SIDRA TRIP
USER GUIDE
SECTION 1 - INTRODUCTION

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November 2011
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The following is a general outline of this User Guide.

**Part 1 - INTRODUCTION**
Includes REFERENCES applicable for all sections of the Guide.

**Part 2 - GETTING STARTED**
Installing, Activating and Using SIDRA TRIP.

**Part 3 - INPUT**
Preparing Input Data for SIDRA TRIP.

**Part 4 - OUTPUT**
Interpreting SIDRA TRIP Output.

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For general enquiries, sales information and training workshops: info@sidrasolutions.com

For technical support enquiries for users with current COVER: support@sidrasolutions.com

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ABOUT THIS GUIDE

This guide contains information and step-by-step procedures for users of the SIDRA TRIP software. It provides information on how to install, register and run SIDRA TRIP, how to prepare input data, how to inspect text output and graphs, and how to interpret SIDRA TRIP output.

INTRODUCTION: Overview of the SIDRA TRIP software; information about what SIDRA TRIP does and how it works; computer system requirements and references.

GETTING STARTED: Step-by-step instructions for installing and registering SIDRA TRIP, information about using the software, information on defaults and options, the help system, and various troubleshooting hints.

INPUT: Detailed information on SIDRA TRIP input data and how to specify data in input dialogs.

OUTPUT: Information about the SIDRA TRIP output system; output tables, viewing and printing text and graphical output (Trip Statistics, Event Statistics, Sums, Graphs), and detailed information about SIDRA TRIP output statistics.

File Management in SIDRA TRIP
All file management functions are performed through the SIDRA TRIP File menu. The Profile file (extension aam) contains the input data and various model parameters pertaining to a particular case. See Section 2.

Viewing and Printing Text and Graphical Output
Text output and graphical displays (Trip Statistics, Event Statistics, Sums, Diagnostics, Graphs) as well as the Input Report can be viewed by double-clicking the corresponding node in the Profile tree. For information about printing and copying pictures and text, refer to Section 4.
1. INTRODUCTION

1.1 WHAT IS SIDRA TRIP?

SIDRA TRIP is a single-trip microsimulation model for realistic assessment of road traffic conditions using in-traffic vehicle data or user-defined drive cycles. It employs an instantaneous speed and acceleration model to determine various trip characteristics for assessing travel level of service, performance (delay, speed, travel time), operating cost, user cost, fuel consumption, vehicle emissions and noise in real-life road networks. SIDRA TRIP uses a power-based vehicle model to estimate fuel consumption and emissions of Carbon Dioxide (CO$_2$), Carbon Monoxide (CO), Hydrocarbons (HC) and Nitrogen Oxides (NO$_x$).

SIDRA TRIP is ideally suited to comparison of traffic and travel conditions before and after introduction of traffic management schemes, intersection and road improvements, residential street traffic calming schemes, and so on, without need for time-consuming and costly network data preparation work. It can also be used for assessing intelligent transport system applications, driver training programs, and vehicle characteristics.

SIDRA TRIP allows analysis of trips of any length as well as selected sections of a trip in a flexible way. It can use trip data collected by an instrumented vehicle, for example, using a GPS data logger. SIDRA TRIP can also be used for trip assessment using drive-cycle data based on speed-change information specified by the user. Simulation can be performed using default (passenger car, light vehicle, heavy vehicle) or customised (user-specified) vehicles. Different driver characteristics can be specified for all vehicle types.

See the References listed at the end of this user guide for more detailed technical information about the methodology employed in SIDRA TRIP.

1.2 ABOUT SIDRA TRIP

The SIDRA TRIP software is supplied under the terms of a software licence agreement. For further information, visit www.sidrasolutions.com or send an email to info@sidrasolutions.com.

SIDRA TRIP has been developed, and is fully owned by, Akcelik & Associates Pty Ltd. It is an evolution of an earlier development version of the software called aaMotion whose development started in 2002. This is the first commercial release of SIDRA TRIP. The software will be developed further in response to feedback from practising traffic engineers and planners.

<table>
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<th>Author</th>
<th>Programmers</th>
<th>Advisers</th>
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<tbody>
<tr>
<td>Rahmi Akçelik</td>
<td>Harry Cai, Tristan McLeay, Bhaskar Ashish, Adnan Bader, Arvid Aakre, David Crafti</td>
<td>Mark Besley, Darren Thompson, Edward Chung</td>
</tr>
</tbody>
</table>
1.3 WHAT CAN SIDRA TRIP DO?

You can use SIDRA TRIP to:

- compare traffic and travel conditions before and after introduction of traffic management schemes, intersection and road improvements, residential street traffic calming schemes, and so on, without need for time-consuming and costly network data preparation work;
- assess intelligent transport system applications, driver training programs and vehicle characteristics;
- analyse trips of any length as well as selected sections of a trip in a flexible way;
- analyse standard drive cycles used in vehicle fuel consumption and emission testing;
- estimate noise levels (dBA) generated during the trip using three different models: ASJ 2003 (Japanese) Model, SonRoad (Swiss) Model, and RLS-90 (German) Model;
- determine vehicle operating and user costs including toll cost;
- simulate light and heavy vehicle movements using default or customised vehicle and driver characteristics.

In using SIDRA TRIP, you can:

- use Metric or US Customary units;
- prepare data and inspect output with ease;
- make use of diagnostic messages given by the program to avoid use of unreliable data;
- import trip data collected by an instrumented vehicle, e.g. using output from a GPS data logger, in a variety of formats:
  - CSV (comma-separated values),
  - Text (tab-separated),
  - NMEA Text,
  - GPS Exchange,
  - Track
  - and Garmin Database;
- define trips simply by specifying initial and final speeds to represent vehicle idling, cruise, acceleration and deceleration manoeuvres with markers representing traffic events;
- simulate detector loop actuation;
- create your own vehicle and driver types using appropriate parameters describing vehicle and driver characteristics;
- calibrate the parameters of the operating and user cost models for your local conditions allowing for factors such as the value of time and resource cost of fuel;
- obtain output including trip statistics, sums of statistics for a given number of trips, and detailed statistics per drive cycle element;
- save the HTML-based text output as separate files suitable for viewing with web browsers;
- you can also save simulation data in csv, txt or xml format;
- animate the movement of a vehicle as defined in the trip profile with dynamic graphs linked to the vehicle movement;
- animate driving on the left-hand and right-hand side of the road;
- use your own default settings for a large number of input, output and model parameters using Tools - Defaults;
- control the text and graph displays, as well as various input, model and animation settings using Tools - Options.

1.4 COMPUTER SYSTEM REQUIREMENTS

Computer system requirements for SIDRA TRIP 1.1 are given below.

<table>
<thead>
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<tbody>
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<td><strong>Operating system</strong></td>
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<td><strong>Other</strong></td>
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<td><strong>Additional</strong></td>
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</table>

REFERENCES

Available for download from [www.sidrasolutions.com/Resources/Articles](http://www.sidrasolutions.com/Resources/Articles)


AKÇELIK, R. (2006b). Operating cost, fuel consumption and pollutant emission savings at a roundabout with metering signals. ARRB 22nd Conference, Canberra, Australia.


SIDRA TRIP
USER GUIDE
SECTION 2 - GETTING STARTED

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September 2011
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SIDRA SOLUTIONS software products are professional tools for the purpose of capacity, level of service, operating performance and travel quality analysis of road traffic. They are not safety design or evaluation tools. We recommend the use of appropriate safety analysis and audit tools for this purpose.

ACKNOWLEDGEMENTS

Akcelik & Associates Pty Ltd acknowledges the contributions by numerous users from many countries around the world through their valuable comments towards the development of SIDRA SOLUTIONS software products.

IMPORTANT

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2. GETTING STARTED

2.1 INSTALLING SIDRA TRIP

2.1.1 Software Installation

Installation of SIDRA TRIP is a straightforward process using the setup file downloaded from the SIDRASOLUTIONS website. Before installing SIDRA TRIP, please ensure that the following conditions are met:

- you are logged in with administrator rights on the computer, and
- the computer meets the system requirements (see the introduction section of this User Guide).

To install SIDRA TRIP 1.1:

- Run SIDRATRIP11Setup.exe to install.
- After the SIDRA TRIP Installation program is loaded, a series of dialog boxes will appear. Follow the instructions. Supply directory information if required. Click the Next button to proceed to the next dialog.

The setup program will install:

- Microsoft .NET Framework Version 2.0 if it is not present on your computer,
- the SIDRA TRIP system files in a folder under C:\Program Files\SIDRA SOLUTIONS (C:\Program Files (x86)\SIDRA SOLUTIONS on 64-bit systems), or in another location that you can choose.

When installation has been completed successfully, a SIDRA TRIP icon will be installed on your desktop. Also, a new program named SIDRA TRIP 1.1 will be created under the SIDRA SOLUTIONS folder in Start - All Programs.

To run SIDRA TRIP, simply double-click the desktop icon.

2.1.2 Uninstalling

In the case of a SINGLE licence, deactivate the licence before uninstalling the software for use on another computer. Uninstalling the software will not automatically deactivate the licence. See Section 2.2.1 for information on activating and deactivating a SINGLE licence.

To uninstall SIDRA TRIP software, use one of the following options depending on your Windows version:

- Windows XP: Use Control Panel - Add or Remove Programs, select SIDRA TRIP from the program list, and click the Remove button.
- Windows 7 and Vista: Use Control Panel - Programs and Features, select SIDRA TRIP from the program list, and click the Uninstall button.

2.1.3 Your Account

SIDRA TRIP is distributed via the SIDRASOLUTIONS eCommerce website which incorporates the software licence management system. Customers are allocated user ACCOUNTS on the eCommerce website. By logging into your Account homepage using your email and password, you can download software, and use the ONLINE STORE to renew COVER and purchase new or upgrade licences.
Account and login information is given to one "Licence Contact" only within an organisation. You must liaise with this person in your organisation in regard to licensing matters and access to the eCommerce website.

2.1.4 Downloading
You can download the SIDRA TRIP setup program from the SIDRA SOLUTIONS website:

- After you sign up for a Free Software Trial, you will be sent an email with the download link for downloading the setup program.
- After your purchase has been processed, the Licence Contact will be sent an email with the download link for downloading the setup program.
- You can also download the setup program from your online account any time after purchase.

2.1.5 Trial Mode
If you do not activate SIDRA TRIP following installation, it will operate in Trial Mode for a limited number of days. In Trial Mode, the program is fully functional. However, the software output produced in this mode will indicate that the software is an "Unregistered Trial Version".

The number of days remaining in Trial Mode will be shown in the Licence Configuration dialog (see Figure 2.1 in Section 2.2).

The Trial Mode period will not be reset if you uninstall and reinstall the software. You will need to purchase a licence to continue to use the software.

Refer to Section 2.2 for detailed information on licence activation.

2.1.6 SIDRA TRIP User Guide
The SIDRA TRIP User Guide is installed with the software for direct access from the SIDRA TRIP menu (Help - User Guide). Refer to Section 2.3.3 for detailed information.

A number of documents of interest to SIDRA TRIP, including various articles providing detailed information related to the analysis methodology used in SIDRA TRIP, can be downloaded from the SIDRA SOLUTIONS website (under Resources - Articles).

2.1.7 Example Files
Various examples of SIDRA TRIP profiles and sample source data files are provided with the software. The examples are provided in two separate folders (Metric Examples and US Units Examples) which will be installed on your computer. These can be accessed via Start - All Programs - SIDRA SOLUTIONS - SIDRA TRIP 1.1 Tools - Examples.

We recommend that you make use of these examples for learning about the software.

2.1.8 Defaults and Options
The initial settings for SIDRA TRIP are:

- Current Default System = Metric Units, and
- Drive Rule = Left.

US users may wish to set:

- Current Default System = US Customary Units (use Tools - Defaults), and
- Drive Rule = Right (use Tools - Options - Animation).
2.2 LICENCE ACTIVATION

Information about activating a SINGLE Licence and setting up an ENTERPRISE licence is given in this section.

At the time of licence purchase, a Customer ID, Licence ID(s) and Password will be allocated by the eCommerce system to the person who purchases the licence. These details will be required to activate the software. This information should be kept safely for future use.

When you start SIDRA TRIP, the Licence Configuration dialog will appear with a message about the unlicensed state of the software (Figure 2.1). You can also access this dialog via Start - All Programs - SIDRA SOLUTIONS - SIDRA TRIP 1.1 Tools - Licence Configuration.

In the Licence Configuration dialog, use the options available for Online Activation, Offline Activation and Deactivation of a SINGLE computer licence (Section 2.2.1), or for setting up an ENTERPRISE licence (Section 2.2.2).

![Figure 2.1 - Unlicensed state of the software when you start SIDRA TRIP](image-url)
2.2.1 SINGLE Licence

In the **Licence Configuration** dialog, use the **Fixed Licence File** option for activating or deactivating a SINGLE licence (Figure 2.2).

**Online Activation of SINGLE Computer Licences**

You need to activate each SINGLE computer licence using the Licence ID and Password issued to you (Figure 2.2):

- Run the unlicensed software, or use **Start - All Programs - SIDRA SOLUTIONS - SIDRA TRIP 1.1 Tools - Licence Configuration** to access the Licence Configuration dialog.
- In the **Licence Configuration** dialog, select the **Fixed Licence File** option (radio button).
- Click **Activate Licence Online**.
- In the **Activate Licence Online** dialog, enter your **Licence ID** and **Password**, and click **Activate**. Wait for the processing to be completed and a message given.
- If you get the message “**Activation Succeeded**”, click **OK** to start using the software in a licensed state (non-Trial mode). In this state:
  - your Company Name, Customer ID and Licence Type will appear in the **Licence Configuration** dialog, and will be displayed in software output reports, and
  - your Licence ID, Company Name and Licence Type will appear in the **Help - About** dialog.

![Figure 2.2 - Licence Configuration dialog and online activation of SINGLE computer licences](image-url)
You may get the message “Activation Failed” with a message related to the problem. A Web Service Error Number may also be given indicating a problem. Refer to the Online Licence Activation Failure section below about possible causes of failure.

Online Licence Activation Failure

Online licence activation may fail for a number of reasons resulting in a failure message. The reasons for failure include the following:

- You have Internet access problems.
- You did not enter your correct Licence ID and Password.
- The licence has already been activated.
- The licence was blacklisted.

These are explained below.

Internet access problems

If the software may not be able to connect to the activation server, you will receive the response "The remote name could not be resolved: 'secure.sidrasolutions.com'". Internet access problems may occur because:

- you do not have an Internet connection, or
- you have an Internet connection but you have a firewall or network administration policies that prevent the sending or receiving of the activation information over the Internet.

You should first check that your Internet connection is working. For example, open a web browser and see if you can look at web pages. If your Internet connection is not working, you should fix it and then try activating the software again.

If your Internet connection appears to be working, but activation still fails, contact your network administrator or IT Department and ask them if there is a problem of Internet access restriction.

If you get a message about "Proxy Authentication Required", or any problem/enquiry mentioning "Proxy settings" or "Proxy Server", this message is being generated by your network and simply reported by SIDRA INTERSECTION. The error indicates that the internet communication required by the SIDRA licensing is being blocked by your proxy server. You need to get your IT department to allow the software to communicate to our activation server as follows:

- Our licensing system runs on the following domain (ssl): secure.sidrasolutions.com (66.29.201.230).
- Our update system runs on our normal website domain: sidrasolutions.com (66.29.201.229).
- The XML Activation web service address is https://secure.sidrasolutions.com/solo/webservices/XmlActivationService.asmx (this Web Service is used for activation and deactivation).
- Standard port numbers are used in both cases and proxy settings are obtained from Internet Explorer.

Licence ID or Password incorrect

The message "Invalid License ID or Invalid License ID/Password combination" will appear. Check your Account homepage on the SIDRASOLUTIONS website for the correct Licence ID and Password.

If you use a valid Licence ID and Password from a different SIDRA INTERSECTION version, or from a different SIDRA SOLUTIONS product, you will get a message like: "SIDRA
INTERSECTION cannot be activated using the Licence ID that you have entered. The Licence ID corresponds to a different SIDRA INTERSECTION version or a different product.” Check your Account homepage on the SIDRASOLUTIONS website for the Licence ID and Password that correspond to the current SIDRA INTERSECTION version.

The licence has already been activated

Error message "Activation Failed - The web service returned an error. Web Service Error Number 5013." may be given when activation has failed because:

(i) the licence specified has already been activated, or
(ii) the software could not receive a response from our activation server.

In relation to case (i), if you have more than one licence, please check that you specified the correct Licence ID (one that is not activated). If your intention is to move a previously activated licence from another computer, you will need to deactivate it on the other computer before you can activate it on this computer.

In case (ii), an online activation may appear to have failed on your computer due to the response from our activation server having been blocked by your firewall or network settings. If the activation information was received correctly and processed by our activation server, the activation status will appear as "activated" in the SIDRASOLUTIONS licensing system despite the response being blocked at your end. If you subsequently change firewall settings to allow the response through and attempt an Online Activation or if you attempt an Offline Activation you will get an activation failure message indicating that the software is already activated. In this case, you should contact us by email to info@sidrasolutions.com for help with resetting your licence activation status.

Licence blacklisted

The Licence ID that you entered may have been cancelled. Please check the most recent information provided to you for your current licence details.

If none of the above reasons apply

If you are still unable to activate the software automatically after ensuring that none of the above reasons for failure of online licence activation applies, you will need to carry out an Offline Activation as described in the section below.

Offline Activation of SINGLE Computer Licences

Offline Activation is NOT the preferred method. The simple Online Activation using the Internet is the preferred method, and you should attempt to resolve your Internet access problems before using the Offline Activation method.

When you have to use the Offline Activation method, you need to use the software and the SIDRASOLUTIONS web page at the same time (Figure 2.3). You can open the web page on a different computer if the computer you are wishing to activate does not have Internet access.

The steps in the offline activation process are as follows:

1. Use the Software:
   - Run the software.
   - In the Licence Configuration dialog, select the Fixed Licence File option (radio button).
   - Click Activate Licence Offline.
   - In the Activate Licence Offline dialog, note the two codes.
2. Use the Website:
   - Login to your Account homepage using your email and password.
   - In the relevant product section in your Account homepage, click on the link provided for use when you cannot achieve Online Activation.
   - On the web page, enter the two codes from the software Activate Licence Offline dialog and click Submit.
   - If the codes have been entered correctly, and the licence has not already been activated, a Licence ID and a Registration Code will be displayed on the web page.

Figure 2.3 - Offline Activation of SINGLE Computer Licences
3. **Use the Software**:
   - In the software [Activate Licence Offline] dialog:
     - enter the [Licence ID] and the [Registration Code] as displayed on the webpage, and
     - complete other [Registration Details].
   - When all details are entered, click Activate.
   - If you get the message “Activation Succeeded”, click OK to start using the software in a licensed state (non-Trial mode).

Offline activation may fail for a number of reasons. Refer to the [Online Licence Activation Failure] section above about possible causes of failure.

### Moving Your Single Licence from One Computer to Another

If you used the [Online Activation] method to activate your SINGLE Computer licence on your computer, it is very easy to transfer your SINGLE Licence from one computer to another computer in your organisation. Follow the steps given below:

- **Before uninstalling the software**, use the [Online Deactivation] method to deactivate your licence on the computer the software is installed on.
- Download and install SIDRA INTERSECTION on your new computer (Section 2.1).
- Activate your licence on your new computer using the [Online Activation] method.

If you uninstall after an [Online Activation] or [Offline Activation] and delete the licence file and do a subsequent installation on the same computer, the software will be in an **unlicensed state** and you will not be able to do a subsequent Online Activation or Offline Activation with this licence ID since, in the SIDRASOLUTIONS licensing system, it will still be tied to the computer where the Offline Activation was carried out.

If you used the [Offline Activation] method to activate your SINGLE Computer licence on your computer, you will need to use the [Offline Licence Transfer] method (Section 1.3.6).

If you need licensing support, contact us by email to info@sidrasolutions.com.

### Online Deactivation of SINGLE Computer Licences

If you used the [Online Activation] method to activate your licence on your computer, deactivation is simple. To deactivate your SINGLE computer licence:

- Use **Start - All Programs - SIDRA SOLUTIONS - SIDRA TRIP 1.1 Tools - Licence Configuration** to access the Licence Configuration dialog.
- In the [Licence Configuration] dialog, select the [Fixed Licence File] option (radio button).
- Click [Deactivate Licence Online].

When you get a message that deactivation has succeeded, click OK.

If you want to move your licence to another computer, you should first deactivate the licence using [Deactivate Licence Online] facility as described above. If you **uninstall** the software without first deactivating it:

- the licence will stay in an activated state;
- if you reinstall the software on the same computer, it will appear to be activated already;
- you will not be able to activate the licence on another computer.
Offline Licence Transfer for SINGLE Computer Licences

If you used the Offline Activation method to activate your SINGLE Computer licence on your computer:

- you cannot use the Online Deactivation method to deactivate a licence activated using the Offline Activation method, and you will not be able to deactivate the licence by uninstalling the software; and
- when you uninstall after an Offline Activation, the licence file will stay in place and a subsequent installation on the same computer will reuse the same licence file and it will appear activated.

If your intention is to move your licence to another computer, and the licence was activated using the Offline Activation method, you will need to use the Offline Licence Transfer method. Follow the steps given below:

- Use Start - All Programs - SIDRA SOLUTIONS - SIDRA TRIP 1.1 Tools - Licence Configuration to access the Licence Configuration dialog.
- In the Licence Configuration dialog, select the Fixed Licence File option (radio button).
- Click Offline Licence Transfer.
- An Offline Licence Transfer dialog will appear. Follow the steps.

If you need licensing support, contact us by email to info@sidrasolutions.com.

2.2.2 ENTERPRISE Licence

The ENTERPRISE Licence allows unlimited use of SIDRA TRIP within the licensed organisation. Only one licence is issued to the licensed organisation and the software can be installed on individual computers using the same licence. No deactivation-reactivation is needed to uninstall and reinstall the licence on individual computers.

Setting up Licensing on Individual Computers

Instructions regarding deployment via a “Silent” installation are provided with the software licence. Alternatively, the software can be installed on individual computers and licensed as follows (note that Administrative rights will be necessary for this process):

- On the local machine where the software has been installed, save the ENTERPRISE Licence file to the folder:
  - (Vista and Windows 7) “C:\ProgramData\SIDRA SOLUTIONS\Licenses”
  - (Windows XP) “C:\Documents and Settings\All Users\Application Data\SIDRA SOLUTIONS\Licenses”
- Run the unlicensed software, or use Start - All Programs - SIDRA SOLUTIONS - SIDRA TRIP 1.1 Tools - Licence Configuration to access the Licence Configuration dialog.
- In the Licence Configuration dialog, select the Custom License File option (radio button) and click the Browse button.
- Browse to and select the licence file saved as indicated above.
- The software should now be in a licensed state (non-Trial mode). In this state:
  - your Company Name, Customer ID and Licence Type will appear in the Licence Configuration dialog, and will be displayed in software output reports, and
  - your Licence ID, Company Name and Licence Type will appear in the Help - About dialog.
- Click OK to close the Licence Configuration dialog.
2.3 USING SIDRA TRIP

2.3.1 Starting SIDRA TRIP

To start SIDRA TRIP, double-click the SIDRA TRIP icon on your desktop. If the Trial Dialog appears, this indicates that your copy of SIDRA TRIP is not registered. You can use SIDRA TRIP in Trial Mode temporarily. To do this click Try in the Trial Dialog. You should register SIDRA TRIP without delay unless you are using a Trial Version as explained in Section 2.2.

When SIDRA TRIP is run for the first time, you may wish to use Tools - Options - Settings to set the Drive Rule (driving on the right-hand side or left-hand side of the road) and Units (Metric, US Customary). The Drive Rule setting will affect the animation only.

You can double-click the name of the data file that contains the trip profile (extension aam) to start SIDRA TRIP using file association. If you start SIDRA TRIP in this way, SIDRA TRIP will start and will automatically open the data file you double-clicked. You should start SIDRA TRIP using this method only by selecting a single file. You can open any further files within SIDRA TRIP. See Section 2.3.2 for further information on SIDRA TRIP file association.

2.3.2 SIDRA TRIP User Interface

The main window of SIDRA TRIP contains the Title Bar, the Main Menu, the Toolbar, the Animation Pane, the Profile Tree Pane, the Display Pane and a Status Bar (Figure 2.9). These are explained below.

Title Bar
The Title Bar has the name SIDRA TRIP. The selected (maximised) window name will also be displayed in the title bar.

Main Menu
The SIDRA TRIP Main Menu consists of File, Edit, View, Animate, Tools, Window, and Help menus. Some commonly used menu items can also be invoked by use of shortcut keys (Ctrl+N for New, Ctrl+P for Print, etc).

All menu items are sensitive to the context of the currently selected object. This means that certain menu options will not be available if they are not applicable to the currently selected object.

Most File menu options apply to the Profile (aam) file. The menu contains the following options:

- **New**: create a new Profile;
- **Open**: open an existing Profile;
- **Save**: save the current Profile;
- **Save As**: create a new Profile by making a copy of the current Profile;
- **Save Sim Data As**: save the detailed step-by-step simulation data for the current Profile in csv, txt or xml format;
- **Save Trip Data As**: save the trip data for the current Profile in csv or txt format;
- **Close**: close the current Profile)
- **Save Output As**: save the selected text output in html format or xml format;
- **Save Graph As**: save the selected graph in emf picture format;
- **Print**: print the contents of the selected output (text or graph) window;
- **Print Preview**: view the print image of the contents of the selected output (text or graph) window;
- **Recent Profiles**: a list of most recently used files is shown (click the desired file to open);
- **Exit**: exit SIDRA TRIP (you can also press **Alt+F4** to exit SIDRA TRIP).

The **Edit** menu options operate on the current output window. The Edit menu contains the following options:

- **Cut**: cuts the selection to the clipboard;
- **Copy**: copies the selection to the clipboard;
- **Paste**: pastes the clipboard contents;
- **Select All**: selects all contents of current window;
- **Find**: prompts for a text string and finds the next or previous occurrence of it in the current text output window.

![Figure 2.9 - SIDRA TRIP user interface](image)
Note that Cut and Paste will be blocked in the Edit menu since the contents of an output window cannot be changed.

The View menu contains the options **Speedometer** (show or hide the Speedometer display), **Powermeter** (show or hide the Powermeter display), and **Animation Pane** (show or hide the Animation Pane). These view options have a toggle action (show or hide). The program remembers the status of these view options.

The Animate menu contains the options **Play** (run animation), **Pause** (stop animation temporarily), and **Reset** (stop animation and reset to the start of trip). Animation speed can be changed by using the **Time Factor** button in the toolbar.

The Tools menu contains the options **Defaults** (to change various settings for input and model parameters), and **Options** (to set options for Drive Rule, Units, Displays & Output Settings, Graphs and Animation options). See Section 2.4 for detailed discussion on Defaults and Options.

The Window menu contains the standard Windows options to allow you to arrange the open windows in the display pane, and a list of currently open windows that allows you to select a desired window.

The Help menu gives access to the Help system, the User Guide, the SIDRA SOLUTIONS website (requires internet connection), and also has an **About** option that gives basic information (version number, licence type, etc.).

**Toolbar**

The Toolbar buttons allow quick access to some frequently used commands (click once). The toolbar buttons (except the Time Factor Scale) have automatic pop-up descriptions.

The toolbar buttons (as displayed from left to right) and their actions are as follows:

- **New Profile**: create a new Profile (same action as File - New);
- **Open Profile**: open an existing Profile (same action as File - Open);
- **Save Profile**: save the current Profile (same action as File - Save);
- **Print** (same action as File - Print);
- **View Speedometer**: view or hide (toggle) the Speedometer display (same action as View - Speedometer);
- **View Powermeter**: view or hide (toggle) the Powermeter display (same action as View - Powermeter);
- **Animation Pane**: view or hide (toggle) the Animation Pane (same action as View - Animation Pane);
- **Play**: run animation (same action as Animate - Play);
- **Pause**: stop animation temporarily (same action as Animate - Pause);
- **Reset**: stop animation and reset to the start of trip (same action as Animate - Reset);
- **Help**: access to the Help system, the User Guide, etc. (same action as Help - Contents);
- **Time Factor Scale**: click and drag the pointer in the range 1 (real-time) to 10 (very fast) to modify the animation speed.

**Animation Pane**

The Animation Pane presents a simple animation of vehicle movement in accordance with the trip profile specified. This pane can be hidden or displayed (toggle action) by clicking the Animation Pane button on the toolbar or using View - Animation Pane.
Profile Tree Pane

The Profile Tree on the left-hand side of the screen displays the current Profile as a node with various child nodes (or sub-nodes) structured in a hierarchical manner (Figure 2.9). The main nodes are:

- **Input**
  - Edit Profile
  - Input Report
  - Diagnostics (if applicable)

- **Output**
  - Trip Statistics
  - Sums
  - Event Statistics
  - Graphs.

The Graphs node contains sub-nodes corresponding to different groups of Graphs, and each group has sub-nodes corresponding to different graphs (see Figure 2.9).

Double-clicking a node in the tree representing a group will open or close the set of sub-nodes in the group (similar to clicking the + or - symbol next to the node name). Double-clicking a node at the lowest level in the hierarchy will display (open) the corresponding item in an input dialog or output window in the Display Pane.

You can change the size of the visible area of the Profile Tree Pane by clicking and dragging the vertical line separating the Profile Tree Pane and the Display Pane.

If the relevant information does not exist, the node(s) representing the input dialog or output display will not appear in the Profile tree. For example, the Event Statistics output node will not exist when the trip profile is created using the Travel Data method.

If any errors are found in processing, output nodes will not be present in the Profile tree (see Section 2.5).

Display Pane

The Display Pane contains all open output windows. These may be the input (Edit Profile) dialog, Input Report window, the Trip Statistics, Sums and Event Statistics text output windows, and windows displaying Graphs. Windows are opened in the Display Pane by double-clicking the corresponding nodes in the Profile tree. You can arrange open windows using the Window menu options.

You can maximise the visible area of the displays in the Display Pane by reducing the size of the visible area of the Profile Tree Pane by clicking and dragging the vertical line separating the Profile Tree and Display Panes.

The Speedometer and Powermeter displays can be placed anywhere on the screen.

Status Bar

The Status Bar appears at the bottom of the SIDRA TRIP window. The Status Bar shows the vehicle type and the type of vehicle manoeuvre during animation.
Opening an Existing Profile

To open an existing Profile, click the **Open** button on the toolbar, or select **File - Open** from the menu. An **Open** dialog box will appear where you can select the desired file. This dialog shows **Files of type: SIDRA TRIP Files** and lists the Profile (**.aam**) files. When you select a file and click **OK**, the Profile will be opened in the Profile Tree Pane, and text output windows will be opened in the Display Pane (according to the output display options selected). Only one Profile can be opened at a time.

An easy way of opening a Profile is to select it from the **Recent Profiles** list under the **File** menu.

Closing a Profile

To close a Profile select **File - Close** from the menu, or right-click on the Profile name in the Profile Tree and select **Close Profile**.

Closing all windows in the display pane will not close a Profile. To close any graph or text output window in the display pane, click the "X" box at the top right-hand corner of the window, or select **Window - Close** from the menu.

To close all windows in the display pane, select **Window - Close All**.

SIDRA TRIP File Extensions and Associations

The Windows operating system associates file types with programs so that users may conveniently double-click a file and start the associated program. This association is based on the three-letter filename extension. For this purpose, SIDRA TRIP uses the **.aam** file extension. You should open only a single file using this method. SIDRA TRIP will list SIDRA TRIP Profile (**.aam**) files when you select **File - Open**.

After installing SIDRA TRIP, all files on your computer with the **.aam** extension will be associated with SIDRA TRIP regardless of whether they were created by SIDRA TRIP or by another program. These files will be labelled as "**SIDRA Trip Profile**" files and have SIDRA TRIP icons associated with them.

The file association process is not related to the file content in any way. SIDRA TRIP will probably give you an error message if you are trying to open a file with an **.aam** extension created by another program. File associations can be changed or removed using standard methods in Windows.

Backup Files

Each time a Profile (**.aam**) file is opened, a backup file is created. The backup file has the name of the original file (including the **.aam** extension) with the further extension **.bak** added and is saved in the same folder as the original file. For example, if you open the file **MyProfile.aam**, the backup file will be named **MyProfile.aam.bak** and will be created in the same folder as **MyProfile.aam**.

The backup file will overwrite any existing backup file that had been created when the Profile was opened at a previous time (multiple backup files are not created). The backup file will not be created if any errors are detected during the process of opening the file in order to prevent the possible overwriting of a "good" backup file.

The backup file is created only at the time the Profile is opened and it is not updated when the Profile is subsequently saved (unless the Profile is closed and then re-opened). It therefore contains an exact copy of the Profile (**.aam**) file as it was at the time that it was last opened. The backup file can be used to restore the previous version of the Profile (**.aam**) file in cases where mistakes have been made during editing, or if there have been any software problems that have damaged the file.
If the program is not able to create the backup file for any reason, you will receive the warning message "Failed to write backup file" followed by the name of the backup file and the reason for the problem. Although this will not prevent you from editing and processing the Profile, you will not have a backup file in this situation and the cause of the problem should be investigated. The most likely cause of this problem is rights or permission issues, particularly if your files are stored on a network.

**If you wish to use the backup file** to replace an unwanted Profile (.aam) file, you should rename or delete the unwanted file and then use the Windows Rename function to remove the .bak extension from the backup file. SIDRA TRIP cannot open the backup files directly (the software can only open Profile (.aam) files.

**Processing**

SIDRA TRIP input data processing, simulation and computations are carried out, and text output and graphs are generated automatically (appearing as nodes in the Profile tree) when the changes made in the Edit Profile dialog are accepted by clicking the OK button. The contents of output windows open in the Display Pane are updated automatically.

**Printing Text and Graphs**

In SIDRA TRIP, printing text output and graphs is easy using the Print function directly, or using the Windows clipboard facility for capturing displays or text and pasting into a word processing (e.g. MS Word) or graphics (e.g. MS Paint) file. Refer to Sections 4.2 and 4.3 for detailed information.

**2.3.3 User Guide**

The SIDRA TRIP User Guide is installed with the software. It is accessible using Help - User Guide in the menu.

The User Guide is in Adobe Acrobat (PDF) format. Adobe Reader is required to read the User Guide. If you do not have Adobe Reader installed on your computer, you will need to install it.

The software licence permits printing of the User Guide for the licensee's own use only. The User Guide is a **restricted document** for use under the SIDRA SOLUTIONS software licence only. Printed copies of the guide may not be placed in any public library, may not be rented, loaned, distributed or reproduced by any means.

Some or all sections of a printed User Guide will become outdated with the release of each version of the software. The electronic copy installed with the software is always the most up-to-date version of the User Guide.

The **SIDRA TRIP User Guide** consists of the following sections:

- Section 1 - Introduction
- Section 2 - Getting Started
- Section 3 - Input
- Section 4 - Output.

Use the facilities of the Adobe Reader window including bookmarks and Search function to find the information you are looking for.
2.3.4 Help System

SIDRA TRIP contains comprehensive help facilities. The Help menu gives access to **Help - Contents**, **Help - Index**, **Help - Search**, the **User Guide**, the **SIDRA SOLUTIONS website** (requires internet connection), and has an **About** option that gives basic information about the software (**Version**, **Serial Number**, **Organisation**, and **Licence type**).

**Help - Contents** will access the Contents page of the help, **Help - Index** will access the Help Index, and **Help - Search** will allow you to search for any string within the help file. The `?` button on the toolbar is equivalent to **Help - Contents** in the Help menu.

Press **F1** for context-sensitive help on most topics in SIDRA TRIP. Most dialog boxes in SIDRA TRIP also include a **What's This** button. This button is on the right-hand end of the title bar, just left of the close button and is labelled with a question mark. If you click this button, the mouse cursor will change to a question mark and pointer. Point to an item in the dialog box and click. Help relevant to the selected item will be opened.
2.4 DEFAULTS AND OPTIONS

2.4.1 Defaults

SIDRA TRIP has an extensive defaults system that covers a large number of input and model parameters (see Figures 2.10a to 2.10g). A Reset function is available to reinstate the standard default values instead of user-specified default values. The current defaults will be used as input parameters in a Profile created using File - New.

When you use Tools - Defaults, the nodes displaying various settings will be seen in the Defaults Tree Pane on the left-hand side of the Defaults dialog (Figure 2.10a). To open a display, click the node in the Defaults Tree Pane. The default values of settings for the selected node will be seen on the right-hand side of the dialog. The name of the Defaults dialog box (top left corner) will appear with the name of the selected node in brackets, e.g. as Defaults (Travel Profile Settings).

Select one of the two defaults sets, namely Metric Units or US Customary Units as the Current Defaults System using the drop-down list (Figure 2.10a). The values of parameters displayed on the right-hand side of the defaults dialog will vary according to the selected units.

The simulation will be performed and output will be generated using the units in accordance with the Current Defaults System. However, trip data to be imported can be in different units, which can be specified as Data Source Units in the Defaults (Travel Profile Settings) dialog (Figure 2.10a).

Figure 2.10a - Defaults (Travel Profile Settings) dialog
Driving on the left-hand or right-hand side of the road is an animation feature (Section 2.4.2) and has no effect on defaults settings.

The standard default sets in the Defaults (Vehicles) and Defaults (Drivers) dialogs cannot be edited (they are blocked). They need to be cloned before editing under the User nodes (see Figures 2.10f and 2.10g). All other parameters can be edited. Data range checks are carried out during editing.

When a Profile which contains user-specified Vehicles or Drivers is opened using File - Open, the program will offer to import them into the defaults system. The settings for Drivers are relevant to the Event Data method (driver characteristics for Travel data method are reflected by the imported data).

**Maximum Power, Maximum Grade, Maximum Speed** and **Maximum Acceleration** parameters specified for Vehicles (Figure 2.10f) are used for checking reliability of data. If simulation data violates these maximum values, messages about data problems will be given in a Diagnostics dialog, as well as the **Event Statistics** output in the case of the Event Data method (see Section 3.10).

All values in the **Fuel Consumption and Emission Parameters** group for Vehicles (Figure 2.10f) are always in Metric Units even when the Current Defaults System is US Customary Units (see Section 2.4.3).

---

**Figure 2.10b - Defaults (Event Profile Settings) dialog**
Figure 2.10c - Defaults (Speed Settings) dialog

Click to specify the Desired Speed

Check / Uncheck and enter values to modify the Speed Groups

Specify Flow Rate for Average Equivalent Noise Level (L_{eqT}) calculation

Figure 2.10d - Defaults (Noise Settings) dialog
Figure 2.10e - Defaults (Cost & LOS Parameters) dialog

Cost Unit is set according to the Windows regional settings. It can be changed in the Cost & LOS Parameters input dialog.

Select Operating Cost or User Cost

Fuel Consumption and Emission Parameters given in this group are always in Metric Units (even when the Current Defaults System is US Customary Units)

Figure 2.10f - Defaults (Vehicles) dialog (for "My Car" in this example)

Maximum values used for Diagnostics

Select Operating Cost or User Cost

Cost Unit is set according to the Windows regional settings. It can be changed in the Cost & LOS Parameters input dialog.

Fuel Consumption and Emission Parameters given in this group are always in Metric Units (even when the Current Defaults System is US Customary Units)
Figure 2.10g - Defaults (Drivers) dialog for Event Data method (for "My Driver" in this example)

2.4.2 Vehicle Classes

SIDRA TRIP provides three classes of default vehicles, namely Passenger Car, Light Vehicle and Heavy Vehicle. Although the Light Vehicle class incorporates Passenger Cars, SIDRA TRIP includes a separate Passenger Car class in order to allow more specific treatment, and also allow the distinction required by the ASJ 2003 (Japanese) Noise model used by the program (Section 3.5).

Definition of a Heavy Vehicle in SIDRA TRIP is consistent with the definition used in the SIDRA INTERSECTION software, and is based on Akçelik (1981b, Section 5). According to this, a Heavy Vehicle is defined as any vehicle with more than two axles or with dual tyres on the rear axle (based on Akçelik 1981b, Section 5). Thus, buses, trucks, semi-trailers (articulated vehicles), cars towing trailers or caravans, tractors and other slow-moving vehicles are classified as Heavy Vehicles. All other vehicles are defined as Light Vehicles (cars, vans, small trucks).
2.4.3 Parameter Values for Default Vehicles

A summary of default vehicle parameters Mass, Maximum Power, and Length are given in Table 2.1.

The three default vehicle classes used in SIDRA TRIP can be considered to be representative vehicles, whose parameters are based on a more detailed analysis of several vehicle types as seen in Tables 2.2a and 2.2b.

Tables 2.2a and 2.2b include parameters used for the fuel consumption model used in SIDRA TRIP. The same model is used with different parameters for estimating fuel consumption and emissions of Carbon Monoxide (CO), Hydrocarbons (HC) and Nitrogen Oxides (NOx). Carbon Dioxide (CO$_2$) is estimated directly from fuel consumption by applying a CO$_2$ factor to the fuel consumption rate.

The model is explained in detail and the full set of default parameters is given in Section 3.8.

Fuel consumption and emission model parameters (Figure 2.10f) are specified in Metric Units even when the Current Defaults System is US Customary Units (Section 2.4.1).

### Table 2.1

**Summary of default vehicle parameters Mass, Maximum Power and Vehicle Length**

<table>
<thead>
<tr>
<th></th>
<th>Passenger Car</th>
<th>Light Vehicle</th>
<th>Heavy Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mass</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric (kg)</td>
<td>1250</td>
<td>1400</td>
<td>11000</td>
</tr>
<tr>
<td>US Customary (lb)</td>
<td>2750</td>
<td>3100</td>
<td>24000</td>
</tr>
<tr>
<td><strong>Maximum Power</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric (kW)</td>
<td>80</td>
<td>85</td>
<td>130</td>
</tr>
<tr>
<td>US Customary (hp)</td>
<td>110</td>
<td>115</td>
<td>175</td>
</tr>
<tr>
<td><strong>Vehicle Length</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric (m)</td>
<td>4.5</td>
<td>5.0</td>
<td>11.0</td>
</tr>
<tr>
<td>US Customary (ft) *</td>
<td>16</td>
<td>18</td>
<td>38</td>
</tr>
</tbody>
</table>

* Larger than the equivalent metric value
### Table 2.2a

**Data used for deriving default vehicle parameters used in SIDRA TRIP**

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>Percentage of Vehicle Kilometres</th>
<th>Fuel type (% Diesel)</th>
<th>Idling fuel cons. (mL/h)</th>
<th>Loaded mass, M (kg)</th>
<th>Maximum engine power (kW)</th>
<th>Power to Weight Ratio (PWR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger Car</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small car</td>
<td>30%</td>
<td>1</td>
<td>900</td>
<td>1100</td>
<td>64</td>
<td>58.2</td>
</tr>
<tr>
<td>Medium car</td>
<td>40%</td>
<td>2</td>
<td>1296</td>
<td>1250</td>
<td>80</td>
<td>64.0</td>
</tr>
<tr>
<td>Large car</td>
<td>30%</td>
<td>2</td>
<td>1728</td>
<td>1500</td>
<td>110</td>
<td>73.3</td>
</tr>
<tr>
<td>Combined</td>
<td>100%</td>
<td>2</td>
<td>1307</td>
<td>1280</td>
<td>84</td>
<td>65.8</td>
</tr>
<tr>
<td><strong>Selected</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Light Vehicle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger car</td>
<td>90%</td>
<td>1.7</td>
<td>1307</td>
<td>1280</td>
<td>84</td>
<td>65.8</td>
</tr>
<tr>
<td>Van</td>
<td>8%</td>
<td>13</td>
<td>1728</td>
<td>2000</td>
<td>70</td>
<td>35.0</td>
</tr>
<tr>
<td>Light rigid</td>
<td>2%</td>
<td>34</td>
<td>1332</td>
<td>2700</td>
<td>75</td>
<td>27.8</td>
</tr>
<tr>
<td>Combined</td>
<td>100%</td>
<td>3</td>
<td>1341</td>
<td>1366</td>
<td>83</td>
<td>60.7</td>
</tr>
<tr>
<td><strong>Selected</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heavy Vehicle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light/Medium rigid</td>
<td>60%</td>
<td>48</td>
<td>1620</td>
<td>5500</td>
<td>90</td>
<td>16.4</td>
</tr>
<tr>
<td>Medium rigid</td>
<td>15%</td>
<td>87</td>
<td>1800</td>
<td>10000</td>
<td>120</td>
<td>12.0</td>
</tr>
<tr>
<td>Medium/heavy truck</td>
<td>15%</td>
<td>98</td>
<td>2340</td>
<td>16000</td>
<td>170</td>
<td>10.6</td>
</tr>
<tr>
<td>Heavy truck</td>
<td>5%</td>
<td>100</td>
<td>2520</td>
<td>28000</td>
<td>260</td>
<td>9.3</td>
</tr>
<tr>
<td>Heavy articulated</td>
<td>5%</td>
<td>100</td>
<td>2520</td>
<td>38000</td>
<td>300</td>
<td>7.9</td>
</tr>
<tr>
<td>Combined</td>
<td>100%</td>
<td>67</td>
<td>1980</td>
<td>10500</td>
<td>126</td>
<td>12.0</td>
</tr>
<tr>
<td><strong>Selected</strong></td>
<td></td>
<td>70</td>
<td>2000</td>
<td>11000</td>
<td>130</td>
<td>11.8</td>
</tr>
</tbody>
</table>


### Table 2.2b

Data used for deriving default vehicle parameters used in SIDRA TRIP

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>No. of tyres</th>
<th>Tyre diameter (m)</th>
<th>Rolling res. factor for tyre type</th>
<th>Frontal area (m²)</th>
<th>Aero. drag coefficient (with wind factor 1.2)</th>
<th>Fuel cons. parameter A</th>
<th>Fuel cons. parameter B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger Car</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small car</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>1.8</td>
<td>0.50</td>
<td>18</td>
<td>0.00460</td>
</tr>
<tr>
<td>Medium car</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>2.0</td>
<td>0.53</td>
<td>20</td>
<td>0.00520</td>
</tr>
<tr>
<td>Large car</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>2.2</td>
<td>0.55</td>
<td>22</td>
<td>0.00580</td>
</tr>
<tr>
<td>Combined Small/med</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>2.0</td>
<td>0.53</td>
<td>20</td>
<td>0.00520</td>
</tr>
<tr>
<td>Selected</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>2.0</td>
<td>0.53</td>
<td>20</td>
<td>0.00500</td>
</tr>
<tr>
<td><strong>Light Vehicles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger car</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>2.0</td>
<td>0.53</td>
<td>20</td>
<td>0.00520</td>
</tr>
<tr>
<td>Van</td>
<td>4</td>
<td>0.65</td>
<td>1.05</td>
<td>2.6</td>
<td>0.62</td>
<td>27</td>
<td>0.00760</td>
</tr>
<tr>
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<td>4</td>
<td>0.80</td>
<td>1.25</td>
<td>4.0</td>
<td>0.66</td>
<td>35</td>
<td>0.11170</td>
</tr>
<tr>
<td>Combined Light</td>
<td>4</td>
<td>0.65</td>
<td>1.01</td>
<td>2.1</td>
<td>0.54</td>
<td>21</td>
<td>0.00550</td>
</tr>
<tr>
<td>Selected Light</td>
<td>4</td>
<td>0.65</td>
<td>1.00</td>
<td>2.1</td>
<td>0.54</td>
<td>21</td>
<td>0.00550</td>
</tr>
<tr>
<td><strong>Heavy Vehicles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light/Medium rigid</td>
<td>6</td>
<td>0.80</td>
<td>1.20</td>
<td>5.0</td>
<td>0.70</td>
<td>64</td>
<td>0.01540</td>
</tr>
<tr>
<td>Medium rigid</td>
<td>6</td>
<td>1.00</td>
<td>1.15</td>
<td>6.0</td>
<td>0.72</td>
<td>86</td>
<td>0.01860</td>
</tr>
<tr>
<td>Medium/heavy truck</td>
<td>10</td>
<td>1.00</td>
<td>1.10</td>
<td>6.5</td>
<td>0.77</td>
<td>135</td>
<td>0.02170</td>
</tr>
<tr>
<td>Heavy truck</td>
<td>18</td>
<td>1.00</td>
<td>1.05</td>
<td>7.0</td>
<td>0.82</td>
<td>229</td>
<td>0.02540</td>
</tr>
<tr>
<td>Heavy articulated</td>
<td>22</td>
<td>1.00</td>
<td>1.05</td>
<td>8.0</td>
<td>0.86</td>
<td>303</td>
<td>0.03070</td>
</tr>
<tr>
<td>Combined Heavy</td>
<td>8</td>
<td>0.88</td>
<td>1.16</td>
<td>5.6</td>
<td>0.73</td>
<td>98</td>
<td>0.01809</td>
</tr>
<tr>
<td>Selected Heavy</td>
<td>8</td>
<td>0.90</td>
<td>1.15</td>
<td>5.6</td>
<td>0.73</td>
<td>100</td>
<td>0.01800</td>
</tr>
</tbody>
</table>

### 2.4.4 Options

You can use **Tools - Options** to set your preferences. This will open the **Options** dialog ([Figures 2.11a to 2.11c](#)) which includes several tabs to specify the following options:

- **Settings** ([Figure 2.11a](#))
  - **Import new Vehicles and Drivers in Profiles**: (for user-specified Vehicles and Drivers found when opening a Profile);
  - **Calculate Grade Data from Altitude Data if available during Import**: Never, If Grade Data not given, Always;
  - **Time Zone Adjustment**: No Time Zone Adjustment, Adjust to Current Time Zone, Adjust to Specified Time Zone (specify a value if the Specified Time Zone option is selected);
  - **Noise Models**: ASJ 2003 (Japanese), SonRoad (Swiss), RLS-90 (German).
- **Output** *(Figure 2.11b)*
  - Default Text Output (options for opening Trip Statistics, Sums and Event Statistics output windows automatically);
  - Graphs (options to plot graphs before animation, specify a Maximum Metric Fuel Economy (L/100km) value for the largest value to be displayed in the Fuel Economy graph, specify various options for Noise graphs, and check boxes to select the graphs to be included in the Profile Tree);

- **Animation** *(Figure 2.11c)*
  - Drive Rule (Left or Right to indicate which side of the road the vehicle uses);
  - Smoothness (Low, Medium or High to determine the smoothness of vehicle movement, which is related to the animation frames per second);
  - Scale (Very Small, Small, Normal, Large or Very Large to determine the distance shown in one frame of animation, which also affects the vehicle size shown).

The Drive Rule will affect the animation only.

In the Output tab, the current graph settings are indicated by check boxes (graphs which are checked will be listed in the Profile Tree).

The parameter Maximum Metric Fuel Economy (L/100km) is relevant when Metric units are in use, and it sets the largest value displayed in the Fuel Economy graph.

*Figure 2.11a - Options dialog - Settings tab selected*
Figure 2.11c - Options dialog - Animation tab selected
2.5 TROUBLESHOOTING

Common questions and problems that may be encountered while using SIDRA TRIP are described in this section. Problem descriptions and solutions are organised into a number of categories.

If you are having problems using SIDRA TRIP, firstly see if your problem is described below. If so, a possible remedy will be suggested. If the suggestion does not work, or you have a problem that is not described, please apply for support. See the Technical Support page at the start of the User Guide.

2.5.1 Installation

Error message during installation (or during registration) such as "You must have Administrative Privileges to install SIDRA TRIP" or "The system administrator has set policies to prevent this installation".

You must be logged in as Administrator or as a user with administrative privileges to install SIDRA TRIP. You must also have administrative privileges to perform the registration process. If you do not have this access to your computer, you must contact your IT department and ask them to perform the installation.

Windows 95, 98, NT, ME

SIDRA TRIP is not supported under Windows 95, 98, NT and ME. If you are running one of these versions of Windows, you will not be able to install SIDRA TRIP on your computer.

Changing File Association for SIDRA TRIP Data Files

After installing SIDRA TRIP, all files on your computer with the .aam extension will be associated with SIDRA TRIP regardless of whether they were created by SIDRA TRIP or by another program. They will be labelled as "SIDRA TRIP Profile" files and have SIDRA TRIP icons associated with them. When you double-click one of these files, SIDRA TRIP will start and open the Profile (and not a program that may have been associated with these files previously).

If you need to use another program to open a file with the .aam extension, you should still be able to start the program that uses these files, and open the files using the File - Open command in that program's menu.

If you do not wish the .aam extension to be associated with SIDRA TRIP, you should follow one of the three options listed below.

1. You could reinstall another program that uses .aam files. The latest program that is installed sets its own associations so this would override those set by SIDRA TRIP.

2. Right-click on the .aam file you wish to open. Select "Open With". Choose the program you wish to be associated with these files, check the box that says "Always use the selected program ...". Then click OK.

3. From a "My Computer" or "Explorer" window, select Tools - Folder Options - File Types. Select .aam files from the list, click the Change option and reset the association to the desired program.

The .aam extension has been chosen by Akcelik and Associates as one that is unlikely to be used by other programs and we do not believe that this would be a common problem.
2.5.2 Starting SIDRA TRIP

Registration

A Trial Dialog will appear when you start SIDRA TRIP if you have not registered it yet. You must click Register and enter your Serial Number and Customer ID (User ID). See Section 2.2 for detailed information about the registration process.

2.5.3 Input Problems

Input Data Checking and Program Errors

SIDRA TRIP input dialogs perform various error checks including data range checks. When a Profile is processed, many more detailed checks of the input data are made before any computations are performed, and messages are given to the user about any errors found.

If an error occurs that cannot be resolved, you should report the problem by supplying the Profile (aam) file together with any relevant information to describe the problem succinctly. Before reporting the problem, refer to the Technical Support page at the start of the User Guide, or visit the website www.sidrasolutions.com for the procedure to follow.

2.5.4 Processing, Defaults and Options

SIDRA TRIP Takes a Long Time to Process a Profile

When you accept the data changes in the Edit Profile dialog by clicking the OK button, the SIDRA TRIP simulation runs and information in all open windows is refreshed to show updated results from the latest run. This process may take a long time if the trip profile contains a very large number of data points.

The screen is empty (nothing in the Profile Tree Pane and no windows are open in the Display Pane)

This situation occurs when there is no Profile open in SIDRA TRIP after you start the program or after you close a Profile. You should simply Open an existing Profile or create a new Profile.

Model Selection

Considerable care is needed when using SIDRA TRIP with different Units (Metric and US Customary).

When you use create a new Profile, it will be created in accordance with the current option settings. To check or change the current model, use Tools - Options - Settings.

When you use the Save As option, the new Profile will retain the model setup of the Profile being copied from.

Working with both US HCM Metric and US HCM Customary Units

It is not possible to convert a Profile created using Metric units to a Profile with US Customary Units. Similarly, it is not possible to convert a Profile created using US Customary Units to a Profile with Metric units.
2.5.5 Output Problems

Results are Different on Another Computer

It is possible to obtain differences in text output and some graphs on different computers because of different Option settings. Use Tools - Options to check your settings.

You should also ensure that your copy of SIDRA TRIP has been kept up to date by the application of all available Update Packs.

Controlling page breaks

The Print option in the SIDRA TRIP File menu is fairly basic and does not handle insertion of page breaks. Before printing SIDRA output, right-click in the text area of the output window and select Print Preview to inspect the output.

Instead of printing the contents of an output window, select the text and pictures using Edit - Select All, and copy to the clipboard using Edit - Copy. Then paste the output into a word processor, e.g. Microsoft Word. Insert page breaks as required. See Section 4 for further information.

No output after processing a Profile

If there is no output produced after processing a Profile, you probably have one or more input errors.

Copying text and graphs

You must select items before copying. Use Edit - Select All in the main menu, press Ctrl+A, or right-click in the display area and click Select All in the menu. Refer to Section 4 for further information.

Exporting to Microsoft Excel

SIDRA TRIP uses Microsoft Internet Explorer to display text output windows. If you install Microsoft Office, this adds the right-click function "Export to Microsoft Excel" to all Internet Explorer windows. Although this provides limited ability to link to data in some web pages, Microsoft unfortunately provides no functionality to link to data in programs such as SIDRA TRIP. If you wish to copy data from SIDRA TRIP to Excel, you should use the copy and paste functions.
SIDRA TRIP USER GUIDE
SECTION 3 - INPUT

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September 2011
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ACKNOWLEDGEMENTS

Akcelik & Associates Pty Ltd acknowledges the contributions by numerous users from many countries around the world through their valuable comments towards the development of SIDRA SOLUTIONS software products.

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3. INPUT

This section discusses general aspects of SIDRA TRIP input (Section 3.1), presents detailed description of data specification in individual input (Edit Profile) dialogs (Sections 3.2 to 3.9), and explains the Diagnostics facility (Section 3.10).

3.1 GENERAL ASPECTS OF SIDRA TRIP INPUT

**Edit Profile Dialog for Input**

The node called Edit Profile in the Input group of the Profile Tree is used for input data specification (see Figure 3.1). To edit input data, double-click the Edit Profile node. Detailed information on the SIDRA TRIP user interface is given in Section 2.3.

When you use **Tools - Edit Profile**, the nodes displaying various settings will be seen in the **Input Data Tree Pane** on the left-hand side of the dialog (Figure 3.1). To open a display, click the node in the Input Data Tree. The input values of settings for the selected node will be seen on the right-hand side of the dialog.

*Figure 3.1 - Edit Profile dialog for input*
When you save the input changes you made in the Edit Profile dialog by clicking the OK button, any existing output will be discarded, the new data will be processed, and new output will be generated automatically. The Input Report provides a summary of input data given in the Edit Profile dialog. You can specify more commonly used parameter values in Defaults dialog (Tools - Defaults).

Methods to Describe Trip Profiles

Trip data representing a vehicle movement for SIDRA TRIP can be in the form of:

- microscopic (second-by-second) trip data from an instrumented car, for example, data collected using a Global Positioning System (GPS) data logger using a variety of data file formats, namely CSV (comma-separated values), Text (tab-separated), NMEA Text, GPS Exchange, Track and Garmin Database formats (see Section 3.3.3), or
- trip data formed by the user in drive-cycle format simply by specifying initial and final speeds to represent vehicle idling, cruise, acceleration and deceleration manoeuvres with markers representing "traffic events".

The first data format is referred to as travel-based trip profile, and the second format is called the event-based trip profile. The corresponding input methods are referred to as the Travel Data Method and Event Data Method, respectively.

Microscopic (second-by-second) trip data representing standard vehicle drive cycles can also be used as travel-based trip profiles.

You cannot convert a travel-based trip profile to an event-based trip profile. You can use File - Save Trip Data As to export data from a travel-based or event-based trip profile contained in the Profile (.aam) file to a raw (source) data file in CSV, Text, GPS Exchange, or Track format as applicable (see Section 3.3.3). You can then import the data after creating a new travel-based trip profile using File - New.

Data Method Dialog

In the SIDRA TRIP main menu, select File - New to create a new Profile, File - Open to open an existing Profile, or File - Save As to create a new Profile by making a copy of the current Profile.

When you choose File - New to create a new Profile, the Data Method dialog will appear (Figure 3.2). You must choose one of the two following data methods:

- **Travel Data Method**: Choose this option to create a travel-based trip profile if you have a file containing a series of time points along with associated speeds, distances and/or coordinates, e.g. based on data obtained using a GPS data logger.

- **Event Data Method**: Choose this option to create an event-based trip profile by specifying initial and final speeds and markers that describe "events". SIDRA TRIP will determine acceleration and deceleration profiles for speed-change manoeuvres.
After you choose the data method you wish to use, the **Edit Profile** dialog will appear for specification of input data for the new Profile (see **Figure 3.1**).

When you use **File - Open** to open *an existing Profile*, or when you use **File - Save As** to create *a new Profile from an existing file*, and double-click the **Edit Profile** node in the Profile Tree, the **Edit Profile** dialog will be opened for editing input data.

The left-hand side of the Edit Profile dialog contains the **Input Data Tree**. Click the desired node in the tree to access the input data fields. As seen in **Figure 3.1**, the Input Data Tree presents the following input groups:

- **General Settings**
- **Trip Data**
- **Speed Settings**
- **Noise Settings**
- **Cost & LOS Parameters**
- **Vehicles**
- **Drivers** (Event Data method only).

Contents of each input data group differ according to the data method. The Drivers data group is not available in the case of Travel Data method since driver characteristics are inherent to the data collected using an instrumented vehicle.

The name of the **Edit Profile** dialog box (top left corner) will include the name of the data method used as well as the name of selected input node in brackets, e.g. **Edit Profile - Travel Data Method (General Settings)**. In this guide, specific aspects of the dialog will be referred to using the name of the node only, e.g. **General Settings** input dialog.

Input data specification in individual dialogs listed above is explained in **Sections 3.2 to 3.9**, and the Diagnostics facility is explained in **Section 3.10**.
3.2 GENERAL SETTINGS

The General Settings input dialog (Figures 3.3a and 3.3b) allows you to:

- type text in the Title, Subtitle and Description data fields (Title and Subtitle will appear in text output),
- select a Vehicle from the Default and User-Specified vehicles using a drop-down list,
- select a Driver from the Default and User-Specified drivers using a drop-down list (if using the Event Data method), or enter a Driver ID (if using the Travel Data method),
- specify the Number of Vehicle Trips for calculating Sums for a number of trips (or a number of vehicles),
- specify a Trip Time (if using the Event Data method),
- specify a Trip ID (intention is a short identifier; use Title and Subtitle lines for longer headers in text output), and
- select the Start Section and End Section from drop-down lists to define the section of trip to be analysed using the markers defined in the Trip Data input dialog (if using the Travel Data method).

Figure 3.3a - General Settings input dialog for Travel Data method
Figure 3.3b - General Settings input dialog for Event Data method

Trip Time data field is used in the case of the Event Data method only.
3.3 TRIP DATA USING TRAVEL DATA METHOD

The Trip Data input dialog is used to specify data that describe the vehicle movement. The Trip Data input dialog is very different for the Travel Data and Event Data methods (Section 3.1). The Travel Data Method is explained in this section. The Event Data Method is explained in Section 3.4.

3.3.1 Importing Trip Data

The Travel Data method uses microscopic (second-by-second) trip data from an instrumented car, for example, data collected using a GPS data logger.

When you create a new Profile using the Travel Data method, and click or right click the Trip Data node in the Input Data Tree on the left-hand side of the Edit Profile dialog, the Trip Data input dialog shown in Figure 3.4a will be displayed. At this stage the Profile is empty.

Click the Import Trip Data button at the bottom of the input dialog, or select the Import Trip Data option in the right-click menu opened when you right-click the Trip Data node in the Input Data Tree. The Open Source Data File dialog will appear (see Figure 3.4b). The available source data file types are CSV (*.csv), Text (*.txt), NMEA Text (*.txt), GPS Exchange (*.gpx), Track (*.trk), and Garmin Database v 1.0/2.0 (*.gdb). Select the desired data file type, and then select the file to open, and click Open.

Although the NMEA Text (GPS-standard) files and the general (tab-separated) Text files have the same (txt) extension, the contents of these file types are very different. When you choose one of these file types, all data files with txt extension (i.e. files of both types) will be presented in the Open Source Data file dialog. SIDRA TRIP will identify the NMEA file type according to the contents of the file. The source data file formats are discussed in more detail in Section 3.3.3.

In the case of GPS Exchange and Garmin Database files, the Select Track dialog will appear for selection of a data track (see Figure 3.4c).

After you click Open in the Open Source Data File dialog, the data will be imported and displayed in a grid in the Trip Data input dialog (see Figure 3.5d). The data shown will depend on the contents of the source data file. The import process must result in at least five rows of data in the Trip Data input dialog for the process to be successful.

Source Data Units for Speed and Distance (top left corner of the Trip Data input dialog) are used to specify the units used for data shown in the grid. In the case of source data files in CSV (*.csv) or Text (*.txt) format, you need to specify the Source Data Units that match the units used in the source data file. On the other hand, in the case of source data files in NMEA Text (*.txt), GPS Exchange (*.gpx), Track (*.trk), and Garmin Database v 1.0/2.0 (*.gdb) formats, the program will determine the units used in the source data file and convert them to match the Source Data Units specified by the user before importing trip data. Once data appear in the grid, you can no longer change the Source Data Units.

The units of the data imported can be different from the units selected in Tools - Defaults (Current Defaults System), which is shown in the Trip Data input dialog. However, irrespective of the units of the imported data, the simulation will be performed and output will be generated in units selected for the Current Defaults System at the time the Profile was created.
Figure 3.4a - Trip Data input dialog for Travel Data method (before importing data)

Figure 3.4b - Open Source Data File dialog (file types shown)
Figure 3.4c - Select Track dialog

Figure 3.4d - Trip Data input dialog for Travel Data method (after importing data)
The units selected for Distance will also apply to the Altitude data. However, when the unit selected for Distance is km or mi, the unit to be used for Altitude will be metres or feet, respectively.

You also need to select the type of data (Speed, Distance or Coordinates) to be used for simulation according to the data available. The choice of one of these options is needed due to the relationships between these parameters.

The use of the Speed option is recommended when speed data are available since speed is the key parameter determining vehicle movement in simulation. When the Distance option is used, SIDRA TRIP will determine the speed to be used as a basis of simulation. When the Coordinates option is used, SIDRA TRIP will determine the distance from the coordinates, and then calculate speed from the distance. When the Distance or Coordinates option is used, the imported data seen in the Speed column of Trip Data input dialog remains unchanged, and is not used in simulation.

If you wish to analyse a subset of data, define the sections to be analysed by specifying the start and end points using markers (any text) given in the Location column (optional).

You can use the right mouse button to access the functions for editing data (Delete Row, Insert Row, Copy Row, Paste Row) as seen in Figure 3.4d. When there are data rows that seem to be problematic, you can edit the data or use the Delete Row function. You can delete multiple rows of data.

If SIDRA TRIP identifies problems with data quality, a Diagnostics node will appear in the Profile Tree and the Diagnostics text window will be opened automatically after data processing is complete. You can inspect the window for messages about the problems and take corrective action in the Trip Data dialog accordingly.

Click OK when the data is ready. The data will be processed (i.e. simulation will be carried out), and several output windows will be opened according to the Options settings, automatically. When you click OK, the Importing Trip Data dialog may appear indicating the progress of data processing. With large data files, this process may take a long time.

Parameter values imported from a data file or computed by SIDRA TRIP as applicable (e.g. speed values from distance data, or distance values from speed data) are stored with up to 7 decimal places accuracy (rounded up).

### 3.3.2 Conversion of Units Used in Data File

You can convert a Travel Data Profile between Metric and US Customary Units by using File - Save Trip Data As and export the trip data as a source data file in CSV (*.csv) or Text (*.txt) format. The exported data will be saved using the units of the Current Defaults System. Use Tools - Defaults, and select Current Defaults System to set units to Metric or US Customary as desired before exporting the data. Thus, if the simulated data is in Metric units and the Current Defaults System is in US Customary units, or vice versa, the units will be converted before being saved in the source data file as appropriate.

The exported data will be in units of:
- km/h for Speed and metres for Distance when the Defaults System is in Metric Units, and
- mph for Speed and feet for Distance when the Defaults System is in US Customary Units.

The next step is to create a new Travel Data Profile using File - New, and import the source data file (CSV or Text) exported previously. Make sure that you specify the Source Data Units (Speed and Distance) to match the data to be imported since the units of the imported data will be determined in accordance with the Source Data Units settings. Irrespective of the units of the
imported data, the simulation will be performed and output will be generated in units of the Current Defaults System.

You cannot directly convert an Event Data Profile between Metric and US Customary Units. However, you can export the trip data created in the Event Data Profile to a source data file in CSV (*.csv) or Text (*.txt) format, and then import the data as a Travel Data Profile using the above procedure.

### 3.3.3 Source Data File Formats

The following data file formats can be imported by SIDRA TRIP:

- **CSV** (comma-separated values) file (csv),
- **Text** (tab-separated text) file (txt),
- **NMEA Text** (GPS-standard) file (txt),
- **GPS Exchange** file (gpx), and
- **Track** file (trk).

**Garmin Database v 1.0/2.0** file (gdb).

For the **CSV** and **Text** (tab-separated) file formats, source data files need to be prepared by the user with parameters given in the order shown in Example 1 in Figures 3.5a and 3.5b. The Units in these examples are km/h for Speed and metres for Distance.

Note the following about the **CSV** and **Text** (tab-separated) file formats:

- These files can include initial descriptive comment lines starting with the # symbol, which will be ignored during the import process.
- It is not necessary to include all parameters (i.e. some may be left blank). The **Time Step** (if Date and Time data not given) and **Speed** (or **Distance**) parameters are essential. An example is given in Example 2 in Figures 3.5c and 3.5d, where only the Time Step, Speed and Distance data are given.

**NMEA Text** (*.txt) files use a standard format many GPS devices can produce. They contain most of the information that can be imported by SIDRA TRIP readily, i.e. the NMEA Text format is recognized by SIDRA TRIP and converted to the required trip data format automatically.

NMEA Text format is defined by the US National Maritime Electronics Association (www.nmea.org). A NMEA file is a comma-separated text file with one or more NMEA records for each time step (typically each second). All NMEA records start with $GP and ends with a checksum starting with a star (*). The NMEA file contains the following NMEA records for each time step:

- **$GPRMC**: Recommended minimum specific GPS data,
- **$GPGGA**: Global positioning system fix data,
- **$GPGSA**: GPS DOP (dilution of precision) and active satellites, and
- **$GPGSV**: GPS Satellites in view (data for up to 4 satellites per GSV line)
### Figure 3.5a - Trip Data: CSV (comma-separated values) file format (Example 1)

<table>
<thead>
<tr>
<th>#TimeStep</th>
<th>Speed (km/h)</th>
<th>Distance (m)</th>
<th>Grade</th>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Altitude</th>
<th>Heading</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.2</td>
<td>9.7</td>
<td>1.8</td>
<td>20051128</td>
<td>084931</td>
<td>-37.951389</td>
<td>145.077083</td>
<td>41.2</td>
<td>9.3</td>
<td>Greythorn Rd</td>
</tr>
<tr>
<td>2</td>
<td>29.6</td>
<td>17.8</td>
<td>1.7</td>
<td>20051128</td>
<td>084932</td>
<td>-37.951306</td>
<td>145.077083</td>
<td>41.5</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>26.2</td>
<td>24.4</td>
<td>1.2</td>
<td>20051128</td>
<td>084933</td>
<td>-37.951222</td>
<td>145.077111</td>
<td>41.8</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19.7</td>
<td>29.7</td>
<td>1.7</td>
<td>20051128</td>
<td>084934</td>
<td>-37.951167</td>
<td>145.077111</td>
<td>42.3</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12.4</td>
<td>33.1</td>
<td>0.6</td>
<td>20051128</td>
<td>084935</td>
<td>-37.951111</td>
<td>145.077139</td>
<td>42.5</td>
<td>9.8</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3.5b - Trip Data: Text (tab-separated) file format (Example 1)

<table>
<thead>
<tr>
<th>#TimeStep</th>
<th>Speed (km/h)</th>
<th>Distance (m)</th>
<th>Grade</th>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Altitude</th>
<th>Heading</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.2</td>
<td>9.7</td>
<td>1.8</td>
<td>20051128</td>
<td>084931</td>
<td>-37.951389</td>
<td>145.077083</td>
<td>41.2</td>
<td>9.3</td>
<td>Greythorn Rd</td>
</tr>
<tr>
<td>2</td>
<td>29.6</td>
<td>17.8</td>
<td>1.7</td>
<td>20051128</td>
<td>084932</td>
<td>-37.951306</td>
<td>145.077083</td>
<td>41.5</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>26.2</td>
<td>24.4</td>
<td>1.2</td>
<td>20051128</td>
<td>084933</td>
<td>-37.951222</td>
<td>145.077111</td>
<td>41.8</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19.7</td>
<td>29.7</td>
<td>1.7</td>
<td>20051128</td>
<td>084934</td>
<td>-37.951167</td>
<td>145.077111</td>
<td>42.3</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12.4</td>
<td>33.1</td>
<td>0.6</td>
<td>20051128</td>
<td>084935</td>
<td>-37.951111</td>
<td>145.077139</td>
<td>42.5</td>
<td>9.8</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3.5c - Trip Data: CSV (comma-separated values) file format (Example 2)

<table>
<thead>
<tr>
<th>#TimeStep</th>
<th>Speed (km/h)</th>
<th>Distance (m)</th>
<th>Grade</th>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Altitude</th>
<th>Heading</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.2</td>
<td>9.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>29.6</td>
<td>17.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>26.2</td>
<td>24.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19.7</td>
<td>29.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12.4</td>
<td>33.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3.5d - Trip Data: Text (tab-separated) file format (Example 2)

<table>
<thead>
<tr>
<th>#TimeStep</th>
<th>Speed (km/h)</th>
<th>Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35.2</td>
<td>9.7</td>
</tr>
<tr>
<td>2</td>
<td>29.6</td>
<td>17.8</td>
</tr>
<tr>
<td>3</td>
<td>26.2</td>
<td>24.4</td>
</tr>
<tr>
<td>4</td>
<td>19.7</td>
<td>29.7</td>
</tr>
<tr>
<td>5</td>
<td>12.4</td>
<td>33.1</td>
</tr>
</tbody>
</table>
Table 3.1
Parameters in NMEA records

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Format</th>
<th>Comment</th>
<th>NMEA Record</th>
<th>Example in Figure 3.5e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude</td>
<td>Real</td>
<td>DDMM.mmmm N/S</td>
<td>RMC, GGA</td>
<td>3757.6004 S</td>
</tr>
<tr>
<td>Longitude</td>
<td>Real</td>
<td>DDMM.mmmm W/E</td>
<td>RMC, GGA</td>
<td>14504.3621 E</td>
</tr>
<tr>
<td>Altitude</td>
<td>Real</td>
<td>Metres</td>
<td>GGA</td>
<td>35.0</td>
</tr>
<tr>
<td>Speed</td>
<td>Real</td>
<td>Knots (nm/h, multiply by 1.852 to get km/h)</td>
<td>RMC</td>
<td>21.3</td>
</tr>
<tr>
<td>Heading</td>
<td>Real</td>
<td>Degrees, 0 = North, clockwise</td>
<td>RMC</td>
<td>100.4</td>
</tr>
<tr>
<td>Date</td>
<td>Integer</td>
<td>DDDMMYY</td>
<td>RMC</td>
<td>190306</td>
</tr>
<tr>
<td>Time</td>
<td>Integer</td>
<td>HHMMSS</td>
<td>RMC, GGA</td>
<td>214701</td>
</tr>
<tr>
<td>HDOP</td>
<td>Real</td>
<td>Horizontal dilution of precision (x,y)</td>
<td>GSA, GGA</td>
<td>1.1</td>
</tr>
<tr>
<td>VDOP</td>
<td>Real</td>
<td>Vertical dilution of precision (z)</td>
<td>GSA</td>
<td>2.0</td>
</tr>
<tr>
<td>PDOP</td>
<td>Real</td>
<td>Point dilution of precision (x,y,z)</td>
<td>GSA</td>
<td>2.2</td>
</tr>
<tr>
<td>NSatUsed</td>
<td>Integer</td>
<td>Number of satellites used to fix position</td>
<td>GGA</td>
<td>8</td>
</tr>
<tr>
<td>NSatView</td>
<td>Integer</td>
<td>Number of satellites in view</td>
<td>GSV</td>
<td>9</td>
</tr>
<tr>
<td>Valid fix</td>
<td>Integer</td>
<td>0-invalid fix, 1-valid fix, 2-8-special</td>
<td>GGA7</td>
<td>1</td>
</tr>
<tr>
<td>2D/3D fix</td>
<td>Integer</td>
<td>1-no fix, 2-2D fix, 3-3D fix</td>
<td>GSA3</td>
<td>3</td>
</tr>
</tbody>
</table>
An example of NMEA Text format is given in Figure 3.5e. The most relevant information from NMEA records is summarised in Table 3.1 (with parameter values for the example shown in Figure 3.5e shown in the last column).

When importing from the NMEA Text data files, SIDRA TRIP determines the horizontal and vertical accuracy index (HAI, VAI) values for each time step according to the number of satellites available at the time data were recorded. These values are kept in the SIDRA TRIP Profile (aam) file but they are not displayed in the Trip Data input dialog. The Trip Statistics output will include average values of HAI and VAI for the trip (or section of a trip as applicable) in the case of NMEA text data. The index values are in the range 1 to 5 (1: Very Poor, 5: Very Good).

A GPS Exchange (www.topografix.com/gpx.asp) file is an XML based text file with information for each point along the track (see Figures 3.5f). A Track file is a semicolon-separated text file with information for each point along the track (see Figures 3.5g). The file can be imported to Excel or similar programs.

The date and time value in the Track format (e.g. 1142649491 in Figure 3.5g) can be decoded by dividing the value by 86400. The resulting whole number is the number of days since 1/1/1970 and the remainder is the number of seconds since midnight:

- **Date:** Int (1142649491/86400) = 13225 days since 1/1/1970
- **Time:** Mod (1142649491, 86400) = 9491 seconds since midnight = 02:38:11 AM

```xml
<?xml version="1.0"?>
<gpx
  creator = "GPS Tuner 4.0 - http://www.gpstuner.com"
  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
  xmlns = "http://www.topografix.com/GPX/1/0"
  xsi:schemaLocation = "http://www.topografix.com/GPX/1/0 http://www.topografix.com/GPX/1/0/gpx.xsd">
  <time>2006-03-17T07:05:22Z</time>
  <bounds minlat="-37.9667333333333" maxlat="-37.7899183333333"
       minlon="145.05493" maxlon="145.101496666667"/>
  <trk>
    <trkseg>
      <trkpt lat="-37.7910366666667" lon="145.0939766666667">
        <ele>58.2</ele>
        <time>2006-03-17T07:05:35Z</time>
        <speed>0.308666666666667</speed>
        <type>Trackpoint</type>
      </trkpt>
      <trkpt lat="-37.7910383333333" lon="145.094">
        <ele>58.7</ele>
        <time>2006-03-17T07:05:36Z</time>
        <speed>0.514444444444444</speed>
        <type>Trackpoint</type>
      </trkpt>
      <trkpt lat="-37.7910383333333" lon="145.094">...<type>Trackpoint</type>
    </trkseg>
  </trk>
</gpx>
```

**Figure 3.5f - Trip Data: GPX Exchange (gpx) file format**

Latitude and Longitude (decimal degrees)
Altitude (m)
Date and Time (YYYY-MM-DD & HH:MM:SS)
Speed (m/s)
Garmin (www.garmin.com) uses a Garmin Database (gdb) format for Garmin GPS units, and the MapSource software for data transfer and communication. SIDRA TRIP can read directly form Garmin Database version 1.0 and 2.0 files.

### 3.3.4 Parameters in the Trip Data Input Dialog

The input data parameters in the Trip Data input dialog are explained below.

#### Time Step

**Time Step** is the number of seconds elapsed since the start of the trip. The size of the time step (**Data Time Interval**) is automatically calculated based on the most common interval in the source data. The **Data Time Interval** determined by the program is given in the Trip Data Settings section of Trip Statistics output.

SIDRA TRIP makes allowance for missing steps by linear interpolation. This can be seen as linear sections in the Speed - Time graph generated as output.

The first Time Step value should be zero, and the subsequent Time Step values represent cumulative trip time since the start of the trip. If the initial step has a Time Step value larger than zero (due to the use of a section of a trip), all Time Step values are normalised with the first Time Step value set to zero. The normalised Time Step values will be saved (overwrite the original values). These can be seen in the Trip Data input dialog next time it is opened.

If **Date and Time** data are specified, the Time Step value will be determined from these parameters and the value in the Time Step column will be overwritten (valid for all data file formats). Time Step is required if Date and Time parameters are not given.

All data values as used in simulation can be seen by exporting the simulation data using **File - Save Trip Data As** (in csv or txt format) or **File - Save Sim Data As** (in csv, txt or xml format).

#### Speed

**Speed** is an instantaneous speed value for a given Time Step (in kilometres per hour, metres per second, miles per hour or feet per second, as specified for the source data in the Trip Data input dialog). Speed data are required if you wish to perform the simulation using the Speed Data option. If you choose the Distance Data or Coordinates option, speed is calculated from Distance or Coordinates for use in simulation. During simulation, the distance travelled is always determined by the speed used in simulation (hence it may differ from the distance values given in the Trip Data input dialog). The original speed data are kept in the Profile when the Speeds are calculated from Distance or Coordinates Data.

---

**Figure 3.5g - Trip Data: Track (trk) file format**

<table>
<thead>
<tr>
<th>Latitude,Longitude,Altitude(m);Speed(km/h);DateandTime</th>
<th>Latitude and Longitude in decimal degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>-37.963746666667;145.065375;37.7;1.2964;1142649491;1</td>
<td>(Latitude and Longitude in decimal degrees)</td>
</tr>
<tr>
<td>-37.963753333333;145.065375;37.8;2.5928;1142649492;0</td>
<td></td>
</tr>
<tr>
<td>-37.963761666667;145.0653733333;37.9;3.704;1142649493;0</td>
<td></td>
</tr>
<tr>
<td>-37.963783333333;145.0653683333;38.1;6.672;1142649495;0</td>
<td></td>
</tr>
<tr>
<td>-37.963815;145.0653666667;38.1;11.2972;1142649496;0</td>
<td></td>
</tr>
<tr>
<td>-37.963853333333;145.06535;38.2;15.5568;1142649497;0</td>
<td></td>
</tr>
<tr>
<td>-37.963898333333;145.0653366667;38.1;18.52;1142649498;0</td>
<td></td>
</tr>
<tr>
<td>-37.963946666667;145.0653166667;38.1;19.446;1142649499;0</td>
<td></td>
</tr>
<tr>
<td>-37.963995;145.065306666667;37.8;19.6312;1142649500;0</td>
<td></td>
</tr>
</tbody>
</table>
**Distance**

**Distance** is the *cumulative* distance travelled since the start of the trip (in metres, kilometres, feet or miles, as specified for the source data in the Trip Data input dialog). If the analysis is performed using the Distance Data option and the initial Distance value is not zero (e.g. when an initial section of data is deleted), the simulated Distance values are normalised with the first Distance value set to zero. The original Distance data are kept in the Profile.

**Grade**

**Grade** is specified as a percentage value. This represents the slope of the road in the direction of travel (positive for uphill grade, negative for downhill grade, zero for level road) as seen in Figure 3.6.

Grade influences instantaneous tractive force, energy and power values, and therefore fuel consumption, emissions and cost estimates. If Grade data are not given, level road is assumed.

In **Tools - Options - Settings**, the following options are available for calculating Grade data from Altitude data (if available) for each Time Step during import:

- Never
- If Grade Data not given
- Always

If the Altitude data are reliable, SIDRA TRIP can calculate plausible grade values.

![Figure 3.6 - The Grade definition in SIDRA TRIP](image)

*Figure 3.6 - The Grade definition in SIDRA TRIP*
**Date and Time**

*Date* and *Time* are obtained from the GPS device. For CSV and Text (tab-separated) file formats:

- *Date* may be specified in YYYY-MM-DD or DD-MM-YYYY format (using a dash, slash or dot as a separator). Leading zeros are optional.
- *Time* must be specified in HH:MM:SS format (using a colon or dot as a separator).
- Date and Time formats with no separators (YYYYMMDD, HHMMSS) are also acceptable.

For NMEA Text and Track formats, internal date formats are used. Date and Time code in the Track format is specified in the number of seconds since 1 January 1970 (see Section 3.3.3).

The GPS Exchange format uses the YYYY-MM-DDTHH:MM:SS format only, where "T" is a literal T that must occur, e.g. 2006-01-29T21:39:24, which is the standard way of showing dates and times in XML-based files.

The date format MM-DD-YYYY is not supported.

If both a Time Step and the Date and Time are specified, the Time Step will be recalculated from the Date and Time.

**Time Zone Adjustment:** Date and Time values in CSV (*.csv) or Text (*.txt) formats are imported without any adjustment. Date and Time values in NMEA Text (*.txt), GPS Exchange (*.gpx), Track (*.trk), and Garmin Database v 1.0/2.0 (*.gdb) formats are stored in UTC format. During trip data import, these may be converted to the current time zone and daylight saving time settings.

In **Tools - Options - Settings**, various options are available for the method to be used for Time Zone Adjustment:

- **No Time Zone Adjustment:** Date and Time values in the source data file are imported without any adjustment;
- **Adjust to Current Time Zone** (default option): Date and Time values are converted to the current time zone according to the Date and Time settings of your computer, including the daylight saving time settings;
- **Adjust to Specified Time Zone:** Date and Time values are adjusted using a specified value.

When trip data are imported from a source data file created in another time zone or before a change to or from daylight saving time, the imported Date and Time values may be wrong when the **Adjust to Current Time Zone** method is used. The option **Adjust to Specified Time Zone** can be used in such cases.

**Latitude and Longitude**

*Latitude* and *Longitude* (Coordinates) are optional unless you wish to perform the simulation using the Coordinates option. Note that unless you have high-precision data, an analysis based on coordinates will not be reliable.

Coordinates are specified as decimal degrees. SIDRA TRIP also supports the format DDDMM.mmm… where DDD is degrees, MM is minutes, and mmm… is decimal minutes, hence 147° 31.842' is formatted as 147.31.842. This format should be used with care. This is equivalent to 147.5307 in decimal degrees.
Altitude

Altitude (elevation) data are used for calculating approximate grade values when Grade data are not given. This is subject to the option selected under "Calculate Grade data from Altitude data if available during import" in Tools - Options - Settings (options available are Never, If Grade Data not given, Always). No smoothing is performed in grade calculations, so the resulting grade values may not be reliable.

The units for Altitude data are based on those used for Distance data but only metres and feet are applicable (metres if Distance data are in metres or kilometres, and feet if Distance data are in feet or miles).

Location

Location provides a way to specify markers for defining sections of a trip. The location markers are specified in free-form text format. These are shown in the Start Section and End Section drop-down lists in the General Settings input dialog. Duplicate location marker descriptions are allowed.
3.4 TRIP DATA USING EVENT DATA METHOD

The Event Data method uses trip data defined by the user in drive-cycle format simply by specifying initial and final speeds to represent vehicle idling, cruise, acceleration and deceleration manoeuvres with markers representing traffic events.

3.4.1 Specifying Event Data

When you create a new Profile using the Event Data method, and click the Trip Data node in the Input Data Tree on the left-hand side of the Edit Profile dialog, the Trip Data input dialog will be opened. At this stage the Profile will have Event Group 1 and Event 1 created automatically. These will be seen under the Trip Data node in the Input Data Tree. Figure 3.7a shows an Event Group with more Events specified by the user. This view is obtained when the Event Group node is clicked. Figure 3.7b shows the view when the Event 2 node is clicked for the same example.

You can right-click the Event Group node in the Input Data Tree, or click the buttons at the bottom of the dialog (see Figure 3.7a), and choose:

- Add Event Group to add an Event Group with a single Event (added after the last Event Group);
- Clone Event Group (make a copy of the selected Event Group and add after the last Event Group);
- Delete Event Group (delete the selected Event Group); or
- Add Event (add new Event at the end of the selected Event Group).

You can right-click any Event node in the Input Data Tree, or click the buttons at the bottom of the dialog (see Figure 3.7b), to choose:

- Add Event (add new Event at the end of Event Group);
- Insert Event (add new Event after the selected Event), or
- Delete Event (delete the selected Event).

The data that can be specified in the Trip Data input dialog for Event Data method include the following:

- Event Data:
  - Initial Speed (km/h or mph)
  - Final Speed (km/h or mph)
  - Grade (percent)
  - Event Duration (s) / Distance (m or ft)

- Marker Data:
  - Marker Type (drop-down list)
  - Setback Distance (m or ft)

- Loop Data:
  - Check box (click the check box for other data fields to be accessible)
  - Length (m or ft)
  - Setback Distance (m or ft)
Figure 3.7a - Trip Data input dialog - Event Group for Event Data method (for "Event Group 1" in this example)

Figure 3.7b - Trip Data input dialog - Event for Event Data method (for "Event 2" in this example)
3.4.2 Initial and Final Speeds

You need to specify an Initial Speed and a Final Speed for the first Event of the trip. For all subsequent Events, the Initial Speed is set equal to the Final Speed of the previous Event automatically. When you change the Final Speed of an Event, the Initial Speed of the next Event will be set equal to it automatically.

When you Add or Insert an Event, or when you Add or Clone an Event Group, the Initial and Final Speed adjustments will be made automatically:

- When the Add Event function is used, a new Event is added to the end of the Event Group. The Initial Speed of the new Event is set equal to the Final Speed of the last Event in the group, and the Final Speed of the new Event is set equal to the Final speed of the Event that was selected when Add Event function was used.
- When the Insert Event function is used, a new Event is added immediately after the selected Event. The Initial and Final Speeds of the new Event are both set equal to the Final speed of the previous Event.
- When the Add Event Group function is used, the Initial and Final Speeds of the first Event in the new Event Group are set equal to the Final Speed of the last Event in the previous Event Group.
- When the Clone Event Group function is used, the Initial Speed of the first Event in the new Event Group is set equal to the Final Speed of the last Event in the previous Event Group.

3.4.3 Event Type

An Event Type is determined automatically according to the Initial and Final Speed values. Possible Event Types are:

- Cruise / Idle if the Final Speed equals the Initial Speed, (Cruise if the speed is greater than zero, Idle if the speed is zero), and
- Speed Change if the Final Speed is greater than the Initial Speed (Acceleration) or if the Final Speed is less than the Initial Speed (Deceleration).

3.4.4 Event Markers

Event Marker Types

The following Marker Types are available in the drop-down list:

- None
- Give-Way / Yield Sign
- Pedestrian Crossing
- Roundabout
- Speed hump
- Stop Sign
- Traffic Signals

The markers are displayed with graphical symbols indicating locations during animation.

**Event Marker Location**

Event Marker location (position) is specified using the **Setback Distance** parameter. The Setback Distance is measured back from the location reached by the vehicle at the end of the current Event (see Figure 3.8). The default value of Event Marker Setback Distance is zero. Marker locations are calculated using simulated distance values.

If the current Event is idling (zero speed), the distance to the end of the Event is the same as the distance at the end of the previous Event. If the first Event is idling, the position of the vehicle at the end of this event is still as at the start of the trip (zero distance travelled). The Setback Distance in this case should be zero only. There are no other restrictions on the Marker Setback Distance, so the Marker location may be within previous Event distance areas.

![Event Marker Location Diagram](image)

*Figure 3.8 - Event Marker location*
3.4.5 Loops

Detector loops can be specified to simulate vehicle detection by presence detectors. Default values of loop data are:

- Loop Length: 4.5 m or 15 ft
- Loop Setback Distance: 1.5 m or 5 ft

Loop location is determined using the Setback Distance parameter in the same way as the method used for Event Markers. The Setback Distance is measured back from the location reached at the end of the current Event (see Figure 3.9). This determines the position of the downstream edge of the loop.

![Figure 3.9 - Loop location](image)
3.5 SPEED SETTINGS

The **Speed Settings** input dialog (**Figure 3.10**) allows you to specify the following speed parameters (km/h or mph).

- **Desired Speed**: Click the check box if you want to specify a desired speed, otherwise the program will determine the desired Speed automatically.

- **Lower Speed for a Stop** and **Upper Speed for a Stop**:
  - for a stop to be counted, the vehicle must cross the speed band defined by these two speeds during deceleration from a speed above the Upper Speed to a speed below the Lower Speed, and
  - for a subsequent stop to be counted, the vehicle must first cross the speed band during acceleration to a speed above the Upper Speed and then must decelerate to a speed below the Lower Speed.

- **Speed Groups**: Click the check boxes and type the desired upper speed values to define speed ranges for the trip time spent and the percentage value of travel in each speed group to be given in Trip Statistics output.

When the program determines the desired Speed, it is rounded to the nearest 5 km/h or 5 mph. Speeds less than 5 km/h or 5 mph are rounded to 5 km/h or 5 mph.

**Figure 3.10 - Speed Settings input dialog**
3.6 NOISE SETTINGS

SIDRA TRIP estimates noise levels (dBA) generated during the trip using three different models:

- ASJ 2003 (Japanese) Model
- SonRoad (Swiss) Model, and
- RLS-90 (German) Model.

The models to be used for generating noise graphs (showing instantaneous values of noise levels) and various noise statistics in text output windows can be specified using check boxes in Tools - Options - Output.

For each model, noise levels received at a Fixed Receptor point and at a Relative Receptor point are simulated. The Fixed Receptor is at a fixed location defined with reference to the start of the trip. The Relative Receptor is at a constant distance from the vehicle, and moves with the vehicle.

The Noise Settings input dialog (Figure 3.11) allows specification of the following parameters:

- **Flow Rate** (veh/h): used for estimating an **Average Equivalent Noise Level** ($L_{eqT}$) for a traffic stream.

![Figure 3.11 - Noise Settings input dialog](image)

Coordinates method not available for Event Data method

Specify Flow Rate for Average Equivalent Noise Level ($L_{eqT}$) calculation

Specify fixed Receptor point
- Fixed Receptor location:
  - Distance from the Start of Trip (m or ft), or
  - Coordinates (this option is not available in the case of the Event Data method, and available in the case of Travel Data method only when Coordinates are being used to perform the simulation).
- Relative Receptor location: Distance between Source (vehicle) and Receptor (m or ft).
- Heights:
  - Height of Source above Ground (m or ft), and
  - Height of Receptor above Ground (m or ft).

According to the average headway, \( h = \frac{3600}{q} \) (seconds) corresponding to the Flow Rate, \( q \) (veh/h) specified, the Fixed Receptor point may be determined by the program if the Fixed Receptor distance is specified as zero (default) or the distance exceeds the total trip distance.

General information about noise modelling is given in Section 4.4.6.
3.7 COST & LOS PARAMETERS

The Cost & LOS Parameters input dialog allows you to specify various parameters for SIDRA TRIP to determine the Operating Cost or User Cost statistics for a trip. The Operating Cost is appropriate for use in traffic management and planning as a cost to the community, and excludes the tax component of the pump price of fuel. The User Cost is appropriate for use by an individual or an operating agency as a cost including the total pump price of fuel as well as any toll costs experienced during the trip.

The Operating Cost and User Cost estimates include:

- the vehicle operating cost (the resource cost or full cost of fuel and additional running costs including tyre, oil, repair and maintenance as a factor of the cost of fuel), and
- the time cost to driver and passengers.

The Cost & LOS Parameters input dialog (Figure 3.12) allows the user to calibrate the cost model for local conditions. Calibration parameters include Cost Unit (user’s own currency), Vehicle Cost Parameters (Pump Price of Fuel, Fuel Resource Cost Factor, Ratio of Running Cost to Fuel Cost), Time Cost Parameters (Average Income, Time Value Factor, Average Occupancy), Level of Service Parameters (Lower Limit for Travel Time Ratio) and Cost Method Parameters (Toll Cost, Cost Method).

![Figure 3.12 - Cost & LOS Parameters input dialog](image)

Select Operating Cost or User Cost
The cost model parameters for Australia, New Zealand and USA are given in Table 3.2. The standard default values of cost model parameters for SIDRA TRIP are the Australian values given in Table 3.2 for when Metric Units are chosen, and the USA values when US Customary Units are chosen (the units are chosen in Tools - Defaults).

In the Tools - Defaults - Cost & LOS Parameters dialog, the Cost Unit (e.g. $) is automatically determined by the Windows regional settings and used as the default value when you create a new profile. The Cost Unit can be changed in the Cost & LOS Parameters input dialog (Figure 3.2).

You can choose the Cost Method (Operating Cost or User Cost) using the drop-down list in the Cost Method Parameters group in the Cost & LOS Parameters input dialog, or using Tools - Defaults - Cost & LOS Parameters. The Toll Cost is added to the total cost when the User Cost method is selected. For User Cost, fuel resource cost factor = 1.0 is used by the program automatically, i.e. pump price of fuel applies fully.

**Table 3.2**

Cost model parameters for SIDRA TRIP

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Australia</th>
<th>New Zealand</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Unit</strong></td>
<td></td>
<td>$(AUD)$</td>
<td>$(NZD)$</td>
<td>$(USD)$</td>
</tr>
<tr>
<td><strong>Parameters for Vehicle Operating Cost</strong></td>
<td>((k_0))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump price of fuel in “Cost Unit” per litre (or per gallon)</td>
<td>((P_p))</td>
<td>1.20 ($/L)</td>
<td>1.60 ($/L)</td>
<td>0.65 ($/L) (2.40 $/gal)</td>
</tr>
<tr>
<td>Fuel resource cost factor *</td>
<td>((f_r))</td>
<td>0.50</td>
<td>0.60</td>
<td>0.70</td>
</tr>
<tr>
<td>Running cost/fuel cost ratio</td>
<td>((f_3))</td>
<td>3.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Parameters for Time Cost</strong></td>
<td>((k_t))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average income (full time adult average hourly total earnings) in “Cost Unit” per hour</td>
<td>((W))</td>
<td>28.00 ($/h)</td>
<td>21.00 ($/h)</td>
<td>19.00 ($/h)</td>
</tr>
<tr>
<td>Time value factor as a proportion of average hourly income</td>
<td>((f_p))</td>
<td>0.60</td>
<td>0.60</td>
<td>0.40</td>
</tr>
<tr>
<td>Average occupancy in persons per vehicle</td>
<td>((f_o))</td>
<td>1.5</td>
<td>1.5</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Calculated Values</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle operating cost factor in “Cost Unit” per litre (or per gallon) of fuel</td>
<td>((k_0 = f_c f_r P_p))</td>
<td>1.800 ($/L)</td>
<td>2.400 ($/L)</td>
<td>1.365 ($/L) (5.040 $/gal)</td>
</tr>
<tr>
<td>Time cost per person in “Cost Unit” per hour</td>
<td>((f_p W))</td>
<td>16.80 ($/h)</td>
<td>12.60 ($/h)</td>
<td>7.60 ($/h)</td>
</tr>
<tr>
<td>Time cost per vehicle in “Cost Unit” per hour</td>
<td>((k_t = f_c f_o W))</td>
<td>25.20 ($/h)</td>
<td>18.90 ($/h)</td>
<td>9.12 ($/h)</td>
</tr>
</tbody>
</table>

* For User Cost, fuel resource cost factor = 1.0 is used.
Values calculated for various parameters described below are given in Table 3.2.

**Total operating cost.** $C_t$ in "Cost Units" (e.g. $), can be calculated from:

$$ C_t = k_o F_t / 1000 + k_t T_t / 3600 $$

(3.7.1)

where

- $k_o =$ vehicle operating cost factor (Cost Unit per litre or per gallon of fuel, e.g. $/L or $/gal),
- $k_t =$ time cost factor ("Cost Unit" per hour, e.g. $/h),
- $F_t =$ total fuel consumption (mL), and
- $T_t =$ travel time (seconds).

The *vehicle operating cost factor*, $k_o$ in Cost Unit per litre or per gallon of fuel, e.g. $/L or $/gal is calculated from:

$$ k_o = f_c f_r P_p $$

(3.7.2)

where

- $f_c =$ an aggregate cost factor used to convert the cost of fuel to total running cost including tyre, oil, repair and maintenance;
- $f_r =$ fuel resource cost factor (ratio of the resource price of fuel to the pump price); resource price is the wholesale price plus retail margin less taxes;
- $P_p =$ pump price of fuel in "Cost Unit" per litre (per gallon if US Customary Units are used), e.g. $/L or $/gal.

The *time cost per vehicle*, $k_t$ in "Cost Unit" per hour, e.g. $/h, is calculated from:

$$ k_t = f_o f_p W $$

(3.7.3)

where

- $f_o =$ average occupancy in persons per vehicle;
- $f_p =$ time value factor that converts the average income to a value of time;
- $W =$ average income (full time adult average hourly total earnings) in "Cost Unit" per hour, e.g. $/h.

**Level of Service**

The default value of the Level of Service (LOS) parameter *Lower Limit for Travel Time Ratio* can be specified using **Tools - Defaults - Cost & LOS Parameters**, or it can be specified for a specific case in the **Cost & LOS Parameters** input dialog. Detailed information about the LOS method for the *Level of Service Index* used in SIDRA TRIP is described in **Section 4.4.1 (Output Statistics - Trip Assessment)**.
3.8 VEHICLES

The input dialogs in the Vehicles group of the Input Data Tree (Figure 3.13) are used to specify data that describe the vehicle characteristics. The title bar of the input dialog gives the name of the selected Vehicle in brackets.

SIDRA TRIP provides three types (classes) of default vehicles under the Vehicles node in the Input Tree, namely Passenger Car, Light Vehicle and Heavy Vehicle. Definitions of these vehicle classes and detailed information about the default vehicle parameters are given in Section 2.4.1.

The parameter values of default vehicles cannot be changed, and the default vehicles cannot be deleted from the tree.

You can right-click the Passenger Car, Light Vehicle or Heavy Vehicle node in the Input Tree Pane and click the Clone Vehicle option, or click the corresponding button at the bottom of the dialog, to clone the selected vehicle. This will make a copy of the vehicle and paste it under the User node in the tree. You can specify the parameters of user-specified vehicles to define a particular vehicle or an aggregate (representative) vehicle type that you may have prepared.

Figure 3.13 - Vehicles input dialog (for "My Car" in this example)
You can right-click the user-specified vehicle node in the Input Data Tree and click the **Delete Vehicle** option, or click the corresponding button at the bottom of the dialog, to delete the selected user-specified vehicle from the tree.

Rather than creating user-specified vehicles in an input dialog for a particular Profile, you can create such vehicles using **Tools - Defaults - Vehicles**. These user-specified vehicles as well as the default vehicles will be available for selection in the General Settings input dialog for all profiles.

SIDRA TRIP allows importing of user-specified vehicles which are included in a Profile when that Profile is opened. This is optional (use the "**Import new Vehicles and Drivers when opening Profiles**" option in Tools - Options - Settings).

3.8.1 Fuel Consumption and Emission Parameters

SIDRA TRIP uses the same power-based model with different parameters for estimating fuel consumption and emissions of Carbon Monoxide (CO), Hydrocarbons (HC) and Nitrogen Oxides (NOx) (Bowyer, Akçelik and Biggs 1985, Holyoake 1985, Biggs 1988, Taylor and Young 1996). Carbon Dioxide (CO₂) is estimated directly from fuel consumption by applying a CO₂ factor to the fuel consumption rate.

Default vehicle parameters for fuel consumption and CO, HC and NOx emission rates are summarised in *Table 3.3*. Fuel consumption and emission model parameters are specified in Metric Units even when the Current Defaults System is US Customary Units (*Section 2.4.1*).

Some fuel consumption model parameters given in *Table 3.3* are based on those reported in Bowyer, Akçelik and Biggs (1985), and the emission model parameters are based on those derived by Holyoake (1985). Heavy vehicle parameters represent a mixture of vehicles that use petrol and diesel fuel (70 per cent diesel use for the selected vehicle composition) as seen in *Table 2.2a* in *Section 2.4.3*. 

---

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### Table 3.3

Default vehicle parameters for estimating fuel consumption and various emission rates
(Metric units only)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Unit for Fuel</th>
<th>Unit for Emissions</th>
<th>Veh. Class</th>
<th>Fuel</th>
<th>CO</th>
<th>HC</th>
<th>NOx</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f_i )</td>
<td>Idling fuel consumption or emission rate</td>
<td>mL/h</td>
<td>g/h</td>
<td>PC</td>
<td>1300</td>
<td>50</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>1350</td>
<td>50</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>2000</td>
<td>50</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>Drag fuel consumption or emission parameter, mainly related to rolling resistance</td>
<td>mL/km</td>
<td>g/km</td>
<td>PC</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>21</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>100</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>Drag fuel consumption or emission parameter mainly related to aerodynamic drag</td>
<td>((\text{mL/km})/(\text{km/h})^2)</td>
<td>((\text{g/km})/(\text{km/h})^2)</td>
<td>PC</td>
<td>0.00500</td>
<td>0.0000</td>
<td>0.00002</td>
<td>0.00006</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.00550</td>
<td>0.0000</td>
<td>0.00002</td>
<td>0.00006</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>0.01800</td>
<td>0.0000</td>
<td>0.00002</td>
<td>0.00006</td>
</tr>
<tr>
<td>( b_1 )</td>
<td>( A / (1000 \beta_1) )</td>
<td>kN</td>
<td>kN</td>
<td>PC</td>
<td>0.2222</td>
<td>0.067</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.2333</td>
<td>0.067</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>1.2500</td>
<td>0.067</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>( b_2 )</td>
<td>( 0.01296 B / \beta_1 )</td>
<td>kN/(m/s)^2</td>
<td>kN/(m/s)^2</td>
<td>PC</td>
<td>0.00072</td>
<td>0.0000</td>
<td>0.00000</td>
<td>0.00078</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.00079</td>
<td>0.0000</td>
<td>0.00000</td>
<td>0.00078</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>0.00292</td>
<td>0.0000</td>
<td>0.00000</td>
<td>0.00078</td>
</tr>
<tr>
<td>( c_1 )</td>
<td>( \beta_1 b_1 )</td>
<td>mL/m</td>
<td>g/m</td>
<td>PC</td>
<td>0.020</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.021</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>0.100</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>( c_2 )</td>
<td>( \beta_1 b_2 )</td>
<td>mL/(m/s)^2</td>
<td>(g/m)/(m/s)^2</td>
<td>PC</td>
<td>0.0000648</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00000078</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.0000713</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00000078</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>0.0002333</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00000078</td>
</tr>
<tr>
<td>( \beta_1 )</td>
<td>Efficiency parameter</td>
<td>mL/kJ</td>
<td>g/kJ</td>
<td>PC</td>
<td>0.0900</td>
<td>0.0150</td>
<td>0.0000</td>
<td>0.0010</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.0900</td>
<td>0.0150</td>
<td>0.0000</td>
<td>0.0010</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>0.0800</td>
<td>0.0150</td>
<td>0.0000</td>
<td>0.0010</td>
</tr>
<tr>
<td>( \beta_2 )</td>
<td>Energy-acceleration efficiency parameter</td>
<td>mL/(kJ/m/s^2)</td>
<td>g'/(kJ.m/s^2)</td>
<td>PC</td>
<td>0.0300</td>
<td>0.0250</td>
<td>0.0004</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LV</td>
<td>0.0300</td>
<td>0.0250</td>
<td>0.0004</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HV</td>
<td>0.0200</td>
<td>0.0250</td>
<td>0.0004</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

PC: Passenger Car, LV: Light Vehicle, HV: Heavy Vehicle
3.8.2 Fuel Consumption Model

The following model is used to estimate the instantaneous fuel consumption rate (mL/s), representing the fuel consumption rate at any instant during the trip determined as a value per unit time:

\[
f_t = \begin{cases} 
\alpha + \beta_1 R_T v + [\beta_2 M_v a^2 v / 1000]_{a>0} & \text{for } R_T > 0 \\
\alpha & \text{for } R_T \leq 0 
\end{cases}
\] (3.8.1)

\[
R_T = \max (0, b_1 + b_2 v^2 + M_v a / 1000 + 9.81 M_v (G/100)/1000) \quad \text{for } v > 0
\] (3.8.2)

\[
P_T = \min [P_{max}, R_T v] \quad \text{(3.8.3)}
\]

where

- \( f_t \) = instantaneous fuel consumption rate (mL/s),
- \( R_T \) = total tractive force (kilonewtons, kN) required to drive the vehicle, which is the sum of drag force (first two terms), inertia force (third term) and grade force (fourth term),
- \( P_T \) = total tractive power (kilowatts, kW),
- \( G \) = road grade (per cent), negative if downhill,
- \( M_v \) = vehicle mass (kg) including occupants and any other load,
- \( v \) = instantaneous speed (m/s) = \( v \) (km/h) / 3.6
- \( a \) = instantaneous acceleration rate (m/s\(^2\)), negative for deceleration,
- \( \alpha \) = constant idle fuel consumption rate (mL/s), which applies during all modes of driving (as an estimate of fuel used to maintain engine operation):

\[
\alpha = \frac{f_i}{3600}
\] (3.8.4)

where \( f_i \) = idle fuel consumption rate in mL/h.

- \( b_1 \) = vehicle parameter related mainly to the rolling resistance (kN):

\[
b_1 = A / (1000 \beta_1) \quad \text{if } \beta_1 > 0 \\
= 0 \quad \text{if } \beta_1 = 0
\] (3.8.5a)

- \( b_2 \) = vehicle parameters related mainly to the aerodynamic drag (kN/(m/s\(^2\))):

\[
b_2 = 0.01296 B / \beta_1 \quad \text{if } \beta_1 > 0 \\
= 0 \quad \text{if } \beta_1 = 0
\] (3.8.5b)

\( \beta_1 \) = the efficiency parameter which relates fuel consumed to the energy provided by the engine, i.e. fuel consumption per unit of energy (mL/kJ or g/kJ), and

\( \beta_2 \) = the efficiency parameter which relates fuel consumed during positive acceleration to the product of inertia energy and acceleration, i.e. fuel consumption per unit of energy-acceleration (mL/(kJ.m/s\(^2\)) or g/(kJ.m/s\(^2\))).

Parameter \( b_1 \) (or \( A \)) is roughly proportional to vehicle mass and parameter \( b_2 \) (or \( B \)) is approximately proportional to the frontal area of the vehicle. Parameters \( b_1 \) and \( b_2 \) (or \( A \) and \( B \)) also reflect some component of drag associated with the engine.
Equation (3.8.1) represents an energy or power-based fuel consumption or emission model, where the total tractive power (kW) is \( P_T = R_T v \) (Equation 3.8.3) and the inertial power (kW) is \( P_I = M_v a \).

### 3.8.3 Model for Emission Rates (CO, HC, NO\(_x\))

The model for estimating the instantaneous Carbon Monoxide (CO), Hydrocarbons (HC) and Nitrogen Oxides (NO\(_x\)) emission rates (g/s), representing the emission production rate at any instant during the trip determined as a value per unit time, has the same structure as the instantaneous fuel consumption model (Equations 3.8.1 and 3.8.2) with different parameters (Table 3.3). For these emission rates, parameters in (Equations 3.8.1 to 3.8.3) are defined as follows:

\[
\begin{align*}
\alpha &= \text{instantaneous emission rate (g/s)}, \\
\beta_1, \beta_2 &= \text{the efficiency parameters (g/kJ and g/(kJ.m/s\(^2\))}. \\
\end{align*}
\]

The definition of \( R_T \) from Equation (3.8.2) as "tractive force" is correct for fuel consumption estimation only. For emission rates (CO, HC, NO\(_x\)), \( R_T \) should not be interpreted as "tractive force". In other words, separate \( R_T \) calculations are needed for fuel consumption and different emission rates using appropriate model parameters.

### 3.8.4 Model for Carbon Dioxide Emission (CO\(_2\))

The values of instantaneous Carbon Dioxide (CO\(_2\)) emission rate (g/s as a value per unit time) are estimated directly from the instantaneous fuel consumption rate:

\[
f_t(CO_2) = f_{CO_2} f_t(fuel) \tag{3.8.6}
\]

where

\[
\begin{align*}
f_t(fuel) &= \text{fuel consumption rate in mL/s calculated from Equation (3.8.1) and}, \\
f_{CO_2} &= \text{CO}_2 \text{ to Fuel Consumption Rate in grams per millilitre (kg per litre) of fuel (g/mL or kg/L)}.
\end{align*}
\]

The following default values of CO\(_2\) to fuel consumption rate (\( f_{CO_2} \)) in kg per litre of fuel (kg/L) are used in SIDRA TRIP:

- Passenger Cars and Light Vehicles: 2.5 kg/L, and
- Heavy Vehicles: 2.6 kg/L.

### 3.8.5 Fuel and Emission Model Calibration

The following step-wise calibration method is recommended for determining the default or input values of fuel consumption and emission model parameters summarised in Table 3.3 (based on Bowyer, Akçelik and Biggs 1985, Appendix B, Section B1). Since fuel consumption and emission model parameters are specified in Metric Units, the conversion factors given in Table 3.4 would be useful if the data are in US Customary units.

1. Determine the idle fuel consumption or emission (CO, HC, NO\(_x\)) rate (\( f_i \)) by measuring the total fuel consumption or emission while idling (warm engine) for about 200 s.
(ii) Determine parameters \(A\) and \(B\) from regression using cruise fuel consumption or emission data obtained by driving at steady speeds between 15 and 120 km/h on a level road. The cruise fuel consumption or emission rate, \(f_c\) (mL/s or g/s) on a level road is given by:

\[
f_c = \alpha + c_1 v_c + c_2 v_c^3 \quad (3.8.7)
\]

where \(\alpha = f_i / 3600\) is the known idle fuel or emission rate (mL/s or g/s) as determined in step (i), \(v_c\) is the steady cruise speed (m/s), \(c_1\) and \(c_2\) are the coefficients found by regression.

Parameters \(c_1\) and \(c_2\) are related to parameters \(b_1\) and \(b_2\) in Equations (3.8.5a) and (3.8.5b) as follows:

\[
\begin{align*}
c_1 &= b_1 \beta_1 \quad (3.8.7a) \\
c_2 &= b_2 \beta_1 \quad (3.8.7b)
\end{align*}
\]

and therefore, parameters \(b_1\), \(b_2\), \(A\) and \(B\) are given by from:

\[
\begin{align*}
b_1 &= c_1 / \beta_1 \quad &\text{if } \beta_1 > 0 \\
&= 0 \quad &\text{if } \beta_1 = 0 \quad (3.8.7c) \\
b_2 &= c_2 / \beta_1 \quad &\text{if } \beta_1 > 0 \\
&= 0 \quad &\text{if } \beta_1 = 0 \quad (3.8.7d) \\
A &= 1000 b_1 \beta_1 = 1000 c_1 \quad (3.8.7e) \\
B &= 1000 c_2 / 12.96 \quad (3.8.7f)
\end{align*}
\]

where the parameter units are as follows:

\[
\begin{align*}
c_1 &: \text{mL/m or g/m} \\
c_2 &: \text{(mL/m)/(m/s)}^2 \text{ or (g/m)/(m/s)}^2 \\
A &: \text{mL/km or g/km} \\
B &: \text{(mL/km)/(km/h)}^2.
\end{align*}
\]

(iii) Determine the efficiency parameters \(\beta_1\) and \(\beta_2\) using instantaneous fuel consumption or emission data collected by at least 1000 s of driving. Data should correspond to a wide range of speed and acceleration values representing on-road driving conditions. Determine the \(f_c\) component of fuel for each point using Equation (3.8.7) with known parameter values \((\alpha, c_1 \text{ and } c_2)\) as determined in steps (i) and (ii). Calculate the inertial component of fuel consumption or emission for each data point (from Equations (3.8.1) to (3.8.3)):

\[
f_i = f_i - f_c = \beta_1 P_{IG} + \beta_2 a P_1 \quad (3.8.8a)
\]

where the inertial components of power are:

\[
P_{IG} = (M_a v + 9.81 M_v v (G/100)) / 1000 \quad (3.8.8b)
\]
\[
a P_1 = M_v a^2 v / 1000 \quad (3.8.8c)
\]

and the total power is:

\[
P_T = b_1 v + b_2 v^3 + P_{IG} \quad (3.8.8d)
\]

Since fuel consumption or emission values cannot be measured accurately as instantaneous values, data should be aggregated into reasonably long time intervals (e.g. 10 to 20 seconds for a fuel flow meter, and 1 to 5 seconds for measurements on a dynamometer). For each time interval \(k\), determine values of:

\[
\begin{align*}
F_i^k &= \Sigma (f_i - f_c) \quad (3.8.9a) \\
P_{IG}^k &= \Sigma P_{IG} \quad \text{for } P_T > 0 \quad (3.8.9b) \\
a P_1^k &= \Sigma a P_1 \quad \text{for } P_T > 0 \text{ and } a > 0 \quad (3.8.9c)
\end{align*}
\]
where the summations are over the points in time interval $k$ subject to restrictions on the total power ($P_T$) and acceleration rate ($a$).

Determine the values of $\beta_1$ and $\beta_2$ jointly by regression of $(P_{IG}^k)$ and $(a P_I^k)$ on $F_I^k$ through the origin.

Apply an iterative method starting with some initial values of $\beta_1$ and $\beta_2$ (e.g. the default values given in Table 3.3) in Equation (3.8.8a), and by substituting the newly estimated values of $\beta_1$ and $\beta_2$ in Equation (3.8.8a) and repeating the estimation process. Continue until estimated $\beta_1$ and $\beta_2$ values do not change.

Negative values of $\beta_2$ should not be obtained (a likely cause of this error is that the time interval for aggregation is too short).

(iv) Once $\beta_1$ and $\beta_2$ are determined, calculate parameters $b_1$ and $b_2$, $A$ and $B$ from Equations (3.8.7c) to (3.8.7f).

### Table 3.4

**Useful conversion factors**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Unit</th>
<th>Unit for Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>foot</td>
<td>$1 \text{ ft} = 0.3048 \text{ m}$</td>
</tr>
<tr>
<td></td>
<td>mile</td>
<td>$1 \text{ mi} = 1609.3 \text{ m}$</td>
</tr>
<tr>
<td>Mass</td>
<td>pound</td>
<td>$1 \text{ lb} = 0.4536 \text{ kg}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1 \text{ lb} = 453.6 \text{ g}$</td>
</tr>
<tr>
<td>Speed</td>
<td>foot per second</td>
<td>$1 \text{ ft/s} = 0.3048 \text{ m/s}$</td>
</tr>
<tr>
<td></td>
<td>mile per hour</td>
<td>$1 \text{ mi/h} = 0.4470 \text{ m/s} = 1.6093 \text{ km/h}$</td>
</tr>
<tr>
<td>Acceleration</td>
<td>foot per second squared</td>
<td>$1 \text{ ft/s}^2 = 0.3048 \text{ m/s}^2$</td>
</tr>
<tr>
<td>Volume</td>
<td>US gallon</td>
<td>$1 \text{ US gal} = 3.7854 \text{ L} = 3785.4 \text{ mL}$</td>
</tr>
<tr>
<td>Force</td>
<td>pound-force</td>
<td>$1 \text{ lbf} = 4.448 \text{ N}$</td>
</tr>
<tr>
<td>Energy</td>
<td>foot pound-force</td>
<td>$1 \text{ ft.lbf} = 1.356 \text{ J}$</td>
</tr>
<tr>
<td></td>
<td>calorie</td>
<td>$1 \text{ cal} = 4.1868 \text{ J}$</td>
</tr>
<tr>
<td>Power</td>
<td>foot pound-force per second</td>
<td>$1 \text{ ft.lbf/s} = 1.356 \text{ W}$</td>
</tr>
<tr>
<td></td>
<td>calorie per second</td>
<td>$1 \text{ cal/s} = 4.1868 \text{ W}$</td>
</tr>
<tr>
<td></td>
<td>horsepower</td>
<td>$1 \text{ hp} = 0.7457 \text{ kW}$</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>US gallon per hour</td>
<td>$1 \text{ US gal/h} = 3785.4 \text{ mL/h} = 1.0514 \text{ mL/s}$</td>
</tr>
<tr>
<td></td>
<td>US gallon per mile</td>
<td>$1 \text{ US gal/mi} = 2.3522 \text{ L/km (or mL/m)} = 235.22 \text{ L/100km}$</td>
</tr>
<tr>
<td></td>
<td>mile per US gallon [mpg (US)]</td>
<td>$1 \text{ mi/US gal} = 0.42514 \text{ km/L (or mL/mL)} = 235.22 \text{ / mpg (US)} = \text{ L/100km}$</td>
</tr>
</tbody>
</table>
3.9 DRIVERS

The input dialogs in the Drivers group of the Input Data Tree (Figure 3.14) are used to specify data that describe the driver characteristics. The title bar of the input dialog gives the name of the selected Driver in brackets.

The **Acceleration and Deceleration Adjustment Factors** in this dialog affect the acceleration time and distance values estimated by SIDRA TRIP in the case of the Event Data method when the time or distance value is not specified by the user.

The Drivers group of data is not available in the case of the Travel Data method since driver characteristics are inherent to the data collected using an instrumented vehicle.

![Figure 3.14 - Drivers input dialog for Event Data method (for "My Driver" in this example)](image-url)

Specify Adjustment Factors to modify acceleration and deceleration rates
3.10 DIAGNOSTICS

If simulation data violate the **Maximum Power**, **Maximum Grade**, **Maximum Speed** or **Maximum Acceleration** values specified for the vehicle (Section 2.4.1), this means that the data are not reliable. In this case, warning messages about data quality will appear in all text output windows, and more detailed information will be given as follows:

- In the case of the Travel Data method, a **Diagnostics** node will appear in the Profile Tree, and the corresponding window will be opened automatically (Figure 3.15). The **Diagnostics** window will include various messages about data problems (highlighted using red font). The data values shown in this dialog are simulated values which may differ from input values.

- In the case of the Event Data method, the **Event Statistics** window will be opened automatically (Figure 3.165). In the Profile Tree, the window will be represented by the Diagnostics icon. The **Acceleration Statistics** table in the **Event Statistics** window will include messages about data problems (highlighted using red font).

![Figure 3.15 - Diagnostics node and window (Travel Data method)](image)

In the case of the Travel Data method, you can inspect the **Diagnostics** window for messages about the problems, and in the Trip Data dialog, you can edit the Speed, Distance or Grade values, or delete data rows that cause the problems. You can then check the output again to see if the data revision removes the problems.
The following should be noted about the use of highlighting in the Diagnostics window to indicate problems:

- If Distance data have been used to perform the simulation, any problems with Speed data will be related to Distance values in the current and previous row used to determine the speed value.
- Any problems with Acceleration data will be related to Speed values in the current, previous and following row used to determine the acceleration value.

In the case of the Event Data method, you can inspect the **Acceleration Statistics** table in the Event Statistics window for messages about the problems, and you can edit the data in the Trip data dialog (Initial Speed, Final Speed, Event Duration / Distance, Grade), or delete Events that cause the problems. You can then check the output again to see if the data revision removes the problems.

You should also review vehicle Mass and Maximum Power values in such problem cases.

---

**Figure 3.16 - Diagnostics in Event Statistics window (Event Data method)**

User-specified short acceleration time for 0 to 100 km/h on 10% uphill grade, and cruise at 100 km/h on 10% grade cause the problems in this example.

Symbol of Event Statistics node changes to indicate a Diagnostics case.
SIDRA TRIP
USER GUIDE
SECTION 4 - OUTPUT

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September 2011
4. OUTPUT

4.1 INTRODUCTION

The SIDRA TRIP output system provides various text output (Trip Statistics, Sums and Event Statistics) and graphs (Motion Graphs, Fuel Graphs, Emission Graphs, Cost Graphs, Noise Graphs, etc.). It also provides animation of vehicle movement using graphical Animation Pane, Speedometer and Powermeter displays.

You can inspect the text output and graphs by double-clicking the corresponding names in the Profile Tree. You can view the animation displays by using the toolbar buttons or the View menu.

Text output, graphs and animation are explained in Section 4.2. Information on printing, copying and saving SIDRA TRIP text output and graphs is given in Section 4.3.

Study Section 4.4 to learn about technical aspects of SIDRA TRIP output. For additional information on SIDRA TRIP models, refer to published papers and reports listed at the end of Section 1 (Introduction).

4.2 TEXT OUTPUT, GRAPHS, ANIMATION

Text output and graph windows can be opened by double-clicking the corresponding names (nodes) in the Profile Tree on the left-hand side of your screen. The display window will be opened in the Display Pane on the right-hand side of your screen. See Section 2.3.2 for detailed information on the SIDRA TRIP user interface.

To close an output display window, click the box at the top right-hand corner of the window or press Ctrl+F4. To close all display windows, use Window - Close All. Closing windows in the display pane will not close a profile. To close the Profile, select File - Close from the menu.

If the relevant information does not exist, the node(s) representing the output will not appear in the Profile Tree. If SIDRA TRIP finds any data or processing error, no output nodes will be present in the Profile Tree.

When processing of input data is completed for the first Profile after starting SIDRA TRIP, Text Output windows will be opened in the Display Pane according to the settings in Tools - Options - Output. No graphs will be opened automatically.

Click the check boxes in the Default Text Output group in Tools - Options - Output to select the output windows you want to be opened automatically. Subsequently, if you use Edit Profile to edit data and click OK, the output in windows that were currently open before data editing will remain open, and the output in those windows will be updated.

To open Text Output windows or Graphs that were closed previously, double-click the corresponding node in the Profile Tree.
4.2.1 Text Output

The following HTML-style text output windows are available in SIDRA TRIP (see Figures 4.1 to 4.3):

- Trip Statistics
- Sums
- Event Statistics (if using the Event Data method)

The Trip Statistics output (Figure 4.1) gives statistics for the evaluation of the simulated single vehicle trip. It includes the following sections:

- Header,
- Trip Assessment,
- Speed,
- Cost (Operating or User),
- Fuel Consumption,
- Emissions (CO₂, CO, HC, NOₓ), and
- Noise.

When the Travel data Method is used, the Trip Statistics output window includes information about Trip Data Settings used in simulation (Data Time Interval, Speed and Distance Units in Source Data, and Simulation Performed Using Speed data / Distance data / Coordinates)

When using data from NMEA Text files, the Trip Statistics output includes a section titled Input Data Accuracy. SIDRA TRIP determines the horizontal and vertical accuracy index (HAI, VAI) values for each time step according to the number of satellites available at the time data were recorded. These values are kept in the SIDRA TRIP Profile (aam) file. The Trip Statistics output includes average values of HAI and VAI for the trip (or section of a trip as applicable) in the case of NMEA text data. The index values are in the range 1 to 5 (1: Very Poor, 5: Very Good).

The Sums output (Figure 4.2) gives results for a given number of trips (or a number of vehicles) using the results for the single vehicle trip.

The Event Statistics (Figure 4.3) output gives detailed results per event (or per drive cycle element) in the case of the Event Data method. This window does not appear when the Travel Data method is used.

The search function (Edit - Find) can be useful for finding the desired section of any text in HTML-based output displays.

For information on printing text output, or copying text output into a word processor file, see Section 4.3.

Detailed information about output statistics is given in Section 4.4.
Figure 4.1 - Example of Trip Statistics output
### Figure 4.2 - Example of Sums output

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sums (Total for all vehicle trips)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Long Trip with Event Markers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Event Data Example - Metric Units</strong></td>
<td></td>
</tr>
<tr>
<td>Vehicle Trips</td>
<td>1000</td>
</tr>
<tr>
<td>Total Travel Distance</td>
<td>1,923.6 veh-km</td>
</tr>
<tr>
<td>Total Travel Time</td>
<td>49.9 veh-h</td>
</tr>
<tr>
<td>Total Travel Delay</td>
<td>22.4 veh-h</td>
</tr>
<tr>
<td>Total Idling Time</td>
<td>4.3 veh-h</td>
</tr>
<tr>
<td>Time between 0 and 5 km/h</td>
<td>6.8 veh-h</td>
</tr>
<tr>
<td>Time between 5 and 10 km/h</td>
<td>1.2 veh-h</td>
</tr>
<tr>
<td>Time between 10 and 40 km/h</td>
<td>14.8 veh-h</td>
</tr>
<tr>
<td>Time between 40 and 55 km/h</td>
<td>12.8 veh-h</td>
</tr>
<tr>
<td>Time between 55 and 75 km/h</td>
<td>14.3 veh-h</td>
</tr>
<tr>
<td>Time above 75 km/h</td>
<td>0.0 veh-h</td>
</tr>
<tr>
<td>Total Number of Stops</td>
<td>3,000 veh-stops</td>
</tr>
<tr>
<td>Total Cost</td>
<td>1,697.3 $</td>
</tr>
<tr>
<td>Total Fuel</td>
<td>244.5 L</td>
</tr>
<tr>
<td>Excess Fuel</td>
<td>115.2 L</td>
</tr>
<tr>
<td>Total CO2</td>
<td>611.3 kg</td>
</tr>
<tr>
<td>Excess CO2</td>
<td>287.9 kg</td>
</tr>
<tr>
<td>Total CO</td>
<td>53.1 kg</td>
</tr>
<tr>
<td>Excess CO</td>
<td>49.8 kg</td>
</tr>
<tr>
<td>Total HC</td>
<td>0.96 kg</td>
</tr>
<tr>
<td>Excess HC</td>
<td>0.74 kg</td>
</tr>
<tr>
<td>Total NOx</td>
<td>1.6 kg</td>
</tr>
<tr>
<td>Excess NOx</td>
<td>0.94 kg</td>
</tr>
</tbody>
</table>
### Event Statistics

**Long Trip with Event Markers**

**Event Data Example - Metric Units**

<table>
<thead>
<tr>
<th>Event Characteristics</th>
<th>Speed</th>
<th>Distance</th>
<th>Time</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event No. Mode</td>
<td>Initial km/h</td>
<td>Final km/h</td>
<td>User m</td>
<td>Sim m</td>
</tr>
<tr>
<td>1 1 Cruise</td>
<td>55.0</td>
<td>55.0</td>
<td>-</td>
<td>128.2</td>
</tr>
<tr>
<td>2 Deceleration</td>
<td>55.0</td>
<td>0.0</td>
<td>-</td>
<td>97.2</td>
</tr>
<tr>
<td>3 Idle</td>
<td>0.0</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>4 Acceleration</td>
<td>0.0</td>
<td>70.0</td>
<td>-</td>
<td>188.8</td>
</tr>
<tr>
<td>5 Cruise</td>
<td>70.0</td>
<td>70.0</td>
<td>-</td>
<td>97.2</td>
</tr>
<tr>
<td>6 Deceleration</td>
<td>70.0</td>
<td>10.0</td>
<td>-</td>
<td>135.7</td>
</tr>
<tr>
<td>7 Acceleration</td>
<td>10.0</td>
<td>50.0</td>
<td>-</td>
<td>84.8</td>
</tr>
<tr>
<td>8 Cruise</td>
<td>50.0</td>
<td>50.0</td>
<td>-</td>
<td>69.4</td>
</tr>
<tr>
<td>9 Deceleration</td>
<td>50.0</td>
<td>20.0</td>
<td>-</td>
<td>71.0</td>
</tr>
<tr>
<td>10 Cruise</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>11 Acceleration</td>
<td>20.0</td>
<td>60.0</td>
<td>-</td>
<td>114.4</td>
</tr>
<tr>
<td>12 Cruise</td>
<td>60.0</td>
<td>60.0</td>
<td>-</td>
<td>82.3</td>
</tr>
<tr>
<td>13 Deceleration</td>
<td>60.0</td>
<td>0.0</td>
<td>-</td>
<td>114.1</td>
</tr>
<tr>
<td>14 Idle</td>
<td>0.0</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>15 Acceleration</td>
<td>0.0</td>
<td>60.0</td>
<td>-</td>
<td>137.0</td>
</tr>
<tr>
<td>16 Cruise</td>
<td>60.0</td>
<td>60.0</td>
<td>-</td>
<td>83.3</td>
</tr>
<tr>
<td>17 Deceleration</td>
<td>60.0</td>
<td>30.0</td>
<td>-</td>
<td>93.5</td>
</tr>
<tr>
<td>18 Cruise</td>
<td>30.0</td>
<td>20.0</td>
<td>20.0</td>
<td>25.0</td>
</tr>
<tr>
<td>19 Acceleration</td>
<td>30.0</td>
<td>65.0</td>
<td>-</td>
<td>124.0</td>
</tr>
<tr>
<td>20 Cruise</td>
<td>65.0</td>
<td>65.0</td>
<td>-</td>
<td>99.3</td>
</tr>
<tr>
<td>21 Deceleration</td>
<td>65.0</td>
<td>0.0</td>
<td>-</td>
<td>122.6</td>
</tr>
</tbody>
</table>

**Trip (Total or Highest)**

<table>
<thead>
<tr>
<th>Event No. Mode</th>
<th>Average Acceleration m/s²</th>
<th>Highest Acceleration m/s²</th>
<th>Highest Jerk m/s³</th>
<th>Highest Power kW</th>
<th>Highest Force kN</th>
<th>Total Energy J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1 Cruise</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.4</td>
<td>0.42</td>
<td>63.9</td>
</tr>
<tr>
<td>2 Deceleration</td>
<td>-1.34</td>
<td>-2.37</td>
<td>1.0</td>
<td>5.9</td>
<td>0.38</td>
<td>2.9</td>
</tr>
<tr>
<td>3 Idle</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>4 Acceleration</td>
<td>1.22</td>
<td>2.19</td>
<td>0.90</td>
<td>29.5</td>
<td>3.4</td>
<td>347.0</td>
</tr>
<tr>
<td>5 Cruise</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>10.4</td>
<td>0.53</td>
<td>51.8</td>
</tr>
<tr>
<td>6 Deceleration</td>
<td>-1.37</td>
<td>-2.41</td>
<td>0.01</td>
<td>9.7</td>
<td>0.50</td>
<td>6.2</td>
</tr>
<tr>
<td>7 Acceleration</td>
<td>1.1</td>
<td>1.91</td>
<td>-0.62</td>
<td>29.9</td>
<td>3.0</td>
<td>156.4</td>
</tr>
<tr>
<td>8 Cruise</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>5.4</td>
<td>0.39</td>
<td>26.8</td>
</tr>
</tbody>
</table>

**Figure 4.3 - Example of Event Statistics output**
4.2.2 Graphs

SIDRA TRIP generates a large number of graphs (Figure 4.4) which will appear in the Profile Tree according to the graph output options selected in Tools - Options - Output (graphs which are checked will be listed in the Profile Tree).

The Graphs are not opened automatically. To view a Graph, double-click the desired Graph (node) listed under Graphs in the Profile Tree. Graphs can be resized on the screen by dragging the window border with the mouse.

To close a Graph window, click the box at the top right-hand corner of the window. See Section 2.3.2 for detailed information on the SIDRA TRIP user interface.

To select a section of a graph (to zoom in), click the graph area and drag the mouse to the right and down. To move the graph contents, right click the graph area and drag. To reinstate the original graph (to zoom out), click and drag in reverse direction (left and up).

For information on printing Graphs, or copying Graphs into a word processor or graphics file, see Section 4.3.

The following graphs for cumulative (total) and instantaneous (per unit time) values of various parameters are available:

- **Motion Graphs** (Distance, Speed, Acceleration, Jerk, Average Speed),
- **Fuel Graphs** (Fuel Consumption Total, Fuel Consumption Time Rate, Fuel Economy),
- **Emission Graphs** (CO2 Total, CO2 Time Rate, CO Total, CO Time Rate, HC Total, HC Time Rate, NOx Total, NOx Time Rate),
- **Cost Graphs** (Cost Total, Cost Time Rate),
- **Energy-Related Graphs** (Energy Total, Power, Tractive Force),
- **Noise Graphs**(ASJ 2003 Japanese, SonRoad Swiss, RLS 90 German), and
- **Miscellaneous** (Loop).

All graphs are linked to animation dynamically, i.e. graphs will be drawn with the vehicle movement during animation. In Tools - Options - Output, an option is available to plot graphs before animation.

The following options are also available in Tools - Options - Output:

- **Maximum Metric Fuel Economy (L/100km)**, which is the largest value to be displayed in the Fuel Economy graph (relevant only when Metric units are in use), and
- various options for **Noise Graphs** (Fixed Receptor or Relative Receptor model, show receptor location for Fixed Receptor, and show $L_{eq}$ and $L_{eqT}$ values, i.e average equivalent noise levels for the trip and for a traffic stream).
Figure 4.4 - Example of graphs

To select a section of the graph (zoom in), click the graph area and drag.

To reinstate the original graph (to zoom out), click and drag in reverse direction (left and up).
4.2.3 Animation

The animation feature in SIDRA TRIP allows you to animate the movement of a vehicle as defined in the trip profile with dynamic graphs linked to the vehicle movement (Figure 4.5). You can animate driving on the left-hand or right-hand side of the road.

The Animation Pane can be hidden or displayed (toggle action) by clicking the Animation Pane button on the toolbar or using View - Animation Pane. The View menu also contains the options Speedometer (show or hide the Speedometer display) and Powermeter (show or hide the Powermeter display). These view options have a toggle action (show or hide). The program remembers the status of these view options.

The size of Speedometer and Powermeter displays can be changed by clicking the plus and minus symbols on the display. Speedometer also displays the distance from the start of trip. These displays can also be closed by clicking the box at the top right-hand corner of the display.

The colour code used for vehicle, Speedometer and Powermeter indicates the status of the vehicle manoeuvre:

- Green: Cruise,
- Yellow: Deceleration,
- Red: Idling,
- Magenta: Acceleration.

In the case of Travel Data method, the distance since the start of trip is shown in the Animation Pane. In the case of the Event Data method, the event markers, their distance from the start of the trip, loops and loop numbers are shown in the Animation Pane.

The Animate menu contains the options Play (run animation), Pause (stop animation temporarily), and Reset (stop animation and reset to the start of trip). Animation speed can be changed by using the Time Factor button in the toolbar.

The following options can be set in Tools - Options - Animation:

- Drive Rule (Left or Right to indicate which side of the road the vehicle uses);
- Smoothness (Low, Medium or High to determine the smoothness of vehicle movement, which is related to the animation frames per second);
- Scale (Very Small, Small, Normal, Large or Very Large to determine the distance shown in one frame of animation, which also affects the vehicle size shown).
Figure 4.5 - Animation

- Adjust the Time Factor Scale to speed up the animation
- Run, Pause, Stop buttons
- Colour code shows vehicle manoeuvre status
4.3 PRINTING, COPYING and SAVING OUTPUT

In SIDRA TRIP, text output and graphs can be printed:

- directly using the associated Print function (standard Windows printing facilities apply), or
- by copying and pasting into a word processing (e.g. Microsoft Word) or graphics (e.g. Microsoft Paint) file.

To print text output or a graph, or copy it to the Windows clipboard, you must first:

- open the desired text output or graph display window by double-clicking its name in the Profile Tree, or
- select the desired text output or graph display window if it was opened previously by using the list of open items in the Window menu or clicking the desired display window in the Display Pane.

If you wish to print or copy only a section of the text output, select the desired section.

Printing Text Output and Graphs

The HTML-based text output (Section 4.2.1) and graphs (Section 4.2.2) generated by SIDRA TRIP can be printed using File - Print (or Ctrl + P) or using the Print function in the right-click menu. These will open the Print dialog before printing. You can use various options to specify print settings in the Print dialog.

SIDRA TRIP text output is printed in a continuous form, i.e. without any page breaks. You can use File - Print Preview before you print the HTML-based text output to check that the display fits in pages as you wish. If not in the format you want, you need to copy the display into a Word document and format for printing.

Network Printers

Sending output to a printer on your network is handled by Windows. It is your responsibility to select the correct printer and set it up correctly (paper settings, etc.). Facilities such as notification that printing has been completed are provided by your network, not by SIDRA TRIP. If you require assistance in this area, contact your network administrator or IT Department.

Copying Text Output and Graphs

To copy text to the clipboard:

- select Edit - Select All then Edit - Copy from the main menu, or
- select the desired section of text, then select Edit - Copy from the main menu, or
- press Ctrl+A then Ctrl+C, or
- right-click in the display area and click Select All in the menu, and then right-click in the display area again and click Copy.

You can then open a word processor (e.g. MS Word) and Paste the text in a new document or the document you are working on (Edit - Paste or press Ctrl+V), edit it (format it as you like, e.g. delete some rows in a table, specify single line spacing with desired spacing before and after the line, specify smaller font size, introduce border lines and shading, etc), and then save or Print as desired.

To copy a graph to the clipboard:

- right-click in the graph area and click Copy in the menu, or
- select **Edit - Copy** from the main menu, or
- press **Ctrl+C**.

You can then open a word processor or graphics application and **Paste** the picture in a new file, edit it and then save or **Print** as desired.

**Saving Text Output and Graphs**

You can save the HTML-based text output as separate files using **File - Save Output As**. Use of the Save As Type selected as **Formatted Web Archive, single file (*.mht)** is recommended. This creates a file suitable for viewing with web browsers like Microsoft Internet Explorer or Mozilla Firefox.

You can also use **File - Save Output As** with Save As Type selected as **Raw XML File (*.xml)**.

You can save a graph as a separate file using **File - Save Graph As**, or using the **Save Graph As** function in the right-click menu. The graph will be saved as a picture file in **Enhanced Metafile (*.emf)** format. You can then use the picture in various applications.

Note that **File - Save** and **File - Save As** functions are relevant to the Profile (.aam) file. **File - Save Sim Data As** is for saving detailed simulation data in XML (*.xml) format, and **File - Save Trip Data As** is for saving trip data contained in the Profile (.aam) file in a raw (source) data format (CSV, Text, GPS Exchange, or Track as applicable).

You can also export data used in simulation using **File - Save Trip Data As** (in csv or txt format) or **File - Save Sim Data As** (in csv, txt or xml format).
4.4 OUTPUT STATISTICS

This section presents detailed information on SIDRA TRIP output statistics.

Information in this section is structured to correspond to sections of the Trip Statistics text output window (Section 4.2.1):

- Trip Assessment,
- Speed,
- Cost (Operating or User),
- Fuel Consumption,
- Emissions (CO₂, CO, HC, NOₓ), and
- Noise.

Information on output statistics contained in the Sums and Event Statistics text output windows (Section 4.2.1) and Graphs (Section 4.2.2) are included in relevant sections.

Generally, output includes total (cumulative) and average values, lowest and highest instantaneous values, and various derived values for the trip. It also includes distance rates (i.e. values per unit distance, per km or per mi) and percentage values (as percentage of total trip value) where relevant.

In the case of Travel Data method, the term "trip" in relation to the output statistics (text and graphs) refers to the simulated trip which corresponds to all or a section of the trip data, in accordance with the Start Section - End Section specification in the General Settings dialog of the Profile.

In SIDRA TRIP, the instantaneous value of a variable, e.g. fuel consumption rate, fₖ (mL/s), for the jᵗʰ simulation interval (whose duration is Tₛ seconds) is considered to belong to the end point of the simulation step. Thus, the instantaneous value at the start of the interval belongs to the previous simulation step (fₖ₋₁)ₖ.

For determining the incremental value of the variable for the simulation step, e.g. fuel consumed during a simulation interval, ΔFₖ (mL), an average value is determined using the instantaneous values at the start and end of the interval, e.g. ΔFₖ = 0.5 (fₖ₋₁ + fₖ) Tₛ.

The cumulative value of the variable since the start of trip is then determined as the sum of incremental values, (∑ ΔFₖ).

Values of statistics (e.g. Desired Cost for Trip, Desired Fuel for Trip, etc) are calculated for conditions of driving at constant Desired Speed, i.e. they are not based on simulation.

Output statistics such as Excess Cost for Trip, Excess Fuel for Trip, etc are determined as the difference between the Cost for Trip, Fuel for Trip, etc and Desired Cost for Trip, Desired Fuel for Trip, etc. The latter are calculated for conditions of driving at constant Desired Speed, i.e. they are not based on simulation. Excess values may be negative if a saving has been made in comparison to the value at the Desired Speed.

All fuel consumption values are in US gallons (not imperial gallons) when US Customary Units are used.
4.4.1 Trip Assessment

**Travel Distance**

Travel Distance, $L_t$ (km or mi) is the total distance travelled during the trip determined as the sum of the distance travelled in each simulation interval:

$$L_t \text{ (km)} = \frac{\sum \Delta L_j}{1000} \quad (4.4.1a)$$

$$L_t \text{ (mi)} = \frac{\sum \Delta L_j}{1609.3} \quad (4.4.1b)$$

$$\Delta L_j = 0.5 \left( v_{j+1} + v_j \right) T_s / 3.6 \quad (4.4.1c)$$

where

- $\Delta L_j$ = distance travelled (metres) during $j$th simulation interval,
- $v_j$ = instantaneous speed at the end of $j$th simulation interval (km/h),
- $v_{j+1}$ = instantaneous speed at the end of previous simulation interval (km/h),
- $T_s$ = Simulation Time Interval (s),

and summation is for all simulation intervals (whole trip).

The Distance graph in the Motion Graphs group shows the cumulative distance travelled (m or ft) during the trip.

Travel Distance is based on the distance determined using the instantaneous speed values used in simulation. When the "Perform Simulation Using Distance Data” option is selected in the Edit Profile - Trip Data input dialog (for the Travel Data method), distance data are used to determine speed values first, and then simulation is carried out using the calculated speed values. As a result, the simulated distance may differ from the input distance values.

Zero Travel Distance, $L_t = 0$ condition will occur when the whole trip consists of idling at zero speed. In this case, all outputs statistics for per unit distance as well as the Travel Time Index and Level of Service will be undefined.

*Figure 4.6* depicts the movement of a vehicle that stops and starts at traffic signals as an example of a time-distance diagram to show definitions of travel distance, time and speed statistics.

**Travel Time**

Travel Time, $T_t$ (seconds) is the total travel time for the trip.

Travel time per unit distance, $T_{tx}$ (s/km or s/mi) is determined from:

$$T_{tx} = T_t / L_t \quad (4.4.2)$$

where $L_t$ is the Travel Distance (km or mi).
**Idling Time**

Idling Time, $T_o$ (seconds) is the total time during the trip when the vehicle is fully stopped (zero-speed condition).

Stopped Time per unit distance, $T_{ox}$ (s/km or s/mi) and the percent time when the vehicle is stopped, $p_{To}$ are determined from:

$$T_{ox} = T_o / L_t \quad \text{(4.4.3a)}$$

$$p_{To} = 100 \frac{T_o}{T_t} \quad \text{(4.4.3b)}$$

where $L_t$ is the Travel Distance (km or mi) and $T_t$ is the Travel Time (seconds).
Running Time

Running Time, $T_r$ (seconds) is the total time during the trip when the vehicle is moving (speed greater than zero):

$$T_r = T_t - T_o \quad (4.4.4a)$$

The Running Time per unit distance, $T_{rx}$ (s/km or s/mi) and the percent time when the vehicle is running, $p_{Tr}$ are determined from:

$$T_{rx} = T_r / L_t \quad (4.4.4b)$$

$$p_{Tr} = 100 \frac{T_r}{T_t} \quad (4.4.4c)$$

where $L_t$ is the Travel Distance (km or mi) and $T_t$ is the Travel Time (seconds).

The percent time when the vehicle is stopped and the percent time when the vehicle is running add up to 100 per cent ($p_{To} + p_{Tr} = 100$).

Desired Trip Time

Desired Trip Time, $T_d$ (seconds) is the time to travel the Travel Distance at constant Desired Speed, $v_d$ (km/h or mph):

$$T_d = 3600 L_t / v_d \quad (4.4.5a)$$

The Desired Trip Time per unit distance, $T_{dx}$ (s/km or s/mi) and the Desired Trip Time as a percentage of Travel Time, $p_{Td}$ are determined from:

$$T_{dx} = T_d / L_t = 3600 / v_d \quad (4.4.5b)$$

$$p_{Td} = 100 \frac{T_d}{T_t} \quad (4.4.5c)$$

where $L_t$ is the Travel Distance (km or mi) and $T_t$ is the Travel Time (seconds).

Travel Delay

Travel Delay, $d_t$ (seconds) is an excess travel time value determined as the difference between the actual Travel Time, $T_t$ and the Desired Trip Time, $T_d$:

$$d_t = T_t - T_d \quad (4.4.6a)$$

The Travel Delay per unit distance, $d_{tx}$ (s/km or s/mi) and the Travel Delay as a percentage of Travel Time, $p_{dt}$ are determined from:

$$T_{dx} = d_t / L_t \quad (4.4.6b)$$

$$p_{dt} = 100 \frac{d_t}{T_t} \quad (4.4.6c)$$

where $L_t$ is the Travel Distance (km or mi) and $T_t$ is the Travel Time (seconds).

The Desired Trip Time and Travel Delay as percentages of Travel Time add up to 100 per cent ($p_{Td} + p_{dt} = 100$).
**Travel Time Index**

The Travel Time Index (TTI) is determined from:

\[
TTI = \begin{cases} 
10 \left( p_T - p_L \right) / \left( 1 - p_L \right) & \text{for } p_T > p_L \\
0 & \text{for } p_T \leq p_L
\end{cases} \quad (4.4.7)
\]

where

\[p_T = T_d / T_t = \text{Travel Time Ratio}, \ i.e. \ the \ ratio \ of \ Desired \ Trip \ Time \ to \ the \ actual \ Travel \ Time \ for \ the \ trip, \ and\]

\[p_L = \text{lower \ limit \ of \ the \ Travel \ Time \ Ratio} \ (a \ selected \ constant; \ range: \ 0 \ to \ 0.3, \ default: \ 0.1).\]

The Travel Time Index is unique to SIDRA TRIP. It has been developed by Akçelik (1999), and is based on driver frustration research reported by Gunatillake, Cairney and Akçelik (2000). The basis of the TTI formulation given in Equation (4.4.7) is shown in Figure 4.7. This formulation gives TTI values in the range:

- **10 = best** \( (p_T = 1.0, \ i.e. \ T_t = T_d, \ hence \ travel \ delay, \ d_t = 0) \) to
- **0 = worst** \( (p_T \leq p_L, \ i.e. \ T_t \geq 10 T_d, \ hence \ travel \ delay, \ d_t \geq 9 T_d) \).

The lower limit of the Travel Time Ratio, \( p_L \), can be specified as input in the Edit Profile - Cost & LOS Parameters input dialog, and the corresponding default value can be specified in Tools - Defaults - Cost & LOS Parameters. This sets the condition for the worst case (TTI = 0). The default value of \( p_L = 0.1 \) means TTI = 0 when \( T_t = 10 T_d \) (i.e. when the Travel Time equals ten times the Desired Trip Time). Using \( p_L = 0.2 \) would mean TTI = 0 when \( T_t = 5 T_d \) (i.e. when the Travel Time equals five times the Desired Trip Time).

![Figure 4.7 - Travel Time Index (TTI)](image-url)
The Travel Time Index is undefined for zero Travel Distance, $L_t = 0$ which may occur when the whole trip consists of idling at zero speed.

Note that $p_T$ is equivalent to the Speed Efficiency Ratio given in the Speed section of Trip Statistics output, $p_T = T_d / T_t = v_t / v_d$ where $v_t$ is the Average Travel Speed and $v_d$ is the Desired Speed.

**Level of Service**

The trip Level of Service (LOS) is determined in relation to a Travel Time Index (TTI) using a method developed by Akçelik (1999). The reader is referred to the US Highway Capacity Manual (TRB 2000) for discussions of the level of service concept and its application to different traffic facilities using different criteria.

*Table 4.1* presents the LOS grades (**Good**, **Fair**, **Poor** and **Very Poor**). The Travel Time Index ranges for LOS grades given in *Table 4.1* were chosen considering their implications for the degree of saturation, speed and travel delay values using travel time - flow functions developed by Akçelik (1991, 1996, 2002a,b, 2003, 2006a).

Level of Service is undefined for zero Travel Distance ($L_t = 0$). This will occur when the whole trip consists of idling at zero speed.

**Table 4.1**

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Traffic Time Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>$7 &lt; \text{Index} \leq 10$</td>
</tr>
<tr>
<td>Fair</td>
<td>$5 &lt; \text{Index} \leq 7$</td>
</tr>
<tr>
<td>Poor</td>
<td>$3 &lt; \text{Index} \leq 5$</td>
</tr>
<tr>
<td>Very Poor</td>
<td>$0 \leq \text{Index} \leq 3$</td>
</tr>
</tbody>
</table>
**Number of Stops**

Number of Stops, $H_t$, for the trip is counted during simulation according to the definition of a Stop using a Lower Speed, $v_L$, and an Upper Speed $v_U$ (km/h or mph) for this purpose (Figure 4.8). The standard default values are:

- Lower Speed for a Stop: 5 km/h or 3 mph
- Upper Speed for a Stop: 25 km/h or 15 mph

These speed values can be specified in Tools - Defaults - Speed Settings as general default values, or in the Edit Profile - Speed Settings input dialog as values specific to a Profile.

For an additional stop to be counted, the vehicle speed needs to be at or above the upper limit first ($v \geq v_U$), and then the vehicle speed must go below the lower limit ($v < v_L$). After this, another stop will be counted only if the vehicle speed goes to or above the upper limit first ($v \geq v_U$), and then goes below the lower limit again.

Number of Stops per unit distance, $H_{tx}$ (stops/km or stops/mi) is determined from:

$$H_{tx} = \frac{H_t}{L_t} \quad (4.4.8)$$

where $L_t$ is the Travel Distance (km or mi).

**Figure 4.8 – Definition of a Stop**
Acceleration and Deceleration Rates

The Trip Assessment section of Trip Statistics output includes Highest Acceleration and Highest Deceleration rates (m/s$^2$ or ft/s$^2$) for the trip as determined during the simulation.

In the case of the Event Data method, Average and Highest Acceleration rates (negative values for deceleration) for each event (relevant to speed change events) are given in the Acceleration Statistics table of Event Statistics output.

The Acceleration graph in the Motion Graphs group shows the instantaneous values of Acceleration (negative for deceleration) during the trip.

For detailed information on acceleration and deceleration models used in SIDRA TRIP (Event Data method), refer to Akçelik and Besley (2001b).

Jerk

Jerk is the rate of change of acceleration (or inertia force). The pattern and values of Jerk gives an indication of driving roughness (or comfort). The Trip Assessment section of Trip Statistics output includes Highest Jerk (m/s$^3$ or ft/s$^3$) for the trip as determined during the simulation.

In the case of the Event Data method, Highest Jerk (negative value for deceleration) for each event (relevant to speed change events) is given in the Acceleration Statistics table of Event Statistics output.

The Jerk graph in the Motion Graphs group shows the instantaneous values of Jerk during the trip.

Tractive Power

The Tractive Power, $P_T$ (kW or hp) required to drive the vehicle includes the drag power, inertia power and grade power (Equation (3.8.3) in Section 3.8.2). This equation also shows the relationship between Tractive Power and Tractive Force.

The Trip Assessment section of the Trip Statistics output includes the Highest Tractive Power for the trip as determined during the simulation.

In the case of the Event Data method, the Highest (Tractive) Power for each event is given in the Acceleration Statistics table of the Event Statistics output.

The Tractive Power graph in the Energy-Related Graphs group shows the instantaneous values of Tractive Power during the trip.

A Powermeter is available to display the instantaneous values of tractive power during animation.

If any instantaneous Tractive Power value exceeds the Maximum Power value specified for the vehicle, Diagnostic messages are given in SIDRA TRIP output (Section 3.10).

When determining the acceleration profile for each speed change event when the Event Data method is used, the Tractive Power values are checked against the Maximum Power, and the acceleration rate is adjusted to satisfy this constraint. The program will override any user-specified Event Duration or Distance in this case. All speed-change Events with user-specified Duration or Distance values will be affected if the Maximum Power constraint applies for any Event. Diagnostic messages will be given in the Event Statistics window in such cases (Section 3.10).
4.20

**Tractive Force**

The Tractive Force, \( R_T (\text{kN or lbf}) \) required to drive the vehicle includes the drag force, inertia force and grade force (Equation (3.8.2) in Section 3.8.2).

The Trip Assessment section of Trip Statistics output includes Highest Tractive Force for the trip as determined during the simulation.

In the case of the Event Data method, Highest (Tractive) Force for each event is given in the Acceleration Statistics table of the Event Statistics output.

The Tractive Force graph in the Energy-Related Graphs group shows the instantaneous values of Tractive Force during the trip.

**Energy for Trip**

Energy for Trip, \( e_t (\text{kJ}) \) given in the Trip Assessment section of the Trip Statistics output is the total energy consumed for the vehicle movement during the trip. This is determined as the sum of energy consumed during all simulation intervals:

\[
e_t = \sum (\Delta e_j) \tag{4.4.9a}
\]

where \( \Delta e_j (\text{kJ}) \) is energy consumed during the \( j \)th simulation interval, which is based on the average Tractive Power during the interval:

\[
\Delta e_j = 0.5 (P_{Tj-1} + P_{Tj}) T_s \tag{4.4.9b}
\]

where:

\( P_{Tj} = \) instantaneous tractive power value at the end of current simulation interval (kW),

\( P_{Tj-1} = \) instantaneous tractive power value at the end of previous simulation interval (kW),

\( T_s = \) Simulation Time Interval (s).

In the case of the Event Data method, Total Energy for each event is given in the Acceleration Statistics table of Event Statistics output.

The Energy Total graph in the Energy-Related Graphs group shows the cumulative values of Energy during the trip.

In SIDRA TRIP, energy results are always given in kilojoules (kJ) even when the US Customary Units are used.

Energy for Trip per unit distance, \( e_{tx} (\text{kJ/km or kJ/mi}) \) is determined from:

\[
e_{tx} = e_t / L_t \tag{4.4.9c}
\]

where \( L_t \) is the Travel Distance (km or mi).
**Acceleration Noise**

Acceleration Noise, \( \sigma_a \) (m/s\(^2\) or ft/s\(^2\)) is a statistic used in the literature to represent speed variations during a trip, e.g. Drew (1968, p.362). The word Noise in this term has no relation to sound.

Acceleration Noise is determined from:

\[
\sigma_a = \left\{ \left( \frac{T_s}{T_r} \right) \sum [a(t) - a_0]^2 \right\}^{0.5} \\
\quad a_0 = \left( \frac{T_s}{T_r} \right) \sum a(t)
\]

where \( T_s \) is the Simulation Time Interval (seconds), \( T_r \) is the Running Time (seconds), \( a(t) \) is the acceleration rate at time \( t \) as determined for each simulation step, \( a_0 \) is the average acceleration rate for the trip, and summation is for the whole trip except idling (zero-speed) intervals.

**PKE**

The Positive Kinetic Energy, PKE (m/s\(^2\) or ft/s\(^2\)) parameter is a useful measure of speed variations during a trip, and has been used in aggregate fuel consumption models in the literature, e.g. Akçelik (1983a), Bowyer, Akçelik and Biggs (1985). PKE (m/s\(^2\)) is determined from:

\[
PKE = 0.3858 \times 10^4 \frac{\left\{ \sum (v_f^2 - v_i^2) \right\}}{L_t}
\]

where

\[
v_i, v_f = \text{initial and final speeds (km/h) during each positive acceleration event (} v_i > v_f, a > 0) \text{, and}
\]

\[
L_t = \text{Travel Distance (km)}.
\]

The summation in Equation (4.4.11) is for all positive speed change events during the trip (i.e. deceleration manoeuvres are not included).

**Total Loop Occupancy Time**

Total Loop Occupancy Time is the sum of all loop occupancy times for the trip. Detector Loops can be specified only when the Event Data method is being used (Section 3.4.5). Occupancy Time for each loop is given in the Loop Statistics section of the Event Statistics output.

As seen in Figure 4.9, the detector loop occupancy starts when the front of the vehicle reaches the upstream edge of the loop (location \( L_1 \), time \( t_1 \)) and finishes when the tail of the vehicle clears the downstream edge of the loop (location \( L_2 = L_1 + L_p + L_v \), time \( t_2 = t_1 + (L_p + L_v) / v \)). As depicted in Figure 4.9, loop occupancy time, \( t_o \) (seconds) for travel at constant cruise speed is:

\[
t_o = \frac{(L_p + L_v)}{v}
\]

where \( L_p \) is the detector loop length (m or ft), \( L_v \) is the vehicle length (m or ft) and \( v \) is the speed (m/s or ft/s).

For example, using loop length, \( L_p = 3.0 \text{ m} \) and car length, \( L_v = 4.5 \text{ m} \), occupancy time for travel at 60 km/h is \( t_o = (3.0 + 4.5) / (60 / 3.6) = 0.45 \text{ s} \).

However, the loop occupancy time for each loop is determined by simulation, hence the accuracy of occupancy time will be limited by the value of the Simulation Time Interval (seconds).

The Loop graph in the Miscellaneous Graphs group shows the loop on/off times during the trip.
4.4.2 Speed

The Speed section of the Trip Statistics output includes various speed statistics which are explained in this section. Speed is the main input parameter that determines other results in the simulation process.

The Speed graph in the Motion Graphs group shows the instantaneous values of Speed during the trip.

Speed, \( v \) (km/h, m/s, mph, or ft/s) is distance travelled per unit time. In a time-distance diagram (e.g. Figures 4.6 and 4.9), the slope of the time-distance trace of a vehicle is its speed.

---

**Figure 4.9 - Loop occupancy**
**Average Travel Speed**

Average Travel Speed, \( v_t \) (km/h or mph) is the average speed including the effect of all time lost (delay) due to slowing down and stopping (idling) during the trip (**Figure 4.6**). It is given by:

\[
v_t = \frac{3600 \ L_t}{T_t}
\]

where

\[
L_t = \text{Travel Distance (km or mi)}, \quad \text{and} \quad T_t = \text{Travel Time (seconds)}.
\]

**Average Running Speed**

Average Running Speed, \( v_r \) (km/h or mph) is the average speed including the effect of all time lost during the trip except any stopped (idling) times (**Figure 4.6**). It is given by:

\[
v_r = \frac{3600 \ L_t}{T_r}
\]

where

\[
L_t = \text{Travel Distance (km or mi)}, \quad \text{and} \quad T_r = \text{Running Time (seconds)}.
\]

**Desired Speed**

Desired Speed, \( v_d \) (km/h or mph) is the reference speed used in determining various output statistics including:

- Desired Trip Time,
- Travel Delay,
- Travel Time Index and Level of Service,
- Speed Efficiency Ratio and Congestion Coefficient,
- Desired Cost for Trip and Excess Cost for Trip,
- Desired Fuel for Trip and Excess Fuel for Trip, and
- Desired \( \text{CO}_2, \text{CO}, \text{HC}, \text{NO}_x \text{ for Trip and Excess } \text{CO}_2, \text{CO}, \text{HC}, \text{NO}_x \text{ for Trip.} \)

Desired Speed is considered to be an average target (base) speed value which drivers aim to use on a given road facility in the absence of all delaying factors. This corresponds to free-flow speed or zero-speed concepts used in the literature, and is related to the quality and speed limit of the road facility.

By default, SIDRA TRIP will determine the Desired Speed for each trip automatically as the highest speed value during the trip but rounded to the nearest 5 km/h or 5 mph. If the highest speed value is less than 5 km/h or 5 mph, the desired speed is 5 km/h or 5 mph.

To override the program determined value, the user may wish to specify a Desired Speed value as a general default using Tools - Defaults - Speed Settings, or as an input value specific to a particular trip using the Edit Profile - Speeds Settings input dialog.
Speed Efficiency Ratio and Congestion Coefficient

Speed Efficiency Ratio, $r_e$ (ratio of Average Travel Speed to Desired Speed) and Congestion Coefficient, $r_c$ (ratio of Desired Speed to Average Travel Speed) have been used in the literature as parameters representing traffic performance:

$$r_e = \frac{v_t}{v_d} \quad (4.4.15a)$$

$$r_c = \frac{v_d}{v_t} \quad (4.4.15b)$$

where

$v_t$ = Average Travel Speed (km/h or mph), and

$v_d$ = Desired Speed (km/h or mph).

Speed Efficiency Ratio is equivalent to the Travel Time Ratio, $r_e = p_T = T_d / T_t$ used in Travel Time Index (Equation 4.4.5), and Congestion Coefficient is related to the Speed Efficiency Ratio through $r_c = 1 / r_e$.

Highest and Lowest Speed

The Speed section of the Trip Statistics output includes Highest Speed and Lowest Speed values (km/h or mph). These are determined from instantaneous speed values observed during the trip.

In the case of the Event Data method, the initial and final speed values for individual events, and the Highest Speed and Lowest Speed values for the trip are given in the Event Characteristics table of Event Statistics output.

The Acceleration graph in the Motion Graphs group shows the instantaneous values of Acceleration (negative for deceleration) during the trip.

For detailed information on acceleration and deceleration models used in SIDRA TRIP (Event Data method), refer to Akçelik and Besley (2001b).

Speed Groups

Trip Statistics output gives information on Speed Groups as specified in Edit Profile - Speed Settings input dialog (or in Tools - defaults - Speed Setting). The information includes time spent (seconds) in the speed range for each group, time per unit distance (s/km or mi/km) and the time as a percentage of the total Travel Time.

The percent time in all Speed Groups should add up to 100 per cent. However, the sum of the percentage values for Speed Groups may differ from 100 per cent due to rounding. Similarly, the sums of the time values for Speed Groups may differ from the values for the trip (Travel Time in the Trip Assessment section of Trip Statistics output).
4.4.3 Operating Cost and User Cost

The Cost results in SIDRA TRIP output may be the Operating Cost or User Cost depending on the user choice (Section 3.7). The Operating Cost is appropriate for use in traffic management and planning as a cost to the community, and excludes the tax component of the pump price of fuel. The User Cost is appropriate for use by an individual or an operating agency as a cost including the total pump price of fuel as well as any toll costs experienced during the trip.

**Cost for Trip.** $C_t$ (in Cost Units, e.g. $) given in the Trip Statistics window is the total cost incurred during the trip. For both Operating Cost and User Cost methods, the total cost includes the vehicle operating cost (the resource cost or full cost of fuel and additional running costs including tyre, oil, repair, maintenance, depreciation and various other running costs), and the time cost to driver and passengers. The Cost model used in SIDRA TRIP is described in Section 3.7.

Cost Unit (e.g. $) is automatically determined by the Windows regional settings and cannot be changed.

In the case of the Event Data method, Total Cost for each Event is given in the Cost, Fuel and Emissions table of Event Statistics output.

**Cost for Trip per unit distance.** $C_{tx}$ ($/km or $/mi) is determined from:
\[ C_{tx} = \frac{C_t}{L_t} \]  \hspace{1cm} (4.4.16a)

where $L_t$ is the Travel Distance (km or mi).

**Cost per hour for Trip.** $C_u$ ($/h) is determined from:
\[ C_u = \frac{3600 \cdot C_t}{T_t} \]  \hspace{1cm} (4.4.16b)

where $L_t$ is the Travel Time (seconds).

**Desired Cost for Trip.** $C_d$ ($) is calculated for conditions of driving at constant Desired Speed. This includes the Toll Cost when the User Cost method is used.

**Excess Cost for Trip.** $C_e$ ($) is determined relative to the cost experienced if the vehicle travelled in the cruise mode at the Desired Speed. This is calculated as the difference between Cost for Trip and Desired Cost for Trip:
\[ C_e = C_t - C_d \]  \hspace{1cm} (4.4.16c)

**Desired Cost per unit distance.** $C_{dx}$ ($/km or $/mi) and Excess Cost for Trip per unit distance, $C_{ex}$ ($/km or $/mi) are calculated in the same way as Cost for Trip per unit distance:
\[ C_{dx} = \frac{C_d}{L_t} \]  \hspace{1cm} (4.4.16d)
\[ C_{ex} = \frac{C_e}{L_t} \]  \hspace{1cm} (4.4.16e)

where $L_t$ is the Travel Distance (km or mi).

The Cost Total and Cost Time Rate graphs in the Cost Graphs group show the cumulative and instantaneous values of Cost during the trip, respectively.
4.4.4 Fuel Consumption

**Fuel for Trip.** \( F_t \) (mL or gal) given in the Trip Statistics window is the total fuel consumed during the trip. The fuel consumption model used in SIDRA TRIP is described in Section 3.8.

Vehicle parameters that influence the amount of fuel consumed by a vehicle can be specified in the input dialogs under **Edit Profile - Vehicles**, or under **Tools - Defaults - Vehicles** (see Sections 2.4.3 and 3.8.1 to 3.8.5).

In the case of the Event Data method, Total Fuel for each Event is given in the **Cost, Fuel and Emissions** table of Event Statistics output.

**Fuel for Trip per unit distance**, \( F_{tx} \) (mL/km or gal/mi) is determined from:

\[
F_{tx} = \frac{F_t}{L_t}
\]  

where \( L_t \) is the Travel Distance (km or mi).

**Fuel per hour for Trip**, \( F_{th} \) (mL/h or gal/h) is determined from:

\[
F_{th} = 3600 \frac{F_t}{T_t}
\]

where \( T_t \) is the Travel Time (seconds).

**Desired Fuel for Trip**, \( F_d \) (mL or gal) is calculated for conditions of driving at constant Desired Speed.

**Excess Fuel for Trip**, \( F_e \) (mL or gal) is determined relative to the fuel consumed if the vehicle travelled in the cruise mode at the Desired Speed. This is calculated as the difference between Fuel for Trip and Desired Fuel for Trip:

\[
F_e = F_t - F_d
\]

**Desired Fuel per unit distance**, \( F_{dx} \) (mL/km or gal/mi) and **Excess Fuel per Trip per unit distance**, \( F_{ex} \) (mL/km or gal/mi) are calculated in the same way as Fuel for Trip per unit distance:

\[
F_{dx} = \frac{F_d}{L_t}
\]

\[
F_{ex} = \frac{F_e}{L_t}
\]

where \( L_t \) is the Travel Distance (km or mi).

Output in the Fuel Consumption section of the Trip Statistics window also include **Fuel Economy for Trip** (L/100km or mpg) and **Desired Fuel Economy** (L/100km or mpg) values. These are determined from:

\[
F_{tx} \text{ (L/100km)= } 0.1 F_{tx} \text{ (mL/km)}
\]

\[
f_{tx} \text{ (mpg)= } 1 / F_{tx} \text{ (gal/mi)}
\]

\[
F_{dx} \text{ (L/100km)= } 0.1 F_{dx} \text{ (mL/km)}
\]

\[
f_{dx} \text{ (mpg)= } 1 / F_{dx} \text{ (gal/mi)}
\]
Note that Fuel Economy (mpg) in the case of US Customary Units is not a fuel consumption rate per unit distance. The relationship between this (based on US gallons) and metric Fuel Economy (L/100km) is given by:

\[ f_x (\text{mpg}) = \frac{235.22}{F_x (\text{L/100km})} \] (4.4.17j)

The **Fuel Consumption Total** (mL or gal) and **Fuel Consumption Time Rate** (L/h or gal/h) graphs in the Fuel Graphs group show the cumulative and instantaneous values of Fuel during the trip, respectively. The **Fuel Economy** (L/100km or mpg) graph included in the same group shows the instantaneous fuel economy values. Since these rates are very high for the metric fuel economy (L/100km) variable when vehicle speed is low, a **Maximum Metric Fuel Economy** (L/100km) parameter is used to set the largest value to be displayed in the Fuel Economy graph. You can specify this parameter using **Tools - Options - Output** (click the check box and enter the desired value).

### 4.4.5 Emissions (CO₂, CO, HC, NOₓ)

The Trip Statistics window includes sections that give output statistics for CO₂, CO, HC, NOₓ emissions. The pattern of statistics is the same for each emission, and the relationships are similar to the Fuel Consumption statistics. The word “Emission” and symbol E will be used in this section to represent any one of CO₂, CO, HC, NOₓ emissions.

Emission statistics are given in metric units only even when the US Customary Units are in use. A mixed rate (grams per mile) is used for emissions per unit distance

**Emission for Trip**, \( E_t \) (grams) given in the Trip Statistics window is the total Emission produced during the trip. The emission model used in SIDRA TRIP is described in Section 3.8.

Vehicle parameters that influence the amount of emission produced by a vehicle can be specified in the input dialogs under **Edit Profile - Vehicles**, or under **Tools - Defaults - Vehicles** (see Sections 2.4.3 and 3.8.1 to 3.8.5).

In the case of the Event Data method, Total Emission for each Event is given in the **Cost, Fuel and Emissions** table of Event Statistics output.

**Emission for Trip per unit distance**, \( E_{tx} \) (g/km or g/mi) is determined from:

\[ E_{tx} = \frac{E_t}{L_t} \] (4.4.18a)

where \( L_t \) is the Travel Distance (km or mi).

**Emission per hour for Trip**, \( E_{th} \) (g/h) is determined from:

\[ E_{th} = 3600 \frac{E_t}{T_t} \] (4.4.18b)

where \( T_t \) is the Travel Time (seconds).

**Desired Emission for Trip**, \( E_d \) (grams) is calculated for conditions of driving at constant Desired Speed.

**Excess Emission for Trip**, \( E_e \) (grams) is determined relative to the emission produced if the vehicle travelled in the cruise mode at the Desired Speed. This is calculated as the difference between Emission for Trip and Desired Emission for Trip:

\[ E_e = E_t - E_d \] (4.4.18c)

**Desired Emission per unit distance**, \( E_{dx} \) (mL/km or gal/mi) and **Excess Emission for Trip per unit distance**, \( E_{ex} \) (mL/km or gal/mi) are calculated in the same way as Emission for Trip per unit distance:
\[ E_{dx} = \frac{E_d}{L_t} \]  \hspace{1cm} (4.4.18d)

\[ E_{ex} = \frac{E_x}{L_t} \]  \hspace{1cm} (4.4.18e)

where \( L_t \) is the Travel Distance (km or mi).

The \( \text{CO}_2, \text{CO}, \text{HC}, \text{NO}_x \) Total (grams) and \( \text{CO}_2, \text{CO}, \text{HC}, \text{NO}_x \) Time Rate (kg/h) graphs show the cumulative and instantaneous values of emission during the trip, respectively.

4.4.6 Noise

The Noise section in the Trip Statistics window gives the following statistics related to the noise levels produced by the vehicle during the trip:

- Minimum Noise Level for the Trip, \( L_{\text{min}} \) (dBA),
- Maximum Noise Level for the Trip, \( L_{\text{max}} \) (dBA),
- Average Equivalent Noise Level for the Trip, \( L_{\text{eq}} \) (dBA), and
- Average Equivalent Noise Level for a traffic stream, \( L_{\text{eqT}} \) (dBA), which is based on the specified flow rate of the traffic stream.

SIDRA TRIP estimates noise levels (dBA) generated during the trip using three different models:

- ASJ 2003 (Japanese) Model,
- SonRoad (Swiss) Model, and
- RLS-90 (German) Model.

For each model, noise levels received at a **Fixed Receptor** point and at a **Relative Receptor** point are simulated. The **Fixed Receptor** is at a fixed location defined with reference to the start of the trip. The **Relative Receptor** is at a constant distance from the vehicle, and moves with the vehicle.

The models to be used for generating noise output can be specified using check boxes in **Tools - Options - Output**. The text output and graphs are given for selected models only.

Output statistics for various Noise levels are affected by vehicle type and various parameters defining Receptor location (Section 3.6). The Flow Rate (veh/h) parameter is used for estimating an Average Equivalent Noise Level for a traffic stream. These parameters can be specified using **Edit Profile - Noise Settings**, or **Tools - Defaults - Noise Settings**.

In the case of the Event Data method, the minimum and maximum Noise levels for each Event are given in the **Noise Levels (dBA) - Fixed Receptor** and **Noise Levels (dBA) - Relative Receptor** tables of Event Statistics output.

The noise graphs (by model name) in the **Noise Graphs** group show the instantaneous noise levels during the trip. The graphs are given either for Fixed Receptor or for Relative Receptor according to the selection in **Tools - Options - Output** (Noise Graphs group).

General information about noise and parameters describing various traffic noise levels is given below to help with understanding of SIDRA TRIP estimates of noise levels.
General Information about Noise

Noise is unwanted sound. Since the sound generated by road traffic is generally unwanted, it is appropriate to refer to it as traffic noise. However, vehicle noise gives a warning of vehicle’s approach and this is used by pedestrians, especially those with sight impairment.

The level of noise is measured using a sound level meter. This instrument mimics the operation of the human ear which responds to minute pressure variations in the air. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound is heard.

Sound pressure is the difference between the pressure in a sound wave and ambient pressure. The instantaneous sound pressure is the deviation from the ambient pressure caused by a sound wave at a given location and given instant in time. The effective sound pressure is the root mean square of the instantaneous sound pressure averaged over a given interval of time.

The SI unit for sound pressure is the pascal (Pa = 1 Newton / m²).

A logarithmic decibel amplitude scale is used since the human ear can detect sounds with a very wide range of amplitudes.

Since the ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds, sound pressure levels are often frequency weighted so that the measured level will match perceived levels (or subjective loudness of the noise) more closely. Several weighting schemes exist. Environmental noise levels are most commonly expressed in terms of the "A-weighted" decibel scale. A-weighted sound pressure levels are labelled dBA or dB(A).

Sound pressure level (SPL or Lp) in decibels (dB) is given by:

\[
L_p = 10 \log_{10}(p^2 / p_o^2) = 20 \log_{10}(p / p_o)
\]

where

\( p = \) sound pressure (Pa),
\( p_o = \) a reference sound pressure which is usually taken to be the approximate threshold of human hearing (20 µPa).

From Equation (4.4.19a):

\[
p^2 / p_o^2 = 10^{L_p/10}
\]

\[
p = p_o \cdot 10^{L_p/20} = 0.00002 \cdot 10^{L_p/20}
\]

The sum of the sound pressure levels from several sound sources is given by:

\[
L_p = 10 \log_{10} \left[ \Sigma_n \left( p_i^2 / p_o^2 \right) \right] = 10 \log_{10} \left[ \Sigma_n \left( 10^{L_{p_i}/10} \right) \right]
\]

where

\( L_{p_i} = \) sound pressure level for the \( i \)th source (dBA),
\( p_i = \) sound pressure for the \( i \)th source (Pa),
\( \Sigma_n = \) summation for \( n \) sound sources.

Table 4.2 shows examples of sound pressure and sound pressure level values, and the corresponding source and loudness descriptions. The quietest sound that humans can hear is associated with a pressure value of approximately 20 µPa (micropascals) or a sound pressure level of 0 dBA. Long-term exposure to a sound pressure level around 90 dBA can permanently damage the ear. Sound levels in excess of 130 dB are more than the human ear can safely withstand and can result in serious pain and permanent damage.
A rise of 10 dBA in sound level corresponds approximately to a doubling of subjective loudness. For example, a sound of 70 dBA is twice as loud as a sound of 60 dBA.

When sound pressure levels from separate sources are added (Equation 4.4.19d), the maximum sound pressure level tends to dominate. For example, adding 70 dBA, 60 dBA and 50 dBA, the sound pressure level is found to be \( L_p = 10 \log_{10} (10^{70/10} + 10^{60/10} + 10^{50/10}) = 70.5 \) dBA.

Sound pressure decreases with distance from a point source (inverse function of distance).

**Traffic Noise Parameters**

There is a large number of parameters (noise indices) used in assessment of road traffic noise (e.g. see AUSTROADS 2005, Homburger, et al 2001). For example:

- **\( L_1 \)**: The noise (or sound pressure) level in dB(A) that is exceeded for 1 per cent of a specified time period.
- **\( L_{10} \)**: The noise level in dB(A) that is exceeded for 10 per cent of a specified time period.
- **\( L_{50} \)**: The noise level in dB(A) that is exceeded for 50 per cent of a specified time period.
- **\( L_{90} \)**: The noise level in dB(A) that is exceeded for 90 per cent of a specified time period.
- **\( L_{eq} \)**: Equivalent noise level in dB(A) as a constant continuous sound level that would produce the same overall amount of noise (total sound energy) as the time-varying sound level received at a receptor point over a given period of time.

**Table 4.2**

*Examples of sound pressure and sound pressure levels (from various sources)*

<table>
<thead>
<tr>
<th>Source of sound</th>
<th>Sound pressure (Pa)</th>
<th>Sound pressure level (dBA)</th>
<th>Loudness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loud thunder, jackhammer at 1.5 m</td>
<td>20</td>
<td>120</td>
<td>Very loud (hearing damage due to short-term exposure)</td>
</tr>
<tr>
<td>Jet engine, 100 m distant</td>
<td>6–200</td>
<td>110–140</td>
<td>Very loud</td>
</tr>
<tr>
<td>Discotheque</td>
<td>2</td>
<td>100</td>
<td>Very loud</td>
</tr>
<tr>
<td>Compressor at 15 m</td>
<td>0.6</td>
<td>90</td>
<td>Very loud (hearing damage due to long-term exposure)</td>
</tr>
<tr>
<td>Passenger car (at 10 m)</td>
<td>0.02–0.2</td>
<td>60–80</td>
<td>Quiet to loud</td>
</tr>
<tr>
<td>Normal talking (at 1 m)</td>
<td>0.002–0.02</td>
<td>40–60</td>
<td>Very quiet to quiet</td>
</tr>
<tr>
<td>Very calm room</td>
<td>0.0002–0.0006</td>
<td>20–30</td>
<td>Very quiet</td>
</tr>
<tr>
<td>Whisper</td>
<td>0.0002</td>
<td>20</td>
<td>Very quiet</td>
</tr>
<tr>
<td></td>
<td>0.000020</td>
<td>0</td>
<td>Threshold of hearing (at 2 kHz)</td>
</tr>
</tbody>
</table>
Traffic Noise Parameters Used in SIDRA TRIP

Minimum and Maximum Noise Levels for a Single Trip

The Minimum Noise Level ($L_{\text{min}}$) and the Maximum Noise Level ($L_{\text{max}}$) for a single trip as received at a fixed receptor or relative receptor point are determined as the lowest and highest values estimated from the simulation of vehicle trip.

Average Equivalent Noise Level for a Single Trip

The Average Equivalent Noise Level for a Single Trip ($L_{\text{eq}}$) as received at a fixed receptor or relative receptor point is calculated using instantaneous noise levels at all simulation intervals.

Average Equivalent Noise Level for a Traffic Stream

The Average Equivalent Noise Level for a Traffic Stream ($L_{\text{eqT}}$) as received at a fixed receptor point (specified by distance from the start of trip) is estimated using instantaneous noise levels and allowing for the specified flow rate of the traffic stream (representing frequency of vehicles passing the receptor point).

Minimum and Maximum Noise Levels for a Traffic Stream

The minimum sound level for a traffic stream, $L_{\text{minT}}$ would differ from $L_{\text{min}}$ for the single trip. The maximum sound level for a traffic stream, $L_{\text{maxT}}$ is the same as the value to for the single trip, $L_{\text{maxT}} = L_{\text{max}}$.

Different Vehicle Classes

To determine the average noise level for a traffic stream consisting of different vehicle classes, SIDRA TRIP can be used to simulate a typical trip for each class using the flow rate (therefore average headway) for each class. The following formula can then be used to calculate the $L_{\text{eqT}}$ value for the mixed traffic stream:

$$L_{\text{eqT}} = 10 \log_{10} \left[ \sum_n (10^{L_{\text{eqTk}}/10}) \right]$$

(4.4.20a)

where

$L_{\text{eqTk}}$ = average equivalent noise level for $k$th vehicle class (dBA), and

$\Sigma_n$ = summation for $n$ vehicle classes.

For example, for light and heavy vehicle classes:

$$L_{\text{eqT}} = 10 \log_{10} \left( 10^{L_{\text{eqTLV}}/10} + 10^{L_{\text{eqTHV}}/10} \right)$$

(4.4.20b)

where

$L_{\text{eqTLV}}$ = average equivalent noise level for light vehicles (dBA), and

$L_{\text{eqTHV}}$ = average equivalent noise level for heavy vehicles (dBA).

In this case, light and heavy vehicle flow rates ($q_{\text{LV}}$, $q_{\text{HV}}$ in veh/h) would be used to determine $L_{\text{eqTLV}}$ and $L_{\text{eqTHV}}$. 

□
Thank you for choosing
SIDRA TRIP