volume three
Software User Guide
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This HDM-4 V1 edition of the Software User Guide describes the HDM-4 software. It is a general purpose document which provides an understanding of the software user interface.

The Software User Guide is one of five manuals comprising the suite of HDM-4 documentation (see Figure 1).

The suite of documents comprise:

- **Overview of HDM-4 (Volume 1)**
  A short executive summary describing the HDM-4 system. It is intended to be used by all readers new to HDM-4, particularly high level management within a road organisation.

- **Applications Guide (Volume 2)**
  A task oriented guide describing typical examples of different types of analyses. It is to be used by the frequent user who wishes to know how to perform a task or create a study.
Software User Guide (Volume 3)

Describes the HDM-4 software. It is a general purpose document which provides an understanding of the software user interface.

Analytical Framework and Model Descriptions (Volume 4)

Describes the analytical framework and the technical relationships of objects within the HDM-4 model. It contains very comprehensive reference material describing, in detail, the characteristics of the modelling and strategy incorporated in HDM-4. It is to be used by specialists or experts whose task is to carry out a detailed study for a road management organisation.

A Guide to Calibration and Adaptation (Volume 5)

Suggests methods for calibrating and adapting HDM models (as used in HDM-III and HDM-4), to allow for local conditions existing in different countries. It discusses how to calibrate HDM-4 through its various calibration factors. It is intended to be used by experienced practitioners who wish to understand the detailed framework and models built into the HDM-4 system.

Notes:

1. Volumes 1, 2 and 3 are designed for the general user.
2. Volumes 4 and 5 will be of greatest relevance to experts who wish to obtain low level technical detail. However, Volume 5, in particular, presents very important concepts, which will be of interest to all users.

Structure of the ‘Software User Guide’

The aim of the Software User Guide is to provide information for using HDM-4. It covers installing, running and using the software, describes the user interface, and details many of the tasks related to working in the HDM-4 environment. It is a general-purpose document for all users.

The information in the Software User Guide is structured in twelve sections:

1. About HDM-4
2. Installing HDM-4
3. Running HDM-4
4. Road Networks
5. Vehicle Fleets
6. Maintenance and Improvement Standards
7. Project analysis
8. Programme analysis
9. Strategy analysis
10. Working with reports
11. Configuring HDM-4
12. Managing your HDM-4 installation
Conventions Used in this Manual

The following symbols are used throughout this manual. The following legend describes the meaning of each symbol:

- **Caution**: the accompanying text warns of the consequences of not following the recommended course of action.
- **Tip**: the accompanying text contains details that may help your understanding of the software, or may describe best practice.
- **Trouble-shooting**: the accompanying text is intended to assist you if you encounter a problem whilst using the respective part of the software.

ISOHDM Products

The products of the International Study of Highway Development and Management Tools (ISOHDM) consist of the HDM-4 software suite, associated example case study databases, and the Highway Development and Management Series collection of guides and reference manuals. This volume is a member of that document collection.

Customer contact

Should you have any difficulties with the information provided in this suite of documentation please report details of the problem by E-mail, or an annotated copy of the manual page by fax to the number provided below.

The ISOHDM Technical Secretariat welcomes any comments or suggestions from users of HDM-4. Comments on the Software User Guide should be sent to the following address:

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Change details

This is the first formal edition (Version 1.0) of the HDM-4 documentation.
Related documentation

HDM-4 documents:

The Highway Development and Management Series Collection is ISBN: 2-84060-058-7, and comprises:


Future documentation

The following documents will be issued at a later release:

Volume 7 - Modelling Road User and Environmental Effects, ISBN: 2-84060-103-6

Terminology handbooks


General reference information

Further details on HDM-4 may be obtained from the following:

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- **Finnish National Road Administration (Finnra)**
- **Inter-American Federation of Cement Producers (FICEM)**

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The study has been co-ordinated by the ISOHDM Technical Secretariat at the University of Birmingham in the United Kingdom. A number of organisations participated in the research including:

- **Finnra**
  
  Specification of the strategic and programme analysis applications.

- **FICEM**
  
  Development of deterioration and maintenance relationships for Portland cement concrete roads.

- **The Highway Research Group (HRG), School of Civil Engineering, The University of Birmingham**
  
  Responsible for system design and software development.

- **Road Research Institute (IKRAM) in Malaysia supported by N.D.Lea International (NDLI)**
  
  Responsible for providing updated relationships for road deterioration and road user costs.

- **Transport Research Laboratory (TRL) in the United Kingdom**
  
  Responsible for review and update of flexible pavement deterioration relationships.
SNRA

Responsible for developing deterioration relationships for cold climates, road safety, environmental effects, and supporting HRG with system design.

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Copyright statement

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1 About HDM-4

The Highway Development and Management (HDM-4) system is a software tool that is used to appraise the technical and economic aspects of road investment projects.

It provides facilities for storing characteristics of road networks, vehicle types, and road works. The available analysis types are:

- Project analysis: the economic evaluation of individual road projects or investment options.
- Programme analysis: the preparation of prioritised work programmes in which investment alternatives are defined, and selected subject to resource constraints.
- Strategy analysis: the analysis of a whole road network.
2 Installing HDM-4

This section describes how to install the HDM-4 software on your PC. There are a number of scenarios in which you may want to install HDM-4 software:

- Installing HDM-4 for the first time
- Installing an upgrade (installing a new version over an existing one)
- Installing an update (installing a bug fix for an existing version)

You may have obtained the software on CD-ROM from a distributor, or via Internet download. The following sections describe the various installation scenarios, and cover CD and Internet use.

The recommended minimum platform requirements for running HDM-4 are as follows:

- Pentium P100 processor (or equivalent)
- 32MB of RAM
- 30MB of hard disk space
- Windows 95/98 or NT 4.0 (with service pack 6)

HDM-4 is a sophisticated modelling tool which involves many processor intensive calculations. As such, execution speed is significantly affected by the specification of the PC on which it is to be run. The above platform requirements are the minimum recommended. Obviously, the performance will improve in relation to the specification of your PC.

2.1 Installing HDM-4 for the first time

The method of installation will differ slightly according to whether you have obtained the software on CD-ROM or via Internet download. If you have the HDM-4 CD-ROM, do the following: Insert the HDM-4 CD in your CD-ROM drive. Microsoft Windows automatically scans the CD and displays the HDM-4 CD window. First choose your preferred installation language. Then click \textit{Install HDM-4}.

Alternatively, if you downloaded the installation program from the Internet, do the following: Select the \textit{Run} option from the Windows Start menu. Specify the path of the HDM-4 installation program (SETUP.EXE). Click \textit{OK}.

Now do the following:

1. In the first window select the \textbf{I Accept the Agreement} option button and click \textbf{Next} to proceed with the installation.

2. In the next window, enter the registration name and 16-digit licence key supplied by the distributor. Click \textbf{Next} to proceed.

3. In the next window, select the \textbf{Typical installation} option button and click \textbf{Next}. 
4 For most users the Typical installation option is recommended. The Custom option should only be used either when doing an upgrade or update, or when replacing individual components or files (see Section 2.2).

5 Do one of the following:
   - Accept the default folder for storing HDM-4
   - Specify a different folder for storing HDM-4

6 Click **Next** to begin installing the HDM-4 program files on your PC.

Please note that the installation program may need to restart Windows in order to register the various user interface controls used by HDM-4. If you are asked whether you want to restart Windows now, answer Yes. When the installation is complete, you will notice that the HDM-4 program group has been added to the Windows Start menu. The program group contains the HDM-4 application, on-line help, and the README.TXT file which includes information on late-breaking changes, and other useful details.

If the licence key is not on the back of the CD case, do one of the following:
   - Consult the person who purchased the software
   - Contact the distributor from whom the software was purchased

If the licence key you entered is rejected, do the following:
   - Make sure that you have entered the serial number correctly
   - Contact the distributor from whom the software was purchased

### 2.2 Installing an HDM-4 update

HDM-4 updates will be issued from time-to-time in response to bug reports. In most cases these will be distributed via the Internet. Having downloaded an update installation program, do the following:

1 Select the **Run** option from the Windows Start menu. Specify the location of the HDM-4 update installation program. Click **OK**.

2 In the first window, enter the username and 16-digit licence key originally supplied by the distributor. Click **Next** to proceed.

3 Click **Next** to begin installing the HDM-4 update on your PC.

If the serial number is not on the back of the CD case, do one of the following:
   - Consult the person who purchased the software
   - Contact the dealer from whom the software was purchased

If the serial number you entered is rejected, do the following:
   - Make sure that you have entered the serial number correctly
   - Contact the dealer from whom the software was purchased
2.3 Installing an HDM-4 upgrade

The method of installation will differ slightly according to whether you have obtained the software on CD-ROM or via Internet download. If you have the HDM-4 CD-ROM, do the following: Insert the HDM-4 CD in your CD-ROM drive. Microsoft Windows automatically scans the CD and displays the HDM-4 CD window. Now choose your preferred installation language. Then click **Install HDM-4**.

Alternatively, if you downloaded the installation program from the Internet, do the following: Select the **Run** option from the Windows Start menu. Specify the path of the HDM-4 installation program (SETUP.EXE). Click **OK**.

Now do the following:

1. In the first window select the **I Accept the Agreement** option button and click **Next** to proceed with the installation.

2. In the next window, enter the username and 16-digit licence key supplied by the distributor. Click **Next** to proceed.

3. Now select the **Custom installation** option button and click **Next**. In the next window select all components except Database. In this way, you will install the upgrade whilst retaining your current ‘default’ database (i.e. the database in the \hdmdict directory).

4. The installation program should automatically detect the folder in which the existing version of HDM-4 is stored. If not, you will be prompted to specify the folder.

5. Click **Next** to begin installing the HDM-4 upgrade on your PC.

If the serial number is not on the back of the CD case, do one of the following:

- Consult the person who purchased the software
- Contact the distributor from whom the software was purchased

If the serial number you entered is rejected, do the following:

- First make sure that you have entered the serial number correctly
- Contact the distributor from whom the software was purchased
3 Running HDM-4

To run HDM-4:

1. Click the Windows Start menu.
2. Select the HDM-4 application item from the HDM-4 program group.
3. The HDM-4 splash screen is displayed. Once HDM-4 is loaded the HDM-4 Welcome screen is displayed.

The HDM-4 Welcome screen

The Welcome screen is designed to introduce you to the concepts and facilities of HDM-4. As you become familiar with the system, you will find it easier to use the Workspace window where you can access all the HDM-4 facilities.

The Welcome screen provides access to the following core HDM-4 facilities:

- Create a new study
  Select this option to create a new Project, Programme or Strategy analysis. For more information, see the following sections:
  - Creating Projects
  - Creating Programmes
  - Creating Strategy analyses

- Open an existing study
  Select this option to open an existing Project, Programme or Strategy analysis. For more information, see the following sections:
  - Viewing / editing Projects
  - Viewing / editing Programmes
  - Viewing / editing Strategies

- Go to the HDM-4 Workspace
  Select this option to open the HDM-4 Workspace window. For more information, see Section 3.1 below.
Make it easier to start-up HDM-4 by adding a shortcut to your Windows desktop (see Section 12.4).

3.1 Working with the HDM-4 Workspace window

The Workspace window is the central hub of HDM-4. Folders are listed on the left, and buttons on the right.

To help you navigate through the system, the folders are listed in the sequence that you would use to create and analyse a new study if you were beginning with a clean system.

The general procedure for performing an operation is:

1. Expand a folder by clicking the + to the left of the folder name.
2. Select an item in the folder.
3. Click the appropriate button for the operation you wish to perform.

The button functions are also available from the **Workspace** menu.
4 Road Networks

4.1 Key concepts

An HDM-4 Road Network stores details of the roads that you wish to analyse. Each Road Network consists of a number of Sections. A Section typically corresponds to an identifiable length of road, but may also be a ‘representative’ Section created solely for the purpose of analysis.

HDM-4 uses the concept of ‘homogenous Sections’, where each Section has uniform strength, geometry, traffic and condition characteristics over its entire length. When adapting existing Road Network data for use in HDM-4, or when entering new road data directly into HDM-4, you will have to divide your network into homogenous Sections.

4.2 Software overview

The Sections in a Road Network are displayed in a spreadsheet in the Road Network window (an example is shown below). Options on the View menu determine which Sections and/or attributes are displayed.

- **A.** Each row displays a separate Section.
- **B.** These buttons allow you to add, delete and edit Sections.
- **C.** The status bar shows information about the currently active control.
- **D.** The title bar shows the name of the Road Network and the category of data currently on display.
- **E.** You can change the size of the window by dragging the Resize Box.

You can edit most (but not all) Section attributes here in the spreadsheet. To edit attributes that are not available in the spreadsheet, double-click a Section. The resulting Section dialog box provides access to all Section attributes.
F. Click this button to view detailed Section parameters.

Road Section data is stored on two levels:

Key Section attributes
- Consists of data that are readily available and/or are applicable in most environments.
- Attributes differ according to the surface class of the Section (i.e. bituminous, concrete or unsealed).
- Key attributes can be viewed and edited in the spreadsheet views.

Detailed Section attributes
- Access detailed data by clicking Details.
- Detailed data include those parameters which are either not readily available, are only required in certain circumstances, or should only be changed by those calibrating the various models.
- Attributes differ according to the surface class of the Section (i.e. bituminous, concrete or unsealed).
- Detailed attributes cannot be viewed or edited in the spreadsheet views.

HDM-4 places no restriction on the number of Road Networks that can be created, or the number of Sections in each Road Network. The only constraint is the amount of free disk space on your PC.

The sections in this chapter describe the tasks of creating, editing and deleting both Road Networks and Sections.
4.3 Creating new Road Networks with no Sections

This section describes how to create a new Road Network that initially has no Sections.

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.

2. Select Road Network and click **OK**.

   The **New Road Network** dialog box is displayed.

   Type the name of the new Road Network in the text box and click **OK**.

   The **Road Network** window is displayed.

   You can now add Sections to the blank Road Network (see Sections 4.10 and 4.11).

   When you have finished working with the Road Network, click **Save** before closing the window. If do not click **Save**, your changes will be lost.

   The new Road Network is added to the **Workspace** window. To view the new copy, see Section 4.5.
In step 2 above, if the Road Networks folder, or any existing Road Network is selected in the Workspace window, the Road Network Item will be automatically selected in the New HDM-4 Item dialog box, and you will only need to click OK.

4.4 Creating Road Networks based on existing networks

If you want to create a Road Network that is similar to an existing one, you can copy the existing network and edit the copy as necessary.

1. In the Workspace window, select the existing network that you wish to copy.
2. To copy the selected network, do one of the following:
   - Click Copy
   - With the Workspace window active, select Copy from the Workspace menu

   The Copy Road Network dialog box is displayed.

3. The name of the Road Network you wish to copy is shown. In the To edit box, enter the name of the new network. This name must be unique.
4. Click OK.

   The new Road Network is added to the Workspace window.

   To view the new copy, see Section 4.5 below.

4.5 Viewing / editing Road Networks

1. In the Workspace window, expand the Road Networks folder.
2. To open a Road Network, do one of the following:
   - Select a Road Network and click Open
   - Select a Road Network. With the Workspace window active, select Open from the Workspace menu
   - Double-click the Road Network

   The Road Network window is displayed.
When you have finished working with the Road Network, click **Save** before closing the window. If you do not click **Save**, your changes will be lost.

To edit the Section details, see Section 4.12.

### 4.6 Deleting Road Networks

1. In the *Workspace* window, select the Road Network that you wish to delete.

2. To delete the selected network, do one of the following:
   - Click **Delete**
   - With the *Workspace* window active, select Delete from the *Workspace* menu

   You are prompted to confirm the deletion. Click **Yes** to delete the Road Network, or **No** to cancel the delete action.

   If you click **Yes**, the deleted Road Network is no longer displayed in the *Workspace* window.

- When you delete a Road Network, all corresponding Sections are also deleted.

- Projects, Programmes and Strategies that use the deleted Road Network will be affected. You will be informed if this is the case.

- You cannot reverse a deletion.

### 4.7 Renaming Road Networks

1. In the *Workspace* window, select the Road Network that you wish to rename.

2. To rename the selected network, do one of the following:
   - Click **Rename**
   - With the *Workspace* window active, select Rename from the *Workspace* menu

   The **Rename Road Network** dialog box is displayed.

3. The current name of the Road Network you wish to rename is shown. In the **To** edit box, enter the new name for the Road Network. The new name must be unique.

4. Click **OK**.

   The renamed Road Network is displayed in the *Workspace* window. The name change is reflected throughout the system.

To work with the renamed Road Network, see Section 4.5.
4.8 Exporting Road Networks

You can use HDM-4 Road Network data in other software applications by exporting individual Road Networks in a `.dbf` file. See the file HDM-4 RoadNet Export Format.doc for details of the Road Network export file format.

1. In the **Workspace** window, expand the **Road Networks** folder and select a Road Network.
2. Click **Export**.

   The **Export Road Network As** dialog box is displayed.

3. Double-click the folder in which the export file is to be stored.
4. Enter a file name for the export file.
5. Click **Save**.

4.9 Importing Road Networks

You can import Road Network data into HDM-4 from other software applications. To do this, the data must be in a `.dbf` file of a specific format. See the file HDM-4 RoadNet Export Format.doc for details of the Road Network export file format.

1. With the **Workspace** window active, select Import from the **Workspace** menu.

   The **Import HDM-4 Export File** dialog box is displayed.

2. Double-click the folder that contains the file to be imported.
3. Select the file to be imported and click **Open**.

   The **Enter Name for Imported Road Network** dialog box is displayed.
Enter a unique name for the Road Network and click OK.

In step 4, above, you are informed if a Road Network of the same name already exists. You must then decide whether to overwrite the existing Road Network, or to rename the Road Network that is being imported, or to cancel the import operation.

### 4.10 Adding Sections based on aggregate data

1. In the **Workspace** window, create or open a Road Network.
   
   The **Road Network** dialog box is displayed.

2. Click **Add New Section**.

   The **New Section** dialog box is displayed.

3. Select the **based on aggregate data** option button and click **OK**.

   The **New Section From Aggregate Data** dialog box is displayed.

4. Enter a name and ID for the Section. These must be unique.

5. Specify values for all the aggregate parameters.

   Aggregate parameters correspond to more particular values for Key and Detailed parameters as defined in the **Configuration** folder (Section Aggregate Data and Section Aggregate Tables). When you specify aggregate parameters, values are derived for all Key and Detailed parameters.
parameters which are then used to populate the edit boxes in the Section dialog box (see next step).

6  Click **OK**.

The **Section** dialog box is displayed.

7  Work through the tab-pages and edit the necessary fields.

8  If necessary, you can click **Details** to edit detailed Section parameters. When you have finished working in the **Details** dialog box, click **OK** to save any changes.

9  When you have finished working in the **Section** dialog box, click **OK** to save any changes and return to the **Road Network** window.

### 4.11 Adding Sections based on existing Sections

If you want to create a Section that is similar to an existing one, you can copy the existing Section and edit the copy as necessary.

1  In the **Workspace** window, create or open a Road Network.

   The **Road Network** window is displayed.

2  Click **Add New Section**.

   The **New Section** dialog box is displayed.

3  Select the **based on existing Section** option button. In the drop-down list, select the existing Section that you wish to copy and click **OK**.

   The **Section** dialog box is displayed. The data in the new Section is a copy of the data in the existing Section.
4 Enter a description and an ID for the new Section. These must be unique. Work through the tab-pages and make any necessary changes.

5 If necessary, you can click Details to edit detailed Section parameters. When you have finished working in the Details dialog box, click OK to save any changes.

6 When you have finished working in the Section dialog box, click OK to save any changes.

4.12 Editing Section attributes

1 In the Workspace window, open a Road Network. The Road Network window is displayed.

2 To edit Section attributes do one of the following:
   - Click anywhere in a Section row and click Edit
   - Double-click anywhere in a Section row

   The Section dialog box is displayed.

3 Work through the tab-pages and make any necessary changes.

4 If necessary, you can click Details to edit detailed Section parameters. When you have finished working in the Details dialog box, click OK to save any changes.
5 When you have finished working in the **Section** dialog box, click **OK** to save any changes.

### 4.12.1 Calculating the SNP (Structural Number of Pavement) for a Section

Pavement strength is characterised in HDM-4 by the adjusted structural number - SNP. This can either be entered directly or calculated using other pavement characteristics such as Falling Weight Deflections, Benkelman Beam Deflections, or surface layer thicknesses and coefficients.

1 In the **Workspace** window, open a Road Network.

   The **Road Network** window is displayed.

2 To edit the Section details, do one of the following:
   - Click anywhere in a Section row and click **Edit**
   - Double-click anywhere in a Section row

   The **Section** dialog box is displayed.

3 **Click the Pavement tab.**

   ![Pavement tab](image)

4 **In the Strength group, select the Calculated SNP option button.**

5 **Click Calculate SNP.**

   The **SNP Calculator Wizard** is displayed. The **Step 1 of 3** tab-page is active.

   ![SNP Calculator Wizard](image)

6 **Select one of the method option buttons to calculate the SNP.**
7 Click Next.

The **Step 2 of 3** tab-page is displayed.

![SNP Calculator Wizard - Step 2 of 3](image)

The fields in this dialog box vary according to the calculation method you selected.

8 Complete the fields as required.

9 Click Next.

The **Step 3 of 3** tab-page is displayed. It shows the calculated SNP results for the calculation method you selected.

![SNP Calculator Wizard - Step 3 of 3](image)

10 Click Finish to accept the calculated SNP value and automatically transfer it to the **Pavement** tab-page of the **Section** dialog box.

When using the wizard, you may return to the previous step (click Back) or cancel the procedure (click Cancel) at any time.

**4.13 Specifying which Sections are displayed in the Road Network window**

You can specify which Sections are displayed in the **Road Network** window on the basis of surface class.

1 In the **Workspace** window, open a Road Network.

The **Road Network** window is displayed.

2 To display the **View** menu, do one of the following:

   - In the main **HDM-4** window, click the **View** menu
Right-click anywhere in the **Road Network** window

The following surface classes are available:

- Bituminous Sections
- Concrete Sections
- Unsealed Sections
- All Sections

The active menu item is marked with a ✓.

Select a surface class from the menu.

Only the Sections with the selected surface class are displayed.

### 4.14 Editing Section details directly from the Road Network window

1. In the **Workspace** window, open a Road Network.
   
The **Road Network** window is displayed.

2. To display the **View** menu, do one of the following:
   
   - In the main **HDM-4** window, click the **View** menu
   - Right-click anywhere in the **Road Network** window

   Data categories from the **Section** dialog box are listed in the lower half of the menu:

   - Definition
   - Geometry
   - Pavement
   - Condition
   - History
   - Miscellaneous

   Categories that are relevant to the current surface class are available. The active category is marked with a ✓.

3. Select a category from the menu.

   The columns in the spreadsheet change according to the category selected. You can edit the tabular information in the **Road Network** window.

   In step 3 above, if the category options are greyed out, try selecting a different surface class, then select the required category.

### 4.15 Deleting Sections

1. In the **Workspace** window, open a Road Network.

   (Note: Additional steps for deleting sections are not described.)
2 In the **Road Network** window, click anywhere in the Section row you wish to delete.

3 Click **Delete**.

You are prompted to confirm the deletion. Click **Yes** to delete the Section, or **No** to cancel the delete action.

If you click **Yes**, the Section is no longer displayed in the **Road Network** window.

4 Click **Close** to return to the **Workspace** window.

- When you delete a Section, all corresponding data are also deleted.
- Studies that use the deleted Section will be affected. You will be informed if this is the case.
- You cannot reverse a deletion.
5 Vehicle Fleets

5.1 Key Concepts

Vehicle Fleets are used to store details of the Vehicle Types to be included in HDM-4 analyses. A Vehicle Fleet consists of a number of Vehicle Types. Each Vehicle Type represents a class of vehicles in the traffic mix being modelled (e.g. small car, large truck, etc.). When creating a Vehicle Fleet, you should include one Vehicle Type for each vehicle class in the traffic mix being modelled.

HDM-4 includes 20 default Vehicle Types. The models for vehicle speed, road user effects, and social and environmental effects have been developed for these default types. The default Vehicle Types fall into the following two categories:

Motorised category
- Motorcycle
- Small Passenger Car
- Medium Passenger Car
- Large Passenger Car
- Light Delivery Vehicle
- Light Goods Vehicle
- Four Wheel Drive
- Light Truck
- Medium Truck
- Heavy Truck
- Articulated Truck
- Minibus
- Light Bus
- Medium Bus
- Heavy Bus
- Coach

Non-motorised category
- Pedestrian
- Bicycle
- Rickshaw
- Animal Cart

You can use these Vehicle Types directly in your analyses, or you can create your own user-defined types. A user-defined type must be based on a default type so that HDM-4 can determine which models to use for analysis.
5.2 Software overview

The Vehicle Types in a Vehicle Fleet are displayed in a spreadsheet in the **Vehicle Fleet** window (an example is shown below). Options on the **View** menu determine which Vehicle Type category and/or group of vehicle attributes is displayed.

![Vehicle Fleet Window](image.png)

You can edit most (but not all) attributes here in the spreadsheet. To edit attributes that are not available in the spreadsheet, you can double-click a Vehicle Type. The resulting **Vehicle Attributes** dialog box provides access to all vehicle attributes.

![Vehicle Attributes Dialog Box](image.png)

Vehicle Type data is stored on two levels:

- **Key vehicle attributes**
  - Consists of data that are readily available and/or are applicable in most environments.
  - Attributes differ according to the category of the Vehicle Type (i.e. motorised or non-motorised).
  - Key attributes can be viewed and edited in the spreadsheet views.

- **Detailed vehicle attributes**
  - Access detailed data by clicking Details.
  - Detailed data include those parameters which are either not readily available, are only required in certain circumstances, or should only be changed by those calibrating the various road deterioration models.
  - Attributes differ according to the category of the Vehicle Type.
Type (i.e. motorised or non-motorised).

- Detailed attributes cannot be viewed or edited in the spreadsheet views.

HDM-4 places no restriction on the number of Vehicle Fleets that can be created, or the number of Vehicle Types in each fleet. The only constraint is the amount of free disk space on your PC.

The sections that follow describe the tasks of creating, editing and deleting both Vehicle Fleets and Vehicle Types.

5.3 Creating Vehicle Fleets

This section describes how to create a new Vehicle Fleet which initially has no Vehicle Types.

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

The **New HDM-4 Item** dialog box is displayed.

2. Select **Vehicle Fleet** and click **OK**.

   The **New Fleet** dialog box is displayed.

3. Type the name of the new Vehicle Fleet and choose a unit cost **Currency** from the drop-down list. This is the Currency in which unit costs should be specified for all Vehicle Types that are added to the fleet.

4. Click **OK**.

   The **Vehicle Fleet** window is displayed. You can now add Vehicle Types to the blank Vehicle Fleet (see Section 5.10 and 5.11).
When you have finished working with the Vehicle Fleet, click **Save** before closing the window. If you do not click **Save**, your changes will be lost.

The new Vehicle Fleet is added to the **Workspace window**. To view it, see Section 5.5.

In step 2 above, if the **Vehicle Fleets** folder, or any existing Vehicle Fleet is selected in the **Workspace** window, the Vehicle Fleet item will be automatically selected in the **New HDM-4 Item** dialog box, and you will only need to click **OK**.

### 5.4 Creating Vehicle Fleets based on existing fleets

If you want to create a Vehicle Fleet that is similar to an existing one, you can copy the existing fleet and edit the copy as necessary.

1. In the **Workspace** window, select the existing Vehicle Fleet that you wish to copy.

2. To copy the selected fleet, do one of the following:
   - Click **Copy** in the **Workspace** window
   - With the **Workspace** window active, select **Copy** from the **Workspace** menu

   The **Copy Vehicle Fleet** dialog box is displayed.

3. The name of the Vehicle Fleet you wish to copy is shown. In the **To** edit box, enter the name of the new fleet. This name must be unique.

4. Click **OK**.

   The new Vehicle Fleet is added to the **Workspace** window.

   To view the new copy, see Section 5.5 below.

### 5.5 Viewing / editing Vehicle Fleets

1. In the **Workspace** window, expand the **Vehicle Fleets** folder.

2. To open a Vehicle Fleet, do one of the following:
   - Select a Vehicle Fleet and click **Open**
Select a Vehicle Fleet. With the **Workspace** window active, select **Open** from the **Workspace** menu.

Double-click the Vehicle Fleet.

The **Vehicle Fleet** window is displayed.

When you have finished working with the Vehicle Fleet, click **Save** before closing the window. If do not click **Save**, your changes will be lost.

To edit the Vehicle Types, see Section 5.12.

### 5.5.1 Changing the fleet Currency

You specify the fleet Currency when you create a Vehicle Fleet. Unit costs for all Vehicle Types in the Vehicle Fleet are specified in this Currency. If you wish to change the fleet Currency all unit costs should be updated to reflect the change. To change the Fleet Currency do the following:

1. In the **Workspace** window, expand the **Vehicle Fleets** folder.
2. To open a Vehicle Fleet, do one of the following:
   - Select a Vehicle Fleet and click **Open**
   - Select a Vehicle Fleet. With the **Workspace** window active, select **Open** from the **Workspace** menu
   - Double-click the Vehicle Fleet
   The **Vehicle Fleet** window is displayed.
3. Click **Info**.
   The **Fleet Information** dialog box is displayed.
4. Select a Currency from the drop-down list.
5.6 Deleting Vehicle Fleets

1. In the Workspace window, select the Vehicle Fleet that you wish to delete.

2. To delete the selected fleet, do one of the following:
   - Click Delete
   - With the Workspace window active, select Delete from the Workspace menu

   You are prompted to confirm the deletion. Click Yes to delete the Vehicle Fleet, or No to cancel the delete action.

   If you click Yes, the deleted Vehicle Fleet is no longer displayed in the Workspace window.

   - When you delete a Vehicle Fleet, all corresponding Vehicle Types are also deleted.
   - Studies that use the deleted Vehicle Fleet will be affected. You will be informed if this is the case.
   - You cannot reverse a deletion.

5.7 Renaming Vehicle Fleets

1. In the Workspace window, select the Vehicle Fleet that you wish to rename.

2. To rename the selected fleet, do one of the following:
   - Click Rename
   - With the Workspace window active, select Rename from the Workspace menu

   The Rename Vehicle Fleet dialog box is displayed.

   The current name of the Vehicle Fleet you wish to rename is shown. In the To edit box, enter the new name for the Vehicle Fleet. The new name must be unique.

   Click OK.

   The renamed Vehicle Fleet is displayed in the Workspace window.

   To work with the renamed Vehicle Fleet, see Section 5.5.
5.8 Importing Vehicle Fleets

You can import Vehicle Fleet data into HDM-4 from other software applications. To do this, the data must be in a .dbf file of a specific format. See the file HDM-4 Vehicle Fleet Export Format.doc for details of the export file format.

1. With the Workspace window active, select Import from the Workspace menu.

The Import HDM-4 Export File dialog box is displayed.

2. Double-click the folder that contains the file to be imported.

3. Select the file to be imported and click Open. The import routine detects the file type. If it is a Vehicle Fleet export file then the Enter Name for Imported Vehicle Fleet dialog box is displayed.

4. Enter a unique name for the Vehicle Fleet and click OK.

In step 4, above, you are informed if a Vehicle Fleet of the same name already exists. You must then decide whether to overwrite the existing Vehicle Fleet, to provide an alternative name for the Vehicle Fleet that is being imported, or to cancel the import operation.

5.9 Exporting Vehicle Fleets

You can use HDM-4 Vehicle Fleet data in other software applications by exporting individual Vehicle Fleets as a .dbf file. See the file HDM-4 Vehicle Fleet Export Format.doc for details of the export file format.

1. In the Workspace window, expand the Vehicle Fleets folder and select a Vehicle Fleet.

2. Click Export.

The Export Vehicle Fleet As dialog box is displayed.
3 Double-click the folder in which the export file is to be stored.

4 Enter a file name for the export file.

5 Click Save.

5.10 Adding motorised Vehicle Types (MT) to a Vehicle Fleet

1 In the Workspace window, create or open a Vehicle Fleet.

2 In the Vehicle Fleet window, click Add New Vehicle.

The New Vehicle Type dialog box is displayed.

3 Select the Motorised option button and select a base Vehicle Type from the drop-down list.

The drop-down list contains default motorised Vehicle Types and user defined Vehicle Types for the current Vehicle Fleet. Initial data for the new Vehicle Type is derived from the base Vehicle Type.

4 Click OK.

The Vehicle Attributes dialog box is displayed.
5 Work through the tab-pages and complete the necessary fields.

6 If necessary, you can click Calibration to edit detailed Vehicle Type parameters. When you have finished working in the Calibration dialog box, click OK to save any changes.

7 When you have finished working in the Vehicle Attributes dialog box, click OK to save any changes.

5.11 Adding non-motorised Vehicle Types (NMT) to a Vehicle Fleet

1 In the Workspace window, create or open a Vehicle Fleet.

2 In the Vehicle Fleet window, click Add New Vehicle.

The New Vehicle Type dialog box is displayed.

3 Select the Non-motorised option button and select a base Vehicle Type from the drop-down list.

The drop-down list contains four default non-motorised Vehicle Types and user defined Vehicle Types for the current Vehicle Fleet. Initial data for the new Vehicle Type is derived from the base Vehicle Type.

4 Click OK.

The NM Vehicle Attributes dialog box is displayed.

5 Work through the tab-pages and complete the necessary fields.

6 If necessary, you can click Calibration to edit detailed Vehicle Type parameters. When you have finished working in the Calibration dialog box, click OK to save any changes.

7 When you have finished working in the NM Vehicle Attributes dialog box, click OK to save any changes.
5.12 Editing Vehicle Type attributes

1. In the **Workspace** window, open a Vehicle Fleet.
   The **Vehicle Fleet** window is displayed.

2. To open the selected fleet, do one of the following:
   - Click anywhere in a Vehicle Type row and click **Edit**
   - Double-click anywhere in a Vehicle Type row
   The **Vehicle Attributes** dialog box is displayed.

3. Work through the tab-pages and make any necessary changes.

4. If necessary, you can click **Calibration** to edit detailed Vehicle Type parameters. When you have finished working in the **Calibration** dialog box, click **OK** to save any changes and return to the **Vehicle Attributes** dialog box.

5. When you have finished working in the **Vehicle Attributes** dialog box, click **OK** to save any changes.

5.12.1 Calculating Annual km and Hours Worked

The values for the utilisation parameters Annual km and Working Hours can either be entered directly (if the data is available) or can be calculated by HDM-4 from age spectrum data. The Vehicle Utilisation Wizard is provided to simplify the calculation process.

1. In the **Workspace** window, open a Vehicle Fleet.
   The **Vehicle Fleet** window is displayed.

2. To edit the Vehicle Type details, do one of the following:
   - Click anywhere in a Vehicle Type row and click **Edit**
   - Double-click anywhere in a Vehicle Type row
   The **Vehicle Attributes** dialog box is displayed.

3. Click the **Basic Characteristics** tab.
4 Click **Calculate** in the Utilisation group.

The **Utilisation Parameters Wizard** is displayed. The **Step 1 of 2** tab-page is active.

5 Click **Add New Year**.

A blank row is created in the table.

6 Enter age spectrum data values in the table.

7 Add the necessary number of years.

8 Click **Next**.

The **Step 2 of 2** tab-page is displayed. It shows the values calculated from the data on the previous tab-page.

9 Click **Finish** to accept the calculated values and insert them in the **Basic Characteristics** tab-page of the **Vehicle Attributes** dialog box.
10 When you have finished working in the **Vehicle Attributes** dialog box, click **OK** to save any changes.

### 5.12.2 Calculating ESAL

The value for the vehicle loading parameter ESAL may be entered directly (if the data is available), or calculated by HDM-4 from raw vehicle axle loading data that you supply. The ESAL Wizard assists with the calculation process.

1. In the **Workspace** window, open a Vehicle Fleet.
   
The **Vehicle Fleet** window is displayed.

2. To edit the Vehicle Type attributes, do one of the following:
   
   - Click anywhere in a Vehicle Type row and click **Edit**
   - Double-click anywhere in a Vehicle Type row
   
The **Vehicle Attributes** dialog box is displayed.

3. Click the **Basic Characteristics** tab.

4. Click **Calculate** in the Loading group.
   
   The **Calculate ESAL Wizard** is displayed. The **Step 1 of 3** tab-page is active.

5. Enter the axle load equivalency exponent (LE) in the edit box.

6. Click **Next**.
   
   The **Step 2 of 3** tab-page is displayed.
7 Click **Add New Axle Group**.

A blank column is created in the table. Note: If you click **Insert New Axle Group**, a blank column will be created at the cursor position, moving any other columns to the right.

8 Click **Add New Vehicle**.

A blank row is added to the bottom of the table.

9 Enter loading data by axle group for the Vehicle Type.

10 Add the necessary number of Vehicles Types

11 Click **Next**.

The **Step 3 of 3** tab-page is displayed.

12 Click **Finish** to accept the calculated ESAL factor and insert it in the **Basic Characteristics** tab-page of the **Vehicle Attributes** dialog box.

13 When you have finished working in the **Vehicle Attributes** dialog box, click **OK** to save any changes.

5.13 **Specifying which Vehicle Types are displayed in the Vehicle Fleet window**

You can specify which Vehicle Types are displayed in the **Vehicle Fleet** window on the basis of category (motorised or non-motorised).

1 In the **Workspace** window, open a Vehicle Fleet.

The **Vehicle Fleet** window is displayed.

2 Do one of the following:
   - In the main **HDM-4** window, click the **View** menu
Right-click anywhere in the **Vehicle Fleet** window

The following categories are available:

- Motorised vehicles
- Non-motorised vehicles
- All categories

The active item is marked with a ✓.

3 Select a category from the menu.

Only the Vehicle Types with the selected category are displayed.

### 5.14 Editing Vehicle Type attributes directly from the Vehicle Fleet window

You can edit Vehicle Type details in the **Vehicle Fleet** window spreadsheet.

1 In the **Workspace** window, open a Vehicle Fleet.

   The **Vehicle Fleet** window is displayed.

2 To select the group of attributes, do one of the following:

   - In the main **HDM-4** window, click the **View** menu
   - Right-click anywhere in the **Vehicle Fleet** window

   The following groups of attributes are listed in the lower half of the menu:

   - Definition
   - Basic Characteristics
   - Economic Unit Costs
   - Financial Units Costs

   The active attribute group is marked with a ✓.

3 Select an attribute group from the menu.

   The columns in the **Vehicle Fleet** window change according to the attribute group you selected. You can edit the tabular information in the **Vehicle Fleet** window.

   In step 3 above, if the attribute group you require is greyed out, select a different vehicle category (Motorised, Non-motorised) first, then select the attribute group.
5.15 Deleting Vehicle Types

1. In the **Workspace** window, open a Vehicle Fleet.

2. In the **Vehicle Fleet** window, click anywhere in the Vehicle Type row you wish to delete.

3. Click **Delete**.

   You are prompted to confirm the deletion. Click **Yes** to delete the Vehicle Type, or **No** to cancel the delete action.

   If you click **Yes**, the Vehicle Type is no longer displayed in the **Vehicle Fleet** window.

4. Click **Close** to return to the **Workspace** window.

   - When you delete a Vehicle Type, all corresponding data are also deleted.
   - Analyses that use the deleted Vehicle Type will be affected. You will be informed if this is the case. If you continue with the deletion, the Vehicle Type will be removed from the analysis and any associated traffic data will be lost.
   - You cannot reverse a deletion.
6 Maintenance & Improvement Standards

6.1 Key concepts

In HDM-4 Maintenance and Improvement Standards are used to represent the targets or levels of condition and response that you aim to achieve.

Maintenance Standards define the maintenance works required to maintain the road network at the target level. Each Maintenance Standard consists of a set of one or more Works Items. Each Works Item is defined in terms of the road surface class to which it applies, an intervention level, an operation type (e.g. resal, overlay, etc.), and the resultant effect on the pavement.

Improvement Standards define the road improvement works to be carried out should the state of the road network fall below a certain level. Each Improvement Standard is defined in terms of the road surface class to which it applies, an intervention level, an improvement type, the costs & duration of the works, and the resultant effect on the pavement in terms of its condition, geometry, strength, etc. Supported improvement types include: lane addition, partial widening, reconstruction, and upgrading.

Typically you will create a set of Maintenance and Improvement Standards that can then be assigned to road sections in many subsequent Projects, Programmes and Strategies that you create.

6.2 Software overview

Below is an example of the Maintenance Standard dialog box. The top part of the dialog shows the definition of the standard including the surface type. The bottom half of the dialog shows the works items defined for the standard.

A Maintenance Standard consists of one or more Works Items. Double-clicking on one of the Works Items in the list box causes the Works Item dialog box to be displayed – an example of which is shown below:
The data that defines the Works Item is separated into 5 categories, each assigned to a separate tab-page as shown in the figure above:

- **General** – the definition of the Works Item: description, operation type and intervention type (scheduled or responsive).

- **Design** – the design and structure of the pavement following the completion of the works: surface material, thickness, strength coefficient, etc.

- **Intervention** – the content of this tab-page will differ according to the intervention type selected. For scheduled intervention you will be prompted to specify the time interval at which the selected Works Item will be triggered. For responsive intervention you will be prompted to specify one or more condition levels at which the Works Item should be triggered (e.g. when Area of All Cracking > 10%).

- **Costs** – the unit cost for the selected operation, appropriate preparatory works costs, and the unit of work (e.g. per m, per m², per km, etc.). HDM-4 stores default costs and work units for each of the supported operation types. Each time you change the operation type for a Works Item, you will be asked if you want to adopt the current default cost and units (see Section 6.17).

- **Effects** – the condition of the pavement following the completion of the works (e.g. roughness and rutting).

Please note that not all of these tab-pages will be displayed for any given Works Item. The operation type determines which pages are displayed.

Below is an example of the Improvement Standard dialog box. Unlike Maintenance Standards, there is no hierarchical Standard / Works Items relationship. For an Improvement Standard only one works type is involved:
The data that defines the Improvement Standard is separated onto various tab-pages, as with Maintenance Standards. Two extra tab-pages are included:

- **Pavement** – detailed description of the pavement structure following improvement.
- **Geometry** – the new geometry / alignment of the road following the improvement.

A common misconception is that the Surface Class parameter on the General tab-page refers to the surface of the pavement following the improvement. This is incorrect. The parameter actually refers to the class of roads to which this standard applies. For example, if the Bituminous surface class is selected, then the standard will only be considered for bituminous road sections.

### 6.3 Creating Maintenance Standards

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.

2. Select Maintenance Standard and click **OK**.

   The **Maintenance Standard** dialog box is displayed.
3 Enter a name and short code for the new Maintenance Standard. These must be unique.

You can now add Works Items to the empty Maintenance Standard (see Section 6.8).

4 Click OK to save the Maintenance Standard and close the dialog box.

The new Maintenance Standard is added to the Workspace window. To view it, see Section 6.5.

In step 2 above, if the Work Standards folder, Maintenance Standards folder, or any existing Work Item is selected in the Workspace window, the Maintenance Std item will be automatically selected in the New HDM-4 Item dialog box, and you will only need to click OK.

6.4 Creating Maintenance Standards based on existing standards

If you want to create a Maintenance Standard that is similar to an existing one, you can copy the existing standard and edit the copy as necessary.

1 In the Workspace window, expand the Work Standards folder.

2 Expand the Maintenance Standards folder.

3 Select the Maintenance Standard that you wish to copy.

4 To copy the selected Maintenance Standard, do one of the following:
   ❑ Click Copy in the Workspace window
   ❑ With the Workspace window active, select Copy from the Workspace menu

The Copy Maintenance Standard dialog box is displayed.

5 The name of the Maintenance Standard you wish to copy is shown. In the To edit box, enter the name of the new standard. This name must be unique.

6 Click OK.

The new Maintenance Standard is added to the Workspace window.

To view the new copy, see Section 6.5 below.
6.5 Viewing / editing Maintenance Standards

1. In the **Workspace** window, expand the **Work Standards** folder.
2. Expand the **Maintenance Standards** folder.
3. To open a Maintenance Standard, do one of the following:
   - Select a Maintenance Standard and click **Open**
   - Select a Maintenance Standard. With the **Workspace** window active, select **Open** from the **Workspace** menu
   - Double-click the Maintenance Standard

The **Maintenance Standard** dialog box is displayed.

4. When you have finished working with the Maintenance Standard, click **OK** to save any changes and close the dialog box.

To edit the Work Items, see Section 6.10.

6.6 Deleting Maintenance Standards

1. In the **Workspace** window, expand the **Work Standards** folder.
2. Expand the **Maintenance Standards** folder.
3. Select the Maintenance Standard that you wish to delete.
4. To delete the selected Maintenance Standard, do one of the following:
   - Click **Delete**
   - With the **Workspace** window active, select **Delete** from the **Workspace** menu

You are prompted to confirm the deletion. Click **Yes** to delete the Maintenance Standard, or **No** to cancel the delete action.

If you click **Yes**, the deleted Maintenance Standard is no longer displayed in the **Workspace** window.

- When you delete a Maintenance Standard, all corresponding Work Items are also deleted.
• Studies that use the deleted Maintenance Standard will be affected. You will be informed if this is the case.

• You cannot reverse a deletion.

6.7 Renaming Maintenance Standards

1. In the Workspace window, expand the Work Standards folder.
2. Expand the Maintenance Standards folder.
3. Select the Maintenance Standard that you wish to rename.
4. To rename the selected Maintenance Standard, do one of the following:
   □ Click Rename
   □ With the Workspace window active, select Rename from the Workspace menu

The Rename Maintenance Standard dialog box is displayed.

5. The current name of the Maintenance Standard you wish to rename is shown. In the To edit box, enter the new name for the Maintenance Standard. The new name must be unique.

6. Click OK.

The renamed Maintenance Standard is displayed in the Workspace window.

To view the renamed Maintenance Standard, see Section 6.5.

6.8 Adding Work Items

1. In the Workspace window, create or open a Maintenance Standard (in the Work Standards folder).

The Maintenance Standard dialog box is displayed.

2. Click Add New Work Item.

The Work Item dialog box is displayed.
3 Enter a name and short code for the Work Item. The Work Item name and code must be unique within a Maintenance Standard.

4 Work through the tab-pages and complete the necessary fields. The number of tab-pages and their content changes according to the operation type you select in the General tab-page.

5 When you have finished working in the Maintenance Works dialog box, click OK to save any changes.

6 When you have finished working in the Maintenance Standard dialog box, click OK to save any changes.

6.9 Adding Work Items by copying existing Work Items

If you want to create a Work Item that is similar to an existing one, you can copy the existing item and edit the copy as necessary.

1 In the Workspace window, create or open a Maintenance Standard (in the Work Standards folder).

The Maintenance Standard dialog box is displayed.

2 Select an existing Work Item from the Work Items group list.

3 Click Copy Work Item.

A new Work Item is added to the list. It is automatically assigned a unique name and short code which you can edit if necessary (see Section 6.10).

4 When you have finished working in the Maintenance Standard dialog box, click OK to save any changes.

6.10 Editing Work Items

1 In the Workspace window, create or open a Maintenance Standard (in the Work Standards folder).

The Maintenance Standard dialog box is displayed.

2 Select a Work Item in the Work Items group list.

3 Click Edit.

The Maintenance Work Item dialog box is displayed.
Work through the tab-pages and complete the necessary fields. The number of tab-pages and their content changes according to the operation type you choose in the General tab-page.

When you have finished working in the Maintenance Work Item dialog box, click OK to save any changes.

When you have finished working in the Maintenance Standard dialog box, click OK to save any changes.

### 6.11 Deleting Work Items

1. In the Workspace window, open a Maintenance Standard (in the Work Standards folder).

   The Maintenance Standard dialog box is displayed.

2. Select a Work Item in the Work Item group list.

3. To delete the selected Work Item, do one of the following:
   - Click Delete
   - With the Workspace window active, select Delete from the Workspace menu

   You are prompted to confirm the deletion. Click Yes to delete the Work Item, or No to cancel the delete action.

   If you click Yes, the deleted Work Item is no longer displayed in the Maintenance Standard dialog box.

4. When you have finished working in the Maintenance Standard dialog box, click OK to save any changes.

- When you delete a Work Item, all corresponding data are also deleted.
- Studies that use the deleted Work Item will be affected. You will be informed if this is the case.
- You cannot reverse a deletion.
6.12 Creating Improvement Standards

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.

2. Select Improvement Standard and click **OK**.

   The **Improvement Standard** dialog box is displayed.

3. Enter a name and short code for the new Improvement Standard. These must be unique.

4. Work through the tab-pages and complete the necessary fields. The number of tab-pages and their content changes according to the improvement type you choose in the **General** tab-page.

5. Click **OK** to save the Improvement Standard and close the dialog box.

   The new Improvement Standard is added to the **Workspace** window. To view it, see Section 6.14.

In step 2 above, if the **Improvement Standards** folder or any existing Improvement Standard is selected in the **Workspace** window, the Improvement Standard item will be automatically selected in the **New HDM-4 Item** dialog box, and you will only need to click **OK**.
6.13 Creating Improvement Standards based on existing standards

If you want to create an Improvement Standard that is similar to an existing one, you can copy the existing standard and edit the copy as necessary.

1. In the Workspace window, expand the Work Standards folder.
2. Expand the Improvement Standards folder.
3. Select the Improvement Standard that you wish to copy.
4. To copy the selected Improvement Standard, do one of the following:
   - Click Copy in the Workspace window
   - With the Workspace window active, select Copy from the Workspace menu

   The Copy Improvement Standard dialog box is displayed.

   The name of the Improvement Standard you wish to copy is shown. In the To edit box, enter the name of the new standard. This name must be unique.

   Click OK.

   The new Improvement Standard is added to the Workspace window.

   To view the new copy, see Section 6.14 below.

6.14 Viewing / editing Improvement Standards

1. In the Workspace window, expand the Work Standards folder.

   Expand the Improvement Standards folder.

   To open an Improvement Standard, do one of the following:
   - Select a Improvement Standard and click Open
   - Select a Improvement Standard. With the Workspace window active, select Open from the Workspace menu
   - Double-click the Improvement Standard

   The Improvement Standard dialog box is displayed.

   Work through the tab-pages and complete the necessary fields.
The tab-pages change according to the improvement type you choose in the General tab-page.

When you have finished working with the Improvement Standard, click OK to save any changes.

### 6.15 Deleting Improvement Standards

1. In the Workspace window, expand the Work Standards folder.
2. Expand the Improvement Standards folder.
3. Select the Improvement Standard that you wish to delete.
4. To delete the selected Improvement Standard, do one of the following:
   - Click Delete
   - With the Workspace window active, select Delete from the Workspace menu

You are prompted to confirm the deletion. Click Yes to delete the Improvement Standard, or No to cancel the delete action.

If you click Yes, the deleted Improvement Standard is no longer displayed in the Workspace window.

- When you delete an Improvement Standard, all corresponding data are also deleted.
- Studies that use the deleted Improvement Standard will be affected. You will be informed if this is the case.
- You cannot reverse a deletion.

### 6.16 Renaming Improvement Standards

1. In the Workspace window, expand the Work Standards folder.
2. Expand the Improvement Standards folder.
3. Select the Improvement Standard that you wish to rename.
4. To rename the selected Improvement Standard, do one of the following:
   - Click Rename
   - With the Workspace window active, select Rename from the Workspace menu

The Rename Improvement Standard dialog box is displayed.

5. The current name of the Improvement Standard you wish to rename is shown. In the To edit box, enter the new name for the Improvement Standard. The new name must be unique.

6. Click OK.

The renamed Improvement Standard is displayed in the Workspace window.
To work with the renamed Improvement Standard, see Section 6.14.

6.17 Updating default works unit costs and energy consumption

HDM-4 stores default unit costs for all works operation types that it supports. When you create a new Work Item, the relevant default costs are inherited. Energy consumption rates for the works operation types are also stored. You can edit both the energy consumption rates and the default works costs.

1. In the Workspace window, expand the Work Standards folder.

2. To edit the default works costs and energy consumption, do one of the following:
   - Select Default Works Costs & Energy Consumption. Click Open.
   - Select Default Works Costs & Energy Consumption. With the Workspace window active, select Open from the Workspace menu.
   - Double-click Default Works Costs & Energy Consumption.

The Default Works Costs And Energy Consumption dialog box is displayed.

3. Click Energy to display the energy consumption columns.

4. Enter values as necessary.

5. When you have finished working in the Default Works Costs And Energy Consumption dialog box, click OK to save any changes.
6.18 Importing Work Standards

You can import Work Standards that were originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the Workspace window active, select Import from the Workspace menu.
   
   The Import HDM-4 Export File dialog box is displayed.
   
   ![Import HDM-4 Export File dialog box]

2. Go into the folder that contains the file to be imported.

3. Select one of the following files:
   
   - IMPROVES.DBF
   - MAINTSTDS.DBF
   - RESPONINT.DBF
   - WORKDEFAULTS.DBF
   - WORKS.DBF

4. Click Open.

   - In step 3, all the Maintenance Standards (including Work Items), Improvement Standards and default works costs and energy consumption records are imported, irrespective of the file you select.

   - In step 3, above, you are informed if a Work Standard of the same name already exists. You are prompted to rename the Work Standard that is being imported.

6.19 Exporting Work Standards

When you export Work Standards from HDM-4, several .dbf and .hdbf files are created. If you are using the export facility to exchange data with other HDM-4 users, you must supply all the files.

1. In the Workspace window, select Work Standards or any of the folder contents.

2. Click Export.
   
   The Browse for Folder dialog box is displayed.
3 Select the folder in which the export file is to be stored.

4 Click OK.

All the Maintenance Standards (including Work Items), Improvement Standards and default works costs and energy consumption records are exported irrespective of the item that you select in the Work Standards folder.
7 Project analysis

7.1 Key concepts

An HDM-4 Project contains information about existing Road Sections, new Road Sections, Vehicle Types, traffic (normal, diverted and generated), and investment alternatives. An alternative is a combination of maintenance and/or Improvement Standards that is applied to a Section. You can analyse the Project using several different alternatives, allowing you to determine which is the most cost effective.

7.2 Software overview

A key feature of the Project window (shown below) is the four workflow buttons on the left-hand side.

The following table shows how the workflow buttons guide you through the process of defining and running a Project analysis.
### Workflow button

<table>
<thead>
<tr>
<th>Tab-page</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| General    | 1. Specify the Road Network that contains the Sections to be analysed.  
2. Specify the Vehicle Fleet that contains the Vehicle Types to be analysed.  
3. Specify general Project information such as the start year, duration, and output Currency.  
4. Specify the analysis mode. There are two modes of analysis:  
    - By Project  
      Determines the best alternative for the group of Sections analysed.  
    - By Section  
      Determines the best alternative for each Section.  
5. Select specific Sections for analysis.  
6. Select specific Vehicle Types for analysis.  
7. Define the traffic composition and expected growth for each Section / Vehicle Type.  
8. Define the alternatives to be analysed. Some alternatives may include diverted and/or generated traffic, exogenous benefits and costs, and new Sections.  
9. Customise the run setup. This includes:  
    - Specifying a base alternative, with which the other alternatives should be compared.  
    - Specifying various sub-models such as energy balance, economic analysis and emissions analysis.  
10. Run the analysis. If vital information is missing, you are informed, and must supply the necessary information so that HDM-4 can complete the run. The time required to perform the analysis depends on the complexity of the Project.  
11. Generate reports and examine the results of the run. |

HDM-4 places no restriction on the number of Projects that can be created. The only constraint is the amount of free disk space on your PC.

### 7.3 Creating Projects

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.
2 Select Project and click OK.

The **New Project** dialog box is displayed.

3 Enter a name for the new Project, and select a Road Network and Vehicle Fleet.

4 Click OK.

The **Project** dialog box is displayed. The **Define Project Details** workflow button is selected and the **General** tab-page is active.

5 Select the mode of analysis:

**Analyse by Section** Alternatives are defined for each Section. Each alternative defines a set of works standards. The analysis determines the optimum alternative for each Section. NPV is calculated for each section alternative. Analysis by Section supports neither New Sections nor diverted traffic.

See Section 7.13.

**Analyse by Project** Each alternative defines a set of work standards for each section. The analysis determines the optimum alternative for the sections as a group. NPV is calculated for each alternative (i.e. for
the group of sections). Analysis by Project supports the analysis of New Sections and diverted traffic.

See Section 7.14.

6 In the Currencies group, select an output Currency from the drop-down list.

7 Edit the other information on the General tab-page as necessary. You can now work through the tab-pages to select Sections and Vehicle Types, and define traffic.

When you have finished working with the Project, click Save before closing the window. If do not click Save, your changes will be lost.

The new Project is added to the Workspace window. To view it, see Section 7.5.

In step 2 above, if the Projects folder or any existing Project is selected in the Workspace window, the Project item will be automatically selected in the New HDM-4 Item dialog box, and you will only need to click OK.

### 7.4 Creating Projects based on existing Projects

If you want to create a Project that is similar to an existing one, you can copy the existing Project and edit the copy as necessary.

1 In the Workspace window, select the Project that you wish to copy.

2 To copy the selected Project, do one of the following:
   - Click Copy
   - With the Workspace window active, select Copy from the Workspace menu

The Copy Project dialog box is displayed.

3 The name of the Project you wish to copy is shown. In the To edit box, enter the name of the new Project. This name must be unique.

4 Click OK.

The new Project is added to the Workspace window.

To view the new copy, see Section 7.5 below.

### 7.5 Viewing / editing Projects

1 In the Workspace window, expand the Projects folder.

2 To open a Project, do one of the following:
   - Select a Project and click Open
   - Select a Project. With the Workspace window active, select Open from the Workspace menu
   - Double-click a Project
The **Project** window is displayed. The **Define Project Details** workflow button is selected and the **General** tab-page is active.

![Project window](image)

When you have finished working with the Project, click **OK** to save any changes.

In steps 1 and 2 above, you can alternatively, double-click the Project in the **Workspace** window.

### 7.6 Deleting Projects

1. In the **Workspace** window, select the Project that you wish to delete.
2. To delete the selected Project, do one of the following:
   - Click **Delete**
   - With the **Workspace** window active, select **Delete** from the **Workspace** menu

You are prompted to confirm the deletion. Click **Yes** to delete the Project, or **No** to cancel the delete action.

If you click **Yes**, the deleted Project is no longer displayed in the **Workspace** window.

- When you delete a Project, associated alternatives, traffic and run settings are also deleted.
- You cannot reverse a deletion.

### 7.7 Renaming Projects

1. In the **Workspace** window, select the Project that you wish to rename.
2. To rename the selected Project, do one of the following:
   - Click **Rename**
   - With the **Workspace** window active, select **Rename** from the **Workspace** menu

The **Rename Project** dialog box is displayed.
3 The current name of the Project you wish to rename is shown. In the **To** edit box, enter the new name for the Project. The new name must be unique.

4 Click **OK**.

   The renamed Project is displayed in the **Workspace** window.

   To work with the renamed Project, see Section 7.5.

### 7.8 Exporting Projects

When you export Project data from HDM-4, a number of files are created—a .dbf file and several .hdbf files. If you are using the export facility to exchange data with other HDM-4 users, you must supply all the files. When importing the Project, only the .dbf file is seen by the importer.

1 In the **Workspace** window, expand the **Projects** folder and select a Project.

2 Click **Export**.

   The **Browse for Folder** dialog box is displayed.

   ![Browse for Folder dialog box]

3 Select the folder in which the export files are to be stored.

4 Click **OK**.

   You can only export one Project at a time. If you want to export a number of Projects one after the other, select a different folder for each Project. **Do not rename** any of the files.

### 7.9 Importing Projects

You can import Project data that was originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1 With the **Workspace** window active, select **Import** from the **Workspace** menu.

   The **Import HDM-4 Export File** dialog box is displayed.
2 Go into the folder that contains the file to be imported.

3 Select the file to be imported and click Open.

You are informed if a Project of the same name already exists. You are prompted to rename the Project that is being imported.

When you import a Project, other items that are used by the Project are also imported (for example, Vehicle Fleet and Maintenance Standards).

### 7.10 Selecting Sections for a Project

1 In the Workspace window, create or open a Project.

The Project window is displayed. The Define Project Details workflow button is selected and the General tab-page is active.

2 Click the Select Sections tab.

In a new Project, all Sections in the Road Network are initially listed, but none are selected for the Project.

3 Click the buttons in the Include column to select/de-select Sections. Selected Sections are marked with a ✓.

- You can choose to display or hide un-selected Sections by ticking or clearing the Show unselected Sections check box.
- Click Unselect All to exclude all Sections from the Project. The ✓ is removed from all the Section lines.
- You can also select Sections by specifying selection criteria (see below).
You can edit/view detailed Section information. Click **Edit/View Section** to access the Section dialog box.

You can edit/view detailed Road Network information. Click **Edit/View Network** to access the Road Network window.

### 7.10.1 Specifying selection criteria

You can select Sections for an analysis by specifying search criteria. The Sections that match the search criteria are selected for analysis. This is particularly useful if the Road Network you are using contains a large number of Sections.

1. In the **Select Sections** tab-page click **Select by Criteria**.

   The **Network Section Selection** dialog box is displayed.

2. Specify pavement, speed flow, traffic and geometry selection criteria.

3. Click the **Add to currently selected** option button, or the **Replace currently selected** option button.

4. Click **Select**.

   The **Selected Sections** dialog box is displayed. The Sections that match the selection criteria are listed.

5. Do one of the following.
Click OK to include the selected Sections in the analysis. The Sections are entered in the spreadsheet and marked with a ✓ to show they are included in the analysis.

If you want to repeat the selection cycle, click Continue Selection.

### 7.11 Selecting Vehicle Types to include in a Project

1. In the Workspace window, create or open a Project.

   The Project window is displayed. The Define Project Details workflow button is selected and the General tab-page is active.

2. Click the Select Vehicles tab.

   In a new Project, all Vehicle Types in the fleet are listed and marked with a ✓ to show they are included in the Project.

3. Click the buttons in the Include column to de-select/select Vehicle Types.

   - You can show/hide un-selected Vehicle Types by ticking/clearing the Show unselected vehicles check box.
   - The Include NMT in analysis option is only enabled if there are non-motorised vehicle types in the selected fleet.
   - You can exclude non-motorised Vehicle Types from the analysis by clearing the Include NMT in analysis check box.
   - You can edit/view the attributes of the selected Vehicle Type. Click View/Edit Vehicle to display the Vehicle Attributes dialog box.
   - You can edit/view the selected Vehicle Fleet. Click View/Edit Fleet to display the Vehicle Fleet window.

### 7.12 Defining normal traffic

Define normal traffic for each Section you have selected for the Project.
Specify the initial traffic mix and the traffic growth for the selected Vehicle Types.

1. In the Workspace window, create or open a Project.
The Project window is displayed. The Define Project Details workflow button is selected and the General tab-page is active.

You must select Sections and Vehicle Types before you can define traffic.

2 Click the Define Normal Traffic tab.

The Sections that you selected for the Project are listed. You can now define traffic details for each Section.

3 Click anywhere in a Section row and click Edit Section Traffic Details.

The Normal Traffic Details dialog box is displayed. The Vehicle Types that you selected for the Project are listed. Motorised Vehicle Types and non-motorised Vehicle Types are separated into two tab-pages.

4 Define the normal traffic details:
   - The sum of the initial compositions must be 100%.
   - Enter traffic growth values for first year of analysis. Use the buttons to add, edit and delete additional traffic growth periods as necessary.
   - N.B. You cannot edit the AADT from this screen. The section AADT may only be changed from the Section Details dialog.

5 Click OK to save any changes.
You can copy traffic growth periods and compositions from one Section to another. Click the Section row with the traffic details you want to copy. Click Copy. Click the Section row where you want to paste the traffic details. Click Paste.

7.13 Analysis by Section

The purpose of analysing a Project by Section is to determine the most cost effective scheme of works for each Section included in the Project. The scheme of works is called an alternative and will typically consist of a number of Maintenance and Improvement Standards. Part of the Project definition is, therefore, to define alternatives for each Section, and assign Maintenance and Improvement Standards to each Section/alternative combination.

7.13.1 Defining alternatives

1  In the Workspace window, create or open a Project. The Project window is displayed. The Define Project Details workflow button is selected and the General tab-page is active.
2  Click the Analyse by Section option button.
3  Click the Specify Alternatives workflow button. The Sections that you selected for the Project are listed. You can now define alternatives for each Section.

Note: The Add New Alternative, Copy Alternative and Delete Alternative buttons are not available for this type of analysis.

4  Select the Section for which you want to define alternatives.
5  Click Edit Alternatives.

The Section Alternatives Details dialog box is displayed. The Description field shows the name of the Section that you are defining alternatives for. A base alternative is automatically created for each Section that has been added to the Project. No maintenance or Improvement Standards are initially assigned to it.
6 Click **Add New Alternative**.

The **New Section Alternative** dialog box is displayed.

7 Enter the name of the new alternative and click **OK**.

The new alternative is added to the list. To assign Maintenance and Improvement Standards, see Section 7.13.2 and Section 7.13.3.

8 Click **OK** to save any changes.

- In step 3 above, tick / clear the **View Details** check box to display / hide alternatives, and assigned Maintenance and Improvement Standards.
- In the **Section Alternative Details** dialog box, you can edit an alternative name by selecting it and clicking **Edit Alternative**.
- In the **Section Alternatives Details** dialog box, you can delete an alternative by selecting it and clicking **Delete Alternative**. The alternative no longer appears in the list.

### 7.13.2 Assigning Maintenance Standards

1 In the **Section Alternatives Detail** dialog box, select the alternative that you want to assign Maintenance Standards to.

2 Click **Assign Maintenance**.

The **Assign Maintenance Standard** dialog box is displayed.
3 Enter the year from which the Maintenance Standard will be considered for implementation, select a Maintenance Standard, and click **OK**.

The dialog box is closed, returning you to the **Section Alternatives Details** dialog box. When you select an alternative, the standards that have been assigned to it are shown in the Assignments column.

### 7.13.3 Assigning Improvement Standards

1 In the **Section Alternatives Details** dialog box, select the alternative that you want to assign Improvement Standards to.

2 Click **Assign Improvement**.

The **Assign Improvement Standard** dialog box is displayed.

3 Enter the year from which the Improvement Standard will be considered for implementation, and select an Improvement Standard.

Road improvements may have associated benefits, costs, and traffic effects. To specify exogenous benefits and costs for an Improvement Standard, see Section 7.13.4. To define generated traffic for an Improvement Standard, see 7.13.5.

4 Click **OK**.

The dialog box is closed, returning you to the **Section Alternatives Details** dialog box. When you select an alternative, the standards that have been assigned to it are shown in the Assignments column.

- You can make alterations to the standard assignments you have made. Select the Section, select the assignment, and click **Edit Assignment**.
- You can remove a standard assignment. Select the Section, select the assignment, and click **Remove Assignment**.
- You can copy standard assignments from one Section to another. Select the Section that you want to copy from and click **Copy Assignment**. Select the Section that you want to copy to, and click **Paste Assignment**.

### 7.13.4 Specifying exogenous benefits and costs

To define benefits and costs for an Improvement Standard, perform the steps listed below:
1 In the **Assign Improvement Standard** dialog box, tick the Ex Bens & Costs check box.

2 Click **Ex Bens & Costs**.

The **Exogenous Benefits and Costs** dialog box is displayed.

![Exogenous Benefits and Costs dialog box](image)

3 Enter a description and the number of years from the start of the improvement work until benefits and costs will start.

4 Click **Append Benefit** and **Append Cost** to add benefit and cost rows to the spreadsheet.

5 Click **Add Period** to add a growth period column to the spreadsheet.

Add the necessary number of growth periods to reflect the growth rate of the benefits and costs. You must define a growth period for the second year of benefits and costs.

6 Enter initial amounts and growth rates for the benefits and costs you have added.

- You can make changes to the growth period definition by clicking anywhere in the period column and clicking **Edit Period**.
- You can delete periods by clicking anywhere in the period column and clicking **Delete Period**.
- You can delete benefits and costs by clicking anywhere in the benefit or cost row and clicking **Delete Ben/Cost**.

### 7.13.5 Specifying generated traffic

Generated traffic is used to model the new trips generated by road improvement.

1 In the **Assign Improvement Standard** dialog box, tick the Generated Traffic check box.

2 Click **Generated Traffic**.

The **Generated Traffic** dialog box is displayed. The Vehicle Types that you selected for the Project are listed in a spreadsheet.
3 Enter a description and the number of years from the start of the improvement until generated traffic begins.

4 Click **Append Period**.

The **Generated Traffic Growth Period** dialog box is displayed. Add the necessary number of growth periods to reflect the growth of the generated traffic. You must define a growth period for the first year of generated traffic.

5 Enter a start year for the period, select a growth type and click **OK**.

A traffic growth period column is added to the spreadsheet.

6 Enter appropriate traffic growth values for the Vehicle Types and click **OK**.

If you do not click **OK** before closing the dialog box, any changes you have made will be lost.

- You can make changes to the traffic growth period definition. Click anywhere in the period column and click **Edit Period**.
- You can delete traffic growth periods. Click anywhere in the period column and click **Delete Period**.

### 7.14 Analysis by Project

The purpose of analysing by Project is to determine the optimum scheme of works for the analysis sections as a whole. Each scheme of works is called an alternative and consists of a number of Maintenance and Improvement Standards. Part of the Project definition is, therefore, to define alternatives for each Section, and assign Maintenance and Improvement Standards to each alternative/Section combination.
7.14.1 Defining alternatives

1. In the **Workspace** window, create or open a Project.
   
   The **Project** window is displayed. The **Define Project Details** workflow button is selected and the **General** tab-page is active.

2. Click the **Analyse by Project** option button.

3. Click the **Specify Alternatives** workflow button.

4. Click **Add New Alternative**.
   
   The **New Alternative** dialog box is displayed.

5. Enter a name and click **OK**.
   
   The new alternative is added to the list. To define Maintenance and Improvement Standards for alternative/Section combinations, see Section 7.14.2 and Section 7.14.3.

   - In step 3 above, tick or clear the **View Details** check box to display or hide Sections, and assigned Maintenance and Improvement Standards.
   - You can copy an alternative by selecting it and clicking **Copy Alternative**. A new copy of the alternative with a unique name is added to the list.
   - You can delete an alternative by selecting it and clicking **Delete Alternative**. The alternative no longer appears in the list.

7.14.2 Assigning Maintenance Standards

1. In the **Alternatives** tab-page of the **Project** window, select the alternative that you want to assign Maintenance Standards to.

2. Click **Edit Alternative**.
The **Alternative Details** dialog box is displayed. The Description field shows the name of the alternative that you are defining Maintenance Standards for. The Sections that you selected for the Project are listed.

3. Select a Section and click **Assign Maintenance**.

The **Assign Maintenance Standard** dialog box is displayed.

4. Enter the year from which the Maintenance Standard will be considered for implementation, select a Maintenance Standard, and click **OK**.

The dialog box is closed, returning you to the **Alternative Details** dialog box. When you select a Section, the standards that have been assigned to the Section/alternative combination are shown in the Assignments column.

### 7.14.3 Assigning Improvement Standards

1. In the **Alternatives** tab-page of the **Project** window, select the alternative that you want to assign Improvement Standards to.

2. Click **Edit Alternative**.

The **Alternative Details** dialog box is displayed. The Description field shows the name of the alternative that you are defining Improvement Standards for. The Sections that you selected for the Project are listed.
3 Select a Section and click **Assign Improvement**.

The **Assign Improvement Standard** dialog box is displayed.

4 Enter the year from which the Improvement Standard will be considered for implementation, and select an Improvement Standard.

Road improvements may have associated benefits, costs, and traffic effects. To specify exogenous benefits and costs for an Improvement Standard, see Section 7.13.4. To define generated traffic for an Improvement Standard, see Section 7.13.5.

5 Click **OK**.

The dialog box is closed, returning you to the **Alternative Details** dialog box. When you select a Section, the standards that have been assigned to the Section/alternative combination are shown in the Assignments column.

- You can make alterations to standard assignments you have made. Select the Section, select the assignment, and click **Edit Assignment**.
- You can remove a standard assignment. Select the Section, select the assignment, and click **Remove Assignment**.
- You can copy standard assignments from one Section to another. Select the Section that you want to copy from and click **Copy Assignment**, Select the Section that you want to copy to and click **Paste Assignment**.
7.14.4 Defining diverted traffic

You can define diverted traffic for each Project alternative when you use the 
**Analyse by Project** analysis mode. The traffic diversion facility is used to 
model traffic diversions resulting from a Project alternative.

1. In the **Alternative Details** dialog box, click **Traffic Diversion**.

   The **Traffic Diversion for Alternative** dialog box is displayed. The 
   Sections that you selected for the Project are listed in a spreadsheet. The 
   spreadsheet also shows the AADT values that you specified when 
   defining normal traffic for the Project.

2. Click **Add Diversion Period**.

   The **Traffic Diversion Period** dialog box is displayed.

3. Enter a description and period start year. The start year cannot be before 
   the second year of analysis.

4. Click **OK** to return to the **Traffic Diversion for Alternative** dialog box.

   A column is added to the spreadsheet for the new diversion period.

5. Click a Section row in the diversion period column.

6. Click **Edit Diversion Details**.

   The **Traffic Diversion Details** dialog box is displayed. The Vehicle 
   Types that you selected for the Project are listed. Motorised and non-
   motorised Vehicle Types are separated onto two tab-pages.

7. Select the growth type and enter the initial traffic compositions and 
   growth.

8. Click **OK**.

9. Repeat steps 5 to 8 for each Section that you want to define diverted 
   traffic for.
10 When you have finished defining diverted traffic, click **OK** in the **Traffic Diversion for Alternative** dialog box to save the changes.

- In step 2 above, you can make alterations to a diversion period. Click in the diversion period column and click **Edit Diversion Period**.
- In step 2 above, you can delete a diversion period. Click in the diversion period column and click **Delete Diversion Period**.

### 7.14.5 Defining new Sections

If you are using the **Analyse by Project** analysis mode, you can define new Sections for one or more Project alternatives. This allows you to compare Project alternatives with and without a new Section.

1. In the **Alternative Details** dialog box, click **Add New Section**.

   The **New Construction Section Option** dialog box is displayed.

2. Enter a name for the new Section, the start year, and the duration of construction. Complete the other fields as necessary.

3. Click **Normal Traffic**.

   The **Normal Traffic Details** dialog box is displayed. The Vehicle Types that you selected for the Project are listed. Motorised Vehicle Types and non-motorised Vehicle Types are separated into two tab-pages.

4. Define the normal traffic details for the new Section:
- The sum of the initial compositions must be 100%.
- Enter traffic growth values for first year of analysis. Use the buttons to add, edit and delete traffic growth periods as necessary.

5 Click **OK** to save the changes and return to the **New Construction Section Option** dialog box.

6 Click **Section Details**.

The **Section** dialog box is displayed. It is divided into four tab-pages: **Definition**, **Geometry**, **Pavement** and **Condition**.

![Section dialog box](image)

7 Work through the tab-pages and enter the necessary values. See Section 4.12.1 for details of how to use the SNP calculation wizard in the **Pavement** tab-page.

8 When you have finished defining the new Section, click **OK** to save the changes and return to the **New Construction Section Option** dialog box.

9 Click **OK** to save the changes and return to the **Alternative Details** dialog box.

The new Section is added to the list. The icon that is used for a Section added in this way is slightly different to the icon used for Sections already included in the Project.

- You can make alterations to a new Section. Select the Section and click **Edit New Section**.
- To remove a new Section, select the Section and click **Remove New Section**.

### 7.15 Customising the analysis run

1 In the **Workspace** window, create or open a Project.

The **Project** window is displayed. The **Define Project Details** workflow button is selected and the **General** tab-page is active.

2 Click the **Analyse Projects** workflow button.

The **Setup Run** tab-page is active.
The check boxes on this tab-page allow you to include / exclude the following models from the analysis:

- Economic analysis
- Accident costs
- Energy balance
- Emissions
- Acceleration effects

Deciding which of these models to include / exclude will depend upon the requirements of the particular Project. Typically, you should only include those models that you require, as each additional model will reduce the speed of the analysis run.

The acceleration effects model is different from the others listed here in the sense that the others merely affect the types of outputs that are produced. If a particular model isn’t included then the respective results will not be calculated. Acceleration effects on the other hand will always be calculated. The setting of the Acceleration effects control determines the method of calculation and therefore the actual results. If selected, then the acceleration effects indicators are calculated using the current congested speed and acceleration noise; if not, then a fixed default is used regardless of the values for speed and acceleration noise.

The setting of the Write Log File check-box determines whether a log file is produced for the analysis run. The log file is a detailed trace of all the individual calculations performed during the course of the analysis. The log file is written to the filename `hdm4log.txt` in the HDM-4 installation folder. The log file is intended for use by modellers and testers.

The content of the log file is very detailed. As a result, the file can become very large even for a relatively small Project (e.g. 12MB is not uncommon). This has a detrimental effect on analysis speed. If analysis speed is important, and you do not need the detailed calculation results, then the log file should be disabled. For further discussion of methods of improving analysis performance please see Section 12.3.
7.16 Running the analysis

1. In the **Workspace** window, create or open a Project.

The **Project** window is displayed. The **Define Project Details** workflow button is selected and the **General** tab-page is active.

Before attempting to run an analysis, you must define Project details and specify alternatives.

2. Click the **Analyse Projects** workflow button.

3. Click the **Run Analysis** tab.

4. Click **Start**.

As the Project is analysed, messages are displayed in the list box and the status of the analysis is shown below the list box.

- If vital information has not been supplied, you are warned and the analysis run stops. The message tells you which information is missing. Supply the information and start the run again.
- If non-vital information has not been supplied, you are warned, but the run continues.
- At the end of the analysis, you can view a complete warning message. Select the message in the list box and click **View**.
- You can abort an analysis at any time by clicking **Abort**.

7.17 Generating reports

1. In the **Workspace** window, create or open a Project.

The **Project** window is displayed. The **Define Project Details** workflow button is selected and the **General** tab-page is active.
Before attempting to generate reports, you must complete an analysis run.

2 Click the **Generate Reports** workflow button.

The **Select Reports** tab-page is displayed.

3 Expand a folder and select a report.

4 Click **Generate Report**.

The report is displayed.

For more information about reports, see Section 10.
8 Programme analysis

8.1 Key concepts

An HDM-4 Programme Analysis allows you to generate a short to medium term programme of works for a selected set of Sections which maximises the economic return subject to budgetary constraints. The investment alternatives defined depend on the mode of analysis selected; Multi-year Forward Programming or Life Cycle Analysis. Each method allows the user to define a combination of maintenance and/or improvement standards for a Section. In the case of Life Cycle Analysis, several investment alternatives can be defined. Multi-year Forward Programming allows you to enter one set of standards and analyse the benefit of performing the work when required or delaying the work until the end of the analysis period.

8.2 Software overview

A key feature of the Programme window (shown below) is the five workflow buttons on the left-hand side.

![Programme window](image)

The following table shows how the workflow buttons guide you through the process of defining and running a Programme analysis.
<table>
<thead>
<tr>
<th>Workflow button</th>
<th>Tab-page</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| Define Project Details | General                  | 1 Specify the Road Network that contains the Sections to be analysed.  
2 Specify the Vehicle Fleet that contains the Vehicle Types to be analysed.  
3 Specify general Project information such as the start year, duration, and output Currency.  
4 Specify the analysis mode. There are two modes of analysis:  
   - Life Cycle Analysis  
     Determines the best investment from a set of alternatives.  
   - Multi-year Forward Programming  
     Determines whether the work should be performed during this budget period, or delayed.  
5 Select specific Sections for analysis.  
6 Select specific Vehicle Types for analysis.  
7 Define the traffic composition and expected growth for the Section/ Vehicle Type combinations. |
| Specify Standards Assignments | Alternatives (for a Life Cycle Analysis) | 8 The steps depend on the analysis mode you are using:  
   - For a Life Cycle Analysis, define the set of alternatives to be analysed.  
   - For a Multi-year Forward Programme, define the Maintenance Standards and Improvements for each Section. |
| Generate Programme | Perform Run              | 9 Customise the run setup.  
   - For a Life Cycle Analysis, specify the base alternative.  
   - For a Multi-year Forward Programme, specify whether an economic analysis should be performed. An unconstrained Programme is generated if economic analysis is not selected. |
| Perform Budget Optimisation | Work Programme           | 10 Run the analysis. If vital information is missing, you are informed. You must supply the necessary information so that HDM-4 can complete the run. The time required to perform the analysis depends on the complexity of the specified Programme. |
| Generate Reports  | Select Reports           | 11 The generated work programme is displayed. If you want to perform a budget optimisation, you can manually select works that you do not want to be considered for optimisation.  
12 Define budget periods and values (Life Cycle Analysis only).  
13 Define the optimisation parameters.  
14 Run the budget optimisation.  
15 The optimised work programme is displayed.  
16 Generate reports and examine the results of the run. |
HDM-4 places no restriction on the number of Programmes that can be created. The only constraint is the amount of free disk space on your PC.

### 8.3 Creating Programmes

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.

2. Select Programme and click **OK**.

   The **New Programme** dialog box is displayed.

3. Enter a name for the new Programme, and select a Road Network and Vehicle Fleet.

4. Click **OK**.

   The **Programme** window is displayed. The **Define Programme Details** workflow button is selected and the **General** tab-page is active.

5. Enter a description for the Programme.
6 Select the analysis mode:

**Life-cycle:** This option allows you to compare two or more alternatives comprising different works for the selected sections.

See Section 8.13.

**Multi-year forward Programme:** This option is a simplification of the lifecycle method. It compares the benefit of performing capital works when triggered, and postponing the capital works to the first year after the budget period.

See Section 8.14.

7 In the Currencies group, select an output Currency from the drop-down list.

8 Edit the other information on the General tab-page as necessary. You can now work through the tab-pages to select Sections and Vehicle Types, and define traffic.

When you have finished working with the Programme, click **Save** before closing the window. If do not click **Save**, your changes will be lost.

The new Programme is added to the **Workspace** window. To view it, see Section 8.5.

In step 2 above, if the **Programmes** folder or any existing Programme is selected in the **Workspace** window, the Programme item will be automatically selected in the **New HDM-4 Item** dialog box, and you will only need to click **OK**.

### 8.4 Creating Programmes based on existing Programmes

If you want to create a Programme that is similar to an existing one, you can copy the existing Programme and edit the copy as necessary.

1 In the **Workspace** window, select the Programme that you wish to copy.

2 To copy the selected Programme, do one of the following:

   - Click **Copy**
   - With the **Workspace** window active, select **Copy** from the **Workspace** menu

The **Copy Programme** dialog box is displayed.

3 The name of the Programme you wish to copy is shown. In the **To edit** box, enter the name of the new Programme. This name must be unique.

4 Click **OK**.

The new Programme is added to the **Workspace** window.

To view the new copy, see Section 8.5 below.
8.5 Viewing / editing Programmes

1. In the Workspace window, expand the Programmes folder.

2. To open a Programme, do one of the following:
   - Select a Programme and click Open
   - Select a Programme. With the Workspace window active, select Open from the Workspace menu
   - Double-click a Programme

The Programme window is displayed. The Define Programme Details workflow button is selected and the General tab-page is active.

3. When you have finished working with the Programme, click Save to save any changes.

8.6 Deleting Programmes

1. In the Workspace window, select the Programme that you wish to delete.

2. To delete the selected Programme, do one of the following:
   - Click Delete
   - With the Workspace window active, select Delete from the Workspace menu

   You are prompted to confirm the deletion. Click Yes to delete the Programme, or No to cancel the delete action.

   The deleted Programme is no longer displayed in the Workspace window.

   - When you delete a Programme, associated alternatives, traffic and run settings are also deleted.
   - You cannot undo a deletion.
8.7 Renaming Programmes

1. In the **Workspace** window, select the Programme that you wish to rename.

2. To rename the selected Programme, do one of the following:
   - Click **Rename**
   - With the **Workspace** window active, select **Rename** from the **Workspace** menu

   The **Rename Programme** dialog box is displayed.

3. The current name of the Programme you wish to rename is shown. In the **To** edit box, enter the new name for the Programme. The new name must be unique.

4. Click **OK**.

   The renamed Programme is displayed in the **Workspace** window.

   To work with the renamed Programme, see Section 8.4.

8.8 Exporting Programmes

When you export Programme data from HDM-4, a number of files are created—a .dbf file and several .hdbf files. If you are using the export facility to exchange data with other HDM-4 users, you must supply all the files. When importing the Programme, only the .dbf file is seen by the importer.

1. In the **Workspace** window, expand the **Programmes** folder and select a Programme.

2. Click **Export**.

   The **Browse for Folder** dialog box is displayed.

3. Select the folder in which the export file is to be stored.

4. Click **OK**.

   You can only export one Programme at a time. If you want to export a number of Programmes one after the other, select a different folder for each Programme. **Do not** rename any of the files.
8.9 Importing Programmes

You can import Programme data that was originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the **Workspace** window active, select **Import** from the **Workspace** menu.

   The **Import HDM-4 Export File** dialog box is displayed.

2. Go into the folder that contains the files to be imported.

3. Select the Programme file to be imported and click **Open**.

   You are informed if a Programme of the same name already exists. You are prompted to rename the Programme that is being imported.

When you import a Programme, other items that are used by the Programme are also imported (for example, Vehicle Fleet and Maintenance Standards).

8.10 Selecting Sections for a Programme

1. In the **Workspace** window, create or open a Programme.

   The **Programme** window is displayed. The **Define Programme Details** workflow button is selected and the **General** tab-page is active.

2. Click the **Select Sections** tab.

   In a new Programme, all Sections in the Road Network are initially listed, but none are selected for the Programme.

3. Click the buttons in the Include column to select/de-select Sections. Selected Sections are marked with a ✓.
When you have finished working with the Programme, click **Save** before closing the window. If do not click **Save**, your changes will be lost.

- You can choose to display or hide unselected Sections by ticking or clearing the **Show unselected Sections** check box.
- Click **Unselect All** to exclude all Sections from the Programme. The ✓ is removed from all the Section rows.
- You can select Sections by specifying selection criteria (see Section 7.10.1).
- You can group Sections (see Section 8.10.1).
- Click **View/Edit Section** to display the **Section** dialog box.
- Click **View/Edit Network** to display the **Road Network** window.

### 8.10.1 Grouping Sections

Sections can be assigned to groups which are then considered together when performing budget optimisation.

1. In the Programme window **Select Sections** tab-page, click **Groups**.

   The **Network Section Groups** dialog box is displayed.

2. Click **Add New** and enter a name and description for the group.
3 Add Sections to the group using one of the following methods:

- Click the buttons in the Include column to select/ de-select Sections. Selected Sections are marked with a ✓
- Click Select by criteria and specify selection criteria (see Section 7.10.1)

4 Click Finished.

The group is added to the list.

- You can choose to display or hide unselected Sections by ticking or clearing the Show unselected sections check box.
- You can make changes to a group. Select the group and click Edit.
- You can delete a group. Select the group and click Delete.

### 8.11 Selecting Vehicle Types to include in a Programme

1 In the **Workspace** window, create or open a Programme.

The Programme window is displayed. The Define Programme Details workflow button is selected and the General tab-page is active.

2 Click the **Select Vehicles** tab.

In a new Programme, all Vehicle Types in the Vehicle Fleet are listed and marked with a ✓ to show they are included in the Programme.
3 Click the buttons in the Include column to de-select/select Vehicle Types.

- Unselected Vehicle Types are listed only when you tick the Show unselected vehicles check box.
- The Include NMT in analysis option is only enabled if non-motorised vehicles are defined in the selected vehicle fleet.
- You can exclude non-motorised Vehicle Types from the analysis by clearing the Include NMT in analysis check box.
- Click View/Edit Vehicle to display the Vehicle Attributes dialog box.
- Click View/Edit Fleet to display the Vehicle Fleet window.

8.12 Defining normal traffic

Define normal traffic for each Section you have selected for the Programme. Specify the initial traffic mix and the traffic growth for the selected Vehicle Types.

1 In the Workspace window, create or open a Programme.

The Programme window is displayed. The Define Programme Details workflow button is selected and the General tab-page is active.

You must select Sections and Vehicle Types before you can define traffic.

2 Click the Define Normal Traffic tab.

The Sections that you selected for the Programme are listed. You can now define traffic details for each Section.
3 Click anywhere in a Section row and click **Edit Section Traffic Details**.

The **Normal Traffic Details** dialog box is displayed. The Vehicle Types that you selected for the Programme are listed. Motorised Vehicle Types and non-motorised Vehicle Types are separated into two tab-page pages.

4 Define the normal traffic details:
   - The sum of the initial compositions must be 100%.
   - Enter traffic growth values for first year of analysis. Use the buttons to add, edit and delete traffic growth periods as necessary.

You can copy traffic growth periods and compositions from one Section to another. Click the Section row with the traffic details you want to copy. Click **Copy**. Select the Section rows where you want to paste the traffic details. Click **Paste**.

### 8.13 Life-cycle analysis

#### 8.13.1 Defining alternatives

If you want to analyse data using the life-cycle method, you must define a base alternative and at least one other.

1 In the **Workspace** window, create or open a Programme.
The **Programme** window is displayed. The Define Programme Details workflow button is selected and the **General** tab-page is active.

2. Click the **Life-cycle** option button.

3. Click the **Specify Standards Assignments** workflow button.

The **Alternatives** tab-page is displayed.

4. Click **Add New Alternative**.

The **New Alternative** dialog box is displayed.

3. Enter a name and click **OK**.

The new alternative is added to the list. To define Maintenance and Improvement Standards for alternative/Section combinations, see Section 8.13.2 and Section 8.13.3.

- In step 3 above, tick or clear the **View Details** check box to display or hide Sections, and assigned Maintenance and Improvement Standards.
You can copy an alternative by selecting it and clicking **Copy Alternative**. A new copy of the alternative with a unique name is added to the list.

You can delete an alternative by selecting it and clicking **Delete Alternative**. The alternative no longer appears in the list.

You can add, edit or delete Maintenance Standards by clicking **Edit Standards**.

### 8.13.2 Assigning Maintenance Standards

1. In the **Alternatives** tab-page of the **Programme** window, select the alternative that you want to assign Maintenance Standards to.

2. Click **Edit Alternative**.

   The **Alternative Details** dialog box is displayed. The Description field shows the name of the alternative that you are defining Maintenance Standards for. The Sections that you selected for the Programme are listed.

3. Select a Section and click **Assign Maintenance**.

   The **Assign Maintenance Standard** dialog box is displayed.

4. Enter the year from which the Maintenance Standard will be considered for implementation, select a Maintenance Standard, and click **OK**.

   The dialog box is closed, returning you to the **Alternative Details** dialog box. When you select a Section, the standards that have been assigned to the Section/alternative combination are shown in the Assignments column.
8.13.3 Assigning Improvement Standards

1. In the Alternatives tab-page of the Programme window, select the alternative that you want to assign Improvement Standards to.

2. Click Edit Alternative.

   The Alternative Details dialog box is displayed. The Description field shows the name of the alternative that you are defining Improvement Standards for. The Sections that you selected for the Programme are listed.

3. Select a Section and click Assign Improvement.

   The Assign Improvement Standard dialog box is displayed.

4. Enter the year from which the Improvement Standard will be considered for implementation, and select an Improvement Standard.

   Road improvements may have associated benefits, costs, and traffic effects. To specify exogenous benefits and costs for an improvement, see Section 7.13.4. To define generated traffic for an improvement, see Section 7.13.5.

5. Click OK.

   The dialog box is closed, returning you to the Alternative Details dialog box. When you select a Section, the standards that have been assigned to the Section/alternative combination are shown in the Assignments column.
You can make alterations to the standard assignments you have made to a Section. Select the Section, select the assignment, and click **Edit Assignment**.

You can remove a standard assignment. Select the Section, select the assignment, and click **Remove Assignment**.

You can copy standard assignments from one Section to another. Select the Section that you want to copy from and click **Copy Assignment**. Select the Section that you want to copy to and click **Paste Assignment**.

### 8.14 Multi-year forward Programme analysis

#### 8.14.1 Assigning Work Standards

1. In the **Workspace** window, create or open a Programme.
   
   The **Programme** window is displayed. The **Define Programme Details** workflow button is selected and the **General** tab-page is active.

2. Click the **Multi-year forward Programme** option button.

3. Click the **Specify Standards Assignments** workflow button.
   
   The **Work Programming** tab-page is displayed. The Sections you chose for the Programme are listed in the spreadsheet.
4 Click the Maintenance column for the first Section.
5 Click **Assign standard**.
   The **Assign Standard** dialog box is displayed.
![Assign Standard dialog box]
6 Select a standard and click **Select**.
   The Maintenance Standard is displayed into the spreadsheet.
7 Repeat this procedure as required for the Improvement column, the Maintenance After Improvement column, and for each of the listed Sections.
   When you have finished working with the Programme, click **Save** before closing the window. If do not click **Save**, your changes will be lost.
   In step 4, you can select more than one Section if you want to assign the same standard to each.

### 8.15 Generating a work programme

1 In the **Workspace** window, create or open a Programme.
   The **Programme** window is displayed. The **Define Programme Details** workflow button is selected and the **General** tab-page is active.
   Before attempting to generate a work programme, you must define Programme details and assign Work Standards.
2 Click the **Generate Programme** workflow button.
3 Click **Run Setup**.
   The **Run Setup** dialog box is displayed.
![Run Setup dialog box]
4 Complete the fields according to the type of analysis you are doing:
Life-cycle analysis
Choose a base alternative from the drop-down list.

Multi-year forward programming—unconstrained
Select the option button **Perform run without economic analysis**. If you choose this option no economic indicators will be calculated, and you will **not** be able to perform a budget optimisation after running the analysis.

Multi-year forward programming—constrained
Select the option button **Perform run with economic analysis**. If you choose this option, you will be able to perform a budget optimisation after running the analysis (see Section 8.16).

Tick the check boxes for the additional options you want to run. The options are:

- Accident costs
- Energy balance
- Emissions
- Acceleration effects

Deciding which of these models to include / exclude will depend upon the requirements of the particular Programme. Typically, you should only include those models that you require, as each additional model will reduce the speed of the analysis run.

The acceleration effects model is different from the others listed here in the sense that the others merely affect the types of outputs that are produced. If a particular model isn’t included then the respective results will not be calculated. Acceleration effects on the other hand will always be calculated. The setting of the Acceleration effects control determines the method of calculation and therefore the actual results. If selected, then the acceleration effects indicators are calculated for the current congested speed and acceleration noise; if not, then a fixed default is used regardless of the values for speed and acceleration noise.

The setting of the **Write Log File** check-box determines whether a log file is produced for the analysis run. The log file is a detailed trace of all the individual calculations performed during the course of the analysis. The log file is written to the filename **hdm4log.txt** in the HDM-4 installation folder. The log file is intended for use by modellers and testers.

The content of the log file is very detailed. As a result, the file can become very large even for a relatively small Project (e.g. 12MB is not uncommon). This has a detrimental effect on analysis speed. If analysis speed is important, and you do not need the detailed calculation results, then the log file should be disabled. For further discussion of methods of improving analysis performance please see Section 12.3.

6 Click **OK**.

7 Click **Start**.
As the Programme is analysed, messages are displayed in the list box and the status of the analysis is shown below the list box.

8 Click the **Work Programme** tab.

The work programme is displayed. The work programme maximises the Net Present Value irrespective of budget constraints.

9 If you are performing a life-cycle analysis or a constrained multi-year forward Programme, you can select the work programme for a Section and exclude it from budget optimisation. Click the Section row and click **Manual Assignment**. The row is shown in italics.

   - If vital information has not been supplied, you are warned and the analysis run stops. The message tells you which information is missing. Supply the information and start the run again.
   - If non-vital information has not been supplied, you are warned, but the run continues.
   - At the end of the Programme analysis, you can view a complete warning message. Select the message in the list box and click **View**.
   - You can abort a Programme analysis at any time by clicking **Abort**.

### 8.16 Optimisation using budget constraints

This facility is only available if you perform a life-cycle analysis or a constrained multi-year forward Programme.

1 In the **Workspace** window, create or open a Programme.

   The **Programme** window is displayed. The **Define Programme Details** workflow button is selected and the **General** tab-page is active.

2 Click the **Perform Budget Optimisation** workflow button.

   The **Define Budget** tab-page is displayed. A budget period equivalent to the Programme duration is listed in the spreadsheet.
3 Define budget periods.
   - If you are optimising a budget for a life-cycle analysis, you can insert, append and delete budget periods.
   - If you are optimising a budget for a constrained multi-year forward Programme, only one budget period is possible and the **Insert Period**, **Append Period** and **Delete Period** buttons are not available.

4 Click **Optimisation Setup**.
   The Optimisation Setup dialog box is displayed.

5 Enter a minimum incremental value and a value for the efficiency frontier zone.

6 Click **OK**.

7 Click **Perform Budget Optimisation**.
   As the budget is optimised, messages are displayed in the list box and the processing status is shown below the list box.

8 Click the **Work Programme** tab.
   The optimised work programme is displayed for the selected Sections.

### 8.17 Generating reports

1 In the **Workspace** window, create or open a Programme.
   The **Programme** window is displayed. The **Define Programme Details** workflow button is selected and the **General** tab-page is active.
Before attempting to generate reports, you must complete an analysis run.

2. Click the **Generate Reports** workflow button.

The **Select Reports** tab-page is displayed.

3. Expand a folder and select a report.

4. Click **Generate Report**.

   The report is displayed.

   ![Diagram of Select Reports tab-page]

   For more information about reports, see Section 10.
9 Strategy analysis

9.1 Key concepts

An HDM-4 Strategy Analysis allows you to generate a medium to long term investment strategy for a selected set of Sections. For each Strategy Analysis, you define optimisation criterion and budget constraints. Three optimisation methods are available: Maximise NPV, Maximise dIRI, and Minimise Cost for Target IRI. The investment alternative is a combination of Maintenance and Improvement Standards that are applied to a Section.

When defining a Strategy Analysis you can either select Sections from a predefined Road Network, or you can define a Network Matrix within the Strategy. The Network Matrix option allows you to define a number of representative Sections using aggregate parameters to represent the Road Network being analysed.

9.2 Software overview

A key feature of the **Strategy** window (shown below) is the five workflow buttons on the left-hand side.

![Strategy window](image)

The following table shows how the workflow buttons guide you through the process of defining and running a Strategy analysis.
9.3 Creating Strategy analyses

1. Do one of the following:
   - Click New in the Workspace window
With the **Workspace** window active, select **New** from the **Workspace** menu.

The **New HDM-4 Item** dialog box is displayed.

![New HDM-4 Item dialog box]

2 Select Strategy and click **OK**.

The **New Strategy Analysis** dialog box is displayed.

![New Strategy Analysis dialog box]

3 Enter a name and select a Vehicle Fleet. Select one of the option buttons:

- **Create new network matrix**—allows you to create representative Sections for the Strategy analysis.

- **Use existing network**—allows you to choose Sections from an existing Road Network. Select the Road Network that you want to use from the drop-down list.

4 Click **OK**.

The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.

If you chose to select Sections from an existing Road Network, the **Select Sections** tab-page is displayed (see Section 9.11).

![Select Sections tab-page]

If you chose to create a network matrix, the **Network** tab-page is displayed (see Section 9.10).

![Network tab-page]

5 Enter a description for the Strategy analysis.

6 Select an optimisation method:

**Maximise NPV:** Maximises the Net Present Value when performing a budget optimisation.
Maximise dIRI: Maximises the change in roughness when performing a budget optimisation.

Minimise cost for target IRI: Maximises the cost for a target roughness when performing a budget optimisation.

7 In the Currencies group, select an output Currency from the drop-down list.

8 Edit the other information on the General tab-page as necessary. You can now work through the tab-pages to select or create Sections, select Vehicle Types, and define traffic.

When you have finished working with the Strategy analysis, click Save before closing the window. If do not click Save, your changes will be lost.

The new Strategy analysis is added to the Workspace window. To view it, see Section 9.5.

In step 2 above, if the Strategies folder or any existing Strategy analysis is selected in the Workspace window, the Strategy item will be automatically selected in the New HDM-4 Item dialog box, and you will only need to click OK.

9.4 Creating Strategy analyses based on existing Strategy analyses

If you want to create a Strategy analysis that is similar to an existing one, you can copy the existing analysis and edit the copy as necessary.

1 In the Workspace window, select the Strategy analysis that you wish to copy.

2 To copy the selected Strategy analysis, do one of the following:
   - Click Copy
   - With the Workspace window active, select Copy from the Workspace menu

The Copy Strategy dialog box is displayed.

3 The name of the Strategy analysis you wish to copy is shown. In the To edit box, enter the name of the new Strategy analysis. This name must be unique.

4 Click OK.

The new Strategy analysis is added to the Workspace window.

To work with the new copy, see Section 9.5 below

9.5 Viewing / editing Strategies

1 In the Workspace window, expand the Strategies folder.
2 To open a Strategy analysis, do one of the following:

- Select a Strategy analysis and click **Open**
- Select a Strategy analysis. With the **Workspace** window active, select **Open** from the **Workspace** menu.
- Double-click a Strategy analysis

The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.

3 When you have finished working with the Strategy analysis, click **OK** to save any changes.

In steps 1 and 2 above, you can double-click the Strategy analysis in the **Workspace** window.

### 9.6 Deleting Strategies

1 In the **Workspace** window, select the Strategy analysis that you wish to delete.

2 To delete the selected Strategy analysis, do one of the following:

- Click **Delete**
- With the **Workspace** window active, select **Delete** from the **Workspace** menu

You are prompted to confirm the deletion. Click **Yes** to delete the Strategy analysis, or **No** to cancel the delete action.

The deleted Strategy analysis is no longer displayed in the **Workspace** window.

- When you delete a Strategy analysis, associated network matrices, alternatives, traffic and run settings are also deleted.
- You cannot undo a deletion.
9.7 Renaming Strategies

1. In the Workspace window, select the Strategy analysis that you wish to rename.

2. To rename the selected Strategy analysis, do one of the following:
   - Click Rename
   - With the Workspace window active, select Rename from the Workspace menu

   The Rename Strategy dialog box is displayed.

3. The current name of the Strategy analysis you wish to rename is shown. In the To edit box, enter the new name for the Strategy analysis. The new name must be unique.

4. Click OK.

   The renamed Strategy analysis is displayed in the Workspace window.

To work with the renamed Strategy analysis, see Section 9.5.

9.8 Importing Strategy analyses

You can import Strategy analysis data that was originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the Workspace window active, select Import from the Workspace menu.

   The Import HDM-4 Export File dialog box is displayed.

2. Go into the folder that contains the file to be imported.

3. Select the file to be imported and click Open.

   You are informed if a Strategy analysis of the same name already exists. You are prompted to rename the Strategy analysis that is being imported.

When you import a Strategy analysis, other items that are used by the Strategy analysis are also imported (for example, Vehicle Fleet and Maintenance Standards).
9.9 Exporting Strategy analyses

When you export Strategy analysis data from HDM-4, a number of files are created—a `.dbf` file and several `.hdbf` files. If you are using the export facility to exchange data with other HDM-4 users, you must supply all the files. When importing the Strategy analysis, only the `.dbf` file is seen by the importer.

1. In the **Workspace** window, expand the **Strategies** folder and select a Strategy analysis.
2. Click **Export**.
   
The **Browse for Folder** dialog box is displayed.

![Browse for Folder dialog box]

3. Select the folder in which the export file is to be stored.
4. Click **OK**.

You can only export one Strategy analysis at a time. If you want to export a number of Strategy analyses one after the other, select a different folder for each Strategy analysis. **Do not** rename any of the files.

9.10 Creating a network matrix

You can create representative Sections in a network matrix only if you selected the **Create new network matrix** option button when creating this Strategy analysis.

1. In the **Workspace** window, create or open a Strategy analysis.
   
The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.
2. Click the **Network** tab.
3 Click **Add new Section**.

The **New Section** dialog box is displayed.

Do one of the following:

- to create a new Section select the **based on aggregate data** option button and click **OK**.
- to create a Section that is similar to an existing one select the **based on existing Section** option button. In the drop-down list, select the existing Section that you wish to copy and click **OK**.

The **Section** dialog box is displayed. The data for the new Section is a copy of the data in the existing Section.

The **New Section from Aggregate Data** dialog box is displayed.

### 9.11 Selecting Sections for a Strategy analysis

You can select Sections only if you selected the **Use existing network** option button when creating this Strategy analysis.

1 In the **Workspace** window, create or open a Strategy analysis.

   The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.

2 Click the **Select Sections** tab.

   In a new Strategy analysis, all Sections in the Road Network are initially listed, but none are selected for the Strategy analysis.
3 Click the buttons in the Include column to select / de-select Sections. Selected Sections are marked with a ✓.

- You can choose to display or hide unselected Sections by ticking or clearing the Show unselected Sections check box.
- Click Unselect All to exclude all Sections from the Strategy analysis. The ✓ is removed from all the Section lines.
- You can also select Sections by specifying selection criteria (see Section 7.10.1).
- Click View/Edit Section to display the Section dialog box.
- Click View/Edit Network to display the Road Network window.

### 9.12 Selecting Vehicle Types to include in a Strategy analysis

1 In the Workspace window, create or open a Strategy analysis.

   The Strategy window is displayed. The Define Strategy Details workflow button is selected and the General tab-page is active.

2 Click the Select Vehicles tab.

   In a new Strategy analysis, all Vehicle Types in the Vehicle Fleet are listed and marked with a ✓ to show they are included in the Strategy analysis.

3 Click the buttons in the Include column to de-select / select Vehicle Types.
Unselected Vehicle Types are listed only when you tick the **Show unselected vehicles** check box.

You can exclude non-motorised Vehicle Types from the analysis by clearing the **Include NMT in analysis** check box.

Click **View/Edit Vehicle** to display the **Vehicle Attributes** dialog box.

Click **View/Edit Fleet** to display the **Vehicle Fleet** window.

### 9.13 Defining normal traffic

Define normal traffic for each Section you have selected for the Strategy analysis. Specify the initial traffic mix and the traffic growth for the selected Vehicle Types.

1. In the **Workspace** window, create or open a Strategy analysis.
   
   The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.
   
   You must select Sections and Vehicle Types before you can define traffic.

2. Click the **Define Normal Traffic** tab.
   
   The Sections that you specified for the Strategy analysis are listed. You can now define traffic details for each Section.

3. Click anywhere in a Section row and click **Edit Section Traffic Details**.
   
   The **Normal Traffic Details** dialog box is displayed. The Vehicle Types that you selected for the Strategy analysis are listed. Motorised Vehicle Types and non-motorised Vehicle Types are separated into two tab-pages.
Define the normal traffic details:

- The sum of the initial compositions must be 100%.
- Enter traffic growth values for first year of analysis. Use the buttons to add, edit and delete traffic growth periods as necessary.

You can copy traffic growth periods and compositions from one Section to another. Click the Section row with the traffic details you want to copy. Click Copy. Click the Section row where you want to paste the traffic details. Click Paste.

### 9.14 Defining alternatives for a Strategy analysis

1. In the **Workspace** window, create or open a Strategy analysis.

   The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.

2. Click the **Specify Alternatives** workflow button.

3. Click **Add New Alternative**.

   The **New Alternative** dialog box is displayed.
Enter a name and click **OK**.

The new alternative is added to the list. To define Maintenance and Improvement Standards for alternative/Section combinations, see Section 9.14.1 and Section 9.14.2.

- In step 3 above, tick or clear the **View Details** check box to display or hide Sections, and assigned Maintenance and Improvement Standards.
- You can copy an alternative by selecting it and clicking **Copy Alternative**. A new copy of the alternative with a unique name is added to the list.
- You can delete an alternative by selecting it and clicking **Delete Alternative**. The alternative no longer appears in the list.

### 9.14.1 Assigning Maintenance Standards

1. In the **Alternatives** tab-page of the **Strategy** window, select the alternative that you want to assign Maintenance Standards to.

2. Click **Edit Alternative**.

   The **Alternative Details** dialog box is displayed. The Description field shows the name of the alternative that you are defining Maintenance Standards for. The Sections that you selected for the Strategy analysis are listed.

3. Select a Section and click **Assign Maintenance**.

   The **Assign Maintenance Standard** dialog box is displayed.
4 Enter the year from which the Maintenance Standard will be considered for implementation, select a Maintenance Standard, and click OK.

The dialog box is closed, returning you to the Alternative Details dialog box. When you select a Section, the standards that have been assigned to the Section/alternative combination are shown in the Assignments column.

9.14.2 Assigning Improvement Standards

1 In the Alternatives tab-page of the Strategy window, select the alternative that you want to assign Improvement Standards to.

2 Click Edit Alternative.

The Alternative Details dialog box is displayed. The Description field shows the name of the alternative that you are defining Improvement Standards for. The Sections that you selected for the Strategy analysis are listed.

3 Select a Section and click Assign Improvement.

The Assign Improvement Standard dialog box is displayed.
Enter the year from which the Improvement Standard will be considered for implementation, and select an Improvement Standard. 

Road improvements may have associated benefits, costs, and traffic effects. To specify exogenous benefits and costs for an Improvement Standard, see Section 7.13.4. To define generated traffic for an Improvement Standard, see Section 7.13.5.

Click OK.

The dialog box is closed, returning you to the **Alternative Details** dialog box. When you select a Section, the standards that have been assigned to the Section/alternative combination are shown in the Assignments column.

- You can make alterations to the standards assigned to a Section. Select the Section, select the assignment, and click **Edit Assignment**.
- You can remove a standard assignment. Select the Section, select the assignment, and click **Remove Assignment**.
- You can copy standard assignments from one Section to another. Select the Section that you want to copy from and click **Copy Assignment**. Select the Section that you want to copy to and click **Paste Assignment**.

### 9.15 Generating a work programme

1. In the **Workspace** window, create or open a Strategy.
   
   The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.
   
   Before attempting to generate a work programme, you must define Strategy details and specify alternatives.

2. Click the **Generate Strategy** workflow button.

3. Click **Run Setup**.
   
   The **Run Setup** dialog box is displayed.
4 Choose a base alternative from the drop-down list.

5 Tick the check boxes for the additional options you want to run. The options are:
   - Accident costs
   - Energy balance
   - Emissions
   - Acceleration effects

Deciding which of these models to include / exclude will depend upon the requirements of the particular Strategy. Typically, you should only include those models that you require, as each additional model will reduce the speed of the analysis run.

The acceleration effects model is different from the others listed here in the sense that the others merely affect the types of outputs that are produced. If a particular model isn’t included then the respective results will not be calculated. Acceleration effects on the other hand will always be calculated. The setting of the Acceleration effects control determines the method of calculation and therefore the actual results. If selected, then the acceleration effects indicators are calculated for the current congested speed and acceleration noise; if not, then a fixed default is used regardless of the values for speed and acceleration noise.

The setting of the Write Log File check-box determines whether a log file is produced for the analysis run. The log file is a detailed trace of all the individual calculations performed during the course of the analysis. The log file is written to the filename `hdm4log.txt` in the HDM-4 installation folder. The log file is intended for use by modellers and testers.

The content of the log file is very detailed. As a result, the file can become very large even for a relatively small Project (e.g. 12MB is not uncommon). This has a detrimental effect on analysis speed. If analysis speed is important, and you do not need the detailed calculation results, then the log file should be disabled. For further discussion of methods of improving analysis performance please see Section 12.3.

6 Click OK.
7 Click **Start**.

As the Strategy is analysed, messages are displayed in the list box and the status of the analysis is shown below the list box.

8 Click the **Work Programme** tab.

The work programme is displayed.

9 You can select the work programme for a Section and exclude it from budget optimisation. Click the Section row and click **Manual Assignment**. The row is shown in italics.

  - If vital information has not been supplied, you are warned and the analysis run stops. The message tells you which information is missing. Supply the information and start the run again.
  - If non-vital information has not been supplied, you are warned, but the run continues.
  - At the end of the Strategy analysis, you can view a complete warning message. Select the message in the list box and click **View**.
  - You can abort a Strategy analysis at any time by clicking **Abort**.

### 9.16 Optimisation using budget constraints

You must generate a work programme before attempting a budget optimisation.

1 In the **Workspace** window, create or open a Strategy.

The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.

2 Click the **Perform Budget Optimisation** workflow button.

The **Define Budget** tab-page is displayed. A budget period equivalent to the Strategy duration is listed in the spreadsheet.
3 Define budget periods and values

4 Click **Optimisation Setup**.

   The **Optimisation Setup** dialog box is displayed.

   ![Optimisation Setup](image)

5 Enter a minimum incremental value and a value for the efficiency frontier zone.

6 Click **OK**.

7 Click **Perform Budget Optimisation**.

   As the budget is optimised, messages are displayed in the list box and the processing status is shown below the list box.

8 Click the **Work Programme** tab.

   The optimised work programme is displayed for the selected Sections.

### 9.17 Generating reports

1 In the **Workspace** window, create or open a Strategy analysis.

   The **Strategy** window is displayed. The **Define Strategy Details** workflow button is selected and the **General** tab-page is active.

   Before attempting to generate reports, you must complete an analysis run.

2 Click the **Generate Reports** workflow button.

   The **Select Reports** tab-page is displayed.

3 Expand a folder and select a report.
4 Click **Generate Report**.

The report is displayed.

ℹ️ For more information about reports, see Section 10 below.
10 Working with reports

10.1 Key concepts

HDM-4 provides sophisticated reporting facilities for the viewing of input and output data. The reporting facilities were developed using Seagate Crystal Reports. A number of default report templates are provided. These can be added to by downloading new templates from the ISOHDM web-site (www.bham.ac.uk/isohdm). Alternatively, if you have access to the Crystal Reports Designer you can create your own report templates and add them to HDM-4 (see Section 10.4).

Previous sections of this guide have dealt with how to display reports:

- Generating reports for Projects - Section 7.17
- Generating reports for Programmes - Section 8.17
- Generating reports for Strategy analyses - Section 9.17

This section deals with making the most of reports once they have been generated. Every HDM-4 report is displayed in a separate report window, an example of which is shown below:

Typically, an HDM-4 report will be larger than the window in which it is displayed. To move about the report you can use the scroll bars. Alternatively you can resize the window so that more of the report is displayed by dragging the resize box in the bottom right-hand corner of the window.

In addition, you can use the navigation controls which appear on the toolbar. These operate as follows:

- Go to the first page of the report
The other controls that appear on the toolbar operate as follows:

- Print the report
- Export the report to a file
- Change the size of the report to the selected setting

The Print and Export controls are explained in the following sections.

10.2 Printing reports

At the end of a Project, Programme or Strategy analysis, you can generate a report, which is displayed on the screen. To print the report, perform the following steps:

1. Click to print the report.

   The Print dialog box is displayed.

2. Specify whether you want to print all the pages in the report, or a range. You can print several copies of the report and have them collated.

3. Click OK.

10.3 Exporting report data to other applications

You can save generated reports to disk to print later or to export to another software application.

1. When you have generated a report, click to export it to a file.

   The Export dialog box is displayed.
2 Select a format and destination for the export file.

If you intend to print the report file later, select one of the following formats:

- Paginated text
- Rich text format
- Text
- Word for Windows document

If you intend to import the report file into another software application, select one of the following formats:

- Character separated values
- Comma separated values (CSV)
- Excel
- Lotus
- Tab separated text
- Tab separated values

3 You are prompted to enter information, depending on the format that you selected in step 2. The final step is to specify a name and destination for the export file.

![Choose Export File](image)

The default destination folder is `c:\Windows\Temp`, but you can select any folder. HDM-4 also enters a default file name, but, again, you can specify any name.

4 Click **Save**.

The report file is saved and can be printed or imported into other software applications.

When you export a report to a file format other than Seagate Crystal Reports format (.RPT), you may lose some or all of the formatting that appears in your report. However, the program attempts to preserve as much formatting as the export format allows.

### 10.4 Adding user defined reports

You can define additional reports for HDM-4 using Crystal Reports (version 7 and above). Save the report template in the folder `c:\Program Files\HDM-4\Reports`. (If you changed the default folder at installation, store the report template in that folder instead.)
template in the reports subfolder of the HDM-4 installation folder). To make the report available from within HDM-4, perform the following steps:

1. In the **Workspace** window, open any Project, Programme or Strategy analysis.

2. Run an analysis and click the **Generate Reports** workflow button (You cannot click the **Generate Reports** workflow button until you have run an analysis).

   The **Select Reports** tab-page is displayed.

3. Click **Add Report**.

   The **Add Report** dialog box is displayed.

4. Select the report template that you want to add, and the folder in which you would like it to appear. Enter a name for the report.

5. Click **OK**.

   To remove a user-defined report, select it and click **Remove Report**.
11 Configuring HDM-4

11.1 Traffic Flow Patterns

11.1.1 Key concepts

Traffic Flow Patterns are used to represent the varying traffic intensities that occur on roads throughout the day. Different road Sections exhibit different traffic flow patterns according to their use. Examples of Traffic Flow Patterns are:

- Commuter
- Seasonal
- Inter-city

Traffic Flow Patterns are defined as a set of flow periods. A flow period represents the hours of the day (over the course of a year) with the same traffic flow.

For each flow period you should specify:

- Total hours per year (HRYR) that the period occupies, and
- The amount of yearly traffic occurring during the period, as either:
  - The proportion of AADT (HV) that occurs during the period, or
  - The percentage of AADT (PCNADT) that occurs during this period

A number of default road uses are defined in HDM-4. Each has an associated set of flow period data. Changing the selection of road use for a Traffic Flow Pattern causes the corresponding flow period default data to be adopted. To reset the flow period data to the default values for the currently selected road use, click Defaults.
11.1.2 Creating Traffic Flow Patterns

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.

2. Select Traffic Flow Pattern and click **OK**.

   The **Traffic Flow Pattern** dialog box is displayed.

3. Enter a name for the new Traffic Flow Pattern.

4. Add flow periods which define the Traffic Flow Pattern. Click **Add New Period** to add flow periods, and enter flow distribution data for each.

5. Click **OK** to save the Traffic Flow Pattern and close the window.

   The new Traffic Flow Pattern is added to the **Workspace** window. To view it, see Section 11.1.4.

   - In step 2 above, if the **Traffic Flow Patterns** folder or any existing Traffic Flow Pattern is selected in the **Workspace** window, the Traffic Flow Pattern item will be automatically selected in the **New HDM-4 Item** dialog box, and you will only need to click **OK**.

   - Using more flow periods improves accuracy but slows down analysis time.
11.1.3 Creating Traffic Flow Patterns based on existing Traffic Flow Patterns

If you want to create a Traffic Flow Pattern that is similar to an existing one, you can copy the existing pattern and edit the copy as necessary.

1. In the Workspace window, expand the Configuration folder.
2. Expand the Traffic Flow Patterns folder.
3. Select the Traffic Flow Pattern that you wish to copy.
4. To copy the selected Traffic Flow Pattern, do one of the following:
   - Click Copy in the Workspace window
   - With the Workspace window active, select Copy from the Workspace menu

The Copy Traffic Flow Pattern dialog box is displayed.

5. The name of the Traffic Flow Pattern you wish to copy is shown. In the To edit box, enter the name of the new pattern. This name must be unique.
6. Click OK.

The new Traffic Flow Pattern is added to the Workspace window.

To view the new copy, see Section 11.1.4 below.

11.1.4 Viewing / editing Traffic Flow Patterns

1. In the Workspace window, expand the Configuration folder.
2. Expand the Traffic Flow Patterns folder.
3. To open a Traffic Flow Pattern, do one of the following:
   - Select a Traffic Flow Pattern and click Open
   - Select a Traffic Flow Pattern. With the Workspace window active, select Open from the Workspace menu
   - Double-click a Traffic Flow Pattern
The Traffic Flow Pattern dialog box is displayed.

4 Edit the flow distribution data as necessary.

5 When you have finished working with the Traffic Flow Pattern, click OK to save any changes and close the window.

11.1.5 Deleting Traffic Flow Patterns

1 In the Workspace window, expand the Configuration folder.

2 Expand the Traffic Flow Patterns folder.

3 Select the Traffic Flow Pattern that you wish to delete.

4 To delete the selected Traffic Flow Pattern, do one of the following:
   - Click Delete
   - With the Workspace window active, select Delete from the Workspace menu

You are prompted to confirm the deletion. Click Yes to delete the Traffic Flow Pattern, or No to cancel the delete action.

If you click Yes, the deleted Traffic Flow Pattern is no longer displayed in the Workspace window.

- When you delete a Traffic Flow Pattern, all corresponding data are also deleted.

- There may be Sections which use the Traffic Flow Pattern to be deleted. These Sections will be affected by the deletion. You will be informed if this is the case.

- You cannot reverse a deletion.

11.1.6 Renaming Traffic Flow Patterns

1 In the Workspace window, expand the Configuration folder.

2 Expand the Traffic Flow Patterns folder.

3 Select the Traffic Flow Pattern that you wish to rename.
4 To rename the selected Traffic Flow Pattern, do one of the following:
   - Click **Rename**
   - With the **Workspace** window active, select **Rename** from the **Workspace** menu

The **Rename Traffic Flow Pattern** dialog box is displayed.

5 The current name of the Traffic Flow Pattern you wish to rename is shown. In the **To** edit box, enter the new name for the Traffic Flow Pattern. The new name must be unique.

6 Click **OK**.

   The renamed Traffic Flow Pattern is displayed in the **Workspace** window.

   To work with the renamed Traffic Flow Pattern, see Section 11.1.4.

### 11.1.7 Importing Traffic Flow Patterns

You can import Traffic Flow Patterns that were originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1 With the **Workspace** window active, select **Import** from the **Workspace** menu.

   The **Import HDM-4 Export File** dialog box is displayed.

2 Go into the folder that contains the file to be imported.

3 Select one of the following files:
   - **FLOWPERIODS.DBF**
   - **TRAFFICFLOWPERIODS.DBF**

4 Click **Open**.

   - In step 3, all the Traffic Flow Patterns are imported, irrespective of the file you select
   - In step 3, above, you are informed if a Traffic Flow Pattern of the same name already exists. You are prompted to rename the Traffic Flow Pattern that is being imported.
11.1.8 Exporting Traffic Flow Patterns

When you export Traffic Flow Patterns from HDM-4, several .dbf and .hdbf files are created. If you are using the export facility to exchange data with other HDM-4 users, you must supply all the files.

1 In the Workspace window, select Traffic Flow Patterns or any of the folder contents.

2 Click Export.

The Browse for Folder dialog box is displayed.

3 Select the folder in which the export file is to be stored.

4 Click OK.

All the Traffic Flow Patterns are exported irrespective of the item that you select in the Traffic Flow Patterns folder.

11.2 Speed Flow Types

11.2.1 Key concepts

The primary function of HDM-4 Speed Flow Types is to represent the capacity characteristics of different road types. Examples of Speed Flow Types are:

- Single Lane Road
- Intermediate Road
- Two Lane Road
- Four Lane Road

Capacity characteristics are defined in terms of the various parameters (such as ultimate capacity and free flow capacity) that constitute the HDM-4 speed flow curve model.
HDM-4 includes a set of default Road Types. Each Road Type has associated default values for the speed flow parameters. Selecting a Road Type from the drop-down list causes the speed flow parameters to be overwritten with the appropriate defaults. To reset the speed flow parameters to the defaults for the currently selected Road Type, click **Defaults**.

Speed Flow Types also define accident rates and speed model calibration factors for the road types they represent.

### 11.2.2 Creating Speed Flow Types

1. Do one of the following:
   - Click **New** in the **Workspace** window
   - With the **Workspace** window active, select **New** from the **Workspace** menu

   The **New HDM-4 Item** dialog box is displayed.

2. Select Speed Flow Type and click **OK**.

   The **Speed Flow Type** dialog box is displayed.
Enter a name for the new Speed Flow Type.

4 Enter capacity data, accident rates, and speed factors as required.

5 Click OK to save the Speed Flow Type and close the dialog box.

The new Speed Flow Type is added to the Workspace window. To view it, see Section 11.2.4.

In step 2 above, if the Speed Flow Types folder or any existing Speed Flow Type is selected in the Workspace window, the Speed Flow Type item will be automatically selected in the New HDM-4 Item dialog box, and you will only need to click OK.

11.2.3 Creating Speed Flow Types based on existing Speed Flow Types

If you want to create a Speed Flow Type that is similar to an existing one, you can copy the existing type and edit the copy as necessary.

1 In the Workspace window, expand the Configuration folder.

2 Expand the Speed Flow Types folder.

3 Select the Speed Flow Type that you wish to copy.

4 To copy the selected Speed Flow Type, do one of the following:

   - Click Copy in the Workspace window
   - With the Workspace window active, select Copy from the Workspace menu

   The Copy Speed Flow Type dialog box is displayed.

5 The name of the Speed Flow Type you wish to copy is shown. In the To edit box, enter the name of the new Speed Flow Type. This name must be unique.

6 Click OK.
The new Speed Flow Type is added to the Workspace window.

To view the new copy, see Section 11.2.4 below.

11.2.4 Viewing / editing Speed Flow Types

1. In the Workspace window, expand the Configuration folder.
2. Expand the Speed Flow Types folder.
3. To open a Speed Flow Type, do one of the following:
   - Select a Speed Flow Type and click Open
   - Select a Speed Flow Type. With the Workspace window active, select Open from the Workspace menu
   - Double-click a Speed Flow Type

The Speed Flow Type dialog box is displayed.

4. Edit the fields as necessary.
5. When you have finished working with the Speed Flow Type, click OK to save any changes and close the dialog box.

11.2.5 Deleting Speed Flow Types

1. In the Workspace window, expand the Configuration folder.
2. Expand the Speed Flow Types folder.
3. Select the Speed Flow Type that you wish to delete.
4. To delete the selected Speed Flow Type, do one of the following:
   - Click Delete
With the **Workspace** window active, select **Delete** from the **Workspace** menu.

You are prompted to confirm the deletion. Click **Yes** to delete the Speed Flow Type, or **No** to cancel the delete action.

If you click **Yes**, the deleted Speed Flow Type is no longer displayed in the **Workspace** window.

- When you delete a Speed Flow Type, all corresponding data are also deleted.
- There may be Sections which use the Speed Flow Type to be deleted. These Sections will be affected by the deletion. You will be informed if this is the case.
- You cannot reverse a deletion.

### 11.2.6 Renaming Speed Flow Types

1. In the **Workspace** window, expand the **Configuration** folder.
2. Expand the **Speed Flow Types** folder.
3. Select the Speed Flow Type that you wish to rename.
4. To rename the selected Speed Flow Type, do one of the following:
   - Click **Rename**
   - With the **Workspace** window active, select **Rename** from the **Workspace** menu.

   The **Rename Speed Flow Type** dialog box is displayed.

5. The current name of the Speed Flow Type you wish to rename is shown. In the **To** edit box, enter the new name for the Speed Flow Type. The new name must be unique.
6. Click **OK**.

   The renamed Speed Flow Type is displayed in the **Workspace** window.

To work with the renamed Speed Flow Type, see Section 11.2.4.

### 11.2.7 Importing Speed Flow Types

You can import Speed Flow Types that were originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the **Workspace** window active, select **Import** from the **Workspace** menu.

   The **Import HDM-4 Export File** dialog box is displayed.
Double-click the folder that contains the file to be imported.

Select the file to be imported and click Open.

You are informed if a Speed Flow Type of the same name already exists. You must then decide whether to overwrite the existing Speed Flow Type, or to rename the Speed Flow Type that is being imported, or to cancel the import operation.

11.2.8 Exporting Speed Flow Types

You can export Speed Flow Types as a .dbf file which can then be imported by other HDM-4 users.

1. In the Workspace window, expand the Configuration folder and click Speed Flow Types.

2. Click Export.

The Export Speed Flow Type As dialog box is displayed.

3. Double-click the folder in which the export file is to be stored.

4. Enter a file name for the export file.

5. Click Save.

11.3 Climate Zones

11.3.1 Key concepts

Climate Zones are used to represent the climatic conditions found in different parts of a Road Network. The data items that represent these climatic conditions affect pavement deterioration. Climate Zone data are divided into two categories:

- Moisture
Temperature

For each of the two categories, aggregate level parameters are provided. These are Temperature Classification and Moisture Classification. HDM-4 supports a fixed set of Temperature Classifications, each of which has an associated set of defaults for the temperature parameters. Changing the Temperature Classification selected for a Climate Zone causes the corresponding set of temperature data to be adopted.

Similarly, HDM-4 supports a fixed set of Moisture Classifications, each of which has an associated set of defaults for the moisture parameters. Changing the Moisture Classification currently selected for a Climate Zone causes the corresponding set of moisture defaults to be adopted.

To reset the default values for Temperature and Moisture Classifications, click Defaults.

11.3.2 Creating Climate Zones

1. Do one of the following:
   - Click New in the Workspace window
   - With the Workspace window active, select New from the Workspace menu

   The New HDM-4 Item dialog box is displayed.

2. Select Climate Zone and click OK.
   The Climate Zone dialog box is displayed.
3 Enter a name for the new Climate Zone.
4 Click OK to save the Climate Zone and close the dialog box.

The new Climate Zone is added to the **Workspace** window. To view it, see Section 11.3.4.

In step 2 above, if the **Climate Zones** folder or any existing Climate Zone is selected in the **Workspace** window, the Climate Zone item will be automatically selected in the **New HDM-4 Item** dialog box, and you will only need to click **OK**.

### 11.3.3 Creating Climate Zones based on existing Climate Zones

If you want to create a Climate Zone that is similar to an existing one, you can copy the existing Climate Zone and edit the copy as necessary.

1 In the **Workspace** window, expand the **Configuration** folder.
2 Expand the **Climate Zones** folder.
3 Select the Climate Zone that you wish to copy.
4 To copy the selected Climate Zone, do one of the following:
   - Click **Copy** in the **Workspace** window
   - With the **Workspace** window active, select **Copy** from the **Workspace** menu

The **Copy Climate Zone** dialog box is displayed.

5 The name of the Climate Zone you wish to copy is shown. In the **To edit** box, enter the name of the new Climate Zone. This name must be unique.
6 Click **OK**.

The new Climate Zone is added to the **Workspace** window.

To view the new copy, see Section 11.3.4 below.
11.3.4 Viewing / editing Climate Zones

1. In the **Workspace** window, expand the **Configuration** folder.
2. Expand the **Climate Zones** folder.
3. To open a Climate Zone, do one of the following:
   - Select a Climate Zone and click **Open**
   - Select a Climate Zone. With the **Workspace** window active, select **Open** from the **Workspace** menu
   - Double-click a Climate Zone

   The **Climate Zone** dialog box is displayed.

4. Edit the fields as necessary.
5. When you have finished working with the Climate Zone, click **OK** to save any changes and close the dialog box.

   In steps 2 and 3 above, you can alternatively, double-click the Climate Zone in the **Workspace** window.

11.3.5 Deleting Climate Zones

1. In the **Workspace** window, expand the **Configuration** folder.
2. Expand the **Climate Zones** folder.
3. Select the Climate Zone that you wish to delete.
4. To delete the selected Climate Zone, do one of the following:
   - Click **Delete**
   - With the **Workspace** window active, select **Delete** from the **Workspace** menu

   You are prompted to confirm the deletion. Click **Yes** to delete the Climate Zone, or **No** to cancel the delete action.
If you click Yes, the deleted Climate Zone is no longer displayed in the Workspace window.

- When you delete a Climate Zone, all corresponding data are also deleted.
- There may be Sections which use the Climate Zone to be deleted. These Sections will be affected by the deletion. You will be informed if this is the case.
- You cannot reverse a deletion.

### 11.3.6 Renaming Climate Zones

1. In the Workspace window, expand the Configuration folder.
2. Expand the Climate Zones folder.
3. Select the Climate Zone that you wish to rename.
4. To rename the selected Climate Zone, do one of the following:
   - Click Rename
   - With the Workspace window active, select Rename from the Workspace menu

   The Rename Climate Zone dialog box is displayed.
5. The current name of the Climate Zone you wish to rename is shown. In the To edit box, enter the new name for the Climate Zone. The new name must be unique.
6. Click OK.

   The renamed Climate Zone is displayed in the Workspace window.

   To work with the renamed Climate Zone, see Section 11.3.4.

### 11.3.7 Importing Climate Zones

You can import Climate Zones that were originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the Workspace window active, select Import from the Workspace menu.

   The Import HDM-4 Export File dialog box is displayed.
2. Double-click the folder that contains the file to be imported.
3 Select the file to be imported and click **Open**.
You are informed if a Climate Zone of the same name already exists.
You must then decide whether to overwrite the existing Climate Zone, or
to rename the Climate Zone that is being imported, or to cancel the
import operation.

11.3.8 Exporting Climate Zones

You can export Climate Zones as a .dbf file which can then be imported by
other HDM-4 users.

1 In the **Workspace** window, expand the **Configuration** folder and click **Climate Zones**.

2 Click **Export**.

The **Export Climate Zone As** dialog box is displayed.

3 Double-click the folder in which the export file is to be stored.

4 Enter a file name for the export file.

5 Click **Save**.

11.4 Currencies

11.4.1 Key concepts

HDM-4 maintains a list of Currencies. These are used to specify the
following:

- Vehicle Fleet unit costs
- Default works unit costs
- Project analysis output
- Programme analysis output
- Strategy analysis output

You can add and delete Currencies.

11.4.2 Adding a Currency

1 In the **Workspace** window, expand the **Configuration** folder.

2 To access the Currency details, do one of the following:
Select **Currencies** and click **Open**

Select Currencies. With the **Workspace** window active, select **Open** from the **Workspace** menu

Double-click Currencies

The **Currencies** dialog box is displayed.

3. Click **Add**.

A row is added to the table.

4. Enter a description and symbol for the Currency. Select a symbol position from the drop-down list.

5. Click **OK** to save the Currency definition and close the dialog box.

### 11.4.3 Deleting a Currency

1. In the **Workspace** window, expand the **Configuration** folder.

2. To access the Currency details, do one of the following:

   - Select Currencies and click **Open**
   - Select Currencies. With the **Workspace** window active, select **Open** from the **Workspace** menu
   - Double-click Currencies

   The **Currencies** dialog box is displayed.

3. Select the Currency you wish to delete.

4. Click **Delete**.

   One of the following will happen:

   - If the Currency has not yet been saved, it is deleted immediately
   - If the Currency has been saved and is not being used elsewhere in the system, you are prompted to confirm the deletion. Click **Yes** to delete the Currency, or **No** to cancel the delete action.
   - If the Currency is being used elsewhere in the system, you are informed of the places it is being used and the consequences of deleting it. You are prompted to confirm the deletion. Click **Yes** to delete the Currency, or **No** to cancel the delete action.

5. Click **OK** to save any changes and close the dialog box.

If you delete a Currency that is in use, the system sets the respective Currency field(s) to `<none>` or `<undefined>`. You must specify another Currency before...
continuing with the analysis. The system informs you that the Currency is missing if you try to perform an analysis without specifying a Currency.

11.4.4 Importing Currencies

You can import Currencies that were originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the Workspace window active, select Import from the Workspace menu.

   The Import HDM-4 Export File dialog box is displayed.

   ![Import HDM-4 Export File dialog box]

2. Double-click the folder that contains the file to be imported.

3. Select the file to be imported and click Open.

   You are informed if a Currency of the same name already exists. You must then decide whether to overwrite the existing Currency, or to rename the Currency that is being imported, or to cancel the import operation.

11.4.5 Exporting Currencies

You can export Currencies as a .dbf file which can then be imported by other HDM-4 users.

1. In the Workspace window, expand the Configuration folder and click Currencies.

2. Click Export.

   The Export Currency As dialog box is displayed.

   ![Export Currency As dialog box]

3. Double-click the folder in which the export file is to be stored.

4. Enter a file name for the export file.

5. Click Save.
11.5 Section aggregate data and tables

Values for the following aggregate parameters (from the New Section from Aggregate Data dialog box) are defined in Section Aggregate Data in the Configuration folder:

- Traffic volume
- Road class
- Geometry class
- Construction quality
- Structural adequacy
- Ride quality
- Surface condition
- Surface texture

The parameter values that you define (for example good, fair, bad) correspond to detailed values for related parameters in the Section Aggregate Tables in the Configuration folder.

Each HDM-4 system can, therefore, have a different definition of what constitutes good, bad or fair to suit the local conditions.

When you select a parameter value in the New Section from Aggregate Data dialog box, the corresponding detailed values from the Section Aggregate Tables are used when you run an analysis.

11.5.1 Adding values for an aggregate parameter

1. In the Workspace window, expand the Configuration folder.

2. To access the Section Aggregate Data, do one of the following:
   - Select Section Aggregate Data and click Open
   - Select Section Aggregate Data. With the Workspace window active, select Open from the Workspace menu
   - Double-click Section Aggregate Data

The Road Network Aggregate Parameters dialog box is displayed.

3. Click one of the Aggregate Parameter option buttons.
The variables for that parameter are displayed in the list box.

4. Click **Add**.

<br>

*New HDM-4 Item* is displayed in the list box.

5. Overwrite *New HDM-4 Item* with the name of the new value.

6. Click **Edit Related Tables** to access the Section Aggregate Tables, where you can define detailed values for the selected aggregate parameter.

![Image of Section Aggregate Tables](image)

To save the changes you have made, click **OK** in both windows.

- You can also delete a parameter value. Select the value and click **Delete**.
- You can rename a parameter value. Select the value and click **Rename**.
- You can also access the Section Aggregate Tables by expanding the **Configuration** folder and double-clicking **Section Aggregate Tables**. All the tables are displayed in tab-pages in the resulting dialog box. The Bituminous layers table can only be accessed in this way.

### 11.5.2 Importing Section Aggregate Data and tables

You can import Section Aggregate Data that were originally exported from HDM-4. This enables data exchange to take place between HDM-4 users.

1. With the **Workspace** window active, select **Import** from the **Workspace** menu.

The **Import HDM-4 Export File** dialog box is displayed.

2. Go into the folder that contains the file to be imported.

3. Select the file **SECAGGCONFIG.DBF**.
4 Click Open.

In step 3, selecting the file SECAGGCONFIG.DBF imports both Section Aggregate Data and tables.

11.5.3 Exporting Section Aggregate Data and tables

When you export Section Aggregate Data from HDM-4, several files are created—one '.dbf' file and several '.hdbf' files. If you are using the export facility to exchange data with other HDM-4 users, you must supply all the files.

1 In the Workspace window, select Section Aggregate Data or Section Aggregate Tables.

2 Click Export.

The Browse for Folder dialog box is displayed.

3 Select the folder in which the export file is to be stored.

4 Click OK.

In step 1, both the Section Aggregate Data and the Section Aggregate Tables are exported irrespective of which you select.
12 Managing your HDM-4 installation

12.1 Working with multiple databases

By default, all HDM-4 input data items (e.g. Road Networks, Projects, Work Standards, etc.) are stored in a single database which is set-up during installation. The database is physically stored as a number of files in the following sub-directories of the HDM-4 installation directory:

- `hdmdbase` - contains the files `objects.dat` and `objects.idx` in which the actual data is stored. These files are called repository files.
- `hdmdict` - contains the files `_objects.dat` and `_objects.idx` which describe the database structure. These files are called dictionary files.

You cannot view the contents of these files unless you have the necessary software development tools.

HDM-4 allows you to create multiple databases, and to partition your data accordingly. A typical scenario might involve a consultant who works on a number of projects and who prefers to separate his data by using separate databases. HDM-4 supports this functionality by supporting multiple Workspaces. A Workspace can be regarded as a separate work-area. Each Workspace is associated with its own separate database. Each separate database consists of a separate set of repository files (objects.dat and objects.idx – as described above). The single set of dictionary files in the `hdmdict` sub-directory are shared between all separate databases. Functions are provided to allow the user to:

- Open an existing Workspace
- Create a new / blank Workspace
- Create a copy of an existing Workspace
- Delete a Workspace

These options are listed on the Workspace menu. Note that only one Workspace (and thus database) may be active at any time. Therefore when you open an existing Workspace, the Workspace that is currently active is closed.

Workspaces are intended to be self-contained. At present it is not possible to directly move/copy one HDM-4 data object (e.g. a Vehicle Fleet) from one Workspace to another. For the time being, this can only be achieved by the use of the import/export facilities (see relevant Sections).

12.2 Backing up your HDM-4 data

It is good practice to regularly back up any data you create in HDM-4. This will protect you from problems such as file corruption, accidental deletion, hardware failure, etc. To be sure of retaining all your data there are three sets of files you should backup:
Dictionary files – the HDM-4 dictionary files are stored in the \hdmdict sub-directory of the installation directory. These two files (_objects.dat and _objects.idx) store information about the structure of the HDM-4 input data stored in repository files (see below). If you are using a new version of HDM-4 or an upgrade, you do not need to backup your dictionary files as you will be able to retrieve them from your CD. However, if you are currently using an update (for which you may not have a CD) you should backup the dictionary files following installation.

Databases – these store the HDM-4 input data. At any one time you may have several of these in use (see Section 12.1 above). You should backup all databases that you need to retain. Each database consists of two repository files objects.dat and objects.idx.

Run-data files – these are stored at the end of each HDM-4 analysis run in a user specified directory. Each set of run-data consists of a number of dBase compatible files (with the extensions ‘.dbf’ and ‘.cdx’). As the total size of each set of files can range from around 10MB for a Project analysis to over 100MB for a Programme or Strategy analysis, you will probably only want to backup those run-data sets which you need to keep.

From the above it can be seen that in the process of using HDM-4 (particularly if you create several databases and retain several sets of run-data), you may use a significant amount of hard disk space. To reduce this overhead, you should regularly review your storage and remove any obsolete databases and/or run-data.

12.3 Improving analysis performance

When running larger analyses you may find that the run-time increases significantly. This is understandable if you consider the complexity of the analysis that is being performed: the level of detail of the various models; the number of sections, vehicles, alternatives, and years, etc. being analysed. There are a number of things you can do to improve the analysis speed – particularly if you are willing to reduce the accuracy of the results. The following is a list of changes that can be made to the software / analysis configuration in order to improve analysis speed:

- close other applications – before starting the analysis run, close down any other Windows applications. Each additional application uses Windows resources, reducing the resources available to HDM-4, and therefore increasing the analysis time.

- improve specification of PC – since the problem is one of limited resources, increase the power of your hardware. Use a PC with more RAM, a faster processor, and more free disk space.

- disable log file – make sure that the log-file is disabled by de-selecting the option on the Run Setup tab-page. The log-file is very detailed. It is primarily intended for modellers and testers, and may not be useful for your purposes. It is not unusual for the log-file to exceed 12MB, so you can imagine the time required to generate it. Take a look at the log-file and you will appreciate the amount of work involved.
- **disable unnecessary models** – turn off those models which you don’t need in your analysis. The controls on the Run Setup tab-page allow you to disable the calculation of emissions, energy balance, acceleration effects, and economic indicators.

- **reduce run-data export size** – a significant part of run-time is spent saving run-data to the hard-disk. If you are not interested in the very detailed results, you can instruct HDM-4 not to save them. This detailed data is the annual road user effects by vehicle, and the annual road user effects by vehicle and by flow period. These are stored in the files ANNUALVEHICLE.DBF and ANNUALVEHPERIOD.DBF respectively. If these aren’t required then select the appropriate options in the Run Data Export Detail section of the Run Setup tab-page.

- **reduce number of flow periods** – check the Traffic Flow Patterns that you are using. The defaults have five flow periods each. Is it possible to reduce the number of flow periods? Doing so may affect the accuracy of your results, but will increase analysis speed.

- **reduce size of study** – this is probably the most drastic way of improving analysis speed. Re-examine your study. Do you need quite so many Vehicle Types? Could the fleet mix you are modelling be represented using fewer Vehicle Types? How about the number of Sections? Could you replace your two hundred sections with eight or so representative sections (in the fashion of strategy analysis)? Also consider the number of years, and the number of options. Obviously changing these aspects of your study will affect the accuracy of the results. However, you may be in the early stages of putting together your study, and initially, detailed results may not be required.

### 12.4 Adding an HDM-4 shortcut to your desktop

To access HDM-4 more quickly, add a shortcut to your desktop.

1. Right-click the Windows desktop.
2. From the menu select **New & Shortcut** as shown below:

   ![Shortcut creation dialog](image)

3. The **Create a Shortcut** dialog box is displayed.
4. Enter HDM-4.EXE and the full path of where the software is installed. For example:
   
   c:\Program Files\HDM-4\hdm4.exe
5 Click **Next**, and then enter HDM-4 as the name for the shortcut.

6 Click **Finish**.

The HDM-4 icon is added to your Windows desktop. In future, to run HDM-4 you can simply double-click the HDM-4 desktop icon.
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