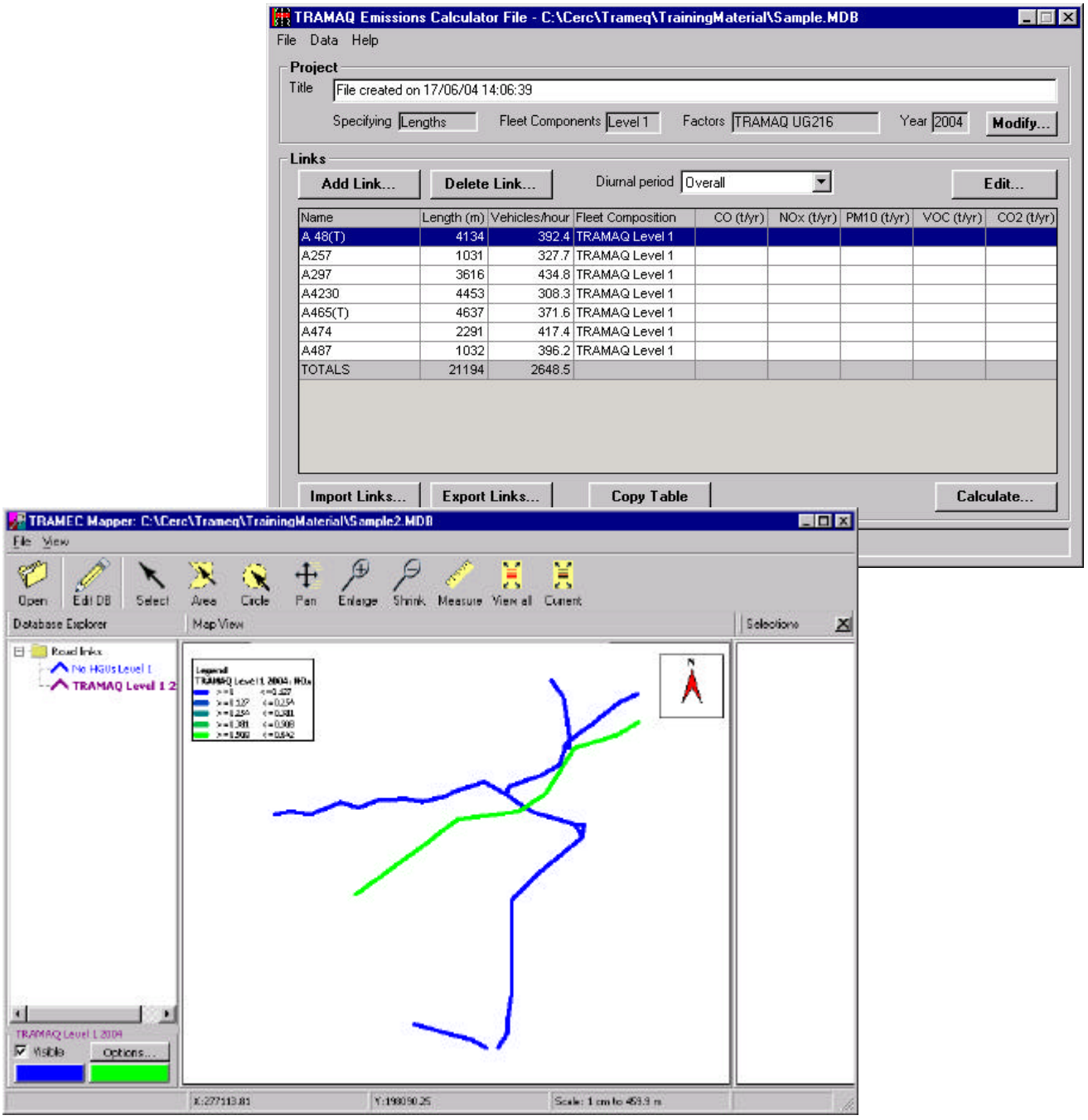
TRAMEC

Department for Transport
TRAMAQ Emissions Calculator



User Guide

TRAMEC

The Department for Transport's

Traffic Management and Air Quality (TRAMAQ)
Emissions Calculator

User Guide

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SECTION 1 Introduction to TRAMEC

1.1 About the TRAMAQ Research Programme

The TRAMEC emissions calculator is a software tool for local authority air quality and traffic management teams that has been created as part of the DfT's Traffic Management and Air Quality (TRAMAQ) programme, project UG218. The UG218 project team comprised TTR (Transport and Travel Research Ltd.), CERC (Cambridge Environmental Research Consultants) and Millbrook. CERC are responsible for the distribution and support of the software tool.

The TRAMAQ research programme began in 1998 and is due to finish in 2004. It researched the effects of traffic management schemes on air quality and vehicle emissions i.e. the effect of schemes on driver behaviour that in turn affects vehicle operation, emission rates and pollutant concentrations.

The various TRAMAQ projects have covered the following topics:

- Traffic management including during high pollution episodes
- Emission measurements
- Traffic composition
- Cold start emissions
- Sources of particulate matter
- Primary NO_2 emissions
- Vehicle operating profiles
- Driver behaviour
- Emissions modelling

For further details about the TRAMAQ research programme see the DfT web site: www.dft.gov.uk/stellent/groups/dft_roads/documents/page/dft_roads_508003.hcsp

1.2 About the TRAMEC emissions calculator

TRAMEC, the TRAMAQ Emissions Calculator, is an emissions model that allows users to take into account the impact of traffic management schemes on vehicle emissions. There are 37 different traffic management schemes or drive cycles developed under TRAMAQ project UG214. The main categories are:

- speed humps
- traffic calming
- bus lanes
- cycle lanes
- traffic lights
- 1-way flow
- mini-roundabouts

The scheme closest to the actual scheme can be selected using the TRAMEC Picture book which contains series of photographs. When a drive cycle is selected, the model calculates the corresponding emissions. The HGV emissions were measured as part of the TRAMAQ project UG216. For all other vehicles the NAEI average speed emissions are used.

SECTION 2 Getting Started

2.1 About this User Guide

This TRAMEC User Guide is both a manual and a technical summary.

Section 2	gives details of document and interface conventions and instructions on how to install TRAMEC
Section 3	is an introductory guide to using TRAMEC. It explains the user-defined input parameters for each screen option, basic manipulation of the data and use of the Picture book
Section 4	is a guide to using the TRAMEC Mapper
Section 5	contains worked examples which you should work through in order to become familiar with TRAMEC
Section 6	describes how to use the Import Wizard as a rapid way to import data about many road links
Section 7	describes some more advanced use of the Mapper
Appendix A	describes the sources of the emissions data used by TRAMEC

2.1.1 User Guide conventions

To make this User Guide simpler to use, certain conventions have been followed with regard to layout and style.

- Keys that you need to press are written in **BOLD CAPITAL LETTERS**, like this: the **ENTER** key.
- Anything you need to type is written in a `computer-style typeface`, like this: Type `install` at the command prompt.
- All interface controls, including the menus and their options, are shown in a bold sans-serif style, e.g. the **Plot** button, the **Select installation type** dialogue box, the **New Scenario...** option from the **File** menu.
- All file, directory and path names are shown in *italics*, e.g. *Sample.mdbc*, *C:\TRAMEC*.
- Any additional useful hints and pieces of information are written as notes, like this:

> *Use the Table of Contents to find your way around this User Guide.*

- References to other sections of the TRAMEC *User Guide* are shown like this: See Section 4.2.
- References to other documents are written in italics, like this: See the *ArcView Tutorial* for further guidance.

2.2 User Interface Conventions

In the user interface there are some options where the user can specify different sets of parameters for the model to use and switch between them.

Greyed data items are uneditable, and usually calculated by the model.

2.3 System requirements

TRAMEC requires a Pentium PC with at least 128 Mbytes of RAM, running Microsoft Windows 98, NT 4.0, 2000 or XP. There must be at least 500 Mbytes of disk space free.

A monitor with a colour resolution of greater than 256 colours is required.

You will find it useful to have access to a printer.

2.4 Installing TRAMEC

To install follow the step-by-step procedure described below. Note that on some operating systems you may be prompted to restart your computer during this procedure. If this occurs the installation will resume automatically following the restart

Step 1 If you are running Windows NT, 2000 or XP, log on to your PC as Administrator. Note that if you are prompted to restart your computer during the install you should log in again as Administrator.

Step 2 Insert the installation CD into your CD-ROM drive.

Step 3 If your computer is set up to auto-run CDs, then the installation program will start automatically on closing the drive. Otherwise click on the Windows **Start** menu button, select **Settings** and then **Control Panel**. Double-click on **Add/Remove Programs** and then click on the **Install...** button and **Browse** to find *setup.exe* on the CD. Click on **Finish**.

Step 4 Follow the instructions given by the TRAMEC Installation Wizard.

SECTION 3 Using the Emissions Calculator

This section guides you around the TRAMEC interface and explains how to enter data, use the Picture book to select a drive cycle, calculate emissions and change parameters to test different traffic management scenarios.

3.1 Launching TRAMEC

Double-click on the TRAMEC icon to launch the program. When TRAMEC opens you have the choice of opening an existing file or creating a new file, **Figure 3. 1**.

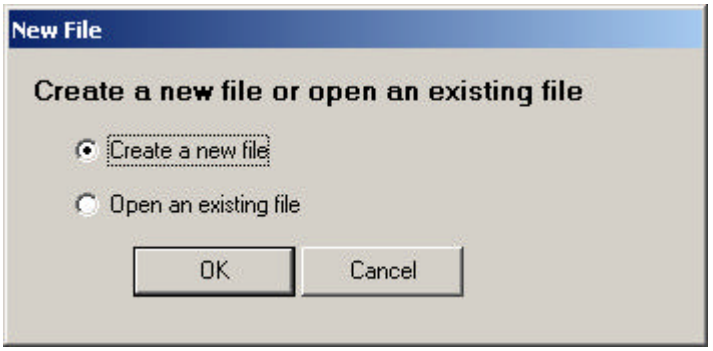

Figure 3. 1 – Select whether to open an existing file or create a new file

3.1.1 Opening and viewing an existing database

To open an existing file select **Open an existing file** when the screen shown in **Figure 3. 1** appears. Navigate to the file you want to open. (*Sample.mdb* is an example file supplied on the TRAMEC CD in the *TrainingMaterial* directory that you could open if you have no other files prepared.) When TRAMEC has opened the file you will see a screen similar to that in **Figure 3. 2**.

At the top of the screen is the Menu bar where you will see the **File**, **Data** and **Help** menus. **Table 3. 1** lists the commands available from the menu bar.

Under the Menu bar there is a section for the **Project** settings i.e. those parameters that are common to all the road links in the file. This section includes:

- a **Title** which may be up to 255 characters long. You should try to record information here about the data in this file that will remind you when you reopen the file what was being calculated.

- **Specifying** shows whether this file specifies road link **Locations** i.e. road geometry, or link lengths, **Lengths**.
- **Fleet Component** shows whether this file uses **Level 1** (3 vehicle categories) or **Level 2** (8 vehicle categories)
- **Factors,** the **Emission factors** being used, whether they are the **NAEI Average Speed** factors or **TRAMAQ UG216**. The **TRAMAQ UG216** factors use the detailed HGV factors for the different drive cycles (traffic management schemes).
- **Year**, the year of the **Emission Factors** and **Fleet Composition**
- The **Modify…** button lets the user change the **Factors** and/or **Year** for this file.

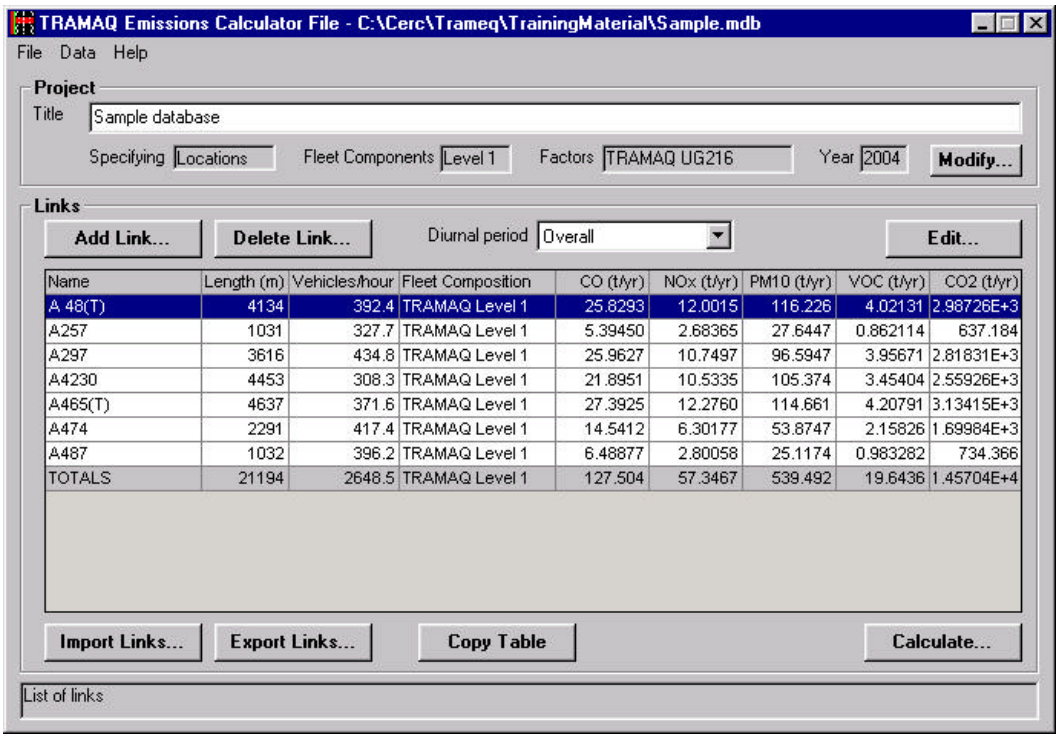

Figure 3. 2 – an existing file which has been opened in TRAMEC

Menu	Command	Explanation
File	**New**	Resets the data parameters to their default values, starting a new database
	Open	Allows you to open a previously saved model file
	Close	Closes the current database
	Mapper	Launches the TRAMEC Mapper
	Compact database	Compacts the TRAMEC database
	Exit	Quits TRAMEC
Data	**Diurnal periods**	Here the user defines the diurnal profile, percentage of the day for the AM peak, PM peak and off-peak counts. The diurnal profile defined here is applied to all roads
	Fleet compositions	Displays all the fleet compositions, those supplied as default data and those created here by the user

	Emission factors	Displays the emission factor data. These cannot be changed by the user
Help	**About…**	Displays information about the model version

Table 3. 1 – Commands available from the TRAMEC Menu bar

After the **Project** parameters there is a section of the screen containing data on the **Links**. This section includes:

- a table that shows the **Name** of each road link, **Length** in metres, the average number of **Vehicles/Hour, Fleet Composition** and then the emissions of CO, NO_X, PM_{10}, VOC and CO_2 in tonnes per year (t/yr). There is one row for each road link. The final row of the table shows the **TOTALS** from all the road links.
- The **Add Link…** button adds a new row to the table for a new road link. This will automatically open the more detailed screen for that link.
- The **Delete Link…** button deletes a row from the table, deleting the data for that road link
- The **Edit…** button allows you to edit the data for a highlighted link. Double clicking on the row you wish to edit also opens the details for that link.
- The **Diurnal period** displays the period relating to the emission totals displayed in the table. Choose from the drop down list whether to view the **AM peak, PM peak**, **Off-peak** or **Overall**. When **AM Peak** is selected here the emissions shown will be the annual emissions due to the **AM Peak** period and similarly when **PM Peak** and **Off-peak** are selected. The **Overall** emissions are the sum of the emissions over the 3 periods.

At the bottom of the screen are four buttons:

- **Import Links…** launches the Import Wizard to import road link data from ArcView *shp*, MapInfo *mif* and *csv* text files which is described in more detail in Section 6.
- **Export Links…** gives the user the choice of exporting the road link data to an ArcView *shp* file or to an ADMS-Urban (dispersion model) emissions inventory. See Section 8.
- **Copy Table** copies the table, for instance for pasting into Excel or a document for reporting
- **Calculate…** calculates the emissions for each road link and gives the total. After changes to any road link or to the overall project parameters the emissions will be deleted from the table and it will be necessary to recalculate the emissions by clicking this button.

3.1.2 Creating a new file

To create a new file select **Create a new file** when the screen shown in **Figure 3. 1** appears. You are then prompted to name the file you are about to create, **Figure 3. 3**.

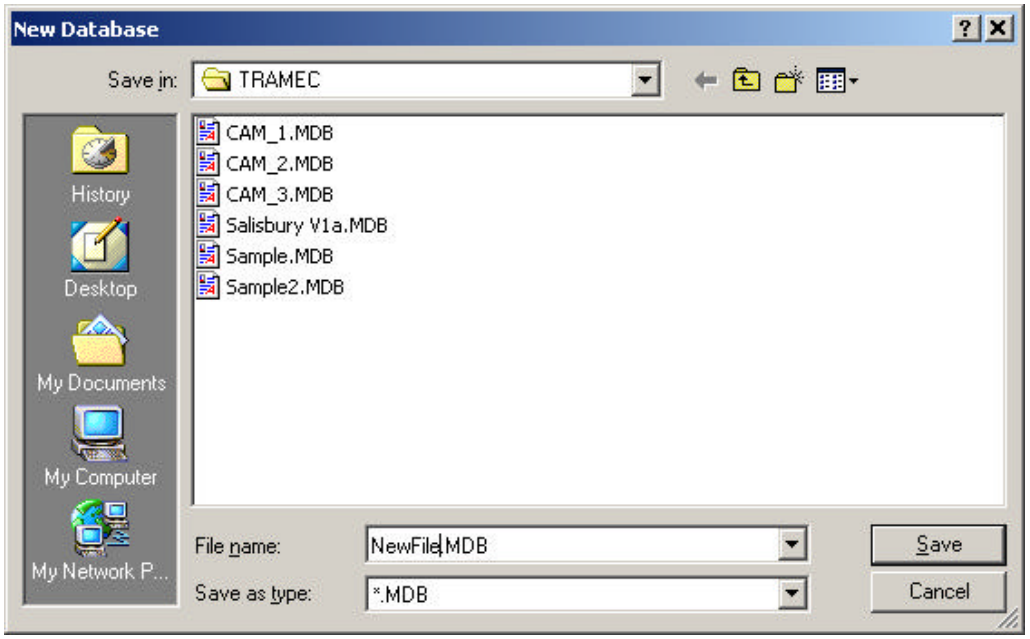

Figure 3. 3 – Naming a new file

You then are asked two questions. Firstly, you are asked to choose whether to use 3 traffic counts (**Level One: light vehicles, heavy vehicles, motorcycles**) or 8 traffic counts (**Level Two: motorcycles, petrol cars, diesel cars, petrol LGV, diesel LGV, rigid HGVs, articulated HGVs, buses**), **Figure 3. 4**

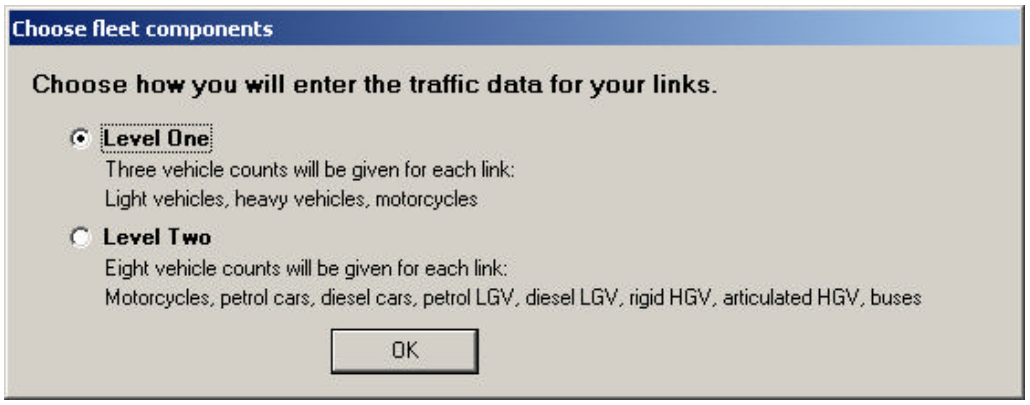

Figure 3. 4 – Select 3 or 8 traffic counts, **Level One** or **Level Two**

When you have selected **Level One** or **Level Two** you are asked whether you will specify just the length of each road link, **Specify lengths**, or if you will specify the location of the road links, **Specify locations**, **Figure 3. 5**.

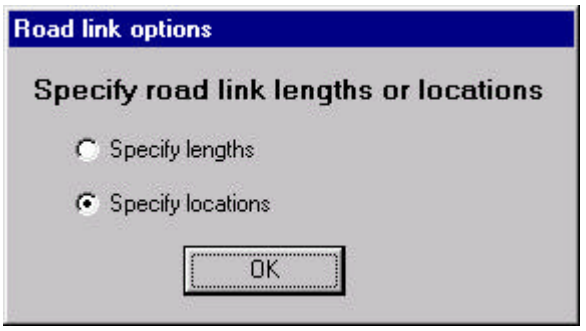

Figure 3. 5 – Choose whether to specify lengths or locations

After selecting to specify lengths or specify locations you will see a screen similar to that shown in **Figure 3. 6**. You are now ready to add data to TRAMEC and calculate emissions, as described in Section 3.2.

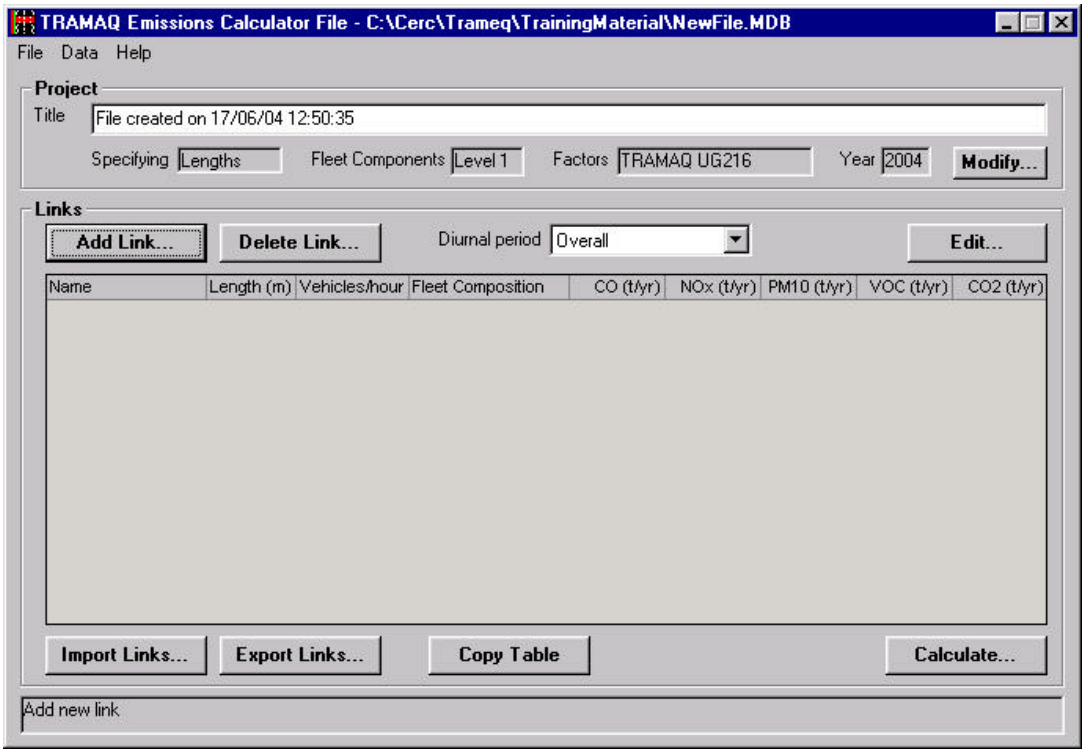

Figure 3. 6 – A new file just created in TRAMEC

3.2 The TRAMEC screens

Clicking **Add Link...** on the main TRAMEC screen brings up the screens for a new road link, as shown in **Figure 3. 7**. The parameters from the left hand side of the window are described in **Table 3. 2** and the parameters on the Geometry tab are described in **Table 3. 3**.

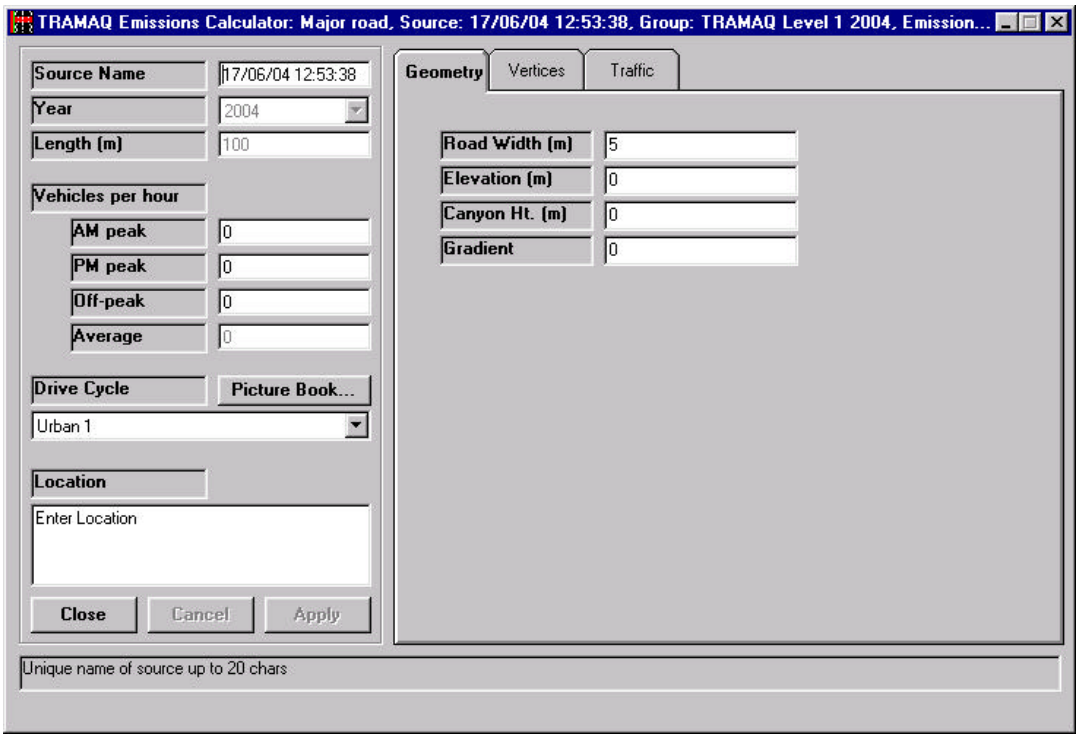

Figure 3. 7 – The Source data screen and **Geometry** tab

SCREEN AREA	DESCRIPTION OF FUNCTION	RESTRICTIONS
Source Name	Allows the source name to be defined/edited. The name must be unique within the database. If this screen has been launched when adding a new source to a group, the name will need to be changed from the default, which is simply based on the current date and time.	Up to 20 characters.
Year	Year associated with the parent group, which therefore applies to all the sources it contains.	Not editable.
Length (m)	The length of the road in metres. This value is calculated by TRAMEC using the vertices data (see the **Vertices** tab) or entered by the user.	Editable if the user is specifying road link length.
Vehicles per hour	Enter **AM Peak, PM Peak** and **Off-peak** counts. If you just have AADT enter AADT/24 in each of the 3 boxes. The overall **Average** is calculated automatically.	
Drive Cycle	Select the driving cycle for the road from the drop-down list box of options that correspond to those shown in the Picture book. To look at the drive cycles in the picture book select the **Picture Book...** button.	
Location	A text description of the location of the road.	Up to 200 characters.
Close	Save any changes, close this screen and return to the calling screen, e.g. the **TRAMEC link** screen.	
Cancel	Reject changes to data (that have not been saved using the **Apply** button).	
Apply	Update the screen as a result of changes to data but do not close the screen.	

Table 3. 2 – The Source data

Geometry tab	DESCRIPTION OF FUNCTION	RESTRICTIONS
Road Width (m)	The width of the road in metres.	$5m \leq x \leq 100m$
Elevation (m)	The height of the road above the ground in metres. This is usually zero, but is non-zero for overhead by-passes, etc.	$0 \leq x \leq 2000m$
Canyon Ht. (m)	The average height of buildings at the side the road in metres. This is needed in urban areas when the emissions data are to be used in a dispersion calculation using ADMS-Urban.	$0 \leq x \leq 100m$
Gradient	Gradient of road in per cent.	$0 \leq x \leq 50\%$

Table 3. 3 – The **Geometry** tab

The Vertices tab is shown in **Figure 3. 8** and the parameters are explained in **Table 3. 4**.

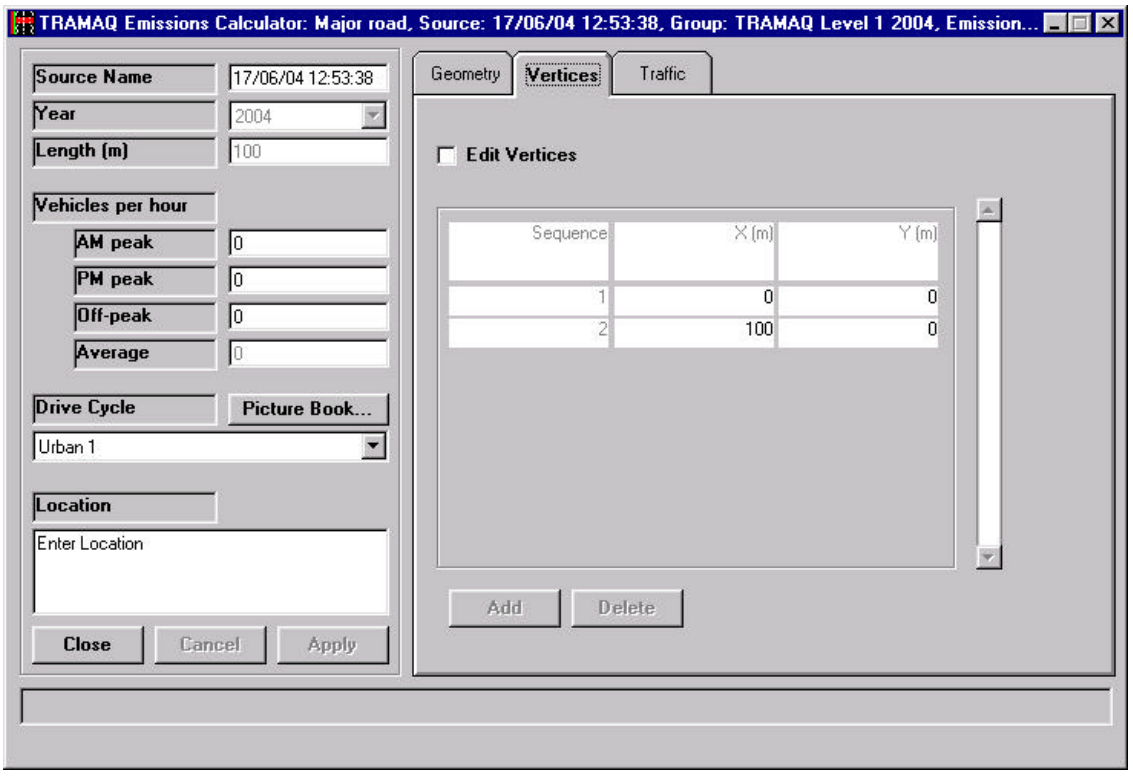

Figure 3. 8 – The **Vertices** tab

Vertices tab	DESCRIPTION OF FUNCTION	RESTRICTIONS
Edit Vertices	This check box must be checked in order to edit the vertices data contained in the table (see below).	
<Table>	The table lists the vertices for the road, listed in sequence along the road, which is assumed to be made up of a series of straight-line segments joining successive vertex points in the list. **Sequence**: Number of vertex along the road. **X(m)**: *x*-coordinate of the vertex **Y(m)**: *y*-coordinate of the vertex The coordinates are usually the 6-figure OS National Grid coordinates of the point (i.e. Eastings and Northings, respectively), or 7-figure UTM[1] coordinates. If the vertices data are modified, the road length may be recalculated by means of the **Apply** button.	Maximum number of vertices is 50. $0 \le x \le 9{,}999{,}999$ for both coordinates.
Add	When **Edit Vertices** is checked, this button adds a vertex (row) to the list of vertices above the vertex where the cursor is currently positioned.	
Delete	When **Edit Vertices** is checked, this button deletes the vertex (row) from the list of vertices where the cursor is currently positioned.	

Table 3. 4 – The **Vertices** tab

The Traffic tab is shown in **Figure 3. 9** and the parameters explained in **Table 3. 5**.

Traffic tab	DESCRIPTION OF FUNCTION	RESTRICTIONS
Fleet composition	The drop-down list box allows the fleet composition for this road to be selected from the available fleet compositions for this database.	
View fleet composition ...	Displays the **Fleet composition** screen.	
<Table>	The table percentage of the fleet in each Fleet component. There will be 3 rows if Level One was selected for this database and 8 rows if Level Two was selected.	$0 \le x \le 2.4\times10^{6}$ veh/day for each fleet component.

Table 3. 5 – The **Traffic** tab

[1] Universal Transverse Mercator coordinates.

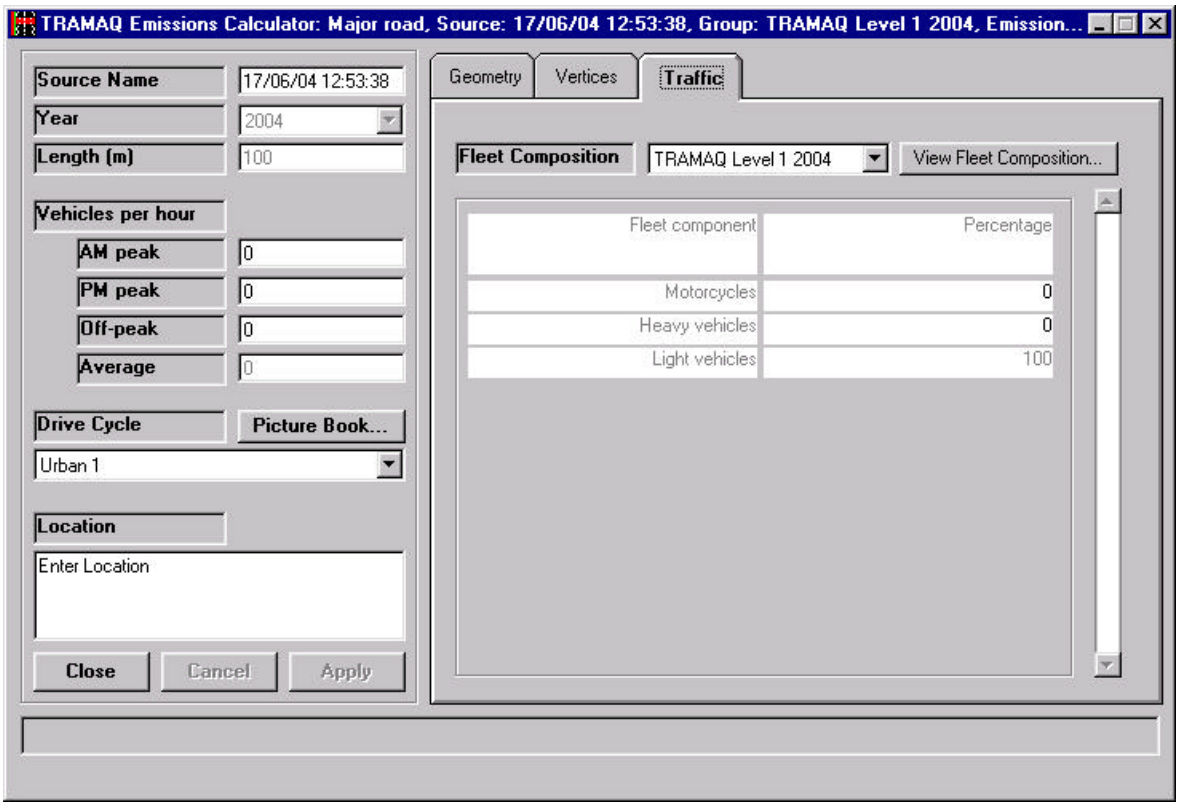

Figure 3. 9 – The **Traffic** tab

To edit detailed data for a single road link select the road link from the main screen and then click **Edit...** To change the parameters for several road links at once use the **SHIFT** key to select multiple road links and then click **Edit...** this will bring up the multiple edit screen shown in **Figure 3. 10**.

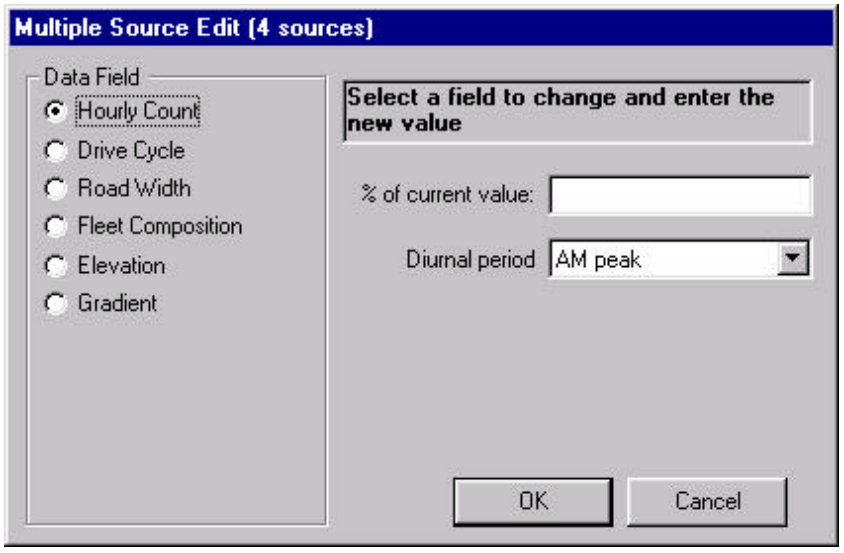

Figure 3. 10 – The multiple edit screen

3.3 Using the Picture book

The TRAMAQ Picture book helps users select an appropriate drive cycle, and hence the appropriate set of TRAMAQ HGV emission factors, for their road link. When the Picture book is launched by opening *PictureBook.html* users first see the Index page, **Figure 3. 11**. There are nine main categories for which emissions are supplied. These are:

- Urban
- Suburban
- Speed humps
- Traffic calming
- Bus lanes
- Cycle lanes
- Traffic lights
- 1-way
- Mini-roundabouts

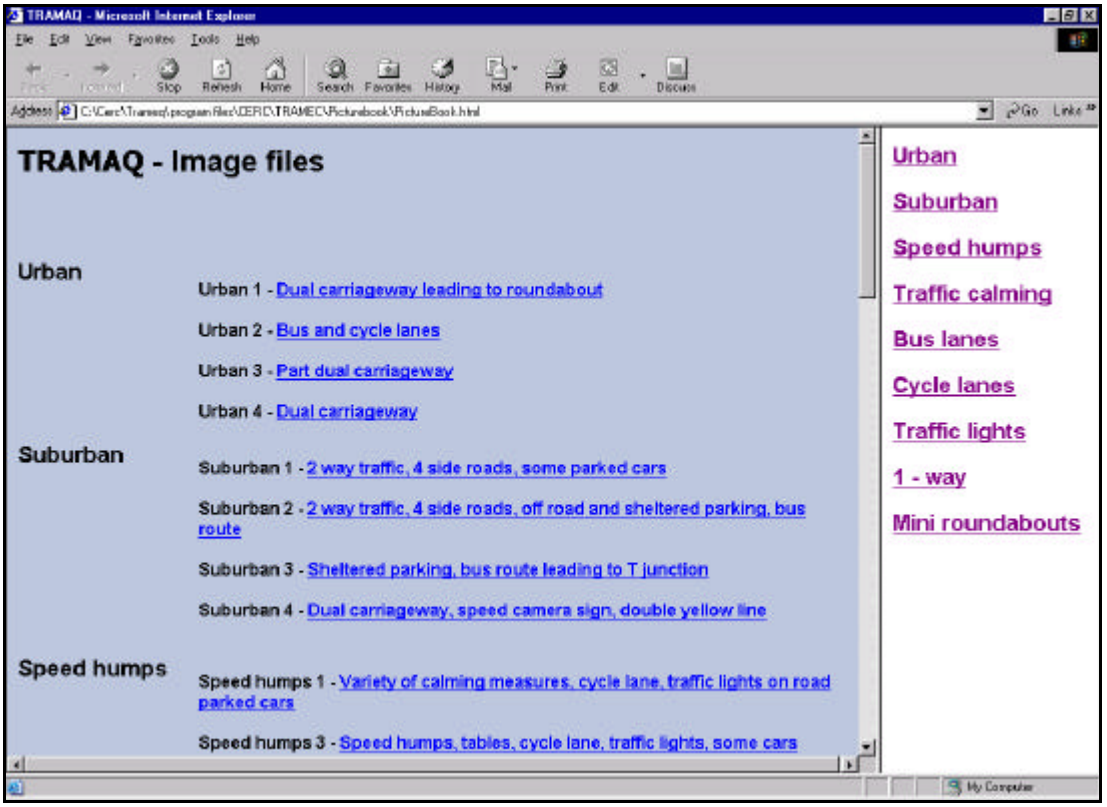

Figure 3. 11 – The Picture book index

To assess which road condition is most suitable users should select a scheme from one of the hyper links. The links listed in purple on the right hand side of the screen will position the main screen at the top of the selected category. When you select a scheme you will see a series of photographs such as that shown in **Figure 3. 12**. Double clicking on any of the images brings up an enlarged view, as in **Figure 3. 13**.

The text given in the second line in the top left of **Figure 3. 12**, is the text that you will find in the **Drive Cycle** drop down list in TRAMEC that corresponds to this drive cycle. While, the text given in the fourth line in the top left of **Figure 3. 12**, labelled as **Import code**, is the text that you will need to use to represent this drive cycle if you want to import data.

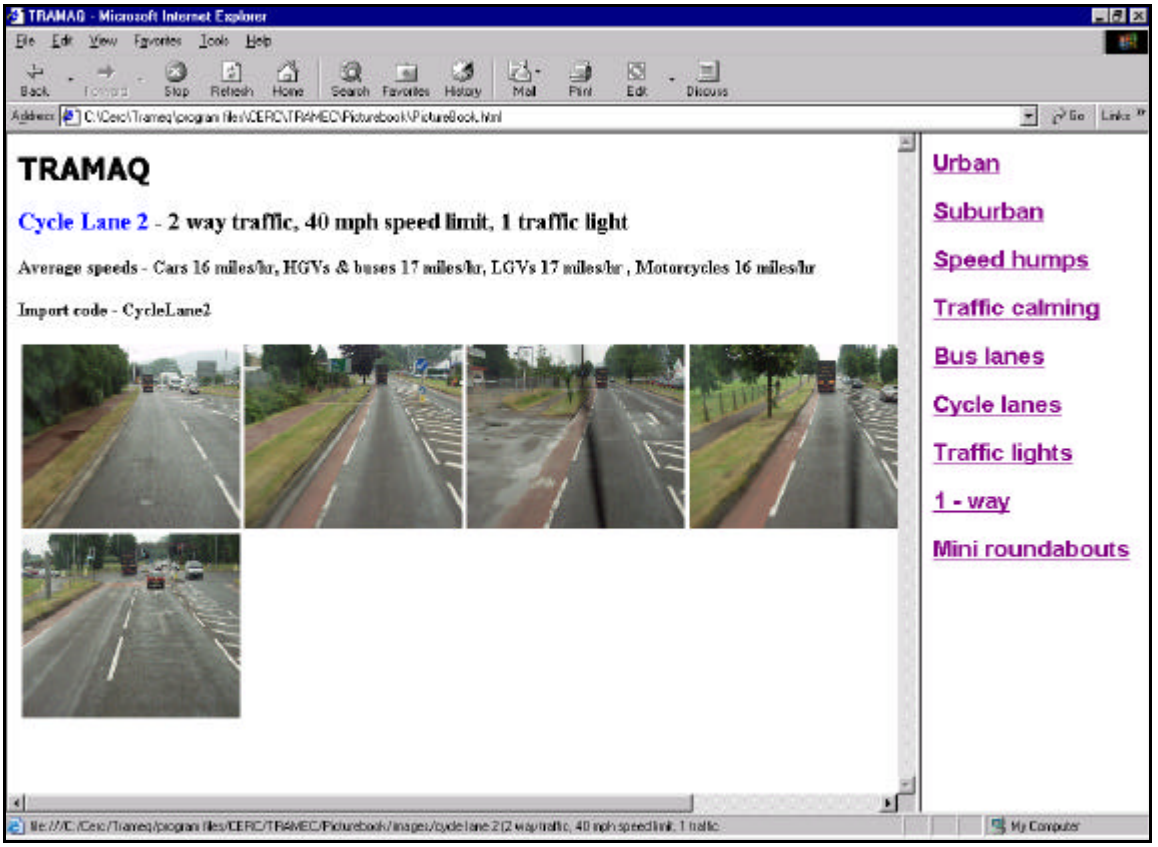

Figure 3. 12 – An example series of photographs, here for a cycle lane

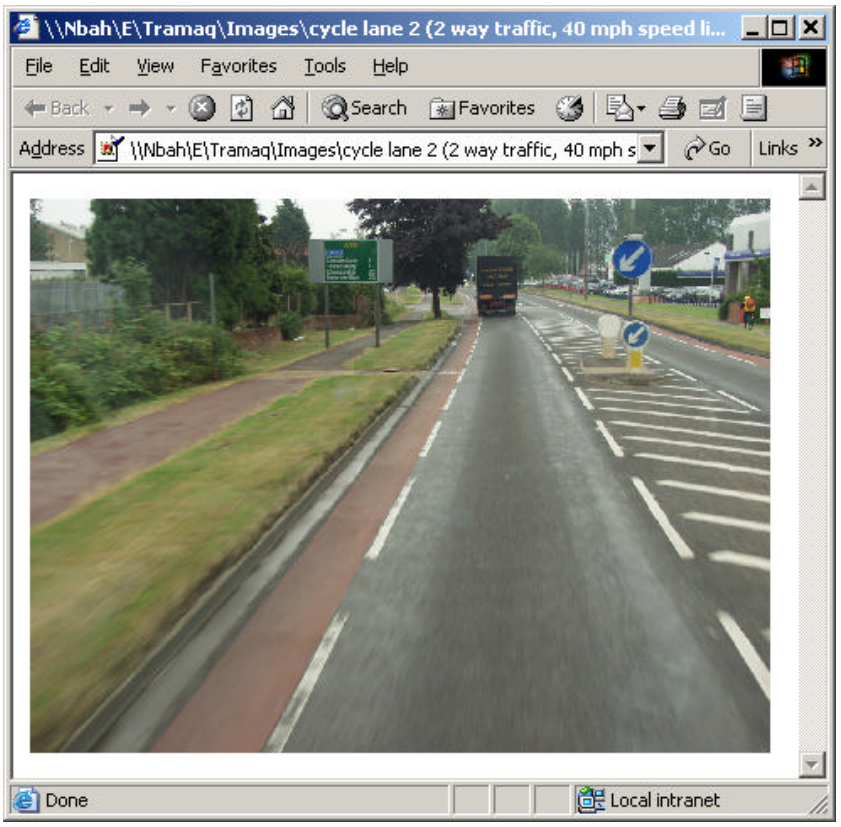

Figure 3. 13 – Enlarged image from the cycle lane series of photographs

The other way of viewing the drive cycle pictures is the select the **Picture Book...** button shown on the detailed link screen see **Figure 3. 9**. This will open the pictures for the drive cycle that you have selected.

SECTION 4 Using the Mapper

The TRAMEC Mapper can be used to display the data held, to colour shade the road links according to their emission rate, to select road links and edit link properties one link at a time.

4.1 Starting the TRAMEC Mapper

To launch the Mapper select **File, Mapper** from the TRAMEC menu bar, or double click the Mapper icon, , on the desktop. Use **File, Open database** from the menu bar, or click the Open icon, , to open a TRAMEC database, see **Figure 4. 1**.

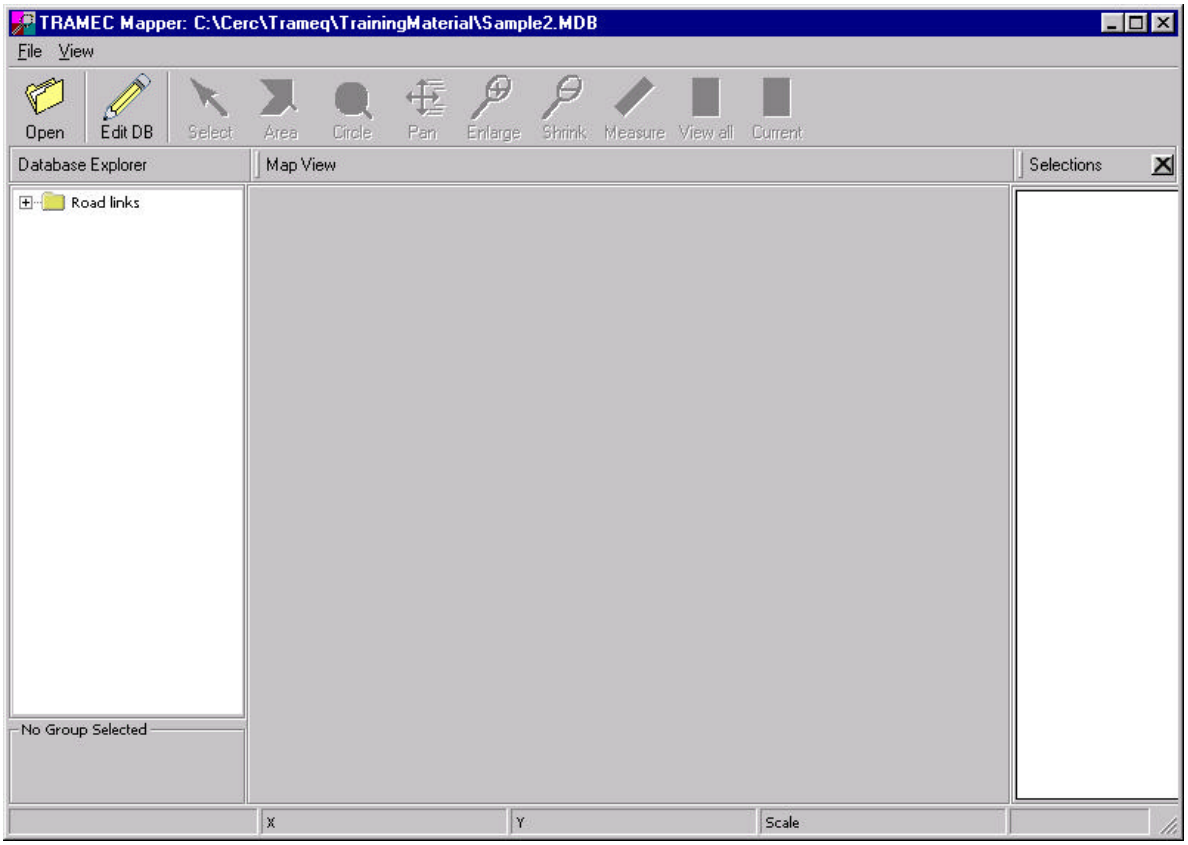

Figure 4. 1 – The TRAMEC Mapper after opening a database

Click on the + sign to expand the **Road links** folder on the left of the screen and show the list of fleet compositions. Many databases will only have one fleet composition listed here if the user has specified that all roads have the same vehicle fleet mixture. Clicking on the names of fleet compositions displays the roads with each composition in different colours, **Figure 4. 2**.

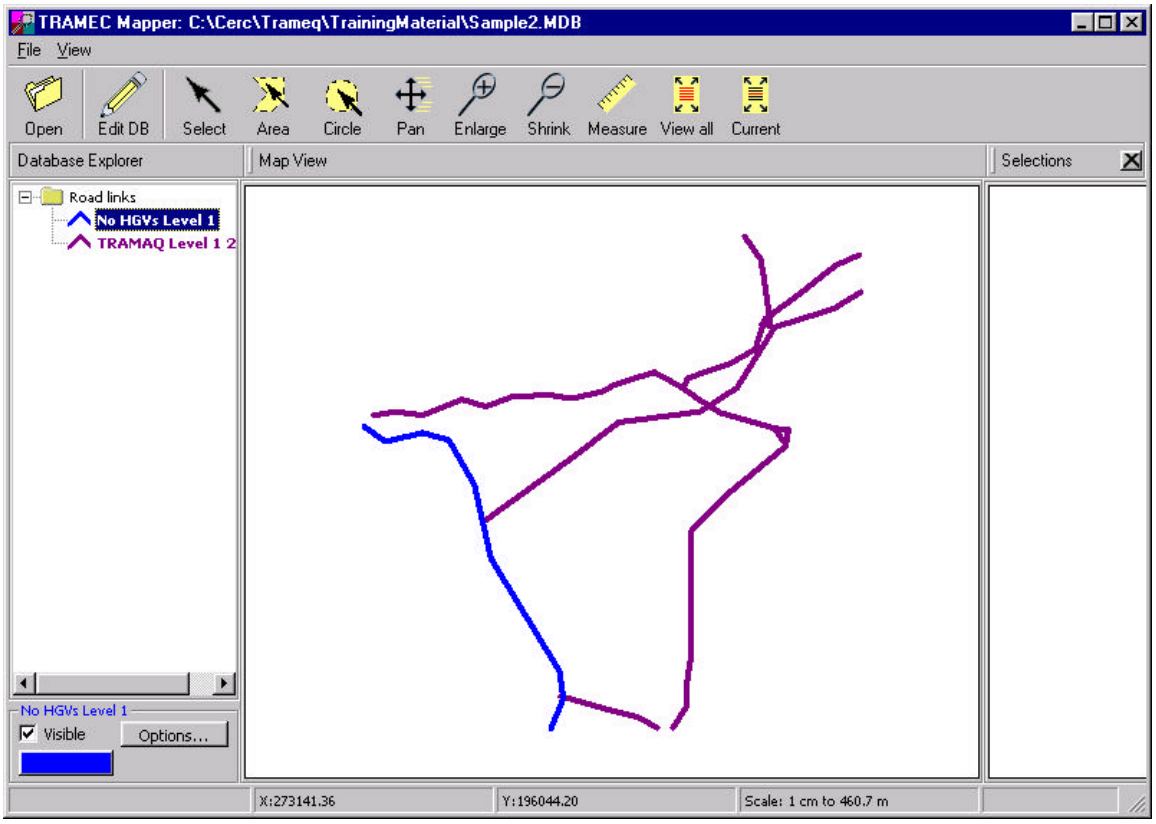

Figure 4. 2 – Mapper with roads of different fleet composition displayed

The Mapper consists of the Menu bar and tool bar at the top of the window and then the **Database Explorer**, **Map View** and **Selections** windows. These are described in more detail in Sections 4.4.1 to 4.4.3 respectively.

The relative size of the **Database Explorer**, **Map View** and **Selections** windows can be changed by clicking and dragging the separators above the relevant window.

Section 4.5 describes how the Mapper can be used to display data and edit road link data.

4.2 The menu bar

There are two menus: **File** and **View**. The **File** menu options allow the opening of database files, the import of background image files, and gives the user the option to **Exit** the TRAMEQ Mapper. The **View** menu options allow the user to change the display: for example, background images such as TIFF files can be switched on and off. In addition, the **View** menu gives the options to copy the **Map View** to the clipboard, or save the map to a file. The menu options are summarised in **Table 4. 1**.

Menu	Option	Use
File	Open Database...	Allows the user to browse for a TRAMEC database to open.
	Load Image...	Loads a background image file (TIFF, JPEG, CompuServe GIF and BMP formats accepted). This is explained in more detail in Section 7.
	Exit	Exits the TRAMEC Mapper.
View	Show Source List	Makes the **Selections** window visible/invisible.
	Show North Arrow	Makes the north arrow visible/invisible.
	Show Images	Makes any background images visible/invisible.
	Save Map View...	Allows the user to save the sources and images currently displayed in the **Map View** as a BMP file.
	Save Map View (high resolution)... **	As above, except the **Map View** is saved to a higher resolution.
	Copy Map View...	Allows the user to copy the sources and images currently displayed in the **Map View** to the clipboard, for pasting into other packages such as Microsoft Word.
	Copy Map View (high resolution)... *	As above, except the **Map View** is copied to a higher resolution.
	Refresh Map	Refreshes the contents of the **Map View** window, for instance after editing data in the TRAMEC interface. Note that if new groups or inventories have been added in the TRAMEC interface these will not be displayed unless the database is reopened in the Mapper.

*The 'high resolution' maps contain significantly more data than the standard maps; these actions therefore require more computer memory and may be slow if running on a minimum specification PC.

Table 4. 1 – Menu options in the TRAMEC Mapper.

4.3 TRAMEC Mapper Toolbar

The toolbar contains buttons for controlling the display and selection of the source data. The TRAMEC Mapper tools are summarised in **Table 4. 2**. Section 4.5 shows how these tools are used to view and manipulate data.

Right clicking on the toolbar allows the user to turn on or off the text that appears on the buttons of the toolbar, but most users will find it helpful to have the text on the buttons as a reminder of what they do. As an additional reminder, as you move the cursor across the tool bar, tooltips appear below the buttons give more detail about the function of each button.

Mapper Tool	Map Cursor	Use when activated
	n/a	Allows the user to browse for a TRAMEC database to open. (It has the same effect as the menu option **File**, **Open TRAMEC Database...)**
	n/a	Enable/disable editing tools. When the **Edit DB** button is down (depressed) data for a selected source can be changed
		The cursor changes to a small box in which part of the source to be selected must be placed. A single click on the source selects it and displays the source name in the **Selections** window. Selected sources are shown in red When **Edit DB** is on, double clicking on a source displays the TRAMEC link form for that source.
		This button allows the selection of sources within a specified polygon. A left click on the mouse defines the vertices of a closed polygon; a right click signals the last vertex. Sources must be *wholly* contained within the polygon to be selected.
		This button allows the selection of sources within a specified circle. It operates in a similar way to the **Area** tool. Click and drag the mouse to define the circle. Release the mouse button to complete the selection. Sources must be *wholly* contained within the circle to be selected.
		Allows the user to move the map around within the **Map View** window, allowing different parts to be viewed. The map remains at the same scale.
		This tool allows the user to 'zoom in' on the **Map View** window. A single mouse click within the **Map View** window causes a magnified display of the region clicked. You can also click and drag the mouse to zoom to a particular rectangle.
		When the cursor is positioned within the **Map View** window a mouse click causes the display centred at the click to be shrunk ('zooming out').

		This tool can be used to measure distances in the **Map View** window. The first click on the left mouse button indicates the starting point of a line to be measured; subsequent clicks define vertices on the line, and a right mouse click indicates the end of a line. The total length of the line in metres is given in the status bar at the bottom of the Mapper window.
	n/a	This button 'zooms' the **Map View** window to show all sources in the currently visible groups.
	n/a	This button 'zooms' the **Map View** window to show all sources in the currently selected fleet composition.

Table 4. 2 – TRAMEC Mapper tools available on the toolbar.

4.4 The TRAMEC Mapper Windows

4.4.1 Database Explorer

The **Database Explorer** window, on the far left of the TRAMEC Mapper, displays the contents of the current TRAMEC database, by fleet composition, using a format very similar to the directory tree structure shown in Windows Explorer. The display incorporates, at the bottom of the scheme, a key indicating the colours and shading used to display each fleet composition in the **Map View** window.

Clicking on a fleet composition within the **Database Explorer** window causes that group of road links to be displayed. This is also indicated by the fleet composition name being displayed in bold. Clicking on a fleet composition in the **Database Explorer** window also causes that group of road links to become the "active" group, and its name, together with the colour used to display it in the **Map View** window, are shown in the box beneath the **Database Explorer** window.

*If the database being displayed used road link **Lengths**, rather than **Locations**, the road links will all be displayed as running east from (0,0). As no location data were entered for the road links the Mapper will have limited use in this case.*

Clicking on the coloured button pops up the **Color** palette dialogue box, **Table 4. 2**, so that the colour in which the sources are displayed can be changed.

The **Visible** check box may be used to show or hide the active group and in this way the user can control what appears in the **Map View** window.

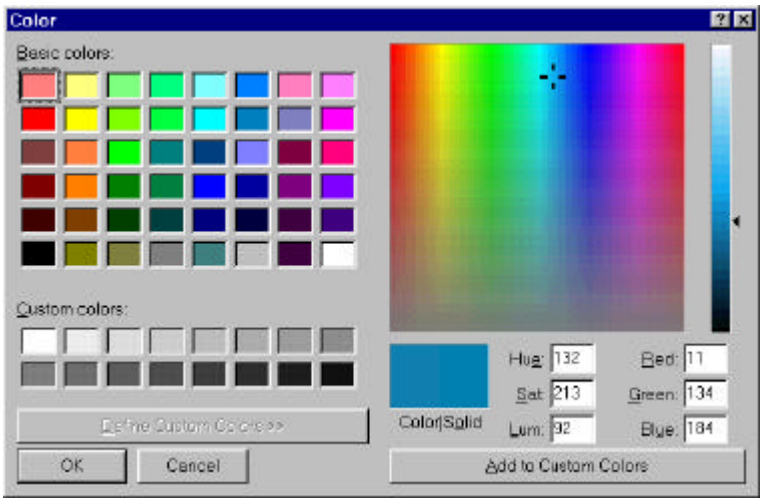

Figure 4. 3 - Colour palette dialogue box.

Clicking on the **Options...** button shows the **Shading/filter controls** screen, **Figure 4. 4**, which allows the user to display the active sources in terms of their emissions of each pollutant. Firstly, sources can be *filtered* such that only those with emissions above and below certain limits will be displayed in the **Map View** window. Secondly, sources can be *shaded* in different colours, depending on their emissions. This is a useful tool that can be used for investigating where emissions are highest or as a rapid visual check to identify errors that may have occurred during the compilation of the road links data.

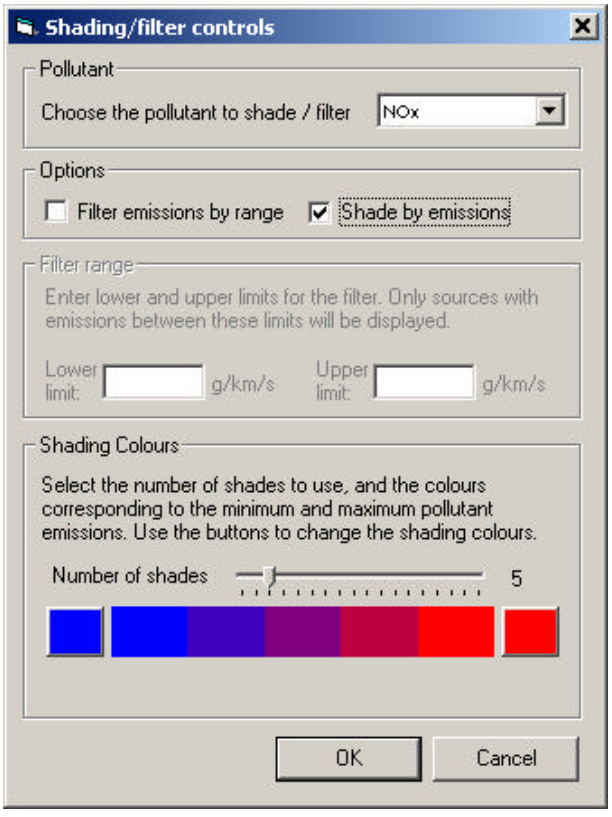

Figure 4. 4 – The filtering and shading screen

The units used to scale the shading of source by emission are g/km/s.

4.4.2 Map View window

The **Map View** window is in the centre of the TRAMEC Mapper interface. This window shows all visible sources. A background image is displayed if one has been loaded. The selection tools, , and , may be used in the **Map View** window to edit sources and the pan, , and zoom tools, , , and are used to view different areas. The location of the cursor in the **Map View** window is given on the status bar (in metres).

Further details about displaying a background image, saving and copying data from the **Map View** can be found in Section 7.

4.4.3 Selections window

This window lists all the sources from the active fleet component that are currently selected. Selected sources are displayed in red in the **Map View** window.

4.5 Viewing and editing data using the TRAMEC Mapper

This section shows, by way of a worked example, how the TRAMEC Mapper can be used to view and edit road link emissions data.

When viewing data the TRAMEC interface can be open at the same time as the Mapper. However, to edit data, the **Edit DB** button must be down and when it is down the TRAMEC interface cannot also be open.

Step 5 Start the TRAMEC Mapper, and open the *Sample2.mdb* database. Click on **Road links** and the **TRAMAQ Level 1 2004** fleet composition to display the group of roads with this fleet composition.

Step 6 Use the **Options...** button to colour shade the roads from blue to green according to emissions of NO_X. You should now see a map like that shown in **Figure 4. 5**.

Step 7 In this view, roads with higher emissions are indicated in green. One road stands out as having a much higher emission than the others. This is not expected and needs further investigation. Click the **Select** button, , and click on the road with the highest emission. The road will be highlighted in red and its name will be displayed in the **Selections** window on the right of the screen. It is the A465(T). We need to investigate whether the very high emissions are correct or not by looking at the data held in TRAMEC.

Step 8 Press the **Edit DB** button, , and double click the A465(T) road link so that the TRAMEC data screen pops up. Go to the **Traffic** tab, **Figure 4. 6**.

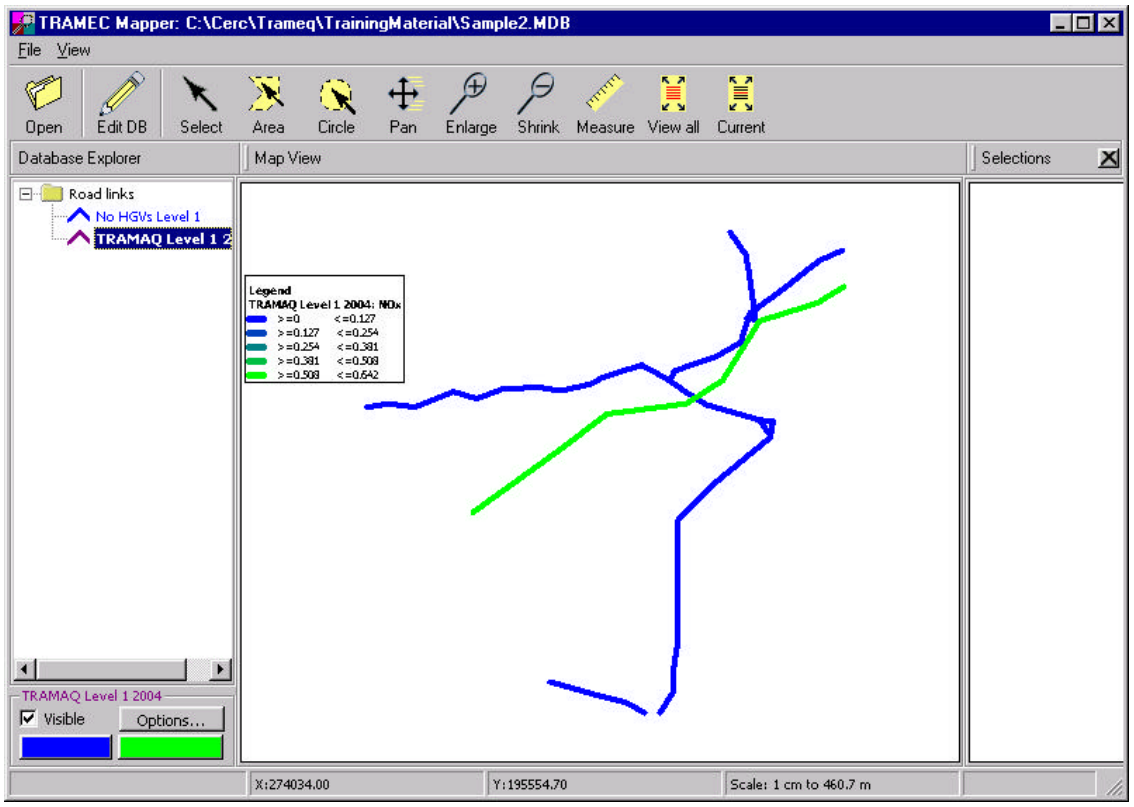

Figure 4. 5 – Road links colour shaded according to emissions of NO_X.

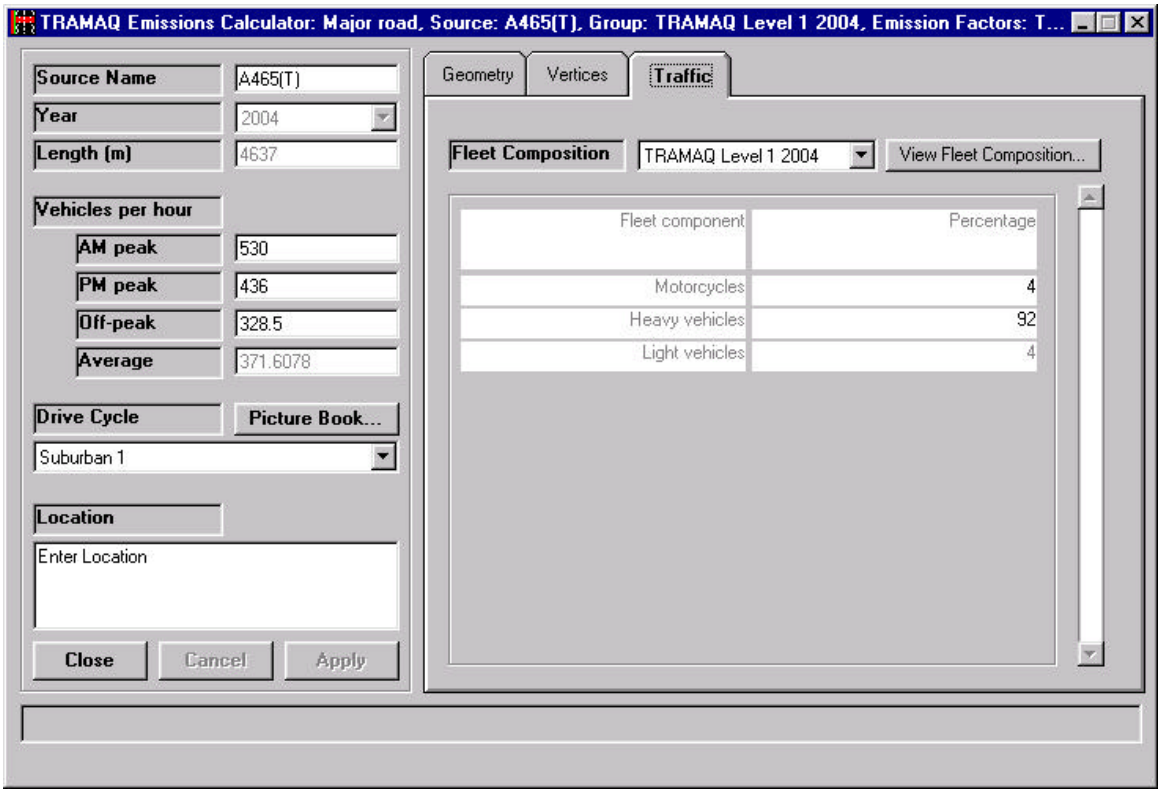

Figure 4. 6 – Traffic tab showing spurious HGV data

Step 9 In the **Traffic** tab, the traffic counts for the AM peak, PM peak and off-peak periods seem reasonable, but the percentage of heavy goods vehicles, 92%, seems to be incorrect. Checking the original data shows that the percentage of HGVs should be 10%. Edit the percentage of HGVs to be the correct value of 10% and then click **Close** to close the TRAMEC screen.

Step 10 The new emissions for the A465(T) won't be displayed until the emissions have been recalculated in TRAMEC. Press the **Edit DB** button, , so it is no longer "down". Now open TRAMEC to view Sample2.mdb. You will see that there are no emissions shown on the main screen, **Figure 4. 7**.

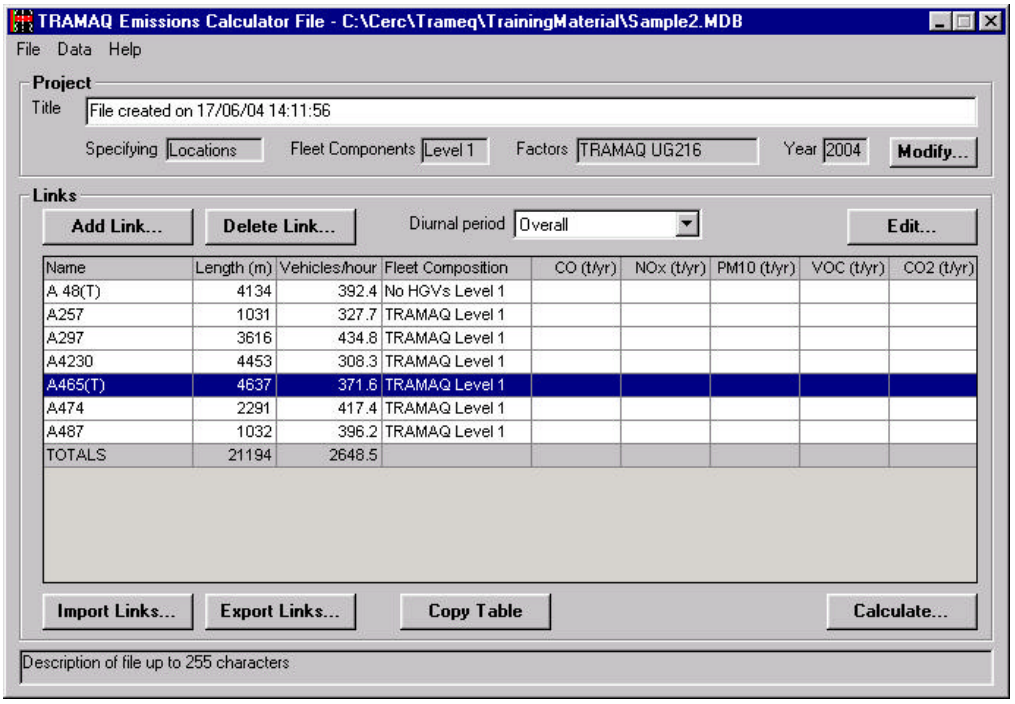

Figure 4. 7 – The main TRAMEC screen, emissions must be recalculated

Step 11 Click **Calculate...** to recalculate the emissions.

Step 12 Switch back to the Mapper by using the Windows Taskbar to make the Mapper active, by clicking on a visible part of the Mapper or using **ALT+TAB** as usual to switch between applications.

Step 13 Use **File, Open database** from the menu bar, or click the Open icon, , to re-open *Sample2.mdb*.

Step 14 Use the **Options...** button as in Step 2 to colour shade the roads according to NO_X emission rate. The A465(T) no longer has a spuriously high emission rate of NO_X.

A similar approach could be used to check the geometry of the road links against a background map or aerial photo. If a road link was found to be incorrectly located, use **Edit DB** to pop up the TRAMEC screen and edit the data on the **Vertices** tab.

SECTION 5 Worked examples

This section shows by way of worked examples, how to build a project using TRAMEC and the Mapper. The first example is going to investigate the expected change in emissions to the centre of Salisbury on the introduction of a new Park and Ride car park. The second example is going to model the change in emissions by introducing a congestion charging area to a central area of Bristol.

5.1 Example 1

We want to investigate the expected change in emissions in the centre of Salisbury when a new Park and Ride scheme is introduced. The new park and ride will increase the number of Park and Ride buses in circulation from 3 to 12. These will all be new EURO IV double-decker buses. Road restrictions can also be introduced to ensure that the buses travel as quickly as possible into and out of the centre.

Step 15 Setting up the project

Once you have opened TRAMEC you will be led through a series of set up screens. Initially **Figure 5.1** will appear where you have to choose either to create a new file or open an existing file. In this case choose to create a new file by pressing the **OK** button.

Figure 5.1 – The screen that appears when you open TRAMEC

The screen in **Figure 5.2** will then appear where you select the location in which to save the database.

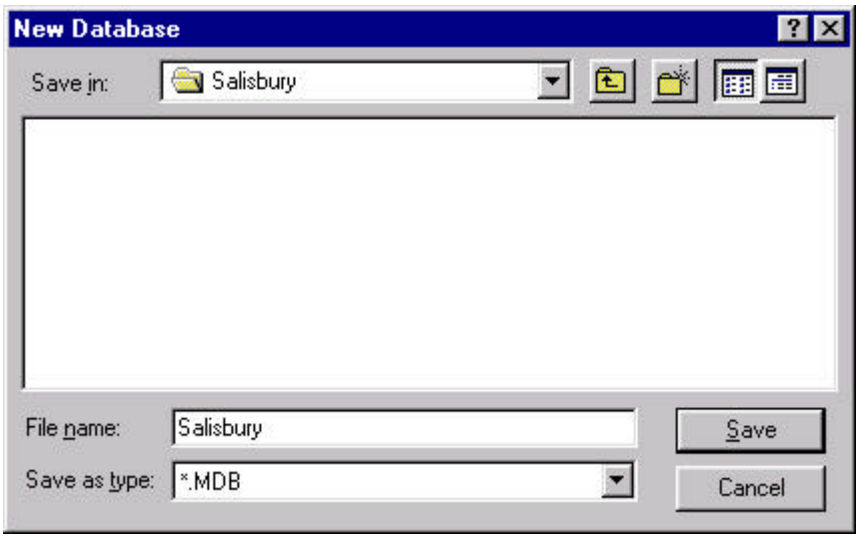

Figure 5.2 – A save dialog screen

In this case the database has been called *'Salisbury.mdb*". Once the **Save** button is pressed the **Choose fleet components** screen will appear **Figure 5.3**. This is the screen where you select the type of traffic count data that you are going to use.

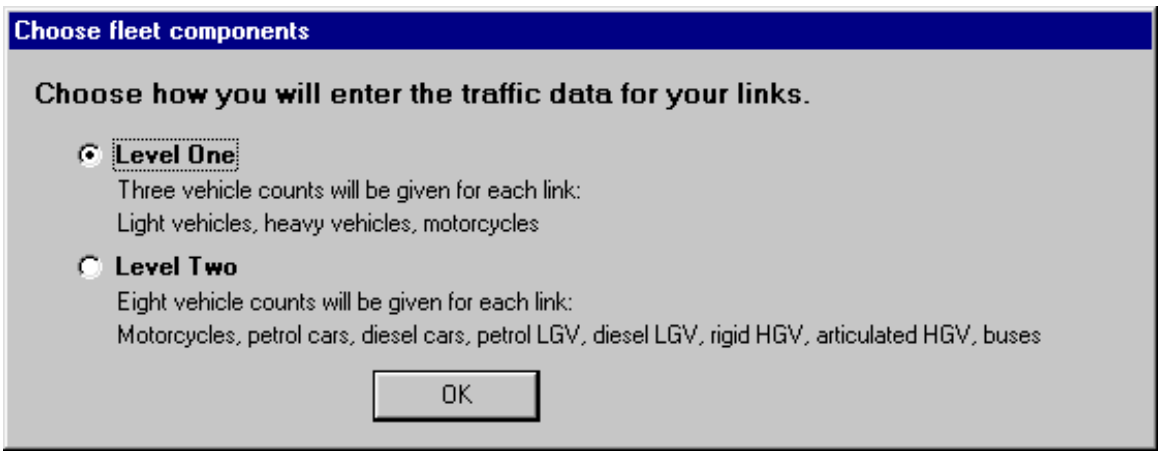

Figure 5.3 – The **Choose fleet components** screen

The choice is either **Level One** which consists of three vehicle counts for each link, light vehicles, heavy vehicles and motorcycles, or **Level Two** which has eight vehicle counts for each link, petrol cars, diesel cars, petrol LGV, diesel LGV, rigid HGV, articulated HGV, motorcycles and buses and coaches.

For this example we have data for the eight vehicle counts so select **Level Two** and click the **OK** button.

Finally the **Road link options** needs to be chosen, see **Figure 5.4**.

Figure 5.4 – The **Road link options** screen

TRAMEC has the capability to calculate emissions either based on the road length without the need for geographical coordinates or by using the geographical coordinates. In this case choose **Specify lengths** because we don't have any detailed geographical information about the roads and click **OK**.

At this point the database is created with the options you have chosen and it may take a moment.

Give the project the **Title** "Salisbury city centre 2004".

Step 16 Entering the road links

There are five roads that have been identified as having potential emission problems. The road details are listed in **Table 5.1**.

					Percentage of fleet composition							
	Length	**AM-peak veh/hr**	**PM-peak veh/hr**	**Off-peak veh/hr**	**M/C**	**D car**	**P LGV**	**D LGV**	**Rigid**	**Artic**	**Bus**	**P car**
Exeter St	430	1493	1813	1231	1.3	12.4	1.2	7.1	3.4	0.3	2.3	72.0
Milford St	200	673	883	418	0.9	12.8	1.0	6.2	3.6	0.0	1.1	74.3
Fisherton St	475	641	789	602	2.0	11.2	1.6	10.0	4.5	0.2	5.3	65.1
Brown St	425	627	1163	863	0.8	11.9	1.1	6.9	7.6	0.1	2.1	69.3
Minster St	200	464	577	518	1.2	11.2	1.1	6.8	8.6	0.2	5.9	65.0

Table 5.1 – Salisbury road data

Select the **Add Link...** button and enter the road details for Exeter Road from **Table 5.1**. Leave the **Road Width** as the default of 5 meters and select the **Traffic** tab (**Figure 5.5**) to enter the **Fleet Compositions**. When you have entered the data select **Apply**. Note that the **Average** number of vehicles per hour is calculated and the number of **Petrol Cars** is automatically generated.

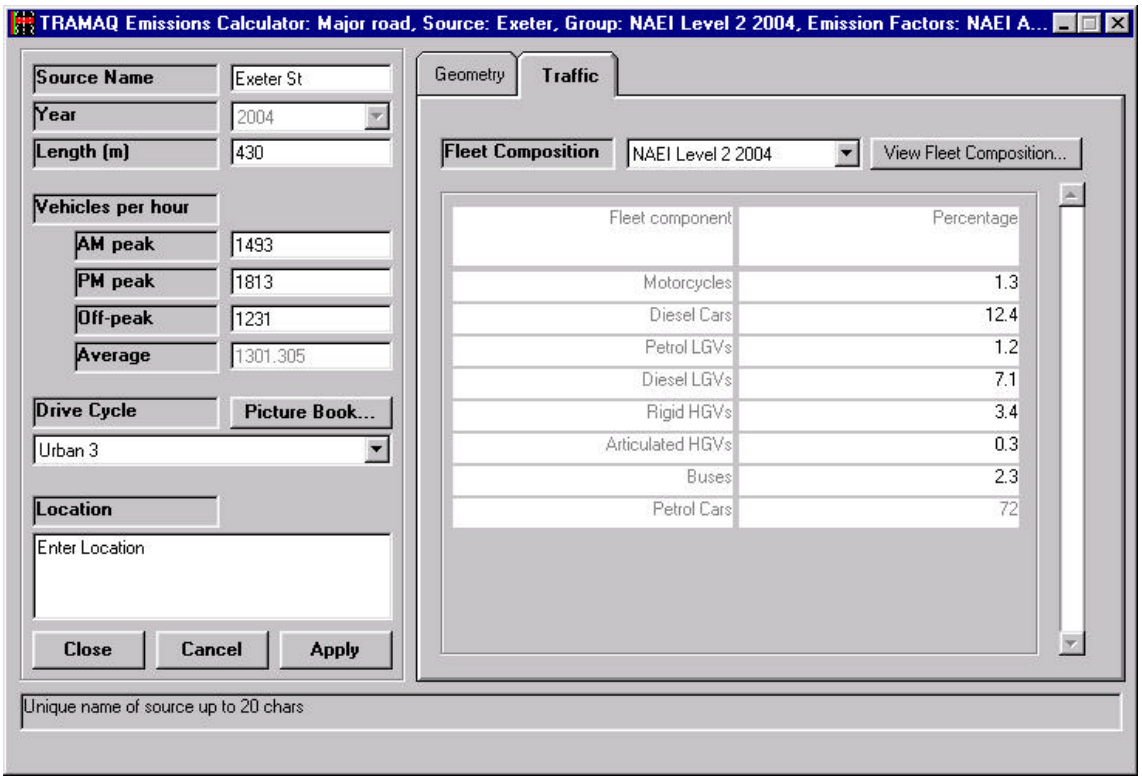

Figure 5.5 – The road link screen

Select **Close** and add the remaining four links in the same manner.

Step 17 Changing the diurnal period

The diurnal period needs to be adjusted to show the percentage of time for the different periods. Select **Data** from the menu bar followed by the **Diurnal Periods** button and the screen shown in **Figure 5.6** will appear.

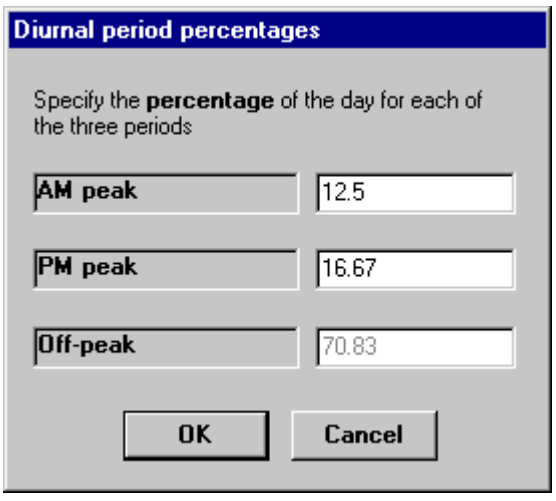

Figure 5.6 – The **Diurnal period percentage** screen

In Salisbury the **AM peak** period runs from 7am to 9am and the **PM peak** from 4pm until 6pm. The diurnal periods are based on a 24 hour clock so change the **AM peak** and **PM**

peak percentages to 8.33%. Notice how the **Off-peak** automatically adjusts. Select the **OK** button.

Step 18 Changing the drive cycle

Open the picture book by double clicking on "*PictureBook.htm*" or by selecting the **Picture Book...** button on the links screen. Each of the roads needs to have a specific drive cycle. Currently the first drive cycle in the list will be selected if no alternative has been chosen.

Select a drive cycle by examining the pictures and using the descriptions given below.

Exeter Street – a two way street running from a large roundabout on the ring road to the city centre. There is a side road on the right hand side about one third of the way down as you head towards the centre. There are no bus lanes or calming features and the speed limit is 30 m/h.

Milford Street - a two way street linking the centre to the ring road on the east side of the city centre. There is a crossroads halfway down. There are no bus lanes or calming features and the speed limit is 30 m/h.

Fisherton Street – a two way street running from a mini roundabout near the station towards the centre. There are two table speed bumps with zebra crossings and the speed limit is 20 m/h.

Brown Street – a one-way street running out of the centre. It has a crossroads halfway down and no other road features, but has a school on it so becomes congested with the school run and the speed limit is 30 m/h.

Minster St – a one-way street in the heart of the centre and the speed limit is 30 m/h.

Return to TRAMEC and select a link by either double clicking on it or selecting the link and pressing the **Edit...** button. Select the most appropriate drive cycle from the dropdown list on the left of the link data screen. Select **Apply** and **Close**.

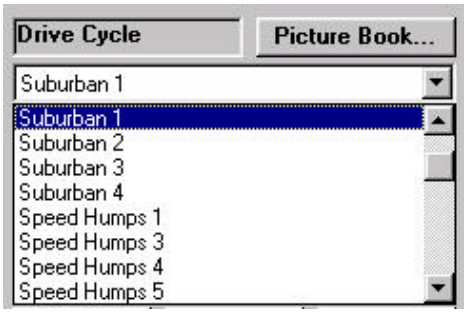

Figure 5.7 – The list of Drive Cycles

If more than one link has the same drive cycle then you can select multiple links by holding down the **Shift** key, then selecting **Edit...**. This will open the **Multiple Source Edit** screen (**Figure 5.8**).

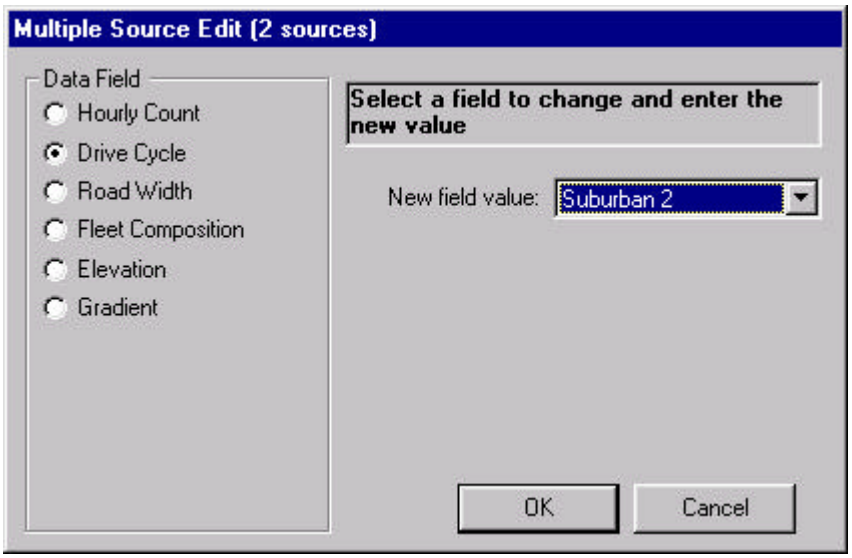

Figure 5.8 – The Multiple Source Edit screen

Select the **Data Field**, **Drive Cycle** and then select the appropriate drive cycle from the drop down. When you select **OK** this will change all the sources you had selected.

Step 19 Calculating the results

Return to the main screen and select the **Calculate...** button. This will calculate the emissions for all the periods. Select the **AM peak** from the **Diurnal period** drop down menu and select the **Copy Table** button. Open Excel and select the **Paste** button.

---

*If any values are larger than 1000 then Excel will automatically display them in scientific notation. To change this to a standard format, select the cells that you which to change or select the whole spreadsheet by clicking on the square between the A and 1 as shown in **Figure 5.9**.*

Notice that the diurnal period, emission factors, year, fleet composition and level have been copied along with the link information. Return to TRAMEC, change the **Diurnal period** to **PM peak** and copy these results. Repeat this process for all the periods and examine them in Excel. You should note that the **Overall** period is the sum of the other three periods.

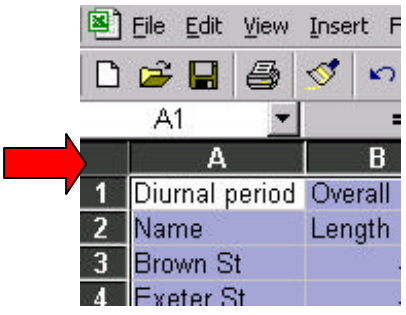

Figure 5.9 – Highlighting a worksheet in Excel

Then select the menu option **Format**, **Cells...** this will open the window shown in **Figure 5.10**. Select the category **Number** and then select **OK**.

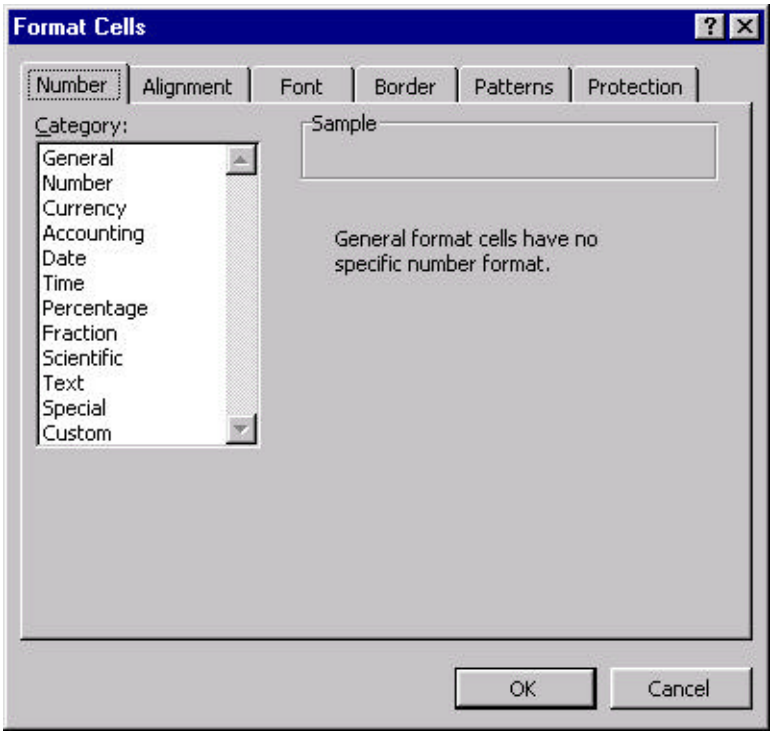

Figure 5.10 – The Format Cells window from Excel

Step 20 Creating a new bus fleet composition

The new Park and Ride is expected to be introduced by 2006. There will be an increase of 9 buses in circulation throughout the day travelling to and from the centre and the Park and Ride. This will increase the overall number of buses by 33% and reduce the number of petrol cars due to more people using the Park and Ride. All the additional, new buses will be EURO IV+ buses leading to a change in the expected fleet composition for 2006.

Open each link in turn and increase the percentage of **Buses** in the Fleet Composition by 33%. E.g. for Brown Street increase the **Buses** fleet composition from 2.1 to 2.8. This will automatically reduce the number of petrol cars.

The 2006 "lower level" fleet composition also needs adjusting to represent the increase in EURO IV+ double-decker buses. Select **Data, Fleet Compositions** from the menu. To create a new fleet composition for 2006, select the **New...** button. **Figure 5.11** will appear, you have to select an existing fleet composition to build on. Name the new fleet composition "Extra buses 2006", select the fleet composition "TRAMAQ Level 2 2006" to copy from, the year "2006" and select **OK**.

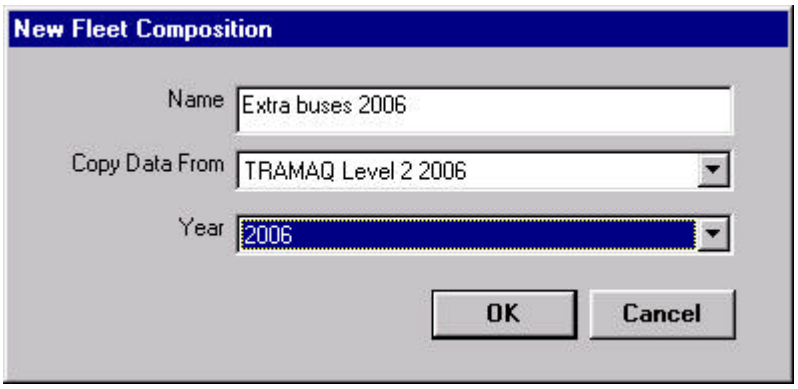

Figure 5.11 – New Fleet Composition screen

You are now ready to select the new fleet composition. Select the **Copy** button and paste the fleet composition into Excel. In Excel you will see the Fleet composition, Emission standard, Size and Percentage columns, as shown in the first four columns of **Table 5.2**.

Fleet component	Emission standard	Size	Percentage		Additional buses	New percentage
Buses	Pre-1988	<17 seats	0.06		0.06	0.04
Buses	Pre-1988	17 to 35 seats	0.53		0.53	0.40
Buses	Pre-1988	>35 seats	1.49		1.49	1.12
Buses	Pre-1988	Double decker	0.86		0.86	0.65
Buses	1988-1993	<17 seats	0.10		0.10	0.07
Buses	1988-1993	17 to 35 seats	0.91		0.91	0.68
Buses	1988-1993	>35 seats	2.57		2.57	1.93
Buses	1988-1993	Double decker	1.48		1.48	1.11
Buses	EURO I	<17 seats	0.14		0.14	0.11
Buses	EURO I	17 to 35 seats	1.33		1.33	1.00
Buses	EURO I	>35 seats	3.76		3.76	2.82
Buses	EURO I	Double decker	2.17		2.17	1.63
Buses	EURO II	<17 seats	0.64		0.64	0.48
Buses	EURO II	17 to 35 seats	6.08		6.08	4.56
Buses	EURO II	>35 seats	17.18		17.18	12.89
Buses	EURO II	Double decker	9.92		9.92	7.44
Buses	EURO III	<17 seats	0.92		0.92	0.69
Buses	EURO III	17 to 35 seats	8.69		8.69	6.52
Buses	EURO III	>35 seats	24.55		24.55	18.41
Buses	EURO III	Double decker	14.17		14.17	10.63
Buses	EURO IV	<17 seats	0.05		0.05	0.03
Buses	EURO IV	17 to 35 seats	0.44		0.44	0.33
Buses	EURO IV	>35 seats	1.24		1.24	0.93
Buses	EURO IV	Double decker	0.72		0.72	0.54
Buses	EURO IV+	<17 seats	0.00		0.00	0.00
Buses	EURO IV+	17 to 35 seats	0.00		0.00	0.00
Buses	EURO IV+	>35 seats	0.00		0.00	0.00
Buses	EURO IV+	Double decker	0.00		33.33	25.00
				Total	133.33	100.00

Table 5.2 – Original percentage and new percentage for the bus fleet composition

Rename this **Percentage** column, **Original Percentage**. The total of that column is 100%. We want to get to the **New percentage**, after the new buses have entered the fleet. Table 5.2 shows how to calculate this in 2 steps.

Firstly, we are told that the overall number of buses increases by 33.33% and all of these are **EURO IV+ Double deckers**. Scroll down until the bus categories are in view. Currently the percentage of EURO IV+ Double deckers (last row) is zero. Create a new column called **Additional buses** by copying the **Original Percentage** column. Change the percentage of EURO IV+ Double deckers in the **Additional buses** column to be 33.33.

The total percentage for the **Additional buses** column is now 133.33 whereas it should be 100. Create a new column called **New Percentage**. The values in this column should be calculated by taking the ones in the **Additional buses** column, dividing them by 133.33 and multiplying them by 100. The new total should be 100%.

Now that you have recalculated the new fleet composition percentages, edit the values in TRAMEC to be the same as the **New percentage** column in **Table 5.2**. Notice that the percentage total updates as you enter data and if the total is not 100% then the total appears in red. You will not be allowed to save the changes to the **Fleet Composition** unless the total is 100%. Once all the values have been entered select **Apply** and **Close** the **Fleet Composition** screen.

Step 21 Changing the bus fleet composition

The new bus fleet composition has been created for 2006, but before we can change the fleet composition of the roads the emission factors need to be changed to be the same year.

Select the **Modify...**button in the Project section and **Figure 5.12** will appear.

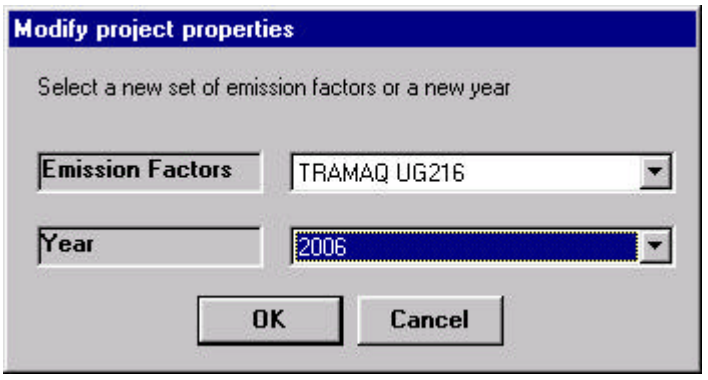

Figure 5.12 – The **Modify project properties** screen

Change the year to 2006 and select **OK**. The fleet composition now needs to be changed to a 2006 composition (**Figure 5.13**). Select "Extra buses 2006" from the drop down menu and select **OK**.

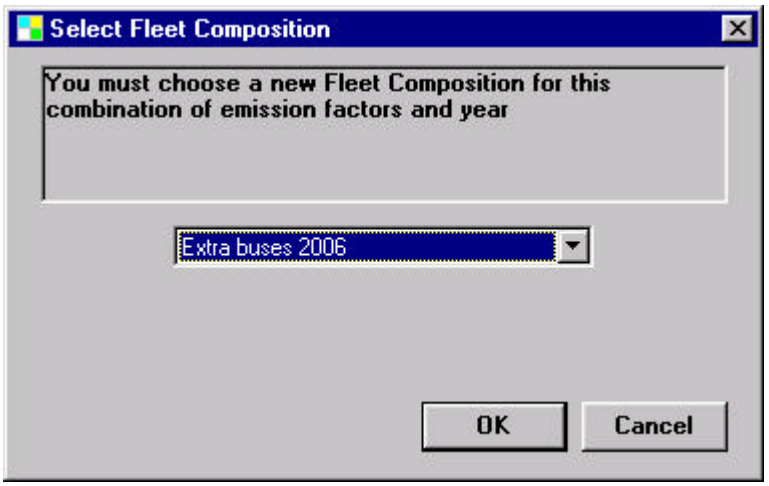

Figure 5.13 – The **Select Fleet Composition** screen

If you now open a link and examine the **Fleet Composition** in the **Traffic** tab you will see that it has been changed.

Step 22 Changing the number of vehicles

By 2006 the total number of vehicles is expected to increase by 10%. Select all the links and click the **Edit...** button and change the **Hourly Count** to be 110% of the present value, then select **OK** (**Figure 5.14**).

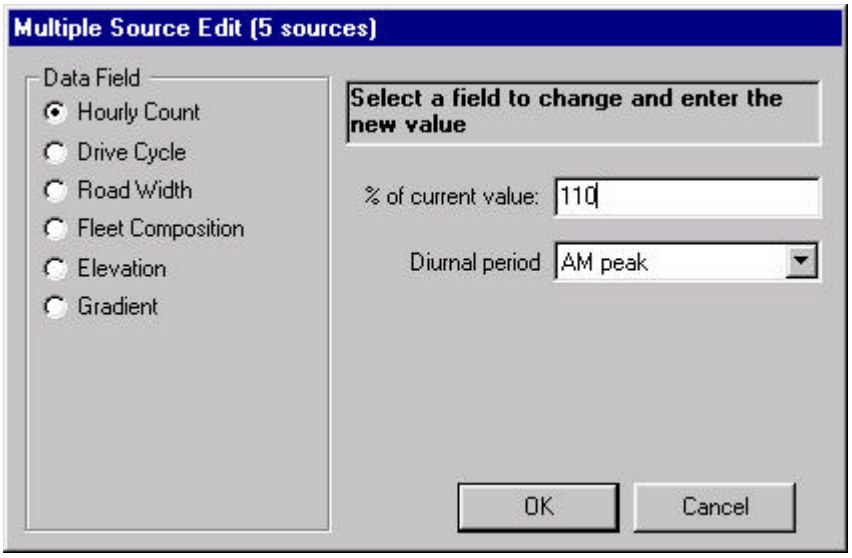

Figure 5.14 – The Multiple **Source Edit** screen

Repeat the process for the **PM** and **Off** peak periods.

Calculate... the totals and copy them to Excel. Compare the emissions to those for 2004, has there been a reduction?

Further investigations:

If the NAEI emission factors were used instead of the TRAMAQ emission factors, what effect would this have on the results?

Investigate the difference made to the emissions factors by changing the drive cycles.

5.2 Example 2

This example is going to investigate the change in emissions to Bristol city centre if a congestion-charging zone is introduced. The congestion charging zone will cover an area of about 1.5 km^2 (**Figure 5.15**). The charging will be in place from 7.30am to 6.30pm, Monday to Saturday. The charging will be staggered with a more expensive charge in the AM and PM peak periods and a reduced charge in the middle of the day. It is expected that the introduction of the charge will cause a 25% reduction in traffic in the peak periods and a 15% reduction in the middle of the day. There is expected to be an increase in traffic in the charging area outside of the charging times causing an overall increase in the off peak period by 15%.

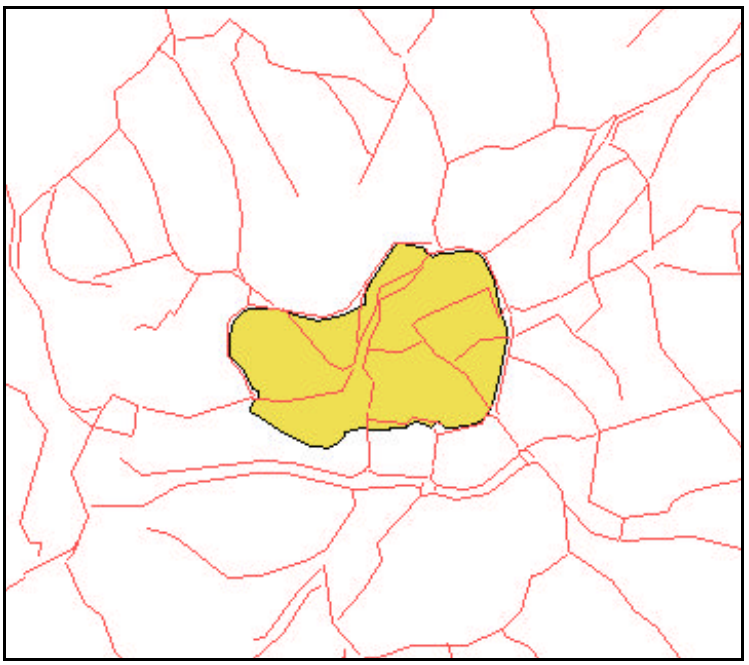

Figure 5.15 – Bristol city centre with the cordon area

Step 1 Organising the data

Currently the available data are in the form of annual average daily traffic flows (AADT) for each road. These data need to be converted into the number of vehicles per hour for each of the time periods, (AM peak, Off-peak and PM peak.)

The percentage of the day for each time period is needed as well as the typical length of each time period. In Bristol the AM peak typically runs from 7.30am until 9.00am and the PM peak typically runs from 5pm until 6.30pm.

Data from Bristol City Council has been collated and can be found in *\TRAMEC\TrainingMaterial\Bris2000.csv* and *\TRAMEC\TrainingMaterial\Bris2005.csv*.

Open the csv files in Excel and examine the different fields, noting the road coordinates at the bottom of the file. Referring to **Table 6.2** you will see that the fields AMPEAK_VH, PMPEAK_VH, OFFPK_VH and DRIVECYCLE need to be added in order to import the data into TRAMEC. This means that the AADT needs to be converted into the number of vehicles per hour for the different time periods. This could be done a number of ways:

- Ideally you would calculate the average number of vehicles per hour from the measured number of vehicles over each time period.
- You might know the typical percentage of vehicles that travel in each period which you could then use to proportion the AADT for all the roads.
- You could simply divide the AADT by 24.

In this example we are going to use the typical percentage of vehicles that travel in each period. For this example approximately 10% of the total daily number of vehicles travel between 7.30 am and 9am and 15% of the total travel between 5pm and 6.30 pm.

Add four new columns to *Bris2000.csv* with the headings, AMPEAK_VH, PMPEAK_VH, OFFPK_VH and DRIVECYCLE. Calculate the number of vehicles per hour over each time period using the percentages given.

$$\text{E.g. AMPEAK_VH} = \frac{(10\% \times AADT)}{1.5\,hours}$$

$$\text{PMPEAK_VH} = \frac{(15\% \times AADT)}{1.5\,hours}$$

$$\text{OFFPK_VH} = \frac{(75\% \times AADT)}{21 hours}$$

Once this has been done ensure that the number of vehicles are copied and "pasted as values" using the **Paste Special...** command.

The DRIVECYCLE also needs to be present for importing the data. At this stage a universal drive cycle is going to be applied to the whole city. The importing drive cycle names can be found in **Table A.1** of the manual or the picture book. Look up the import name for a drive cycle that you think is representative for the city and paste this into every link in *Bris2000.csv*.

	A	B	C	D	E	F	G	H	I	J	K	
1	ROADNAME	DESCRIPT	AMPEAK_VH	PMPEAK_VH	INTER_VH	DRIVECYCLE	AADT	PCNTMC	PCNTHVY	CANYON	HEIGHT	WI
2	1400_1 _2000	A4032 NEWFOUNDLAND STREET	3643.20	5314.8	1868.1429	Urban3	53148	0.01	0.05	0	0	
3	99025_3a3 _2000	BOND STREET (SOUTH)	3488.60	5232.9	1868.8929	Urban3	52329	0.01	0.06	10	0	
4	1440_1 _2000	BROAD PLAIN EAST OF TEMPLE \	1904.47	2856.7	1020.25	Urban3	28567	0.01	0.04	0	0	
5	38476 _2000	WEST STREET WEST OF TRINITY	1333.87	2000.8	714.57143	Urban3	20008	0.01	0.08	10	0	
6	8391 _2000	A420 CLARENCE ROAD EAST OF	1492.20	2238.3	799.39286	Urban3	22383	0.01	0.07	10	0	
7	1830_1 _2000	ST. PHILIPS ROAD NORTH OF ALE	1906.47	2859.7	1021.3214	Urban3	28597	0.01	0.09	0	0	
8	028348 _2000	A420 TRINITY ROAD SOUTH OF LA	1175.07	1762.6	629.5	Urban3	17626	0.01	0.07	10	0	
9	1750_1 _2000	B4465 EASTON ROAD EAST OF W	636.47	954.7	340.96429	Urban3	9547	0.01	0.03	0	0	
10	1430_1 _2000	AVON STREET EAST OF TEMPLE	351.00	526.5	188.03571	Urban3	5266	0.01	0.04	0	0	
11	1310_1 _2000	A4 TEMPLE GATE NORTH OF STA	3189.40	4784.1	1708.6071	Urban3	47841	0.01	0.08	10	0	
12	037715 _2000	A4044 REDCLIFFE WAY WEST OF	999.73	1499.6	535.57143	Urban3	14996	0.01	0.13	0	0	

Figure 5.16 – The import file 'Bris2000.csv'

The spreadsheet should look similar to **Figure 5.16**.

Repeat the process for *Bris2005.csv*, save the files making sure they are saved as *csv* files and close them. Open the files in notepad and scroll down to where the road coordinates start. Check that there are no extra commas as shown in **Figure 5.17**. If there are extra commas at the end of the rows then they should be deleted.

The files are now in the correct format to be imported.

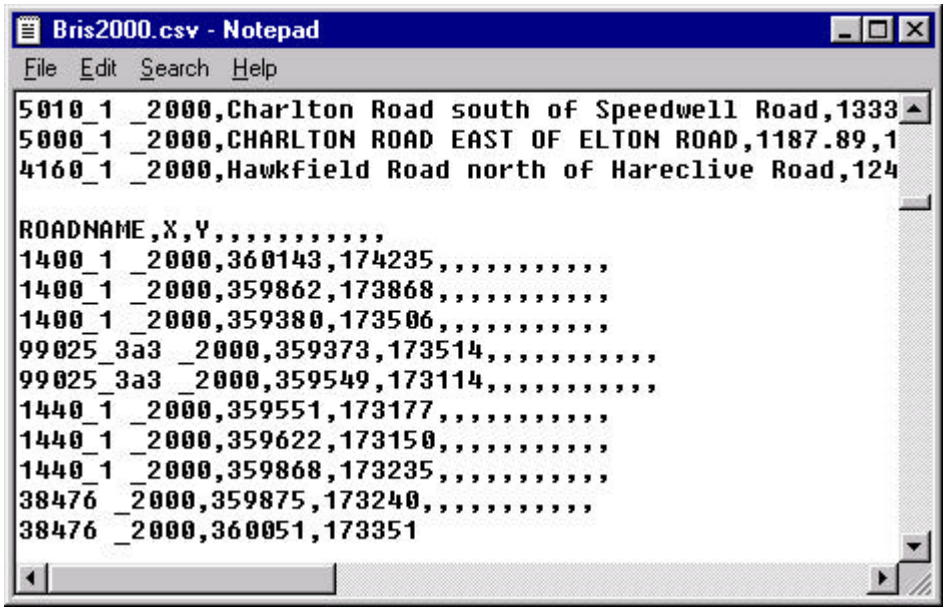

Figure 5.17 – The import file Bris2000.csv viewed in notepad

Step 2 Setting up the project

If TRAMEC is already open then select **File**, **New** from the menu and create a new database called "*Bristol2000.MDB*", otherwise open TRAMEC and select **Create a new file**. Select **Level One** and **Specify locations**.

Give the project the **Title** "Bristol city centre 2000".

Step 3 Importing the data

To import the data select the button **Import Links...**. This will open the import wizard. Select the **Browse...** button and locate the file "*Bris2000.csv*" followed by the **Open** button. The wizard should now look the same as **Figure 5.18**.

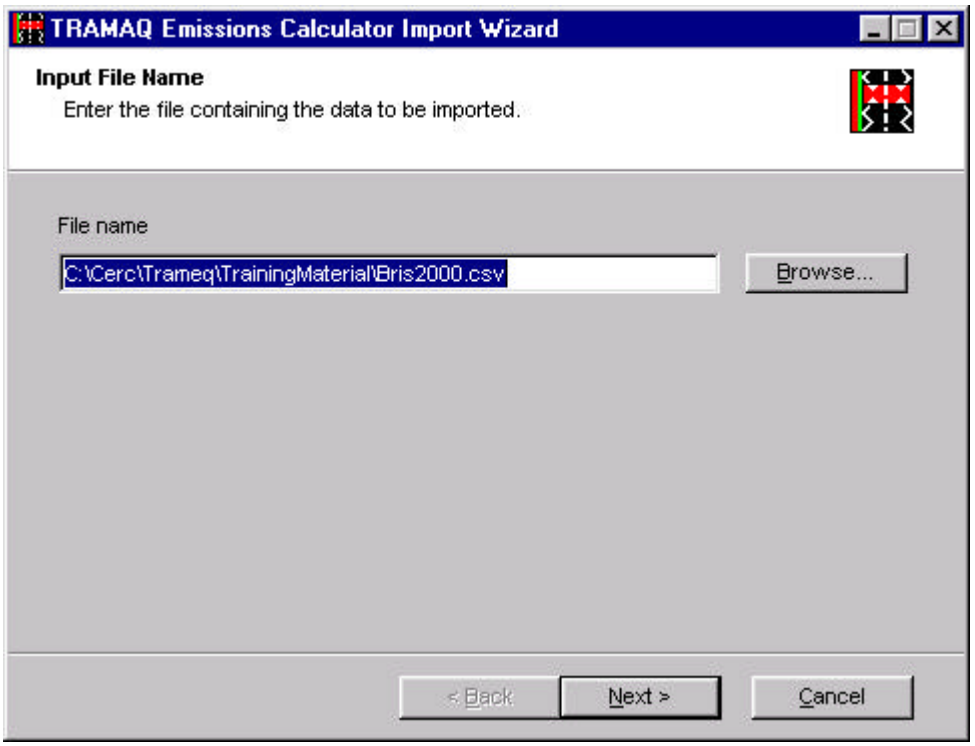

Figure 5.18 – The **Import Wizard** screen

Select **Next >** and the wizard examines the data. A screen with the list of fields that are going to be imported will appear. Continue by selecting **Next >** until the integrity checks are carried out. If all the data were in the correct format then **Figure 5.19** will appear. If any errors occur then details will be given.

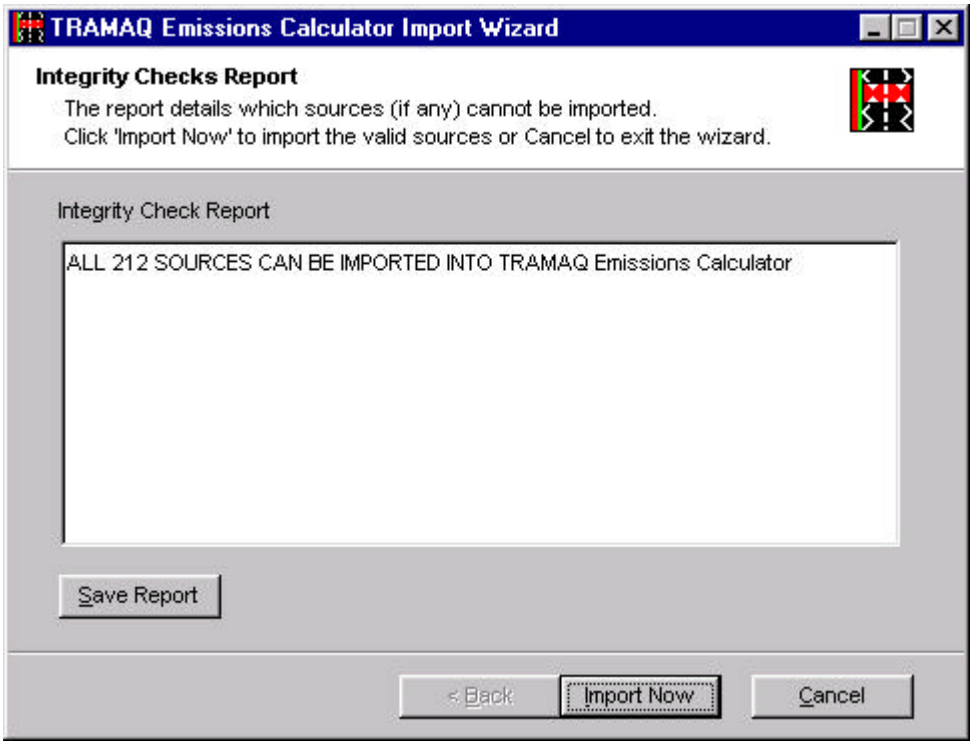

Figure 5.19 – The **Integrity Checks Report** screen of the **Import Wizard**

Select **Import Now** followed by **Exit**, a progress window will appear on the screen while the links are imported, this may take a moment. Once the links have been imported you will be able to see them on the main screen. They can be edited either by double clicking on a selected link or pressing the **Edit...** button.

Step 4 Changing the emission factors

The emission factors default is "TRAMAQ UG126 2004". Initially we are considering the year 2000 so we want to change the emission factors to this year. Select the button **Modify...** and the **Modify project properties** screen appears. (**Figure 5.20**)

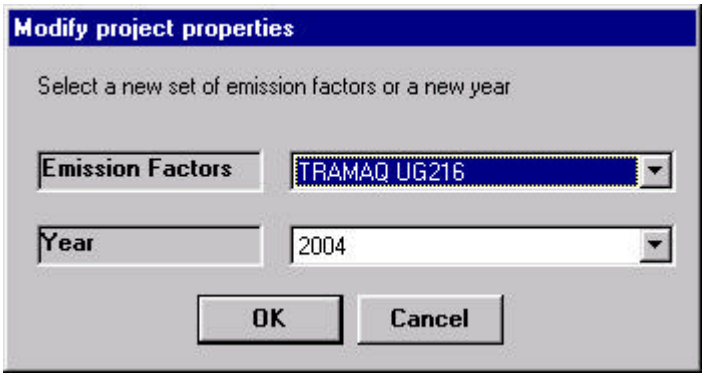

Figure 5.20 – **Modify project properties** screen

Select the **Year** 2000 from the drop down menu then press **OK**. The **Select Fleet Composition** screen appears, so that you can select the appropriate fleet composition. There is only the TRAMAQ Level 1 2000 available because no custom built compositions have been created. Select **OK** and you will notice that the emission factor details have changed on the front screen.

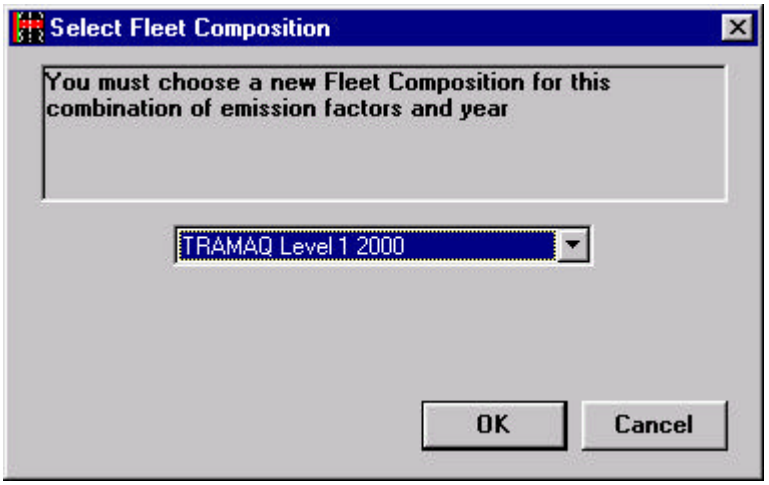

Figure 5.21 – The **Select Fleet Composition** screen

Step 5 Changing the diurnal period

The diurnal period needs to be adjusted to represent Bristol. Select **Diurnal Periods** from the **Data** menu and the screen shown in **Figure 5.22** will appear.

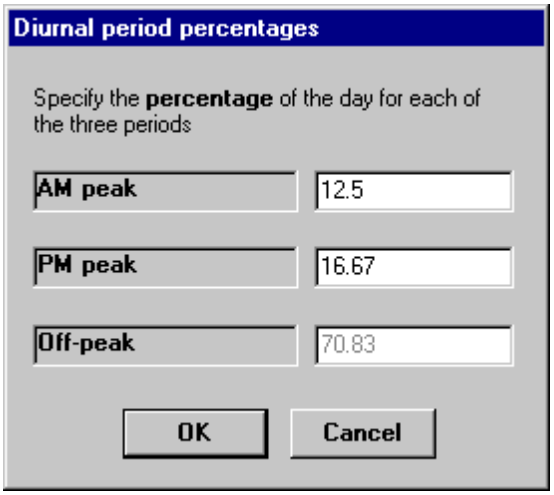

Figure 5.22 – The **Diurnal period percentages** screen

Change the AM peak and PM peak percentages to 6.25%. Notice how the Off-peak automatically adjusts. Select the **OK** button.

Step 6 Calculating the totals

Select the **Calculate...** button, this calculates all the totals. Change the diurnal period to **AM peak** and press the **Copy Table** button. Open Excel and paste the emissions. Return to TRAMEC and change the diurnal period to **PM peak** and press the **Copy Table** button again and paste the data into Excel. Repeat this for the **Off-peak** and **Overall** periods. Examine the results noticing that the **Overall** period is a sum of the other periods.

Step 7 Calculating Bristol 2005 data

- Select **File**, **New** from the menu and create a new database called "*Bristol2005.MDB*". Select **Level One** and **Specify locations**.
- Import "*Bris2005.csv*" by selecting the **Import Links...** button and following the wizard.
- Once the data has been imported change the emission factors year to 2005 and the fleet composition to "TRAMAQ Level 1 2005" by selecting the **Modify...** button.
- Change the diurnal profile to be the same as Step 5.
- **Calculate...** the totals and then copy the **Overall** period and compare with the 2000 data. You will notice that all the emissions have reduced by 2005 except for CO_2. You might not expect this since the number of vehicles per hour has increased but the emission factors take account of the uptake of new fuels and the changes in technology.

Step 8 Viewing the data in the Mapper

Close TRAMEC and open the TRAMEC Mapper. Select the **Open** button and an open dialog window will appear. Locate the database *"Bristol2005.mdb"*. In the Database Explorer window expand the Road Links folder and select "TRAMAQ Level 1 2005". The screen should look like **Figure 5.23**.

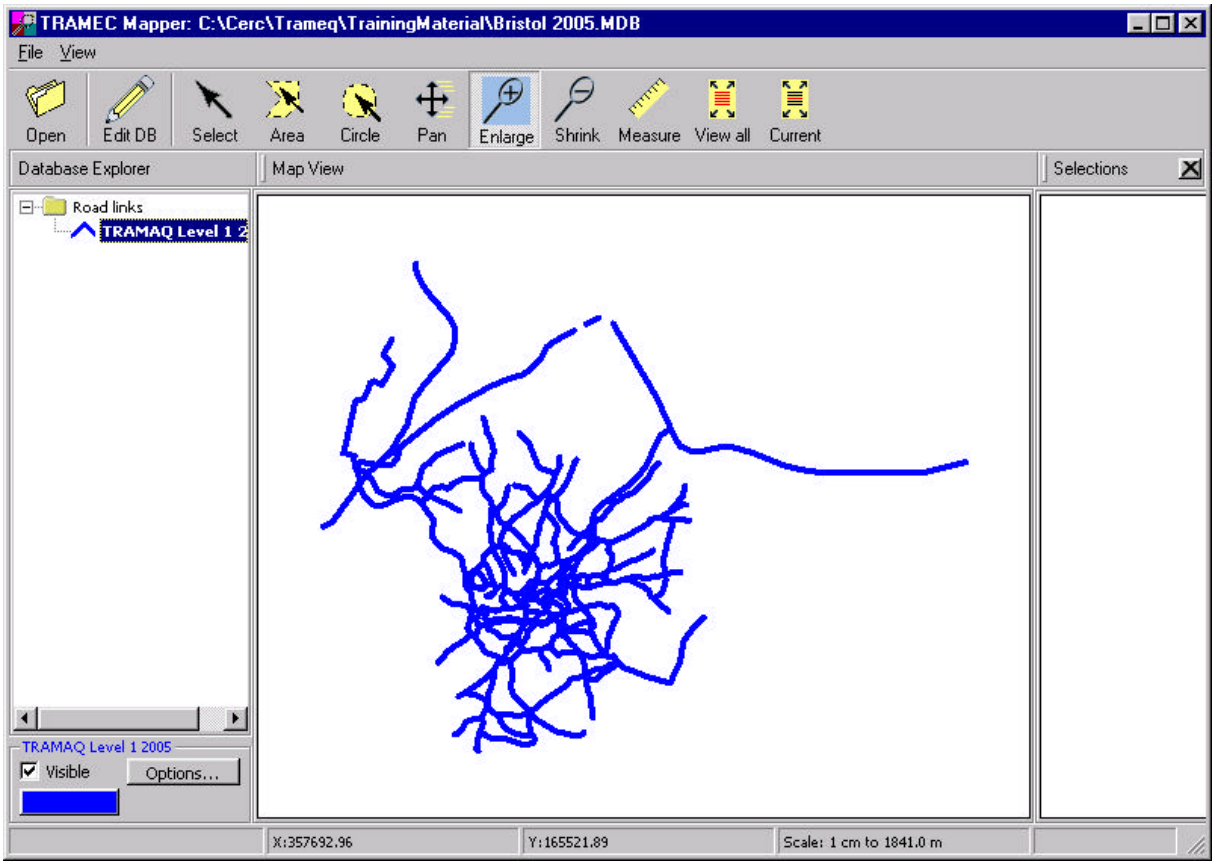

Figure 5.23 – The links from Bristol2005.mdb viewed in the Mapper

Use the **Enlarge** and **Pan** buttons to zoom in on the centre. Use the **Circle** button to select most of the links shown in red in **Figure 5.24**. Then press the **Select** button hold down the **Ctrl** key and select or deselect links until you have selected all the links shown in **Figure 5.24**. You will notice that the names of the selected links appear on the right.

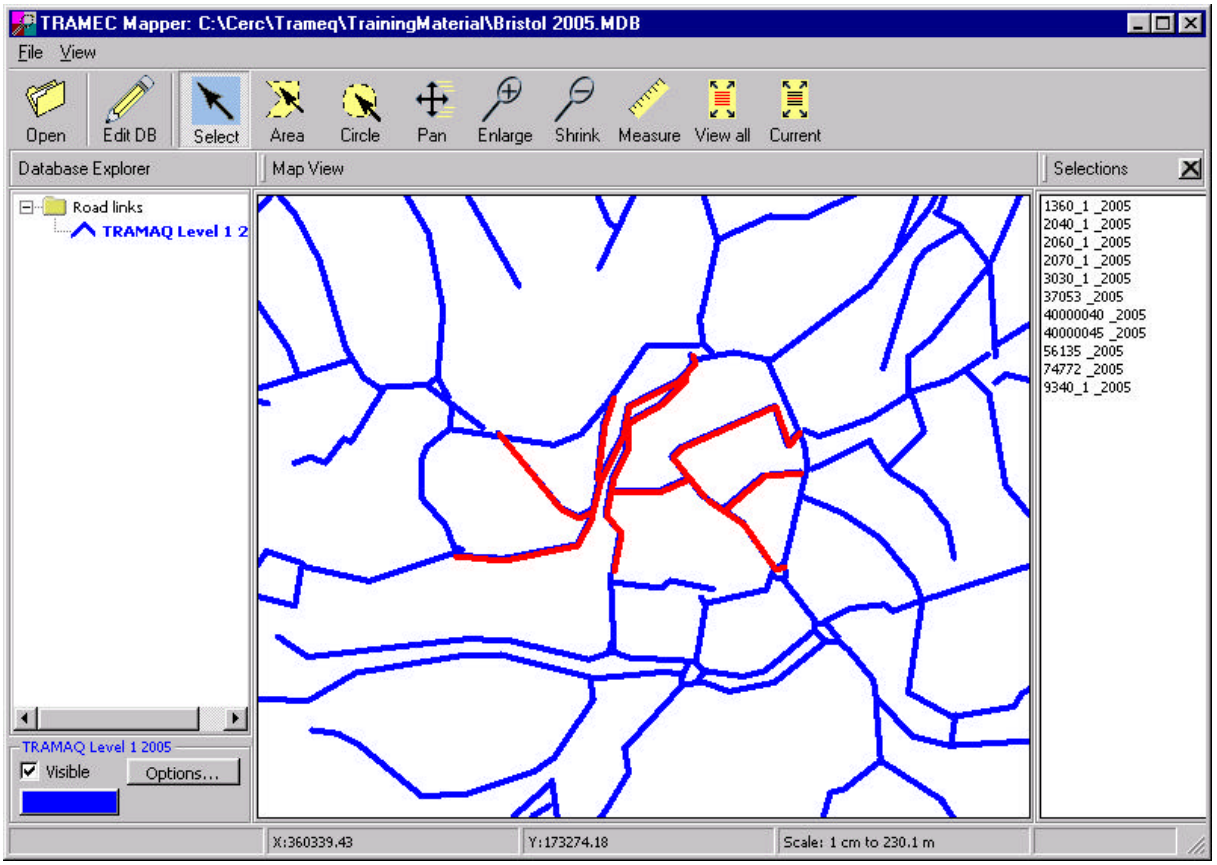

Figure 5.24 – The Mapper showing the links with in the cordon area in red

The roads that have been selected are the roads that fall within the cordon area. Make a note of the names of these roads. Select the **Options...** button and **Figure 5.25** will appear. Choose the pollutant PM_{10} from the drop down menu. Tick the **Filter emissions by range** and the **Shade by emissions** boxes. Set the lower limit to zero and the upper limit to 0.01. Change the number of shades to 12 by sliding the marker, then select **OK**. You will notice that there are two roads which are very red in the cordon area, select these and note their names.

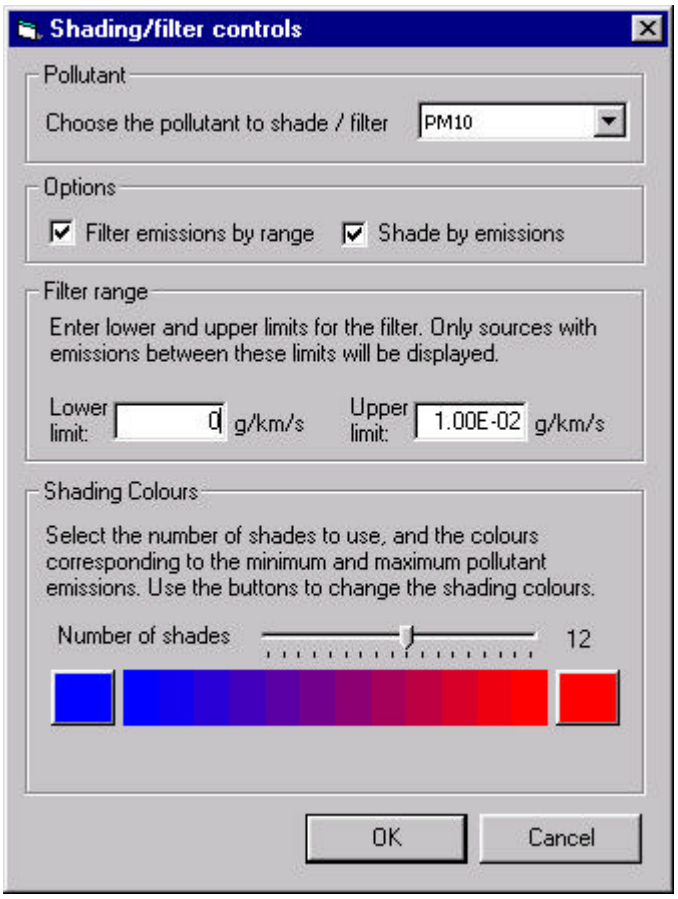

Figure 5.25 – The mapping options

Close the Mapper and open "Bristol2005.mdb" in TRAMEC.

Step 9 Reducing the number of vehicles in the cordon area

Select then names of the roads within the Cordon area by selecting the links and holding the **Shift** key down, then select the **Edit...** button. The **Multiple Source Edit** Screen will appear (**Figure 5.26**).

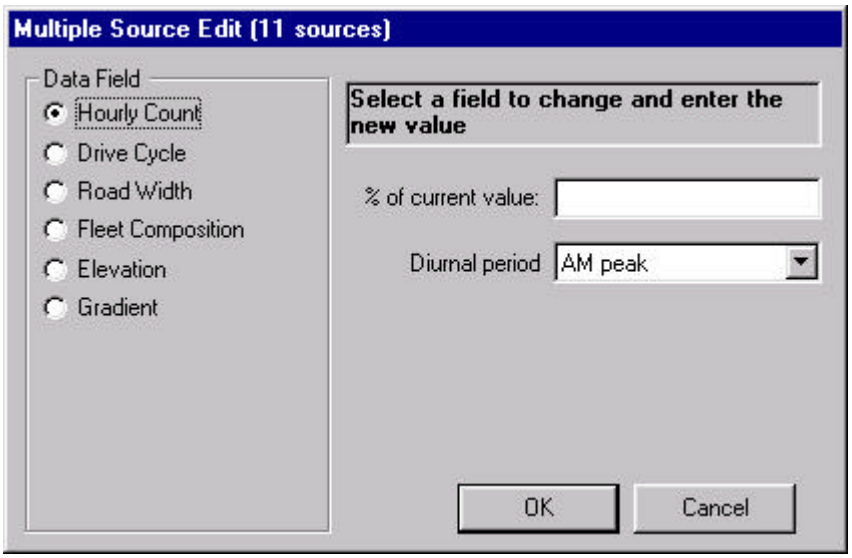

Figure 5.26 – The **Multiple Source Edit** screen

We are going to apply the restriction of the cordon area to the selected sources. Select **Hourly Count** and ensure the **Diurnal period** is AM peak, enter 75% of the current value. Repeat this process for the PM peak and enter 115% of the current value for the Off-peak.

Select **Calculate...** and copy the results to Excel by selecting the **Copy Table** button. What difference has this made to the overall emissions?

Further investigations:

Investigate what would happen to emissions if you banned HGV vehicles entering the cordon area in the AM and PM peak periods by creating a new fleet composition.

View the results in the Mapper and notice how the different fleet components are shown in different colours.

SECTION 6 Importing Data

6.1 Preparing the data files

If you have data for more than a few roads it may be convenient to import the data from ArcView shape (*shp*), MapInfo (*mif)* and comma separated text (*csv)* files, rather than typing the data into the interface.

Table 6. 1 and **Table 6. 2** show valid fields, or column headings, for the data files. From **Table 6. 2** you will see that the following fields are required:

- **ROADNAME** the name of the road (no more than 20 characters)
- **WIDTH** width of the road in metres
- **CANYON** height of buildings along the road in metres
- **HEIGHT** height of the road above local ground level – usually this will be zero but might be 10m, say, for a flyover
- **DRIVECYCLE** name of a valid drive cycle selected from the Picture book
- **AMPEAK_VH** hourly vehicle count during the morning peak period
- **PMPEAK_VH** hourly vehicle count during the evening peak period
- **OFFPK_VH** hourly vehicle count during the off peak period

If you do not have information on the variation of the traffic throughout the day (the diurnal profile) but just have the **AADT**, the annual average daily traffic count, divide the AADT by 24 to give a constant hourly traffic count. Then set the **AMPEAK_VH, PMPEAK_VH** and **OFFPK_VH** all equal to the hourly traffic count. If you have a daily traffic count based on 18 hours then the total should be divided by 18, not 24.

From **Table 6. 1** you will see that one of the following sets of names are required. If the TRAMEC file is set up to use **Level One** Fleet Components, these fields are required:

- **PCNTMC** the percentage of motorcycles in the fleet
- **PCNTHGV** the percentage of HGVs in the fleet

The percentage of Light vehicles in the fleet will be calculated by TRAMEC so that the total is100%.

If the TRAMEC file is set up to use **Level Two** Fleet Components, these fields are required:

- **PCNTMC** the percentage of motorcycles in the fleet
- **PCNTDCAR** the percentage of diesel cars in the fleet

- **PCNTPLGV** the percentage of petrol LGVs in the fleet
- **PCNTDLGV** the percentage of diesel LGVs in the fleet
- **PCNTRHGV** the percentage of rigid HGVs in the fleet
- **PCNTAHGV** the percentage of articulated HGVs in the fleet
- **PCNTBUS** the percentage of buses in the fleet

The percentage of petrol cars in the fleet will be calculated by TRAMEC so that the total is100%.

The following sets of field names from **Table 6. 2** are optional.

- **GRADIENT** the gradient of the road in percentage from 0%-50%. The gradient will not be used by TRAMEC but can be exported for use, for instance, in noise modelling
- **DESCRIPT** text description, up to 200 characters

If users add other fields to the *shp, mif* and *csv* files they will be simply be ignored by TRAMEC.

Fleet components	Vehicle type	Column heading
Level One	Motorcycles	PCNTMC
Level One	Light vehicles*	-
Level One	Heavy vehicles	PCNTHVY
Level Two	Motorcycles	PCNTMC
Level Two	Petrol cars*	-
Level Two	Diesel cars	PCNTDCAR
Level Two	Petrol LGVs	PCNTPLGV
Level Two	Diesel LGVs	PCNTDLGV
Level Two	Rigid HGVs	PCNTRHGV
Level Two	Articulated HGVs	PCNTAHGV
Level Two	Buses	PCNTBUS

Table 6. 1 – Valid Fleet Component field names. * will be calculated automatically to make 100%

Figure 6. 1 shows an example *csv* file, *Import.csv*. This file is also supplied with TRAMEC as an example.

Note that in the csv files the road geometry data follows the other road link data. In the geometry data there is one line for each vertex of each road. If importing from *shp* or *mif* files the road geometry will be stored in ArcView and MapInfo format respectively and does not have to be specified, vertex by vertex, by the user. Each road can have up to 50 vertices.

Column heading	Data	Units	Restrictions	Required?	Default
ROADNAME	Unique name of source	*text*	20 characters maximum	Yes	-
WIDTH	Road source width	m	5 – 100m	Yes	-
HEIGHT	Height of road above ground	m	0 – 2000m	Yes	-
CANYON	Canyon height	m	0 – 100m	Yes	-
DRIVECYCLE	Drive cycle	*text*	10 characters, must be a valid drive cycle (see Picture book)	Yes	-
AMPEAK_VH	Hourly vehicle count during the morning peak period	*vehicles/hour*	0-100,000	Yes	-
PMPEAK_VH	Hourly vehicle count during the evening peak period	*vehicles/hour*	0-100,000	Yes	-
OFFPK_VH	Hourly vehicle count during the off-peak period	*vehicles/hour*	0-100,000	Yes	-
DESCRIPT	Description of source	*text*	200 characters maximum	No	blank
GRADIENT	Gradient of road	-	0 – 50%	No	0
CSV FILES ONLY (data following the above)					
ROADNAME	Unique name of source	*text*	20 characters maximum	Yes	-
X	X-location of source vertex	m	0 – 9,999,999m	Yes	-
Y	Y-location of source vertex	m	0 – 9,999,999m	Yes	-

Table 6. 2 – TRAMEC Import Wizard column headings. The data under the heading “CSV FILES ONLY” must be included in *.csv* files for import immediately below the columns of source data

ROADNAM	WIDTH	CANYON	GRADIEN	HEIGHT	DESCRIPT	DRIVECY	AMPEAK	PMPEAK	OFFPK_V	EMFACTO	YEAR	PCNTMC	PCNTHV
A 48(T)	5	0	0	0	Enter Loca	Suburban	510	544	336	TRAMAQ I	2004	1	7
A257	5	0	0	0	Enter Loca	Suburban	450	460	275	TRAMAQ I	2004	1	8
A297	5	0	0	0	Enter Loca	Suburban	650	656	345	TRAMAQ I	2004	2	6
A4230	5	0	0	0	Enter Loca	Suburban	522	524	220	TRAMAQ I	2004	1	8
A465(T)	5	0	0	0	Enter Loca	Suburban	530	436	329	TRAMAQ I	2004	1	7
A474	5	0	0	0	Enter Loca	Suburban	630	636	329	TRAMAQ I	2004	1	6
A487	5	0	0	0	Enter Loca	Suburban	540	544	336	TRAMAQ I	2004	1	6

ROADNAM	X	Y
A 48(T)	270973	197089
A 48(T)	271185	196939
A 48(T)	271558	197027
A 48(T)	271824	196957
A 48(T)	272081	196604
A 48(T)	272249	195780
A 48(T)	272840	194625
A 48(T)	272976	194350
A 48(T)	272852	194056
A 48(T)	272852	194049
A 48(T)	272852	194049
A257	272949	194377
A257	273419	194244
A257	273729	194164
A257	273924	194058
A257	273924	194058
A297	274080	194058
A297	274213	194270
A297	274213	194474
A297	274266	194811
A297	274267	196046
A297	274460	196246
A297	274614	196399
A297	275215	196894
A297	275241	197063
A297	275100	197071
A297	275100	197071
A4230	271070	197205
A4230	271283	197240
A4230	271558	197205
A4230	271956	197364
A4230	272196	197293
A4230	272462	197391
A4230	272625	197408
A4230	273065	197373
A4230	273375	197444
A4230	273481	197506
A4230	273889	197639
A4230	274164	197488
A4230	274341	197364
A4230	274554	197231
A4230	275103	197072
A4230	275192	196939
A4230	275192	196948
A465(T)	272160	196123
A465(T)	273056	196770
A465(T)	273534	197134
A465(T)	274350	197240
A465(T)	274722	197479
A465(T)	275103	196091
A465(T)	275897	196277
A465(T)	275972	196446
A465(T)	275972	196446
A474	274199	197506
A474	274226	197577
A474	274660	197726
A474	274906	197870
A474	275006	196171
A474	275369	196437
A474	275715	196712
A474	275954	196818
A474	275954	196818
A487	274970	196118
A487	275050	196109
A487	275050	196189
A487	274997	196579
A487	274961	196774
A487	274802	196004
A487	274802	196004

Figure 6. 1 – Example *csv* file for import

6.2 Importing the road link data

Step 10 With the chosen file open in TRAMEC, launch the TRAMEC Import Wizard by clicking the **Import Links...** button.

Step 11 You will be prompted to specify the path name of the file containing the data to be imported, **Figure 6. 2**. Enter the full path name of the input file in the text box under **File name** or use the **Browse...** button and navigate to the correct file.

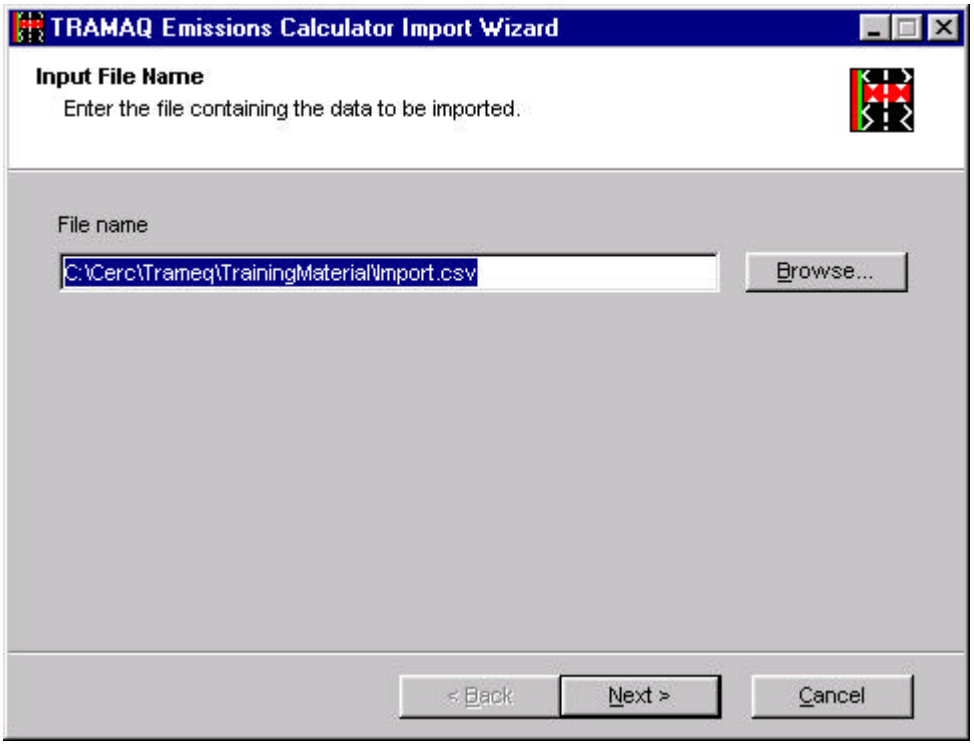

Figure 6. 2 – Select the file from which data will be imported

Step 12 Click on **Next>** and a screen will then appear that displays the fields to be imported, **Figure 6. 3**.

Step 13 If the input file does not contain all the required fields, for example, if it is missing the **PMPEAK_VH** field (number of vehicles per hour in the PM peak) a warning message will appear, **Figure 6. 4**.

Step 14 If this happens, the data cannot be imported and the user is advised to exit the Import Wizard. Click **OK** to return and then click yes when the **Exit Wizard Confirmation** shown in **Figure 6. 5** appears.

Step 15 If all the required fields are present click **Next >** on the screen shown in **Figure 6. 3**.

Step 16 Click **Next >** when the screen shown in **Figure 6. 6** appears. The integrity checks then begin and a progress bar will be displayed if you are importing many road links. The Import Wizard will check that road link names are not duplicated, that no road names are longer than 20 characters and that the number of fleet components (3 or 8 vehicle categories) is compatible with the choice of **Level One** or **Level Two** in the file.

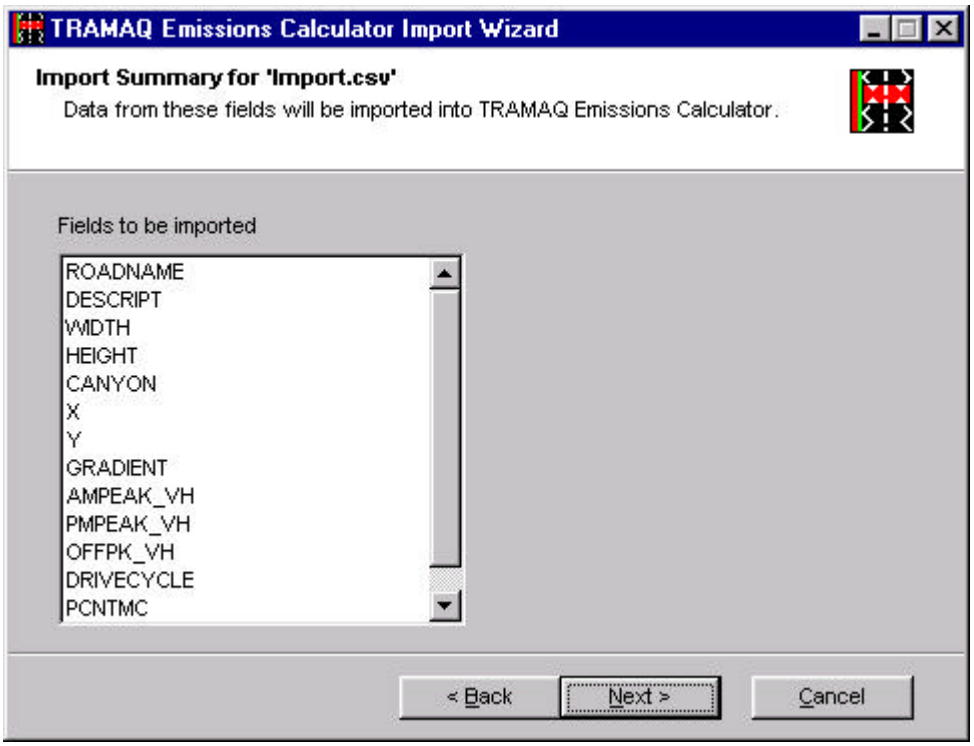

Figure 6. 3 – Summary of fields to be imported

Figure 6. 4 – Warning message if a required field is missing

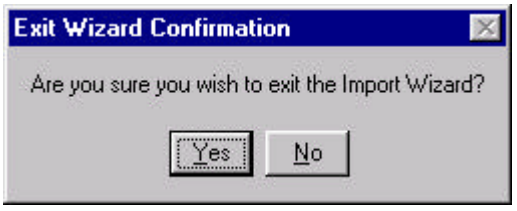

Figure 6. 5 – Prompt to exit the Import Wizard

Step 17 The results of the integrity checks are shown in a screen similar to the one in **Figure 6. 7**. If one or more of the sources have been rejected, then the user can choose whether to import just the valid sources by clicking **Import Now,** or to **Cancel** the import altogether. The best option may be to **Cancel,** exit the Import Wizard and go back and recheck the input data file. You can use **Save Report** to save the report as a text file.

Step 18 When the data have been imported the final report is shown, **Figure 6. 8**. Click **Save Report** if you wish to save the report as a text file. Click **Exit** to finish. You will then see a progress bar whilst TRAMEC automatically compacts the database.

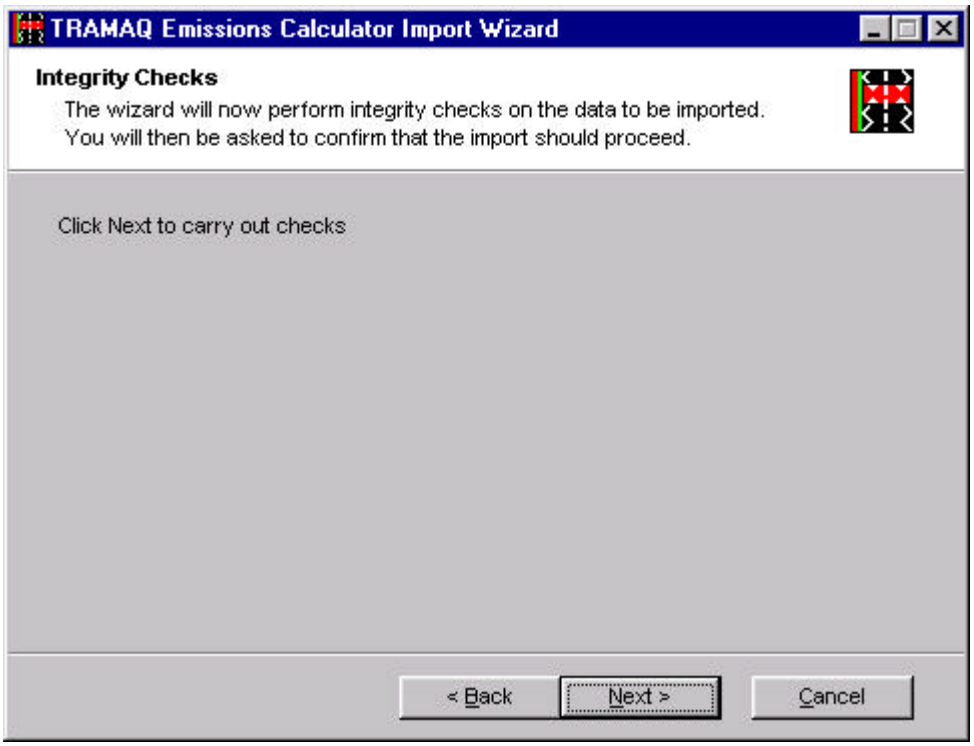

Figure 6. 6 – Prompt to proceed with data integrity checks.

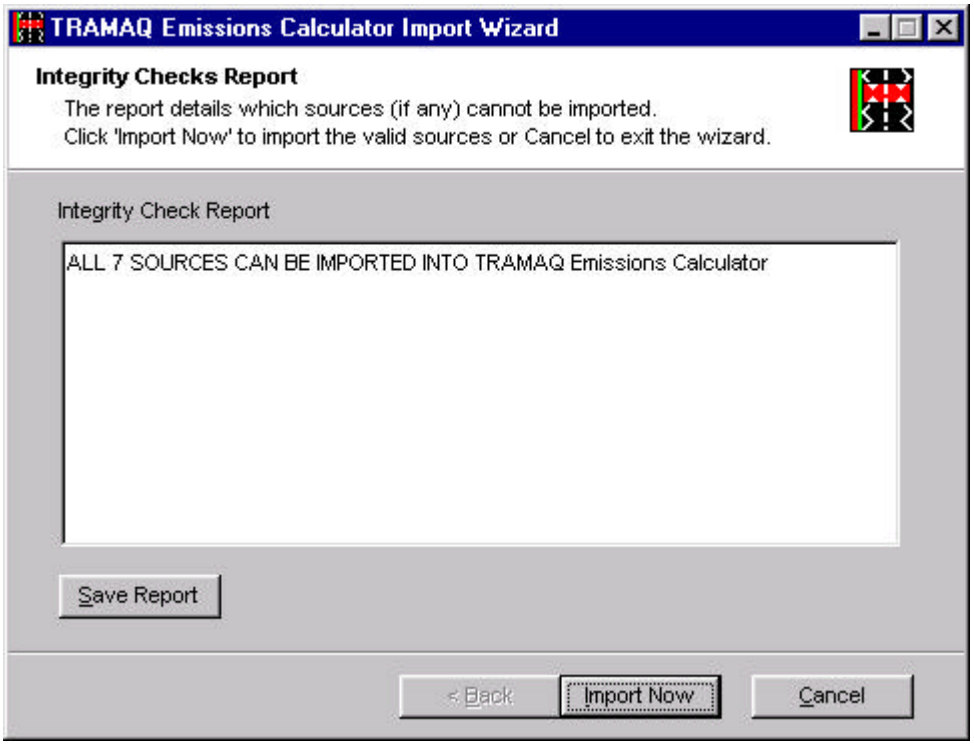

Figure 6. 7 – Results of the integrity checks

Step 19 The imported sources are displayed in the main screen of TRAMEC, **Figure 6. 9**, ready for analysis as described in Section 3 and Section 4.

The import process can be stopped at any time prior to the final screen by clicking ***Cancel****. If this is done, then no data will have been transferred to TRAMEC.*

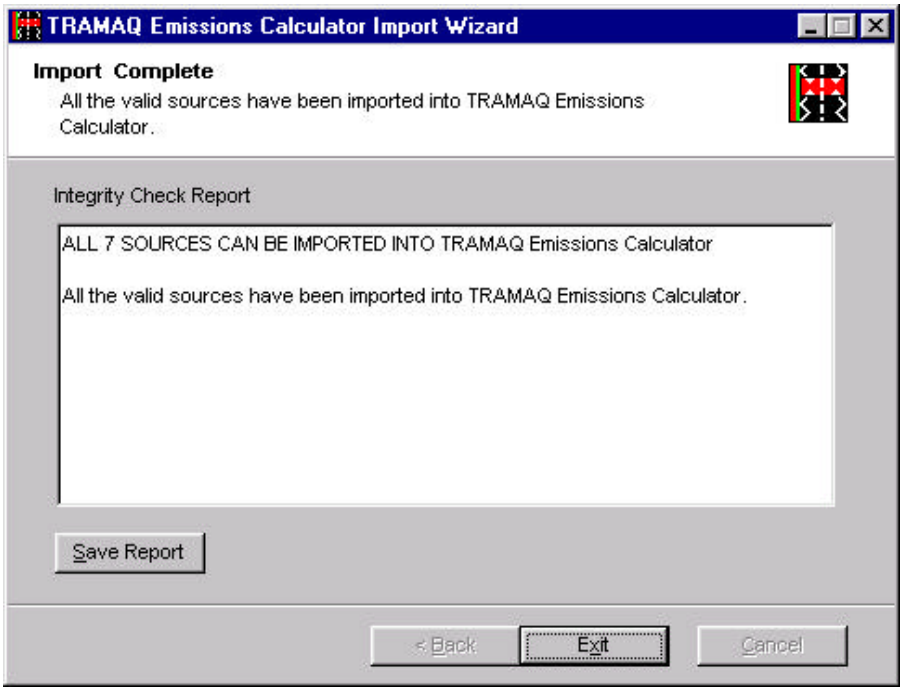

Figure 6. 8 – Import Wizard final report

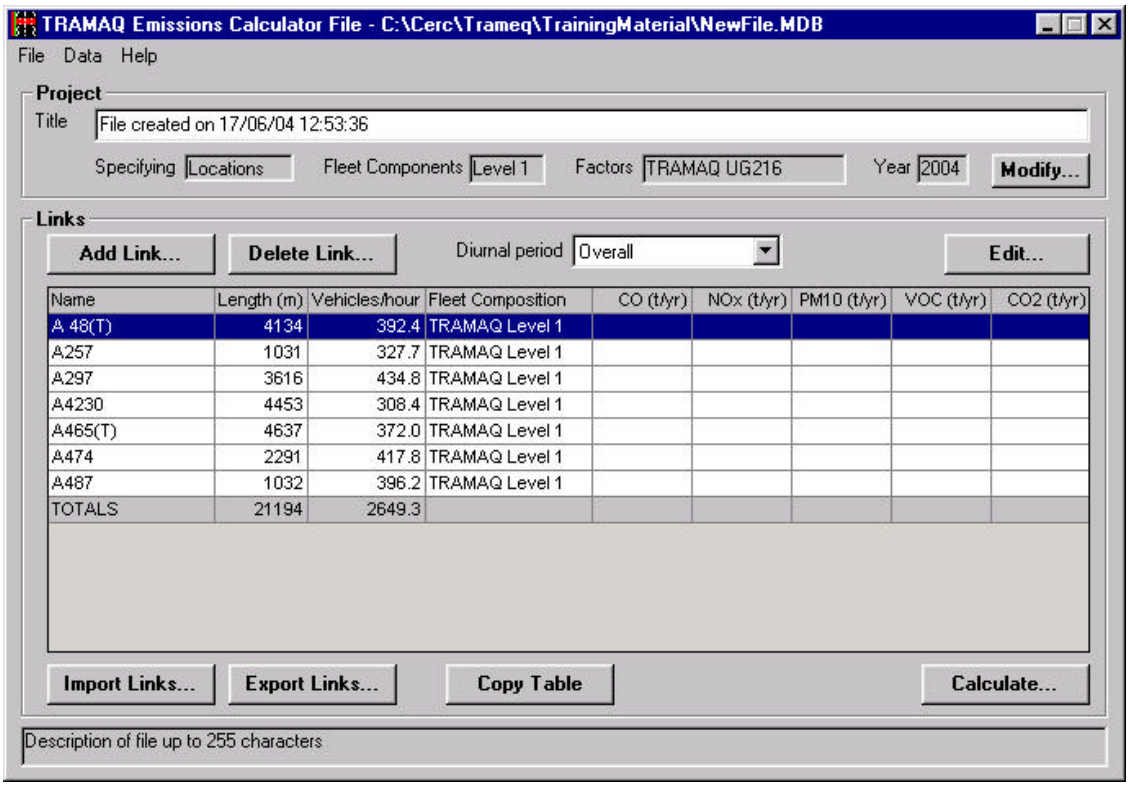

Figure 6. 9 – Imported sources

SECTION 7 Advanced use of the Mapper

7.1 Displaying a background image

This example follows on from **Step 10** of **Section 4.5** and assumes you have some roads displayed. Go to the **File** menu and select the **Load Image** option. If you do not have any roads displayed in the Mapper the **Load Image** option is greyed and unavailable.

Browse to locate the Ordnance survey tile, *Ss79r.tif*. The image location is entered via the dialogue box shown in **Figure 7. 1**. The coordinates of the south west corner of this tile are (271000,194000), and the dimensions are 5km by 5km.

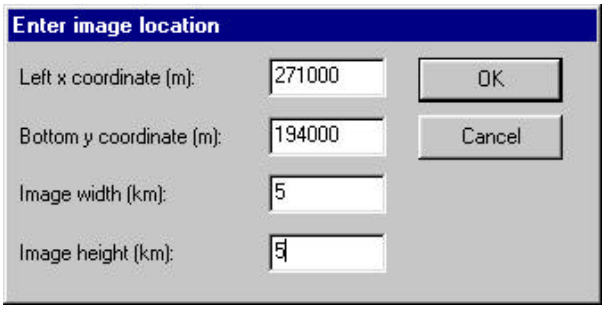

Figure 7. 1 – **Enter image location** dialogue box with the coordinates and dimensions of the Neath Ordnance Survey tile, *Ss79r.tif*.

Clicking **OK** loads this tile to the view, **Figure 7.10**.

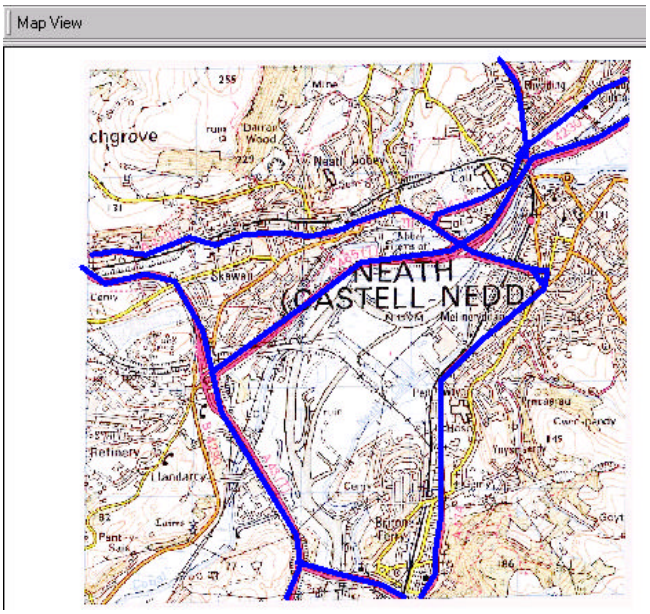

Figure 7. 2 – Roads and Ordnance Survey tile displayed in the **Map View** window

7.2 Copying and Saving the Map View

It is possible to copy all the components in the **Map View** of the TRAMEC Mapper to the clipboard, for use in other applications such as Microsoft Word, by selecting the **View** menu and choosing either **Copy Map View** or **Copy Map View (high resolution);** the image can then be pasted into another package such as Microsoft Word. Similarly, the **Save Map View** and **Save Map View (high resolution)** can be used to save the **Map View** to a bitmap (BMP) file.

Users may also wish to copy or save the map (not including the background image), the legend or the north arrow separately. The map can be copied (or saved to a file) by right clicking in the **Map View**; this action activates the list of options shown in **Figure 7. 3**. The **Copy map to clipboard** command can be used to copy and paste the map into another package as a Windows metafile (WMF file); the **Save map to file...** can be used to save the map as a BMP or a WMF file.

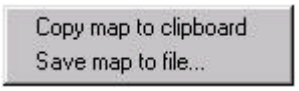

Figure 7. 3 – The list of options enabled by right clicking in the **Map View**

Note that the format of the plot created using the three options:

- **Copy Map View** (from the **View** menu),
- **Copy Map View (high resolution)** (from the **View** menu), and
- **Copy map to clipboard** (by right clicking in the **Map View**)

are all slightly different in terms of resolution and formats; similarly, the corresponding save commands all create slightly different files. Users are advised to spend a bit of time investigating the different formats in order to decide which is most suitable for their purpose.

7.3 Editing, copying and pasting the legend

Right clicking on the legend in the **Map View** allows users to edit, copy or save the legend: the option list shown in **Figure 7. 4** is displayed. The legend can be edited in the following ways:

- the legend can be resized (using the **Resize legend box** command), and
- the legend font can be changed (using the **Change legend font...** command).

Figure 7. 4 – The list of options enabled by right clicking in the map legend (before editing the size of the legend)

After the legend box has been resized, the **Stop resizing legend box** option can be selected from the list of options activated by right clicking on the legend (options shown in **Figure 7. 5**). Alternatively, clicking with the left mouse button anywhere in the **Map View** away from the legend deactivates the **Resize legend box** command.

Figure 7. 5 – The list of options enabled by right clicking in the map legend (after editing the size of the legend)

The **Copy legend to clipboard** and **Save legend to file...** commands shown in **Figure 7. 5** behave in a corresponding way to the **Copy map to clipboard** and **Save map to file...** commands described above.

Finally, the legend can be moved around the **Map View** by 'clicking' (using the left mouse button) and 'dragging', as required.

7.4 Adding a north arrow to the Map View

It is sometimes useful to include a north arrow on a map. This can be done by selecting the **View** menu and choosing the **Show North Arrow** option. By default, the north arrow is displayed in the top left hand corner of the **Map View**. Using the left mouse button, the north arrow can be dragged to any location in the **Map View**; right clicking on the north arrow activates the option list shown in **Figure 7. 6**.

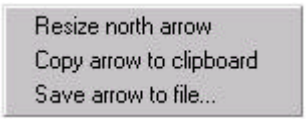

Figure 7. 6 – The list of options enabled by right clicking in the north arrow (before editing the size of the arrow)

The **Resize north arrow** command is analogous to the **Resize legend box** command described above, with the option to **Stop resizing north arrow** corresponding to the **Stop resizing legend box**. Similarly, the **Copy arrow to clipboard** and **Save arrow to file...** commands work in the same way as the **Copy map to clipboard** and **Save map to file...** options discussed above.

Appendix A Data

A.1 Introduction

The objectives of this research project were to carry out emission measurements on a range of heavy-duty vehicles including buses under conditions that reflect various types of traffic management schemes. The test cycle used for measuring the emissions data where those developed in the UG214 project (Latham et al, 2001). A total of 50 vehicles were tested, with a focus on newer vehicles UG216. The data collected has been processed in order for it to be used to form or supplement an emissions model database. These are the data that have been used in the UG218 model.

In the analysis of the emissions data the UG216 project tried to get away from using average speed to represent driving conditions and looked at a number of other factors. From the analysis carried out the best indicator of driving conditions, for heavy duty vehicles, was engine power requirements. These power requirements were derived from the measurements on the chassis dynamometer when the emissions tests were carried out. Therefore the project developed a power-based model for emissions that allowed the calculation of emissions from a range of driving conditions based on the original drive cycles from UG214 and with a correction for gradient.

The UG218 project has used the power-based model developed in UG216 to generate a database of emissions factors for a range of driving conditions. These driving conditions are related to the original 9 test cycles from UG214. Each of these nine basic cycles has been subdivided into sub-cycles related to specific traffic management situations. This has given a total of 37 driving conditions relating to traffic lights, one-way systems and so on, which the user can choose from to represent the conditions on the road he/she is considering.

A.2 TRAMAQ emission datasets

The TRAMAQ data from UG216 is only available for heavy duty vehicles (HGV's and Buses), there is no data available yet for the light duty vehicles. The standard NAEI data has been included to supplement the TRAMAQ data and provide a light duty vehicle emissions data set. Since the NAEI data is based on a speed emissions relationship an average speed was needed related to each drive cycle to produce an NAEI emissions data point. This average speed was derived from the original UG214 test data and was used to generate a set of emissions factors comparable to that generated by the UG216 model. **Table A.1** shows each drive cycle, the import code, the average speed that was derived and a short description. The average speeds were derived for three categories, car and motorcycles, LGV and HGV.

Therefore the model has two sets of emissions data, TRAMAQ and NAEI, which are chosen through a defined drive cycle (or road condition) for each of the links or roads being considered. So the whole model has moved away from needing to know about average speeds to needing to know what types of roads you have.

Name	Import Code	Average speeds in mph			Description
		Cars & motorcycles	LGV	HGV	
Bus lane 1	BusLane1	16	15	28	Suburban 2 way traffic, 2 sets of pedestrian traffic lights, double yellow lines
Bus lane 2	BusLane2	16	15	8	Mostly 2 lanes, 1 way traffic, traffic lights, pedestrian crossing, double yellow lines
Bus lane 3	BusLane3	16	15	22	2 way traffic, central turning lanes, pedestrian crossing, double yellow lines
Cycle Lane 1	CycleLane1	16	17	20	Speed cushion, junction traffic light and pedestrian crossing, no parked cars
Cycle Lane 2	CycleLane2	16	17	17	2 way traffic, 40 speed limit, 1 traffic light
Cycle Lane 3	CycleLane3	16	17	23	30 speed limit, speed camera, traffic light, double yellow lines
Cycle Lane 4	CycleLane4	16	17	31	2 way traffic leading up to bus lane, single yellow line
Cycle Lane 5	CycleLane5	16	17	24	1 lane leading to 2 lanes, single red line
Cycle Lane 6	CycleLane6	16	17	9	Advisory cycle lane, pedestrian crossing, some double yellow lines
Cycle Lane 7	CycleLane7	16	17	5	3 sets of traffic lights, pedestrian crossing
Mini Round-about 1	MiniRound1	19	19	15	With cycle lane at entry
Mini Round-about 2	MiniRound2	19	19	12	At a T junction
One way 1	OneWay1	13	12	16	2 lanes expanding to 3, pedestrian crossings
One way 2	OneWay2	13	12	13	1 side of dual carriageway
One way 3	OneWay3	13	12	12	1 lane expanding to 2 lanes then 3 lanes
One way 4	OneWay4	13	12	4	3 lanes beside major bus stop
Speed humps 1	Shumps1	19	17	9	Variety of calming measures, cycle lane, traffic lights, on road parked cars
Speed humps 3	Shumps3	19	17	16	Speed humps, tables, cycle lane, traffic lights, some cars parked on cycle lane
Speed humps 4	Shumps4	19	17	19	Widely spaced speed cushions, leading up to roundabout, no parked cars on road
Speed humps 5	Shumps5	19	17	12	Closely spaced speed cushions, sheltered parking + 20 zone
Speed humps 6	Shumps6	19	17	12	3 abreast speed cushions, speed cameras, leading to T junction
Speed humps 7	Shumps7	19	17	12	Raised tables, zebra crossing, cycle lane, cars parked in cycle lane, leading to mini roundabout
Suburban 1	Suburban1	23	22	13	2 way traffic, 4 side roads, some parked cars
Suburban 2	Suburban2	23	22	15	2 way traffic, 4 side roads, off road and sheltered parking, bus route
Suburban 3	Suburban3	23	22	13	Sheltered parking, bus route leading to T junction
Suburban 4	Suburban4	23	22	14	Dual carriageway, speed camera sign, double yellow lines
Traff Calm (other) 1	TraffCalmO1	22	21	13	Cycle lane, traffic lights, speed camera sign, sheltered parking
Traff Calm (other) 3	TraffCalmO3	22	21	18	20 zone with traffic islands, speed cushions, centre hatching, pedestrian crossing
Traff Calm (other) 4	TraffCalmO4	22	21	17	Speed cushions winding suburban road leading up to T junction
Traff Calm (other) 5	TraffCalmO5	22	21	20	Parking lane, double yellow lines on remainder, pedestrian crossing leading to roundabout
Traffic Lights 1	Trafflght1	8	6	17	3 sets of traffic lights, multiple lanes
Traffic Lights 2	Trafflght2	8	6	10	2 sets traffic lights on dual carriageway with bends
Traffic Lights 4	Trafflght4	8	6	13	2 sets of traffic lights interspaced by a pedestrian crossing and zebra crossing
Urban 1	Urban1	17	15	29	Dual-carriageway leading to roundabout
Urban 2	Urban2	17	15	16	Bus and cycle lanes
Urban 3	Urban3	17	15	24	Part dual carriageway
Urban 4	Urban 4	17	15	20	Dual carriageway

Table A.1 – the drive cycle import codes, average speeds and description