | real | Value Added Tax (%) |
| 5 | carbon emissions | real | Carbon grams/litre used |

## A.18. Fuel cost changes

Table name: FUEL_COST_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | fuel type | int | value in the range 1-2 |
| 4 | resource cost change | real | % change p.a. in resource value of fuel |
| 5 | duty change | real | % change p.a. in duty |
| 6 | VAT change | real | % change p.a. in VAT |
| 7 | carbon_density_change | real | % change p.a |

## A.19. Carbon value changes

Table name: CARBON_VALUE_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 4 | cost change (rate) | real | % change p.a. in value of carbon emissions |
| 5 | cost change (absolute) | real | absolute change £/p.a. in value of carbon emissions |

## A.20. Fleet

Table name: FLEET

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type/submode | int | value in the range 1-10 |
| 2 | fuel type 1 split | real | % fuel type 1 |
| 3 | fuel type 2 split | real | % fuel type 2 |
| n+1 | fuel type n split | real | % fuel type n |

## A.21. Fleet changes

Table name: FLEET_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | vehicle type/submode | int | value in the range 1-10 |
| 4 | fuel type 1 split change | real | % p.a. change |
| 5 | fuel type 2 split change | real | % p.a. change |
| n | fuel type n-1 split change | real | % p.a. change |

## A.22. Fuel consumption

Table name: FUEL_CONSUMPTION

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type | int | value in the range 1-10 |
| 2 | fuel type | int | value in the range 1-2 |
| 3 | a - fuel consumption | real | fuel consumption coefficients |
| 4 | b - fuel consumption | real | |
| 5 | c - fuel consumption | real | |
| 6 | d-fuel consumption | real | |
| 7 | cut_off_speed | int | 3 digit (km/hr) |

VOC parameters should only be defined for vehicle types/submodes that obtain their data from a highway model, such as cars or LGVs. If VOC parameters are not defined for a particular vehicle type/submode then VOC benefits are not calculated.

**a, b, c, d fuel consumption coefficients**

These give the fuel consumed in litres per km using the formula:

$$Fuel\ consumed = \frac{T}{D}\left(a + b\left(\frac{D}{T}\right) + c\left(\frac{D}{T}\right)^2 + d\left(\frac{D}{T}\right)^3\right)$$

where D and T are the distance in kilometres and the time in hours. The maximum value of D/T is restricted to the cut-off speed specified in the last column of the fuel consumption table for fuel consumption purposes.

## A.23. Efficiency

Table name: FUEL_EFFICIENCY

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 3 | vehicle type | int | value in the range 1-20 |
| 4 | fuel type | int | value in the range 1-2 |
| 5 | eff | real | efficiency gains (%) |

## A.24. Non-fuel Vehicle Operating Costs

Table name: NON_FUEL_VOC

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type | int | value in the range 1-10 |
| 2 | a - non-fuel VOC - business | real | non-fuel resource cost coefficients |
| 3 | b - non-fuel VOC - business | real | |
| 4 | a - non-fuel VOC - consumer | real | |
| 5 | b - non-fuel VOC - consumer | real | |

**a, b non fuel VOC coefficients**

These give the non-fuel VOC (in pence) when used in the formula:

$$Non-fuel\,VOC = aD + bT$$

where T is the travel time in hours and D is the distance in kilometres.

Different non-fuel VOC parameters are defined for business and consumer trips, reflecting the difference in vehicle fleet composition.

Non-fuel VOC parameters and the value of fuel should be input as resource values (i.e. exclusive of all taxes).

## A.25. Non-fuel VOC changes

Table name: NON_FUEL_VOC_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | vehicle type | int | value in the range 1-20 |
| 4 | non-fuel | real | % change in non-fuel VOC coeffs |

## A.26. Non-fuel VOC tax rates

Table name: NON_FUEL_TAX_RATES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type/submode | int | value in the range 1-10 |
| 2 | final | real | tax on non-fuel VOC final consumption |
| 3 | intermediate | real | tax on non-fuel VOC intermediate consumption |

## A.27. Non-fuel VOC tax rate changes

Table name: NON_FUEL_TAX_RATES_CHANGES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | vehicle type/submode | int | value in the range 1-10 |
| 4 | Final | real | % p.a. increase |
| 5 | intermediate | real | % p.a. increase |

## A.28. Purpose split

Table name: DEFAULT_PURPOSE_SPLIT

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | Vehicle type/submode | int | value in the range 1-10 |
| 2 | purpose | int | value in the range 1-10 |
| 3 | period 1 split | real | split value (%) in period 1 |
| 4 | period 2 split | real | split value in period 2 |
| n+2 | period n split | real | split value in period n |

Purpose splits should add up to 100 when summed over each vehicle type/submode and time period combination.

## A.29. Person factors

Table name: DEFAULT_PERSON_FACTORS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type/submode | int | value in the range 1-10 |
| 2 | purpose | int | value in the range 1-10 |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 3 | person type | real | value in the range 1-20 |
| 4 | period 1 | real | person type factor in period 1 |
| 5 | period 2 | real | person type factor in period 2 |
| n+3 | period n | real | person type factor in period n |

Default person factors are an extension of occupancy factors, but recognise that a more detail categorisation than driver/passenger may be required. Occupancies can be deduced by summing the factors over all person types for a particular vehicle type/submode, purpose and time period.

If the user is unable to input matrices by person type then these factors are used to calculate mean VOTs for each vehicle type/submode, purpose and time period combination.

## A.30. Person factors

Table name: DEFAULT_PERSON_FACTORS_CHANGE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2001) |
| 2 | end year | int | 4 digit year (eg 2005) |
| 3 | vehicle type | int | value in the range 1-10 |
| 4 | Purpose | int | value in the range 1-10 |
| 5 | person type | real | value in the range 1-20 |
| 6 | period 1 | real | % change in person type factor, period 1 |
| 7 | period 2 | real | |
| n+5 | period n | real | % change in person type factor, period n |

## A.31. Preparation & Supervision Costs

Table name: PREPARATION&SUPERVISION

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | Mode | int | 1-5 |
| 2 | prep: SI | real | Prep costs, stage SI, % of land and construction costs for this mode |
| 3 | prep: PC | real | |
| 4 | prep: PR | real | |
| 5 | prep: OP | real | |
| 6 | prep: WC | real | |
| 7 | superv | real | Supervision costs, % of land and construction costs for this mode |

# Appendix B. Scheme-specific file

## B.1. Parameters

Table name: PARAMETERS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | Name | char | string |
| 2 | Value | (various) | integer, real, logical or character value |
| 3 | description | char | any string |

The parameters currently recognised are:

- TUBA_version
- The current TUBA version
- run_name
- A descriptive title for this TUBA run.
- do_min_name
- A descriptive title for the do-minimum scheme.
- do_som_name
- A descriptive title for the do-something scheme.
- first_ yr
- The first year for which user benefits can be calculated.
- horizon_ yr
- The last year for which user benefits should be calculated (usually 60 years after the opening year).
- modelled_ yrs

The years for which trip and cost matrices will be defined (between first_yr and horizon_yr). If the opening year and horizon year are the same then there can be only one modelled year. Otherwise there must be at least two modelled years (a maximum of 6 is allowed).

**detail**

If 'yes' then the detailed results file is output. If 'no' the detailed results file is suppressed.

**current_yr**

The first year for which scheme costs are incurred.

**print_warn**

Whether to print all warning messages ('All') or limit the number of each warning type (in which case the parameter value should be set to the desired maximum).

**p&r_car_speed**

The average speed of the car leg of park and ride trips. Used in the calculation of vehicle operating costs for park and ride trips.

**zones_as_sectors**

If 'yes' then TUBA assumes a one to one correspondence between zones and sectors.. If 'no' then all zones are allocated to one sector. This parameter has no effect on the sectoring system for modes for which a scheme file has been explicitly defined.

## B.2. Time slices

Table name: TIME_SLICES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | time slice | int | value in the range 1-32 |
| 2 | duration (mins) | real | length of time slice |
| 3 | annualisation factor | real | how many of this time slice in a whole year |
| 4 | time period | int | value in the range 1-10 |
| 5 | description | char | |

## B.3. Schemes (DM and DS)

Table name: SCHEMES_DM, SCHEMES_DS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode | int | value in the range 1-5 |
| 2 | first construction year | int | first year of construction for scheme for this mode |
| 3 | opening year | int | 4 digit year - opening year for scheme for this mode |
| 4 | stage | char | current preparation stage for this mode: SI, PC, PR, OP or WC |

## B.4. Costs (DM and DS)

Table name: DO_MIN_COSTS, DO_SOM_COSTS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | type | char | C,L,M,O, S, P, G or D: construction, land, maintenance, operating, supervision, preparation, grant/subsidy or developer or other contribution |
| 2 | mode | int | value in the range 1-5 |
| 3 | sector | char | pri/cen/loc (private sector, central govt, local govt) |
| 4 | cost | real/char | total cost (£1000s), or 'default' for TUBA to calculate (P & S costs only) |
| 5 | price | char | M (market prices) or F (factor cost) |
| 6 | RPI | real | RPI in quarter for which costs are estimated |

## B.5. Profile (DM and DS)

Table name: DO_MIN_PROFILE, DO_SOM_PROFILE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | year | int | 4 digit year (eg 2000) |
| 2 | mode | int | value in the range 1-5 |
| 3 | % construction | real | % of total construction cost for this mode that is spent in this year |
| 4 | % land | real | |
| 5 | % prep | real | |
| 6 | % super | real | |
| 7 | % maintenance | real | |
| 8 | % operating | real | |
| 9 | % grant/subsidy | real | |
| 10 | % developer or other contribution | real | |

-1 can be entered as the % for land, preparation, supervision or operating costs to indicate that the default profile should be used.

## B.6. Delay costs (DM and DS)

Table name: DO_MIN_DELAY_COSTS, DO_SOM_DELAY_COSTS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | year | int | 4 digit year (eg 2000) |
| 2 | mode | int | value in the range 1-5 |
| 3 | construction and maintenance delays - business | real | value of delay costs during construction and maintenance (£1000s base year market prices) |
| 4 | construction and maintenance delays – commuting | real | " |
| 5 | construction and maintenance delays - other | real | " |
| 6 | construction and maintenance delays - freight | real | " |

## B.7. Benefit changes

Table name: BENEFIT_CHANGE

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | start year | int | 4 digit year (eg 2021), after last modelled year |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 2 | end year | int | 4 digit year (eg 2069), up to 60 years after 'first year' |
| 3 | vehicle type | int | value in the range 1-10 |
| 4 | Benefit growth, time period 1, %pa | real | |
| 3+n | Benefit growth, time period n, %pa | real | |

## B.8. User classes

Table name: USER_CLASSES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | class number | int | value in range 1-32 |
| 2 | vehicle type/submode | int | value in range 1-10 |
| 3 | purpose | int | value in range 1-10 |
| 4 | person type | int | value in range 1-20 |

Purpose and person type can be zero, representing 'all purposes' and 'all person types' respectively.

## B.9. Input matrices

Table name: INPUT_MATRICES

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | matrix number | int | value in the range 1-1500 |
| 2 | user class number | - | single value (formats 1,2) or range for format 3 matrices |
| 3 | time slices | - | single value or range for format 3 matrices |
| 4 | type | char | veh trips(V), passenger trips(P), time(T), charge(Cn) or distance(D) |
| 5 | format | int | 1,2,3 |
| 6 | scenario | int | 0=do-min, 1=do-som, a b c d or e for intermediate points |
| 7 | year | int | 4 digit year (eg 1996) |
| 8 | factor | real | factor to convert to standard units (default=1.0) |
| 9 | filename | char | |

## B.10. Sectors

Table name: SECTORS

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode number | integer | value in the range 1-5 |
| 2 | sector file name | char | name of sector file name for this mode |

# Appendix C. Matrix formats

Three different formats are available in TUBA. They are designed to be compatible with the most widely-used transport modelling packages.

**Format 1**

| Row | Field | Attribute | Data Type | Range / Description |
|---|---|---|---|---|
| n | m | value for origin n, destination m | real | non-negative; CSV format |

Example:
0,20,15
25,0,15
20,30,0

(3 x 3 matrix with zero intra-zonal trips)

This is a 'square' matrix format, with values defined for all origin-destination pairs.

**Format 2**

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | origin | int | |
| 2 | destination | int | |
| 3 | value | real | non-negative, CSV format |

Example:
100,101,20
101,100,15

(value of 20 from zone 100 to zone 101, and 15 from zone 101 to zone 100)

Note that data only needs to be defined for origin-destination pairs with non-zero values.

**Format 3**

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | origin | int | |
| 2 | destination | int | |
| 3 | user class | int | |
| 4 | value in first time slice | real | non-negative |
| 5 | value in second time slice | real | non-negative |
| n+3 | value in nth time slice | real | non-negative |

Example:
100 101 1 20 15 25
101 100 1 30 25 20

(data for user class 1 for three time slices)

Formats 1 and 2 are comma separated variable formats. Format 3 is ‘free’ format, i.e. there must be a space between fields.

In format 1 origin and destination numbers are not defined explicitly and are allocated to a sequential numbering system. Also in format 1 data must be defined for every single OD pair. In formats 2 and 3 only data for OD pairs with non-zero trip numbers needs to be defined.

# Appendix D. Sector file format

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | zone number | integer | zone number |
| 2 | sector number | integer | sector to which this zone belongs |

The sector definition file consists of two columns. The first identifies the zone number and the second defines the sector to which it belongs. Sectors must be defined for all zones.

In the following example zones 1 and 2 belong to sector 1 and zones 3 and 4 belong to sector 2:

```
1 1
2 1
3 2
4 2
```

# Appendix E. Output file (*.out)

Like the input files the output file is divided into a series of tables. Unless stated otherwise, all costs and benefits are reported as perceived costs and market prices in thousands of pounds. Monetary values are discounted to the present value year unless otherwise stated.

## E.1. Input summary

This table contains a summary of key input data.

## E.2. Economics File Comparison summary

This section summarises the differences between the standard economics file and the economics file used in the appraisal. If the standard economics file has been used this section is empty.

## E.3. Errors and warnings

This is a full list of errors, warnings and serious warnings encountered during the calculations. Errors cause the program to stop and therefore their cause must be rectified. The program will carry on after a warning or serious warning; it is the responsibility of the user to check that they are not caused by errors in the input data.

## E.4. DM and DS scheme costs

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode | string | |
| 2 | year | integer | |
| 3 | prep | real | preparation costs |
| 4 | super | real | supervision costs |
| 5 | constr | real | construction costs |
| 6 | land | real | land costs |
| 7 | maint | real | maintenance costs |
| 8 | oper | real | operating costs |
| 9 | grant/sub | real | grant/subsidy costs |

These tables give undiscounted scheme costs in base year market prices. Their main use is in checking the application of default calculations for preparation and supervision costs and in the use of default profiles.

## E.5. Present value costs

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode | string | |
| 2 | year | integer | All cost years and total |
| 3 | DM scheme costs | integer | £, discounted to PVY |
| 4 | DS scheme costs | integer | |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 5 | Difference | integer | DS-DM scheme costs |

This is a tabulation of the scheme costs in base year prices discounted to the present value year. It contains investment and operating costs only (i.e. it excludes the grant/subsidy and delays that were defined in the scheme costs table).

## E.6. Trip matrix totals

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | submode | string | |
| 2 | year | integer | modelled years only |
| 3 | time period | string | |
| 4 | do-min trip totals | integer | annualised trip totals |
| 5 | do-some trip totals | integer | |

This table reports annualised trip numbers, using the same units as the input matrices (i.e. vehicle trips or person trips).

## E.7. DM and DS user costs

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode | integer | |
| 2 | year | integer | Modelled years only |
| 3 | do-min : user time | integer | |
| 4 | do-min : user charges | integer | split by charge type |
| 5 | do-min : fuel VOC | integer | |
| 6 | do-min : non fuel VOC | integer | |
| 7 | do-som : user time | integer | |
| 8 | do-som : user charges | integer | |
| 9 | do-som : fuel VOC | integer | |
| 10 | do-som : non fuel VOC | integer | |

This is a tabulation of total user costs in the DM and DS scenarios. For example, the DM total time is the value of the total travel time in the DM scenario.

In a fixed trip matrix appraisal the user benefits will be the DM cost minus the DS cost. This will not be the case with a variable trip matrix.

## E.8. Fuel consumption

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type | integer | |
| 2 | year | integer | Modelled years and all years total only |
| 3 | do-min : fuel type 1 | integer | total fuel consumption, thousands of litres |
| 4 | do-min : fuel type 2 | integer | |
| 5 | do-som : fuel type 1 | integer | |
| 6 | do-som : fuel type 2 | integer | |

Total fuel consumption by vehicle type, fuel type and scenario (DM and DS). These are not monetary units and are therefore not discounted.

## E.9. Carbon emissions

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | vehicle type | integer | |
| 2 | year | integer | Year or All for total over all years |
| 3 | DM tonnes | integer | DM emissions, 1000s of tonnes |
| 4 | DS tonnes | integer | DS emissions, 1000s of tonnes |
| 5 | DS-DM tonnes | integer | Increase in emissions, 1000s of tonnes |
| 6 | DM value (low) | integer | Value of DM emissions (low) |
| 7 | DS value (low) | integer | Value of DS emissions (low) |
| 8 | DS-DM value (low) | integer | Increase in value (DS-DM) (low) |
| 9 | DM value (central) | integer | Value of DM emissions (central) |
| 10 | DS value (central) | integer | Value of DS emissions (central) |
| 11 | DS-DM value (central) | integer | Increase in value (DS-DM) (central) |
| 12 | DM value (high) | integer | Value of DM emissions (high) |
| 13 | DS value (high) | integer | Value of DS emissions (high) |
| 14 | DS-DM value (high) | integer | Increase in value (DS-DM) (high) |

## E.10. Carbon emissions by time period

This table gives a break down of carbon emissions and carbon benefits by time period for each of the modelled years and for the overall totals. The table below gives an example of the format for an appraisal with AM, IP and PM time periods; and 2010, 2025 as modelled years:

| | | Emissions (tonnes) | | | Cost (£000s,low) | | | Cost (£000s,medium) | | | Cost (£000s,high) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Period | Year | DM | DS | Increase | DM | DS | Increase | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2010 | | | | | | | | | | | | |
| AM peak | 2025 | | | | | | | | | | | | |
| PM peak | 2010 | | | | | | | | | | | | |
| PM peak | 2025 | | | | | | | | | | | | |
| Inter-peak | 2010 | | | | | | | | | | | | |

| | | Emissions (tonnes) | | | Cost (£000s,low) | | | Cost (£000s,medium) | | | Cost (£000s,high) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Period | Year | DM | DS | Increase | DM | DS | Increase | DM | DS | Increase | DM | DS | Increase |
| Inter-peak | 2025 | | | | | | | | | | | | |
| AM peak | Total | | | | | | | | | | | | |
| PM peak | Total | | | | | | | | | | | | |
| Inter-peak | Total | | | | | | | | | | | | |

## E.11. Mode

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode | integer | |
| 2 | year | integer | All years and total |
| 3 | benefits : user time | integer | |
| 4 | benefits : user charges | integer | split by charge type |
| 5 | benefits : fuel VOC | integer | |
| 6 | benefits : non fuel VOC | integer | |
| 7 | benefits : operator revenues | integer | split by charge type |
| 8 | benefits : indirect taxes | integer | |

User benefits, operator revenues and indirect taxes by mode and year for all years from the scheme opening year to the horizon year.

## E.12. Submode

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | veh type/ submode | integer | |
| 2 | year | integer | Modelled years and all years total only |
| 3 | benefits : user time | integer | |
| 4 | benefits : user charges | integer | split by charge type |
| 5 | benefits : fuel VOC | integer | |
| 6 | benefits : non fuel VOC | integer | |
| 7 | benefits : operator revenues | integer | split by charge type |
| 8 | benefits : indirect taxes | integer | |

User benefits, operator revenues and indirect taxes by vehicle type/submode and year for all modelled years.

## E.13. Person types

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | person type | integer | |

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 2 | year | integer | Modelled years and all years total only |
| 3 | benefits : user time | integer | |
| 4 | benefits : user charges | integer | split by charge type |
| 5 | benefits : fuel VOC | integer | |
| 6 | benefits : non fuel VOC | integer | |
| 7 | benefits : operator revenues | integer | split by charge type |
| 8 | benefits : indirect taxes | integer | |

User benefits, operator revenues and indirect taxes by person type and year for all modelled years.

## E.14. Purpose

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | purpose | integer | |
| 2 | year | integer | Modelled years and all years total only |
| 3 | benefits : user time | integer | |
| 4 | benefits : user charges | integer | split by charge type |
| 5 | benefits : fuel VOC | integer | |
| 6 | benefits : non fuel VOC | integer | |
| 7 | benefits : operator revenues | integer | split by charge type |
| 8 | benefits : indirect taxes | integer | |

User benefits, operator revenues and indirect taxes by purpose and year for all modelled years.

## E.15. Period

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | period | integer | |
| 2 | year | integer | Modelled years and all years total only |
| 3 | benefits : user time | integer | |
| 4 | benefits : user charges | integer | split by charge type |
| 5 | benefits : fuel VOC | integer | |
| 6 | benefits : non fuel VOC | integer | |
| 7 | benefits : operator revenues | integer | split by charge type |
| 8 | benefits : indirect taxes | integer | |

User benefits, operator revenues and indirect taxes by period and year for all modelled years.

## E.16. Benefits broken down by time saving and distance

There are six output tables with the same format - three giving the breakdown of benefits by time saving, three for the breakdown by distance:

- NON_MONETISED_TIME_BENEFITS_BY_TIME_SAVING
- MONETISED_TIME_BENEFITS_BY_TIME_SAVING
- TOTAL_BENEFITS_BY_TIME_SAVING
- NON_MONETISED_TIME_BENEFITS_BY_DISTANCE
- MONETISED_TIME_BENEFITS_BY_ DISTANCE
- TOTAL_BENEFITS_BY_DISTANCE

An example format is given below.

| NON_MONETISED_TIME_BENEFITS_BY_TIME_SAVING<br>Time benefits (thousands of person hrs) by size of time saving | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vehicle type/submode | Purpose | Year | <-5 mins | -5 to -2 mins | -2 to 0 mins | 0 to 2 mins | 2 to 5 mins | >5 mins |
| Car | Business | 2010 | | | | | | |
| Car | Business | 2025 | | | | | | |
| Car | Business | Total | | | | | | |
| Car | Commute | 2010 | | | | | | |
| Car | Commute | 2025 | | | | | | |
| Car | Commute | Total | | | | | | |
| … | | | | | | | | |
| Rail | Other | 2010 | | | | | | |
| Rail | Other | 2025 | | | | | | |
| … | | | | | | | | |

## E.17. Sensitivity

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | mode | string | |
| 2 | sensitivity | real | user benefits divided by DM user costs |
| 2+n-1 | “ | “ | n is number of modelled years |

User benefits, by mode and modelled year, as a percentage of total DM user costs.

## E.18. Economy: Economic Efficiency of the Transport System (TEE Table)

A summary of the benefits (transport users and private sector providers) in TEE table format, giving the present value of benefits (PVB) of the scheme.

## E.19. Public Accounts Table

A summary of the costs of the project to the public sector, giving the present value of costs (PVC) of the scheme.

## E.20. Analysis of Monetised Costs and Benefits

A summary of all monetised costs and benefits assessed by TUBA. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented may not provide a good measure of value for money and should not be used as a basis for decisions.

For example, accident benefits will have to be added by the user.

# Appendix F. Partitioned time benefits file (*.tbn)

This file contains the time benefits for each mode and modelled year cross-tabulated according to the change in travel time and trip numbers at OD level. It is used to assess the impact of large cost changes on total benefits and to decide whether it is necessary to use intermediate points.

| Field | Attribute | Data Type | Range / Description |
|---|---|---|---|
| 1 | range of change in trip numbers | char | e.g. 10%-20% |
| 2 | time benefits for first range of time changes | integer | Discounted £000s. |
| N+1 | time benefits for Nth range of time changes | integer | |