Department for Transport

Vehicle Emissions Carbon Tool

User Guide

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Department for Transport
Great Minster House
33 Horseferry Road
London
SW1P 4DR

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1. Introduction

Background

1.1 The **V**ehicle **E**missions **CA**rbon **T**ool (VECAT) has been developed to provide an approach to the quantification of road user carbon emissions for scheme appraisal. The Tool works on a link-by-link basis using the parameters and formulae from the DfT's Transport Analysis Guidance (TAG) and the TAG Data Book. VECAT has the functionality to annualise road user emissions and calculate emissions over a set appraisal period.

1.2 It is expected that VECAT is used to quantify road user carbon emissions in all business case stages whenever a transport model exists. The Tool can also be used in the absence of a transport model provided users are able to produce the required inputs.

1.3 The Tool requires forecast link flows and speeds for the With and Without Scheme scenarios to be input as well as more general input parameters (scheme opening year, appraisal period, etc). The outputs of the Tool include annual quantified carbon emissions (in tonnes of CO2 equivalent, tCO2e. CO2 equivalent includes greenhouse gases, such as nitrous oxide and methane, as well as carbon dioxide.) over a specified appraisal period for Without Scheme and With Scheme scenarios. The Tool also calculates the difference between these scenarios to provide outputs that can be directly used in the TAG Greenhouse Gases (GHG) Workbook to monetise the road user carbon impacts of a scheme.

1.4 This User Guide sets out how VECAT has been structured and provides details of what data are required for each input sheet in the Tool. It also details what is included in the output sheets of the Tool and provides some use case examples.

2. Overview

Methodology

2.1 The Tool inputs include road traffic model outputs by time period for each modelled year (forecast traffic flows by vehicle type and speeds for each modelled link) and the Tool interpolates flows and speeds for all years in the user specified appraisal period. The Tool uses the flows and speeds to calculate road user carbon emissions for each year, using fuel consumption and carbon factors by fuel type based on fleet composition data. The parameters used in the calculation of carbon emissions can be defined by the user, with the Tool offering use of TAG core parameters (taken from the TAG Data Book), Common Analytical Scenarios (CAS) parameters (taken from the CAS Data Book) or a user defined set of parameters.

2.2 The CAS are a set of seven standardised future scenarios which explore key national-level uncertainties, for use in transport modelling and appraisal. For the purpose of using VECAT, by CAS parameters we understand the CAS technology scenario and the two CAS decarbonisation scenarios. All other CAS scenarios share the same parameters as TAG core. All the CAS scenarios are described in Appendix B of the Uncertainty Toolkit. The CAS will no longer be published in their current format after December 2025. This is part of a wider refresh of scenario guidance being undertaken by DfT. We will consider if it is possible to replace the CAS databook option with a similar alternative in future.

2.3 The Tool outputs include a range of tables and graphs to aide interpretation of results and includes carbon emission data formatted for input to the TAG GHG Workbook. A more detailed description of the inputs, calculations and outputs is provided in the rest of this section and the later chapters of this User Guide.

Key Inputs

2.4 The key inputs to the Tool are shown in Table 1 to Table 3. A full description of user inputs and guidance on populating the input sheets of the Tool is provided in Chapter 4.

Table 1 – General inputs

Input	Options
Modelled years	Up to 10 modelled years can be input
Scheme opening year	Opening year of the scheme
Time periods	Up to 10 modelled time periods can be input
Annualisation factors	Annualisation factors for the specified time periods
OGV1/OGV2 split	Proportion of HGVs that are OGV1/OGV2
Data Book option	TAG core, CAS, or custom values
Appraisal Period	Scheme appraisal period over which the calculations are performed (maximum appraisal period of 100 years)
Calculate full appraisal period impacts	Option to calculate impacts for modelled years only or for the full appraisal period
Export interpolation calculations	Option to export year-by-year link level flows and speeds to Comma Separated Values (CSV) files, and specify the location these files should be saved
Export year-by-year results	Option to export year-by-year link level carbon emissions to CSV files, and specify the location these files should be saved

Table 2 – Link data inputs (defined separately for each time period and Without Scheme and With Scheme scenarios)

Input	Options
Link ID	Link identifier defined by user Links should be defined as one-way. Two-way links should have two separate link identifiers
Link length	Link length (km)
Speed	Average speed on link by modelled year (kph)
Traffic flow - car	One-way car traffic flow on the link by modelled year (vehicles)

Input	Options
Traffic flow - LGV	One-way LGV traffic flow on the link by modelled year (vehicles)
Traffic flow - HGV	One-way HGV traffic flow on the link by modelled year (vehicles)
Traffic flow - PSV	One-way PSV traffic flow on the link by modelled year (vehicles)

Table 3 - Data Book inputs

Input	Options
Base fuel consumption parameters and minimum/maximum speeds	Fuel consumption (litres per km) and energy consumption (kWh per km) parameter values Minimum and maximum speed values (kph) used in speed consumption calculations
Proportion of vehicle kilometres by fuel/energy type and year	Annual proportion of cars, LGV, OGV1, OGV2 and PSV vehicle kilometres using petrol, diesel, or electric
Forecast fuel/energy consumption parameters by year	Forecast fuel consumption (litres per km) and energy consumption (kWh per km) parameter values by year
Fuel efficiencies	Fuel efficiencies (litres per 100km) and energy efficiencies (kWh per 100km) for each vehicle and fuel/energy type
Carbon factors	Carbon dioxide emissions per litre of fuel/kWh used (kgCO2e per litre or kgCO2e per kWh)

2.5 The data inputs described in Table 1 and Table 2 above are user defined (with some defaults included in the Tool). The inputs for Table 3 can use TAG core values from the TAG Data Book or CAS values from the CAS Data Book (both of which are provided in the Tool) or can be user defined.

2.6 There are three CAS scenarios which differ from the TAG core values for fleet composition and fuel efficiency. These three scenarios (Technology, Vehicle-Led and Mode-balanced) have the same fleet composition and fuel efficiency values, hence only a single CAS scenario option is provided in VECAT.

Carbon Emission Calculations

2.7 The calculation of carbon emissions is performed by vehicle type, time period, year, and scenario (Without Scheme or With Scheme). Figure 1 shows an overview of the general TAG carbon emissions calculation applied on a link-by-link basis. Figure 9 later shows how this calculation fits into VECAT.

2.8 The grey box below each step in the calculation shown in Figure 1 represents the output at that stage.

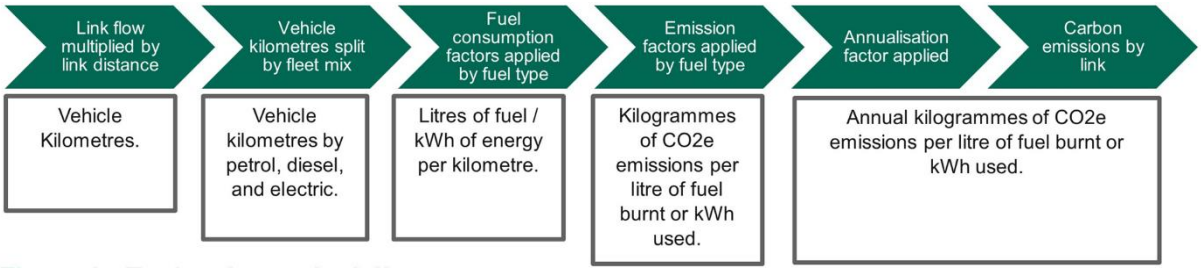

Figure 1 - Tool carbon calculation process

2.9 The user's selected Data Book option (whether TAG, CAS or a user defined 'Custom' option) determines the fleet mix and the fuel consumption factors that are used in the calculation.

2.10 Traffic flow by vehicle type for each link is split by fuel type, and the fuel consumption per kilometre is calculated based on the link speed and vehicle/fuel type mix. This follows the formula provided in TAG Data Book Table A 1.3.11 shown in Figure 2.

Fuel consumption is estimated using a function of the form: $L = a/v + b + c.v + d.v2$

Where:

L = consumption, expressed in litres per kilometre;

v = average speed in kilometres per hour; and

a, b, c, d are parameters defined for each vehicle category.

Figure 2 - Fuel consumption formula

2.11 The speeds used in the calculation are capped to the maximum and minimum range set out in TAG Data Book Table A 1.3.8. Speeds outside this range are not valid for calculating fuel consumption. Therefore, if link speeds above or below these thresholds are input to VECAT they will be replaced in the calculation by the maximum or minimum bounds.

2.12 The fuel consumption calculations take account of changes in vehicle efficiency through time, as provided by the fuel / energy consumption parameters included in TAG Data Book Table A 1.3.11.

2.13 Emission factors from TAG Data Book Table A3.3 are applied by fuel type to calculate carbon dioxide emissions per litre of fuel burnt or kWh used (kgCO2e per litre or kgCO2e per kWh).

2.14 For appraisal years beyond the final year of data included in a Data Book table, the calculations use the values from that final year. For example, if the final year of data in TAG Data Book Table A1.3.9 is 2050, the 2050 values will be used for all appraisal years beyond 2050.

2.15 The total carbon emissions for each year are annualised using the factor(s) provided by the user.

Interpolation and Extrapolation

2.16 Within the Tool, link-by-link traffic flows (by vehicle type), and speeds are interpolated/extrapolated over the appraisal period. This process is carried out separately for Without Scheme and With Scheme inputs, and for each time period and vehicle type.

2.17 The 'standard' interpolation/extrapolation follows a similar process to the DfT's Transport User Benefits Appraisal (TUBA) software as follows:

- data (flows and speeds) for appraisal years between the modelled years are linearly interpolated;
- data for appraisal years before the first modelled year are linearly extrapolated from the first and second modelled years; and
- data for appraisal years beyond the last modelled year are extrapolated horizontally (i.e. assuming no further change beyond the last modelled year) by default, this is in line with the approach to extrapolation used in TUBA. An option is provided to users to enable a proportion of the annual change between the final two modelled years to be applied beyond the final modelled year if considered appropriate. To implement this, the proportion is input in the *I- User Inputs* sheet. The process for this is detailed in Chapter 4.

2.18 Figure 3 shows an illustration of the 'standard' interpolation and extrapolation for a scheme opening year of 2028 and two modelled years 2030 and 2045.

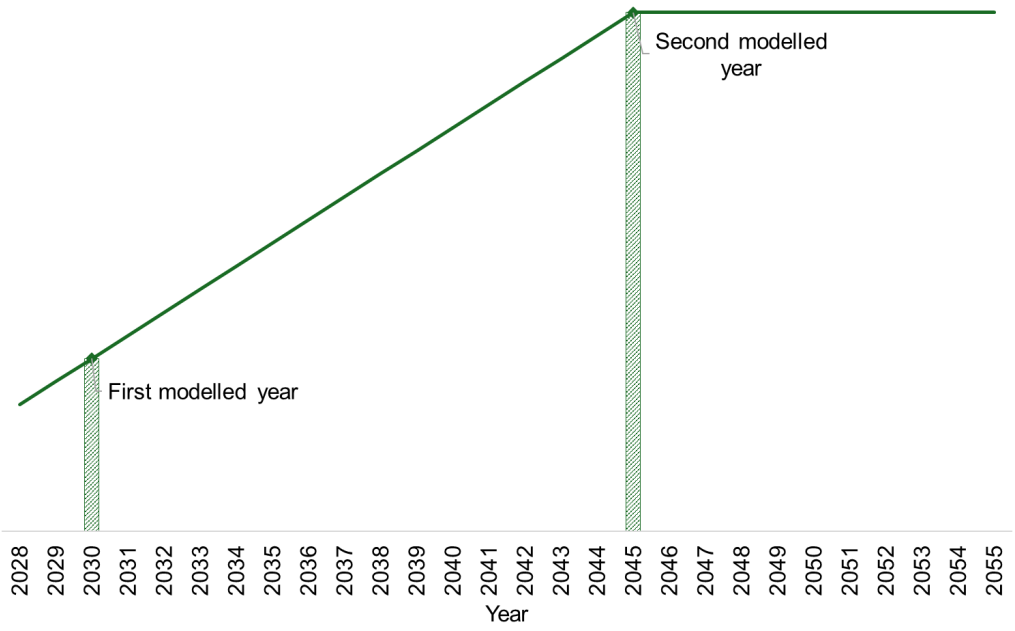

Figure 3 - Standard interpolation and extrapolation

2.19 The Tool checks if any link has zero flow (as summed across all vehicle types) in one of the input modelled years. If this is the case, an alternative approach to interpolation/extrapolation will be applied, whereby the Tool will extrapolate flows and speeds horizontally between modelled years. To illustrate how this is implemented an example is provided as follows:

- where the link input data has zero flow in the modelled year 2025 and non-zero flow in (the next modelled year) 2040, then the Tool assumes zero flow across 2026-2039; and

- where the link input data has non-zero flow in the modelled year 2025 and zero flow in (the next modelled year) 2040, then the Tool extrapolates the 2025 non-zero flow across 2026-2039.

2.20 Figure 4 and Figure 5 show illustrations of the previously described approaches to interpolation/extrapolation. Figure 6 and Figure 7 include examples where the third modelled year (2050) is non-zero.

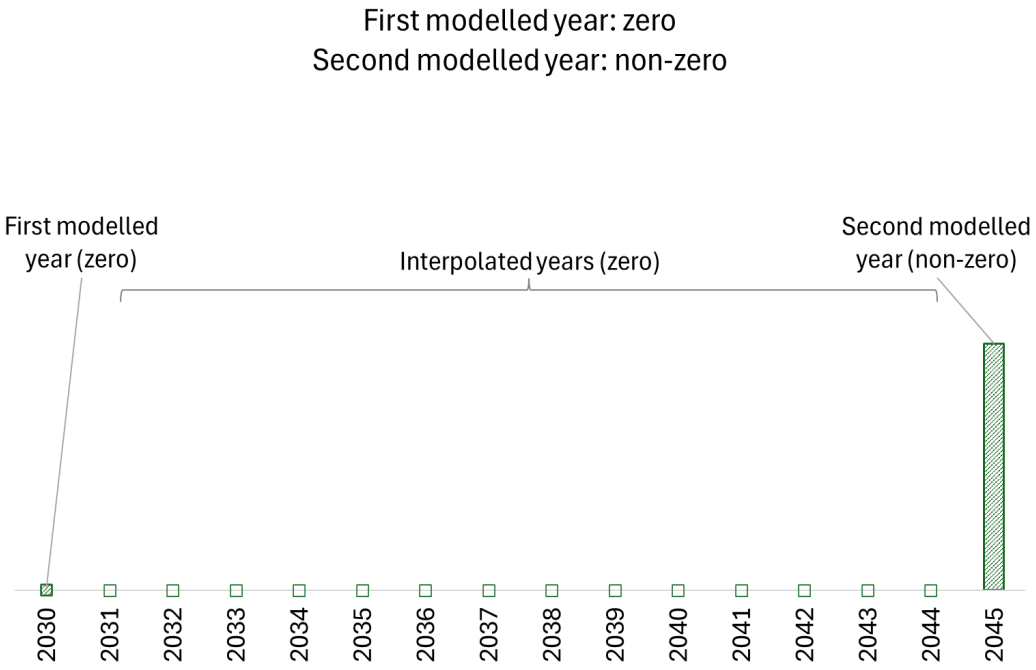

Figure 4 – Zero flow interpolation and extrapolation for two modelled years

Figure 5 - Zero flow interpolation and extrapolation for two modelled years

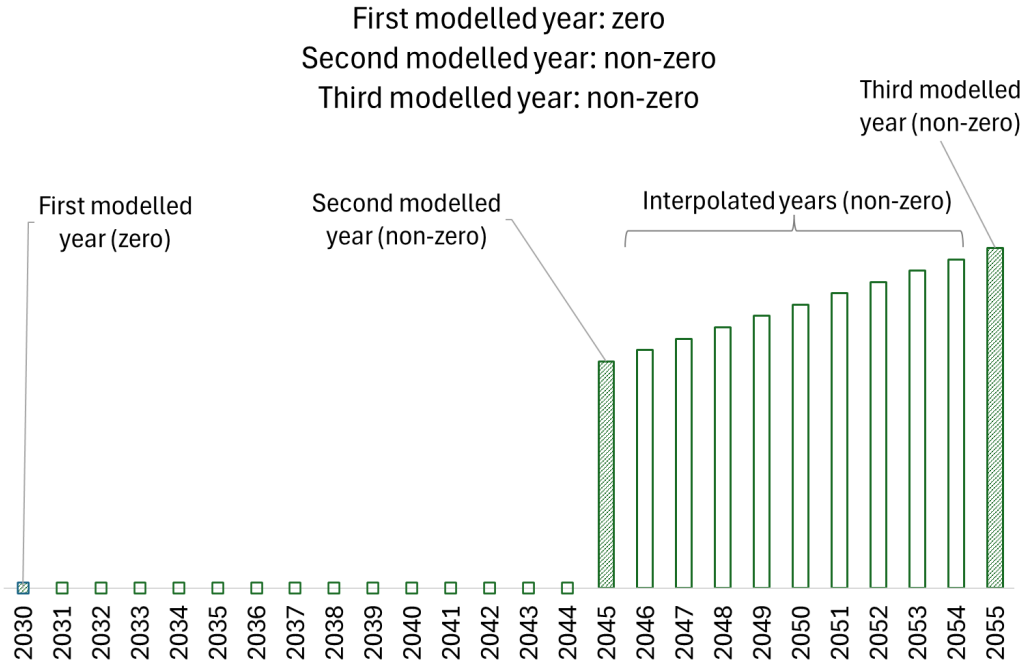

Figure 6 – Zero flow interpolation and extrapolation for three modelled years

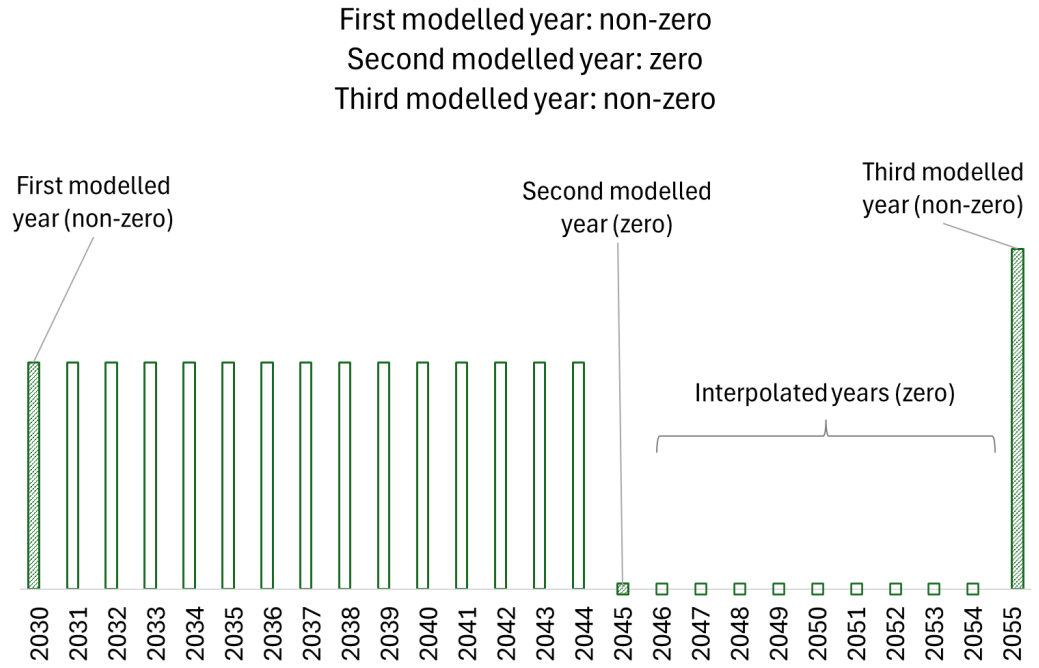

Figure 7 – Zero flow interpolation and extrapolation for three modelled years

2.21 Users must ensure that input link data is appropriately defined such that the interpolation/extrapolation of flows and speeds implemented in the Tool will produce sensible results, and in some cases users may need to adjust their link inputs as necessary.

2.22 If there are links that are added or removed in forecast years that are not modelled years, a more representative interpolation/extrapolation to that implemented in the Tool may be required. For example, if there are two modelled years 2030 and 2045 but there is a road scheme that is built in 2035, the Tool interpolation could only calculate zero flow on these scheme links between 2030 and 2045 and would not be able to interpolate the actual non-zero flows between 2035 and 2045. In such cases, the user should provide forecasts for interim modelled years (as recommended in TAG), to better reflect the changes in flow brought about by any network changes.

Outputs

2.23 There are five output tabs populated by the Tool:

- *O– GHG Workbook Inputs*;
- *O– Summary Tables (Emissions)*;
- *O- Summary Tables (vkms)*;
- *O– Data Book Summary*; and
- *O– Diagnostics*.

2.24 *O- GHG Workbook Inputs* produces annual greenhouse gas emissions for the With and Without Scheme scenarios split by emissions in the non-traded and traded sectors. This is produced for each year in the appraisal period.

2.25 *O- Summary Tables (Emissions)* includes the following for the With and Without Scheme scenarios:

- annual emissions (tCO2e);
- change in total annual emissions (With Scheme scenario – Without Scheme scenario) (tCO2e);
- emissions by vehicle type, fuel type and time period (tCO2e); and
- change in emissions (With Scheme scenario – Without Scheme scenario) by vehicle type, fuel type and time period (tCO2e).

2.26 *O- Summary Tables (vkms)* includes the following for the With and Without Scheme scenarios:

- annual vehicle kilometres (000s vkm);
- change in total annual vehicle kilometres (000s vkm);
- vehicle kilometres by vehicle type, fuel type and time period (000s vkms); and
- change in annual vehicle kilometres (With Scheme scenario – Without Scheme scenario) by vehicle type, fuel type and time period (000s vkms).

2.27 *O- Data Book Summary* provides a summary of the inputs from the selected Data Book to help users to understand the emission outputs. This shows how the values from the selected Data Book impact the electric vehicle proportions and fuel consumption and carbon emissions per vehicle km over the specified appraisal period.

2.28 *O- Diagnostics* shows the outputs of a check of the input data including: the total number of links; the number of links with zero flow, distance or speed; and errors and warnings.

2.29 The Tool also produces four output charts as follows:

- *CH- Annual Emissions* shows a line chart of the annual emissions (in tCO2e) in the With and Without Scheme scenarios;
- *CH- Change in Emissions* shows a line chart of the change in emissions (in tCO2e) between the With and Without Scheme scenarios;
- *CH- Annual vkms* shows a line chart of the annual vehicle kilometres (000s vkm) by fuel type; and
- *CH- Change in vkms* shows a line chart of the change in annual vehicle kilometres (000s vkm) by fuel type between the With and Without Scheme scenarios.

3. Format and Structure

Format of Tool

3.1 The aim is for the Tool to be transparent and easy-to-use by scheme promoters. The Tool has been developed in a spreadsheet format using Microsoft Excel. The Tool uses Visual Basic for Applications (VBA) within Excel to enable the carbon calculation processes.

3.2 The Tool has been developed in DfT's spreadsheet model template. Cells have been formatted in line with the legend on the *Cover Sheet* (see Figure 8Figure 8 below). Throughout the input sheets there are user notes to provide guidance on the format of the inputs required, and these notes are expanded on within this User Guide.

3.3 Before running the tool, it is important to ensure macros have been enabled.

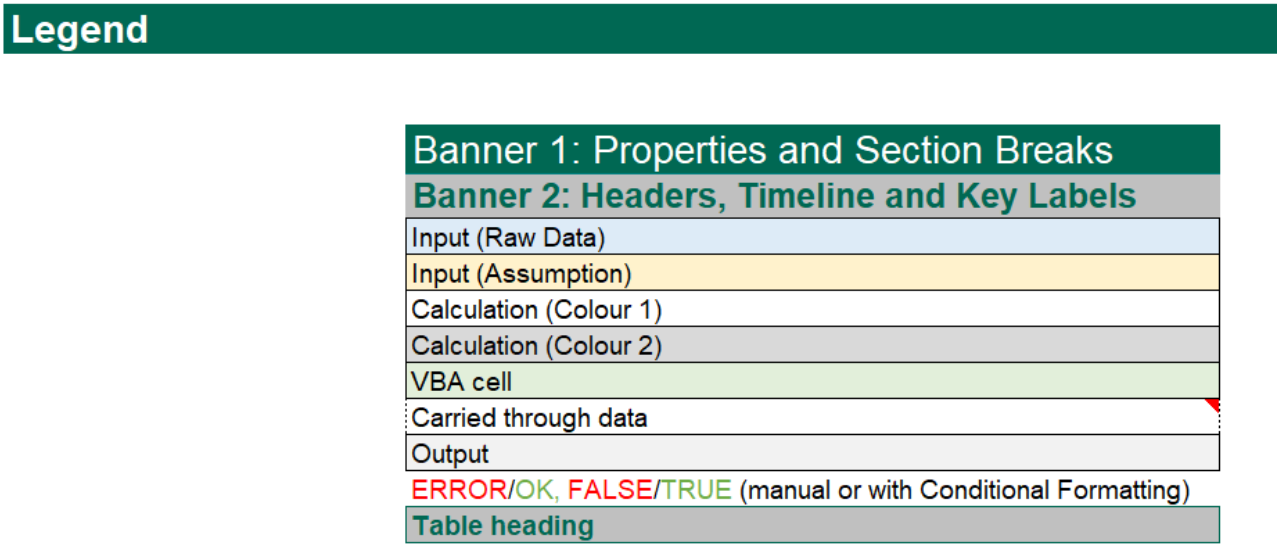

Figure 8 – Cell formatting legend

Tool Structure

3.4 The Tool is structured such that input, calculation and output sheets are separated. There are divider pages (*Inputs*> >, *Calculations*> >, *Outputs*> >) to group the sheets and to ensure the integrity of the model flow.

3.5 The Tool is structured on each sheet such that it follows the format of how a book should be read, from left to right and from top to bottom.

3.6 A map showing the input, calculation and output stages of the Tool is included in Figure 9 below. The Tool uses VBA scripting to sequentially run the calculation and output stages for each scheme scenario, time period and appraisal year.

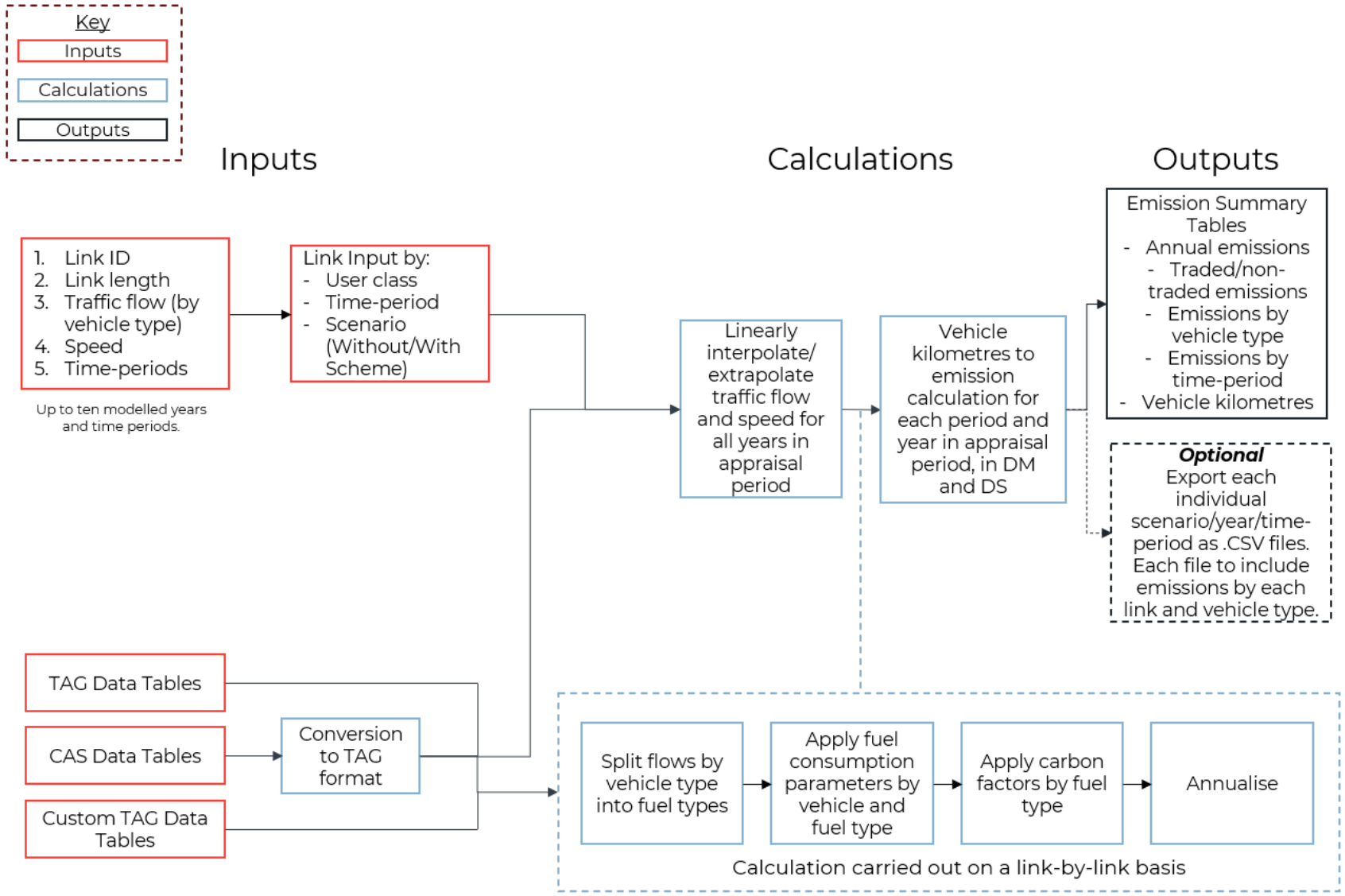

Figure 9 – Tool map

4. Inputs

Inputs by Sheet

4.1 There are three types of input sheets in the Tool that the user should review and populate where necessary prior to running the Tool:

- *I- User Input* – includes information related to data inputs, appraisal assumptions and run settings. Inputs include modelled years, time periods, annualisation factors, appraisal period, etc.;
- *I- With and Without Scheme TPX Links* – are the input sheets for the modelled network data. Inputs include traffic flow, speed and length by link for each modelled year. There is a separate input sheet for each time period for the With and Without Scheme scenarios; and
- *I- Data Book (Custom)* – allows users to input alternative values for fuel consumption parameters, fleet composition, etc. (in TAG Data Book format). This sheet only needs to be updated if neither the TAG core values (from the TAG Data Book) nor the CAS scenario values (from the CAS Data Book) are being used in the run of the Tool. Use of either of these 'default' Data Books can be specified in the *I- User Input* sheet.

4.2 The following sections describe each of the input sheet types in more detail.

I- User Inputs

4.3 The *I- User Inputs* sheet is split into two main input blocks:

- 'Modelled Years and Time Periods'; and
- 'Tool Run Settings'.

4.4 The 'Modelled Years and Time Periods' input block is shown in Figure 10 Figure 10below.

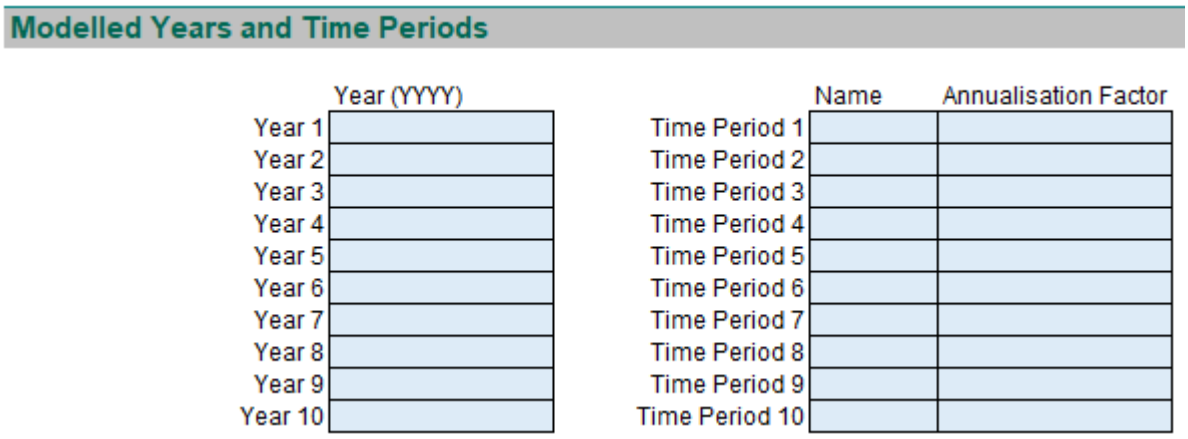

Figure 10 – Modelled years and time periods input

4.5 The 'Year' column should be populated by the user, defining the years for which link data will be input to the Tool (in the *I- With and Without Scheme TPX Links* sheets). This should be a four-digit number (e.g. 2025). Up to 10 different input years can be defined, and these should be listed in chronological order starting at 'Year 1'. Any unused input years should be left blank.

4.6 The time periods for which link data will be input to the Tool need to be defined by the user. Up to 10 different time periods can be defined, and these should be given a unique name and associated annualisation factor. The time period name and annualisation factor should be input in the appropriate columns on *I- User Inputs* (in the 'Name' and 'Annualisation' columns respectively).

Note on Annualisation Factors

TAG advises that all 8,760 hours of the year need to be included and properly represented in the assessment of carbon. Transport models typically cover specific periods of the day, so that scheme impacts estimated from model outputs have to be expanded to cover the whole day and then a full year (i.e. annualisation).

Where time periods are explicitly modelled and where they represent the average hour, expansion will be relatively straightforward, with the number of hours covered by the modelled time period (h) multiplied by the number of days a year containing that time period (d); whereby the annualisation factor is given by h x d.

The value of d should be estimated assuming that a year (365 days) is divided up as follows:

- *253 peaked weekdays;*
- *52 Saturdays;*
- *52 Sundays;*
- *8 bank holidays;*

with a total of 8,760 hours.

For time periods that are not explicitly modelled it will be necessary to adapt model outputs to account for those periods. As noted in the TUBA guidance, it is not possible to make general recommendations as to how this is undertaken and it depends on local circumstances. The decision should be informed by the profile of observed count data, to enable appropriate adjustments to be made to modelled flows and speeds and to derive appropriate annualisation factors.

TUBA guidance provides the example (replicated here) of where only the 0800-0900 hour is modelled in the AM peak, with the average interpeak hour also modelled and suggests a number of options for using modelled outputs to cover the AM peak shoulders, these being:

- *Use of interpeak data;*
- *Use of peak hour data; or*
- *Modify the trip and/or speed data, for example reduce the 0800-0900 data with a factor derived from traffic counts, or speeds and trips could be interpolated between the interpeak and the peak hour.*

The principles outlined in this example should be used to represent all non-modelled time periods. In most cases this is likely to require some factoring of modelled data to represent non-modelled time periods, with annualisation factors calculated as described above.

A further note of caution is identified in the TUBA guidance and should be considered when producing inputs to VECAT. The relationship between hourly trip numbers and speeds is not linear; so any factoring or interpolation of modelled speed data to cover non-modelled time periods should take this into account.

Another issue which needs to be considered in the interpolation of non-modelled speeds is that the speed/carbon emission function is not monotonic. An interpolated speed could therefore lead to lower emissions than would be seen from the speeds in the modelled periods used for interpolation. For example, if modelled speeds were 50 kph and 100 kph, then the interpolated speed could be 75 kph which would likely lead to lower emissions of carbon than would be seen for either modelled speed.

Chapter 7 provides some use case examples of the application of annualisation factors in VECAT.

4.7 The 'Tool Run Settings' input block is shown in Figure 11Figure 11.

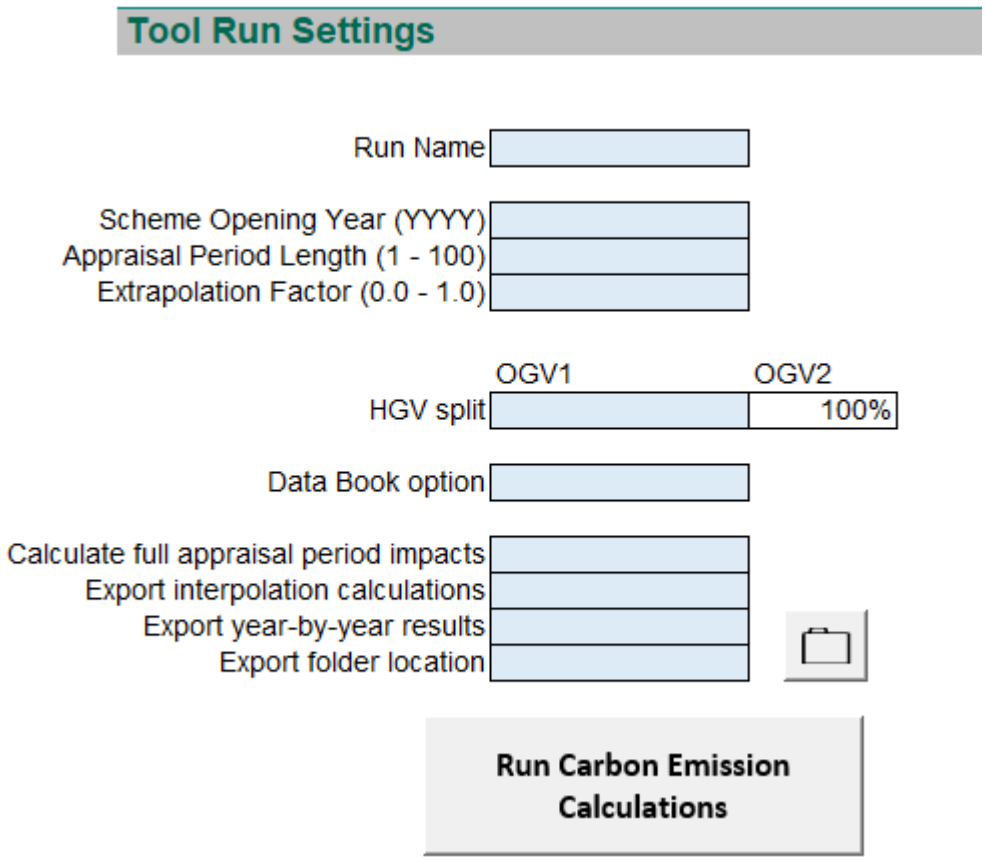

Figure 11 – Tool run settings input

4.8 The 'Run Name' cell should be populated to identify the test being undertaken and will be used by the export function in the Tool to name output files.

4.9 The 'Scheme Opening Year' cell should be populated as a four-digit number (e.g. 2025). This will be used by the Tool to set the start of the appraisal period.

4.10 The 'Appraisal Period Length' cell should be populated to define the length of the appraisal period used in years. This should be an integer value between 1 and 100. It is anticipated for most applications of the Tool this will be set to 60 (to define a 60-year appraisal period).

4.11 The ‘Extrapolation Factor’ cell should be populated with a number between 0 and 1. The Tool extrapolates flow and speed data from the last modelled year to the end of the appraisal period based on the annual rate of change between the last two modelled years, and the extrapolation factor determines what proportion of this change is used. This factor should normally be set to 0, which will lead to a horizontal extrapolation of flows and speed after the final year of input link data. A value greater than 0 will apply the corresponding proportion of the annual rate of change of speed and flow from the last two modelled years across the remainder of the appraisal period. For example, a value of 1 will use annual rate of change as-is for extrapolation, while a value of 0.5 will use half the annual rate of change for extrapolation. Using a value greater than 0 will need to be recorded and justified by the user when reporting emission results.

4.12 The ‘HGV Split’ cell allows the user to define the proportion of Heavy Goods Vehicles that are OGV1. This should be input as a percentage. The Tool will automatically populate the proportion of OGV2 to total to 100% across both OGV1 and OGV2 categories. As defined in Table A1.3.9 of the TAG Data Book, OGV1 comprises rigids up to 26 tonnes, whereas OGV2 comprises rigids over 26 tonnes and artics. Rigids and artics are as defined in the DfT Traffic Statistics. Where available, local count data should be used to define the OGV1 and OGV2 proportions, if this is not available national sources (including TRA3105: Heavy goods vehicle traffic by axle configuration and road category in Great Britain) could be used.

4.13 The ‘Data Book option’ cell offers users a choice of which Data Book will be used in the current run of the Tool. The options are ‘TAG’, which uses the TAG core scenario values (from the TAG Data Book); ‘CAS’ which uses the CAS Vehicle-led / Mode-balanced / Technology decarbonisation scenario values (from the CAS Data Book); or ‘Custom’ where the user can change the values used (in the *I- Data Book (Custom)* sheet).

4.14 The ‘Calculate full appraisal period impacts’ cell offers users a yes/no choice related to the extent of emissions calculations. This provides users with an option to undertake quicker runs of VECAT calculating emissions in only the modelled years. This allows users to check the reasonableness of the inputs and outputs. This cell should be set to ‘Yes’ if the Tool is being used to calculate emissions across the full appraisal period, or ‘No’ to calculate emissions for the years of input data only. For example, if the ‘Calculate full appraisal period impacts’ is set to ‘No’ and two modelled years have been defined in the Tool then the emissions will be calculated only for the two modelled years. The setting should be ‘Yes’ when producing results to be used in an appraisal.

4.15 The ‘Export interpolation calculations’ cell offers users a yes/no choice relating to exporting interpolated data for each link in the network. If both this cell and the ‘calculate full appraisal period impacts’ cell are set to ‘Yes’ the link flow/speed interpolation calculations will be output in CSV format. Individual CSV files by vehicle type/speed, time period and With and Without Scheme scenarios will be exported.

4.16 The ‘Export year-by-year results’ cell offers users a yes/no choice related to exporting emissions data. If set to ‘Yes’ the carbon emissions will be output in CSV format. Individual CSV files by year, time period and With and Without Scheme scenarios will be exported.

4.17 The ‘Export folder location’ allows users to define the folder where the CSV outputs will be saved (the filename will be as defined in the ‘Run Name’ cell). If CSV files already exist in the folder location, and the Run Name is not changed prior to running VECAT, these files will be overwritten.

I- With and Without Scheme TPX Links

4.18 There are separate link data input sheets by time period and for the With and Without Scheme scenarios. Once the modelled years and time periods have been defined in *I- User Inputs* and the ‘Show link input sheets for selected time periods’ button has been clicked (see Chapter 5 Running the Tool), the individual link input sheets will be shown in the Tool. Whilst the Tool can be used for up to 10 time periods, these input sheets will only be shown for the number of time periods entered on *I- User Inputs*.

4.19 Each of the link data input sheets are structured in the same format. Each row should contain a unique link and the columns are then arranged in flow inputs by year and within that by vehicle class. A single distance is entered for each link, and an average speed in each of the modelled years (not by vehicle type). The flow and speed data for each of the modelled years identified on *I- User Inputs* should be populated. These years should be input in chronological order as specified on *I- User Inputs* as this will impact the interpolation/extrapolation.

4.20 The ‘Link ID’ should be input by the user in column B. Each link should represent a one-way flow and a unique identifier should be used for each link. The maximum number of links that can be input for a single scheme scenario and time period is 1,048,565, although it should be noted that the Tool runtime will increase with the number of input links.

4.21 For each link, the ‘Distance’ should then be input in column C. This distance must be in km and should be a numerical value greater than 0. The distance cannot be changed by year. If there are changes to the network between modelled years, the specification of links would need to reflect this. For example, if as a result of a scheme being implemented a link in one modelled year becomes two links in the next modelled year, then each link will need to be uniquely defined and flows/speeds for the modelled years included, which in this example will lead to zero flows for some links in some modelled years. The Interpolation and Extrapolation section in the Overview chapter of this guide describes how zero flows are treated by the Tool when interpolating and extrapolating flows.

4.22 The flow on each link in each time period by car, LGV, HGV and PSV should be input for each of the modelled years. For the first modelled year this flow data should be input in columns D to G, for the second modelled year this flow data should be input in columns I to L, etc. This flow should be the number of vehicles on the link in that time period under the With or Without Scheme scenarios. The input should be a numerical value greater than or equal to 0.

Note on Spatial Coverage and Traffic Flow Inputs

Promoters should demonstrate that the study area is sufficient to capture the scheme carbon impacts. As minimum, this should cover the Area of Detailed Modelling and Rest of the Fully Modelled Area as defined in Section 2.2.5 of TAG Unit M3.1. While changes may be small on individual links, the cumulative effect of the small changes can be significant.

The link distances, speeds and traffic flows (broken down by user classes) should be extracted from a traffic model. Traffic flows should be extracted on a one-way basis. Flows should be input in terms of vehicles rather than passenger car units.

4.23 The average 'Speed' on each link should be entered in kph. These speeds should include delays from the link itself and the downstream junction. A speed should be input for each of the modelled years. For the first modelled year the speed should be entered in column H, for the second modelled year the speed should be entered in column M, etc. The speed should be entered as a numerical value greater than or equal to 0.

4.24 Within the Tool, the minimum and maximum speeds by vehicle type from the TAG Data Book Table A1.3.8 (or, if selected, as defined in *I- Data Book Custom*) are used to cap the speeds used in the fuel consumption calculation. For example, the TAG Data Book maximum speed for calculating fuel consumption is 130kph for petrol/diesel cars and 85kph for OGVs. Therefore, for a link with an input average speed of 96kph, the Tool would calculate petrol/diesel car fuel consumption using a speed of 96kph while it would calculate OGV fuel consumption using the capped speed of 85kph.

4.25 The link input sheets should be completed for each time period and for the With and Without Scenarios prior to running the Tool. Whilst the Tool will perform some diagnostic checks related to the link input distances, flows and speeds (see Chapter 6), the input data should be fully checked prior to input to the Tool.

I- Data Book (Custom)

4.26 The *I- Data Book (Custom)* sheet allows users to input alternative values to those in the TAG Data Book to be used in the Tool. For the values in this sheet to be used, the 'Data Book option' cell on *I- User Inputs* needs to be set to 'Custom'.

4.27 The sheet is structured in the same style as the TAG Data Book, and includes the following tables:

- Table A1.3.8 Fuel and energy consumption parameter values and minimum and maximum speeds by vehicle type;
- Table A1.3.9 Proportion of vehicle kilometres using petrol, diesel and electric by vehicle type and year;
- Table A1.3.11 Forecast fuel/energy consumption parameter values; and
- Table A3.3 Carbon dioxide emissions per litre of fuel burnt/kWh used.

4.28 If the values entered in this sheet are different to those in the core TAG Data Book the cells will be shown in **bold** (see Figure 12). The default setting is that the values within this sheet align with the core TAG Data Book.

Table A 1.3.8

Table A 1.3.8: Fuel consumption parameter values (litres per km, 2015)						
	Parameters				Min speed	Max speed
Vehicle Category	a	b	c	d	kph	
Petrol Car	0.45195	0.09605	-0.00109	0.000007	10	**120**
Diesel Car	0.48191	0.06909	-0.00066	0.000005	10	130
Petrol LGV	0.34435	0.19309	-0.00303	0.000020	10	120
Diesel LGV	0.46348	0.11328	-0.00163	0.000014	10	110
OGV1	2.69628	0.14306	-0.00103	0.000011	12	85
OGV2	5.66560	0.29422	-0.00195	0.000012	12	85
PSV	3.36019	0.29525	-0.00321	0.000024	12	85

Figure 12 – Custom Data Book input

5. Running the Tool

5.1 To run VECAT macros must be enabled within Excel. It is recommended that in Windows, the folder containing VECAT is added to the list of “Trusted Locations” which can be set via “Trust Centre Settings” to enable the correct function of macros.

5.2 All entries to the input sheets detailed in Chapter 4 should be reviewed before running VECAT to ensure all values and assumptions are appropriate. The degree of regularity with which some of these inputs will need to be considered and potentially updated is likely to vary. For example, the sheets *I- TAG Data Book*, *I- CAS Data Book* are likely to only require updating should revised versions of the Data Books be released.

Modelled Years and Time Periods

5.3 The modelled years, time periods and associated annualisation factors should be input on *I- User Inputs*. For each time period specified, a separate input sheet should be populated with the link data. In order to display the necessary link data input sheets the ‘Show link input sheets for selected time periods’ button should be clicked. The Tool will then show a separate input sheet for each time period and With or Without Scheme scenario.

5.4 There is a separate button to ‘Clear all link data’. This will remove any existing data within the link input sheets. This should be run before entering new input data to ensure all rows are clear.

5.5 The link data should be added to each of the relevant link input sheets that have been created. The detail of the link data input sheets is covered in the I- With and Without Scheme TPX Links section in Chapter 4.

5.6 Once the link data has been input on each of the required sheets, the ‘Validate link data’ button can be used to run a check on the inputs. This first checks for errors in the *I- User Inputs* sheet and will show error messages if any errors are found. The outputs of this validation are presented in the *O- Diagnostics* sheet. This will flag up any warnings and errors in the input link data. Warnings indicate that there are link inputs that are potentially unsuitable for emissions calculations, and these should be reviewed and the input data adjusted as required. The Tool can still be run with warnings in place. Errors indicate that there are invalid link inputs, and these need to

be corrected before the Tool can be run. This is discussed in further detail in Chapter 6. The button 'Go to 'I- User Inputs' sheet' on *O- Diagnostics* can be used to return to the *I- User Inputs* sheet.

5.7 Figure 13Figure 13 shows the 'Show link input sheets for selected time periods', 'Clear all link data' and 'Validate link data' buttons in the *I- User Inputs* sheet.

Figure 13 – Link input buttons

Tool Run Settings

5.8 The inputs in the Tool Run Settings part of *I- User Inputs* also need to be populated to reflect the scheme being assessed.

5.9 If 'Custom' is selected in the 'Data Book option' cell then any necessary updates to the standard TAG Data Book values should be made in the sheet *I- Data Book (Custom)*. The cells for any values that can be edited are shown in yellow, and any inputs that are different to those in the TAG Data Book are shown in bold.

5.10 Once the modelled year, time periods, and tool run settings have been set on *I- User Inputs*, any amendments made to the Custom Data Book and the With and Without Scheme link data sheets populated for each time period and modelled year the Tool can be run. To run the Tool the 'Run Carbon Emission Calculations' button should be clicked (see Figure 14). This will prompt the VBA script and the progress of the run will be shown at the bottom left of the Excel page.

5.11 The first step of 'Run Carbon Emission Calculations' carries out the same checks as the 'Validate Link Data' button, and message boxes will appear if any warnings or errors are found. Each warning message will prompt for whether the Tool run should be continued or whether it should be halted. Error messages only prompt for acknowledgment and the Tool run is halted automatically.

5.12 It should be noted that the runtime of the Tool can increase significantly if there are a large number of links and/or 'calculate full appraisal period impacts' is set to Yes. Enabling either of the export CSV options will also increase the runtime of the Tool.

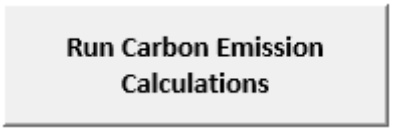

Figure 14 – Tool run button

5.13 Once the run is complete a ‘pop-up’ box is generated informing the user, which also provides details of the total run time.

5.14 The output sheets of the Tool will be populated, and, if selected in *I- User Inputs*, the detailed results are exported to CSV files saved in the folder location specified. The outputs of the Tool are discussed in detail in Chapter 6.

6. Outputs and Diagnostics

6.1 There are five output tabs populated by the Tool:

- *O– GHG Workbook Inputs*;
- *O– Summary Tables (Emissions)*;
- *O- Summary Tables (vkms)*;
- *O– Data Book Summary*; and
- *O– Diagnostics*.

6.2 There are also four charts produced using these outputs: annual carbon emissions, change in annual carbon emissions, annual vkms and change in annual vkms.

6.3 The following sections describe what is shown on each of these sheets.

O- GHG Workbook Inputs

6.4 This sheet shows the annual greenhouse gas (GHG) emissions in tCO2e for the With and Without Scheme scenarios split by non-traded and traded sectors. This sheet has been structured such that it corresponds with the format of the GHG TAG Workbook.

6.5 An example of the outputs on this sheet is shown in Figure 15.

Greenhouse Gas Workbook - Inputs

Non-traded sector (tCO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Road Without Scheme	111,696	109,008	105,875	101,594	96,244	89,677	83,578	78,035	73,217	68,862	65,038
Road With Scheme	116,077	113,300	110,057	105,618	100,063	93,241	86,906	81,148	76,143	71,620	67,648

Traded sector (tCO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Road Without Scheme	2,482	2,856	3,153	3,433	3,565	3,418	3,098	2,715	2,322	1,950	1,614
Road With Scheme	2,618	3,013	3,328	3,624	3,764	3,611	3,273	2,869	2,454	2,062	1,706

With Scheme - Without Scheme difference (tCO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Non-traded difference	4,381	4,292	4,183	4,024	3,819	3,565	3,328	3,113	2,926	2,758	2,611
Traded difference	136	157	175	191	199	192	175	154	132	111	93

END

Figure 15 – *O- GHG Workbook Inputs* example output

O- Summary Tables (Emissions and vkms)

6.6 These two sheets provide more detailed results for carbon emissions and vehicle kilometres. They include the annual carbon emissions/vehicle kilometres in each year and the change between the With and Without Scheme scenarios. They also show the carbon emissions/vehicle kilometres in each year by vehicle type, by fuel type, by time period for With and Without Scheme scenarios, and the change between these scenarios.

6.7 Figure 16 and Figure 17 show examples of the emissions (sum of traded and non-traded) and vehicle kilometres outputs on this sheet.

Summary Tables (CO2e emissions)

Annual emissions (tCO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Road Without Scheme	114,178	111,864	109,028	105,026	99,808	93,095	86,677	80,750	75,539	70,812
Road With Scheme	118,695	116,313	113,385	109,242	103,827	96,852	90,179	84,017	78,597	73,681

Change in annual emissions (With Scheme - Without Scheme) (tCO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Difference in emissions	4,517	4,449	4,357	4,215	4,019	3,757	3,503	3,267	3,058	2,870

Emissions by vehicle type (tCO2e) - Without Scheme

Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Car	73,030	71,354	69,292	66,272	62,255	57,190	52,351	47,851	43,783	40,061
LGV	18,360	18,141	17,743	17,125	16,275	15,214	14,188	13,273	12,483	11,798
HGV	19,558	19,177	18,811	18,460	18,125	17,555	17,016	16,510	16,143	15,819
PSV	3,230	3,192	3,183	3,169	3,153	3,135	3,122	3,117	3,130	3,133
Total	114,178	111,864	109,028	105,026	99,808	93,095	86,677	80,750	75,539	70,812

Emissions by vehicle type (tCO2e) - With Scheme

Vehicle Type										
Car	76,063	74,327	72,188	69,051	64,874	59,602	54,562	49,873	45,634	41,757
LGV	19,153	18,931	18,521	17,883	17,000	15,897	14,829	13,875	13,053	12,340
HGV	20,174	19,787	19,415	19,059	18,718	18,136	17,584	17,067	16,693	16,363
PSV	3,306	3,269	3,261	3,250	3,235	3,218	3,205	3,202	3,216	3,222
Total	118,695	116,313	113,385	109,242	103,827	96,852	90,179	84,017	78,597	73,681

Emissions by vehicle type (tCO2e) - Change in emissions (With Scheme - Without Scheme)

Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Car	3,033	2,973	2,896	2,779	2,619	2,412	2,211	2,022	1,852	1,696
LGV	793	790	778	757	725	683	640	603	570	541
HGV	616	610	604	599	593	580	568	557	550	544
PSV	76	77	79	80	81	82	84	85	87	88
Total	4,517	4,449	4,357	4,215	4,019	3,757	3,503	3,267	3,058	2,870

Emissions by fuel type (tCO2e) - Without Scheme

Fuel Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Petrol	43,419	43,609	43,521	42,676	41,048	38,589	36,222	33,953	31,769	29,651
Diesel	68,277	65,399	62,353	58,918	55,196	51,088	47,357	44,082	41,448	39,210
Electric	2,482	2,856	3,153	3,433	3,565	3,418	3,098	2,715	2,322	1,950
Total	114,178	111,864	109,028	105,026	99,808	93,095	86,677	80,750	75,539	70,812

Figure 16 – *O- Summary Tables (Emissions)* example output

Summary Tables (Vehicle kilometres)

Annual vehicle kilometres

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Road Without Scheme	600,414	605,266	610,119	614,971	619,824	624,676	629,529	634,381	639,234	644,086
Road With Scheme	633,370	638,645	643,920	649,194	654,469	659,743	665,018	670,292	675,567	680,841

Change in annual vehicle kilometres (With Scheme - Without Scheme)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Difference in vkms	32,957	33,379	33,801	34,223	34,645	35,067	35,489	35,911	36,333	36,755

Vehicle kilometres by vehicle type - Without Scheme

Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Car	478,522	482,259	485,997	489,735	493,472	497,210	500,948	504,685	508,423	512,161
LGV	91,766	92,814	93,862	94,909	95,957	97,004	98,052	99,100	100,147	101,195
HGV	26,006	26,019	26,033	26,046	26,060	26,073	26,087	26,100	26,114	26,127
PSV	4,119	4,173	4,227	4,281	4,335	4,388	4,442	4,496	4,550	4,604
Total	600,414	605,266	610,119	614,971	619,824	624,676	629,529	634,381	639,234	644,086

Vehicle kilometres by vehicle type - With Scheme

Vehicle Type										
Car	505,564	509,619	513,675	517,731	521,787	525,843	529,899	533,955	538,011	542,067
LGV	96,427	97,563	98,698	99,834	100,970	102,106	103,241	104,377	105,513	106,649
HGV	27,140	27,164	27,188	27,212	27,236	27,260	27,284	27,308	27,332	27,356
PSV	4,240	4,299	4,358	4,417	4,476	4,535	4,594	4,652	4,711	4,770
Total	633,370	638,645	643,920	649,194	654,469	659,743	665,018	670,292	675,567	680,841

Vehicle kilometres by vehicle type - Change in emissions (With Scheme - Without Scheme)

Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Car	27,042	27,360	27,678	27,996	28,315	28,633	28,951	29,269	29,588	29,906
LGV	4,660	4,748	4,837	4,925	5,013	5,101	5,189	5,278	5,366	5,454
HGV	1,134	1,145	1,155	1,166	1,176	1,187	1,197	1,207	1,218	1,228
PSV	121	126	131	136	141	146	151	156	162	167
Total	32,957	33,379	33,801	34,223	34,645	35,067	35,489	35,911	36,333	36,755

Vehicle kilometres by fuel type - Without Scheme

Fuel Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Petrol	261,818	263,645	263,706	258,912	249,185	234,411	220,009	206,213	192,943	180,162
Diesel	280,663	267,011	252,119	235,057	216,325	196,650	178,966	163,524	150,246	138,974
Electric	57,932	74,609	94,293	121,002	154,314	193,615	230,554	264,644	296,045	324,951
Total	600,414	605,266	610,119	614,971	619,824	624,676	629,529	634,381	639,234	644,086

Figure 17 – *O- Summary Tables (vkms)* example output

O- Data Book Summary

6.8 The purpose of this sheet is to provide a summary of the Data Book parameters that are being used as inputs to the carbon calculation. This is to aide review and understanding of the outputs of VECAT.

6.9 This sheet shows how the selected input Data Book parameters impact the electric vehicle proportions, and fuel consumption and carbon emissions per vehicle kilometre over the selected appraisal period. Where the appraisal period goes beyond the last year of data for a given Data Book table, the values are extrapolated horizontally from the last year of data.

6.10 The values in the fuel consumption per vehicle kilometre and carbon emissions per vehicle kilometre tables vary based on the vehicle speed, so the speed to use (1 – 130kph) can be set in the input cell above the fuel consumption per vehicle kilometre table.

6.11 Figure 18 shows the outputs on this sheet.

Data Book Summary Tables

Proportion of electric vehicles (EVs) across appraisal period

A1.3.9 Last Year: 2050

Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Car	11%	14%	17%	22%	27%	34%	40%	45%	50%	55%	59%	62%	65%
LGV	5%	7%	10%	14%	19%	26%	31%	36%	40%	44%	47%	50%	53%
HGV	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PSV	10%	12%	13%	14%	14%	15%	15%	16%	16%	16%	16%	16%	16%

Fuel consumption per vehicle km (l/km or kWh/km) across appraisal period

Speed (kph): 64 *Input a speed between 1 and 130kph to view the fuel consumption factors at that speed. The speed used for the factors is limited by vehicle type as defined in the selected Data Book Table A 1.3.8.*

A1.3.11 Last Year: 2089

Vehicle Type	Fuel	Limited speed (kph)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Car	Petrol	64	0.0598	0.0596	0.0595	0.0594	0.0593	0.0592	0.0592	0.0592	0.0592	0.0592	0.0591	0.0591	0.0591
Car	Diesel	64	0.0552	0.0553	0.0555	0.0557	0.0560	0.0562	0.0565	0.0568	0.0571	0.0574	0.0577	0.0579	0.0582
Car	Electric	64	0.1908	0.1879	0.1852	0.1822	0.1792	0.1763	0.1742	0.1725	0.1711	0.1698	0.1687	0.1676	0.1665
LGV	Petrol	64	0.0712	0.0705	0.0683	0.0678	0.0675	0.0673	0.0692	0.0688	0.0678	0.0649	0.0686	0.0676	0.0670
LGV	Diesel	64	0.0681	0.0682	0.0682	0.0681	0.0681	0.0681	0.0681	0.0682	0.0681	0.0683	0.0683	0.0683	0.0682
LGV	Electric	64	0.2578	0.2562	0.2553	0.2541	0.2534	0.2544	0.2570	0.2608	0.2652	0.2696	0.2734	0.2764	0.2787
OGV1	Diesel	64	0.1623	0.1606	0.1591	0.1575	0.1561	0.1537	0.1515	0.1494	0.1473	0.1454	0.1436	0.1419	0.1404
OGV1	Electric	64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OGV2	Diesel	64	0.2873	0.2819	0.2767	0.2720	0.2675	0.2586	0.2502	0.2425	0.2358	0.2298	0.2247	0.2205	0.2171
OGV2	Electric	64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PSV	Diesel	64	0.2411	0.2410	0.2408	0.2406	0.2403	0.2399	0.2396	0.2398	0.2397	0.2384	0.2379	0.2378	0.2367
PSV	Electric	64	1.1910	1.1910	1.1900	1.1887	1.1872	1.1855	1.1840	1.1849	1.1844	1.1780	1.1755	1.1752	1.1697

Carbon emission factors (kg CO2e/l or kg CO2e/kWh) across appraisal period

A3.3 Last Year: 2100

Fuel	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Petrol	2.114	2.114	2.114	2.114	2.114	2.114	2.114	2.114	2.114	2.114	2.114	2.114	2.114
Diesel	2.454	2.443	2.432	2.421	2.409	2.398	2.388	2.376	2.377	2.378	2.383	2.382	2.382
Electric	0.211	0.191	0.169	0.145	0.120	0.093	0.071	0.055	0.042	0.032	0.025	0.019	0.015

Figure 18 – *O- Data Book Summary* example output

O- Diagnostics

6.12 This sheet shows a number of diagnostic outputs that should help the user to sense check the inputs to the Tool. The diagnostics include a summary of the user inputs and any errors and warnings.

Summary of user inputs

6.13 The diagnostics sheet includes a summary of user inputs as follows:

- user inputs:
  - number of years between first modelled year and scheme opening year; and
  - number of years between last modelled year and final appraisal year.
- link inputs, for each year and time period for the With and Without Scheme scenarios:
  - number of links entered;
  - number of duplicate link IDs;
  - number of links where the total flow across all vehicle types is zero;
  - number of links where distance is zero;
  - number of links where distance is greater than 100km;
  - number of links where speed is zero; and

- number of links where speed is greater than 113kph (70mph).

Errors and warnings

6.14 The diagnostics sheet includes a list of errors and warnings as follows:

- errors and warnings:
  - warnings (do not prevent the Tool from being run):
    - duplicate link IDs;
    - links with zero distance;
    - links with distance greater than 100km;
    - links with non-zero flow and zero speed; and
    - links with zero flow and non-zero speed.
  - errors (prevent the Tool from being run):
    - missing, non-numeric or negative distances;
    - non-numeric or negative flows; and
    - non-numeric or negative speeds.

CH- Annual Emissions

6.15 This plots the annual carbon emissions (in tCO2e) for the With and Without Scheme scenarios, showing the profile of emissions over the appraisal period. Figure 19Figure 19 shows an example of the output.

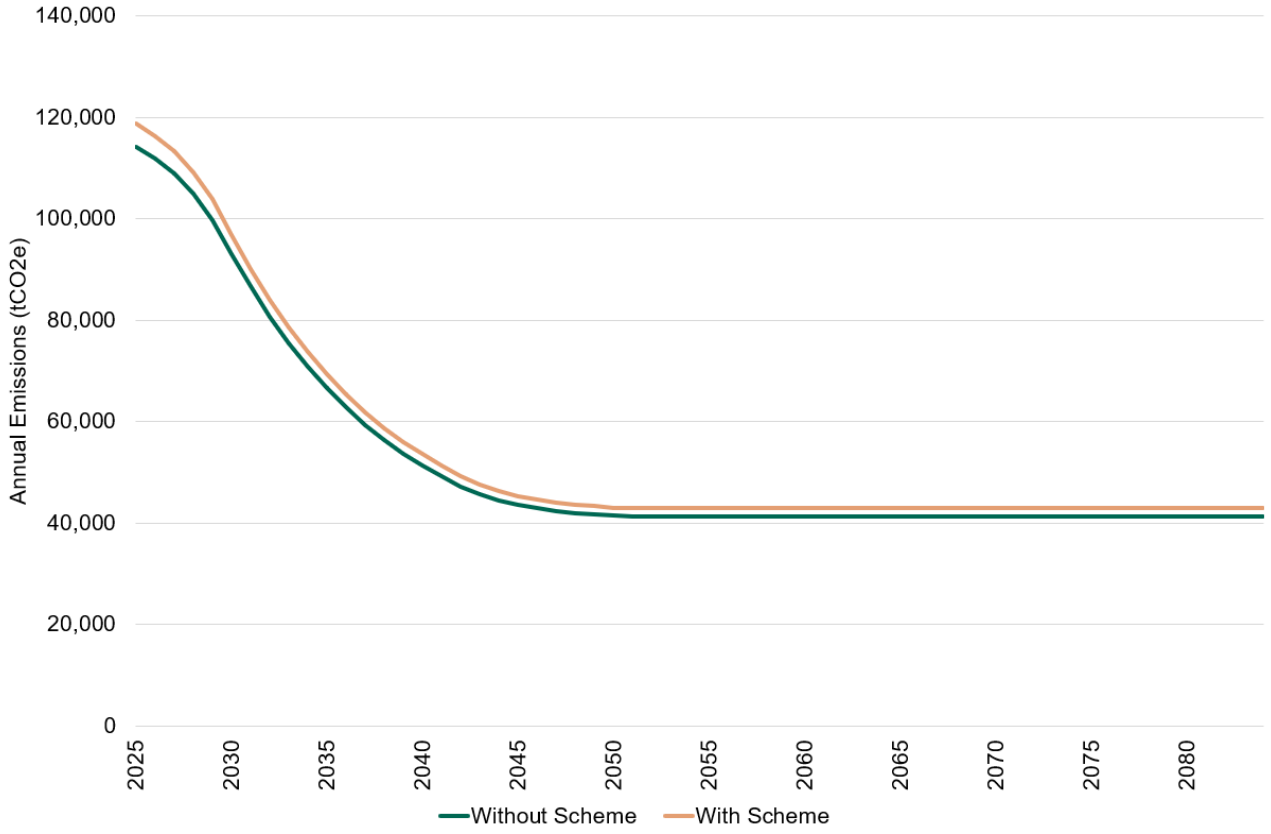

Figure 19 - *CH- Annual Emissions* example output

CH- Change in Emissions

6.16 This chart shows the change in annual emissions between the With and Without Scheme scenarios over the appraisal period. Figure 20Figure 20 shows an example of the output where there is an increase in emissions in the With Scheme scenario compared to the Without Scheme scenario.

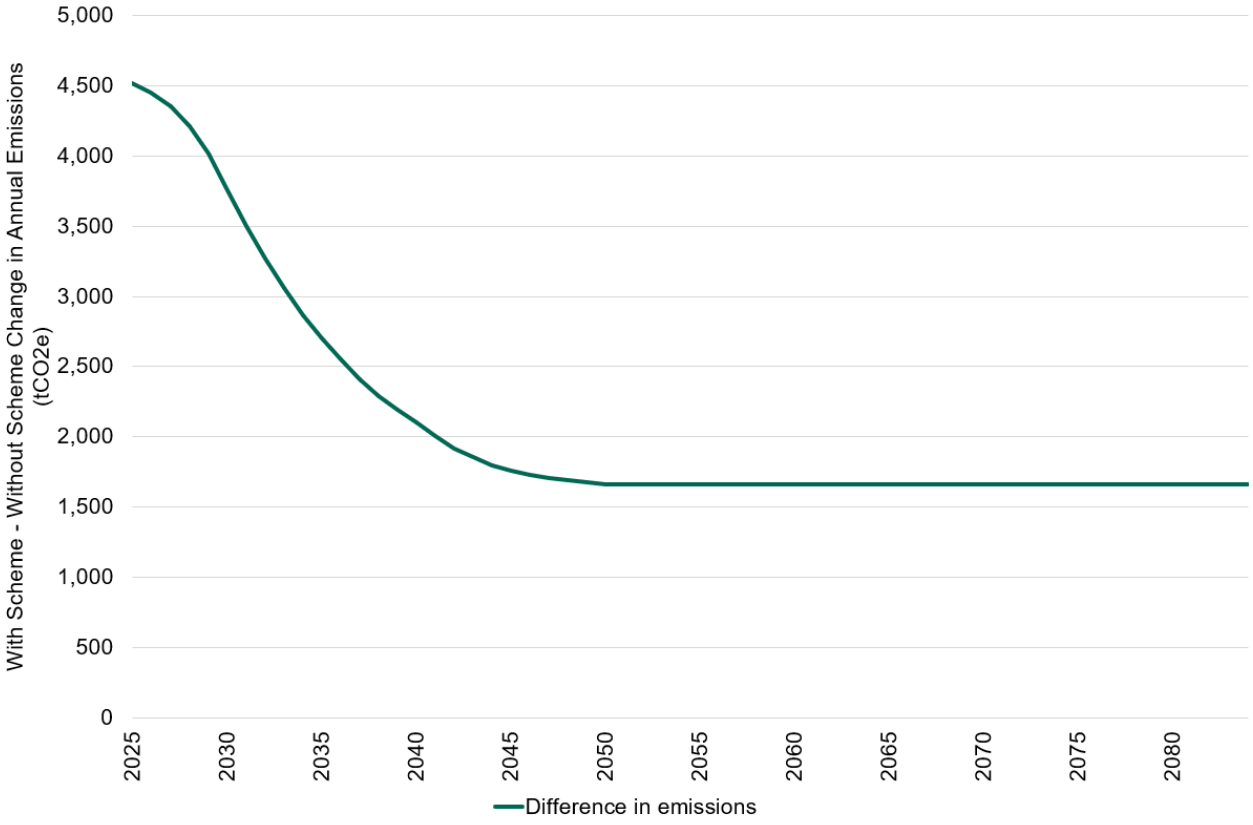

Figure 20 - *CH- Change in Emissions* example output

CH- Annual vkms

6.17 This chart shows the annual vehicle kilometres by fuel type for the With and Without Scheme scenarios over the appraisal period. Figure 21 shows an example of the output.

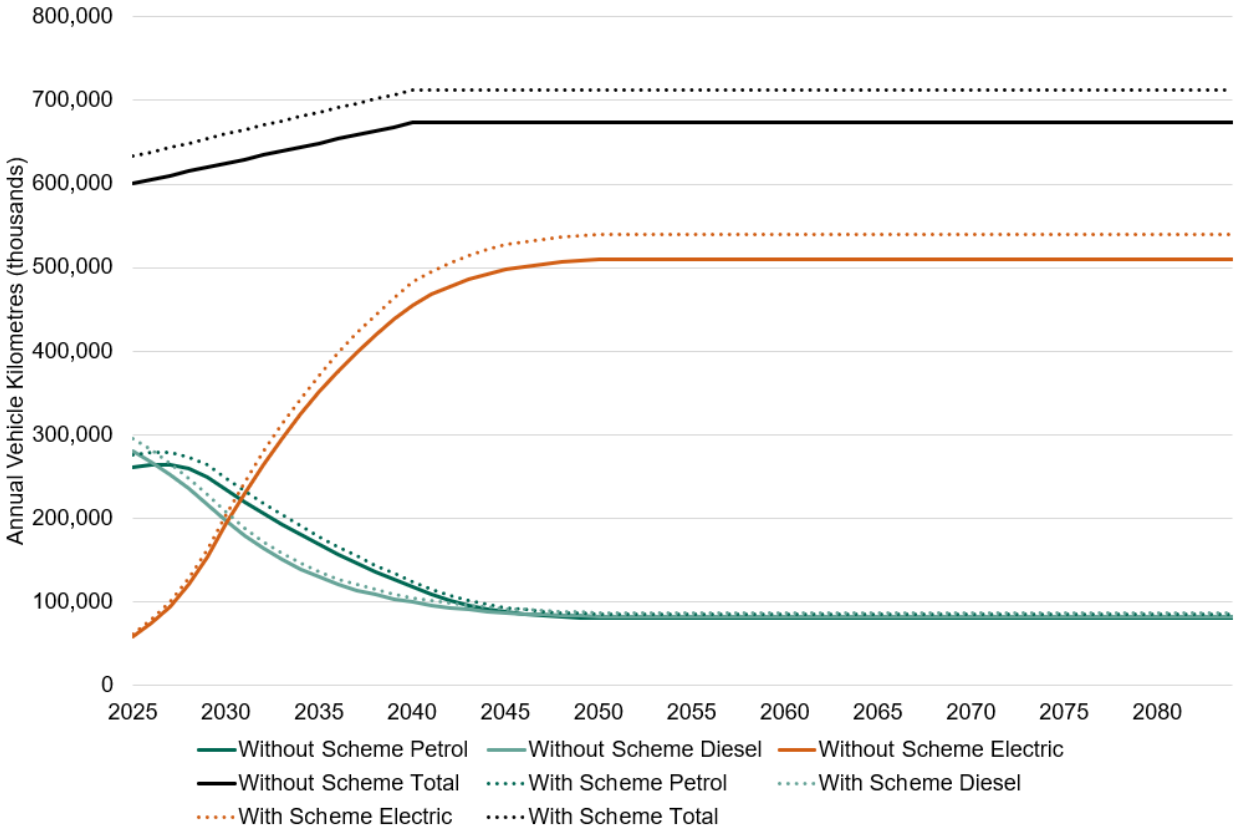

Figure 21 - *CH- Annual vkms* example output

CH- Change in vkms

6.18 This chart shows the change in annual vehicle kilometres by fuel type between the With and Without Scheme scenarios over the appraisal period. Figure 22 shows an example of the output.

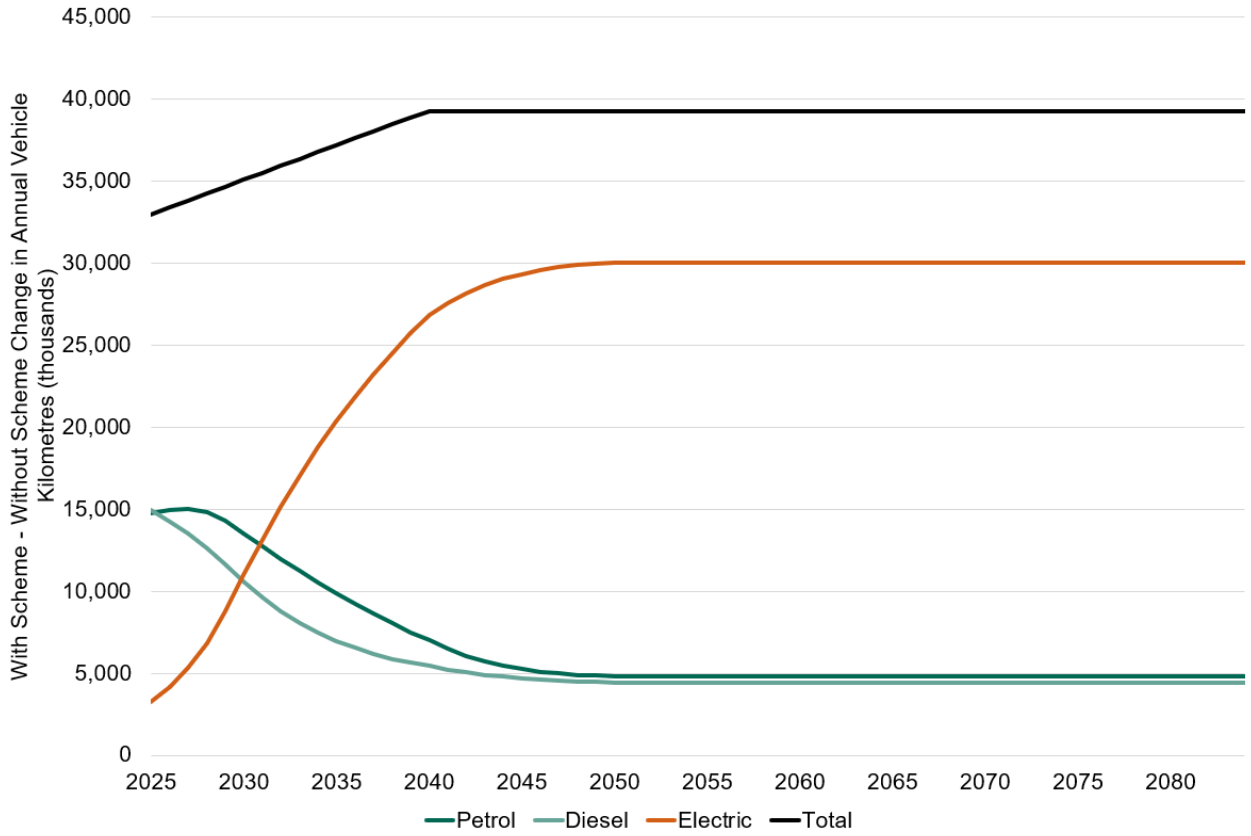

Figure 22 - *CH- Change in vkms* example output

7. Use Case Examples

7.1 This chapter of the User Guide shows how the *I- User Inputs* sheet should look for a range of different input combinations.

Example 1

7.2 VECAT is being used to assess the carbon impacts of a scheme. The strategic model has been run for three forecast years – the scheme opening year (2028) and forecast years 2042 and 2055. Within each forecast year the model has three time periods – AM Peak (average hour within the 3 hour period), Inter-peak (average hour within the 6 hour period) and PM Peak (average hour within the 3 hour period), and the annualisation factors for these periods are 759, 1,518 and 759 respectively. A further non-modelled time period has been included (using Inter-peak flows/speeds as a proxy), with an annualisation factor of 550 (to account for all non-modelled time period flows).

7.3 A 60-year appraisal period is used, and the extrapolation is horizontal after the last modelled year. The TAG Data Book is used for the parameters and whilst full appraisal period impacts will be calculated, no CSV files will be exported.

7.4 Figure 23 shows the completed *I- User Inputs* for this example scheme.

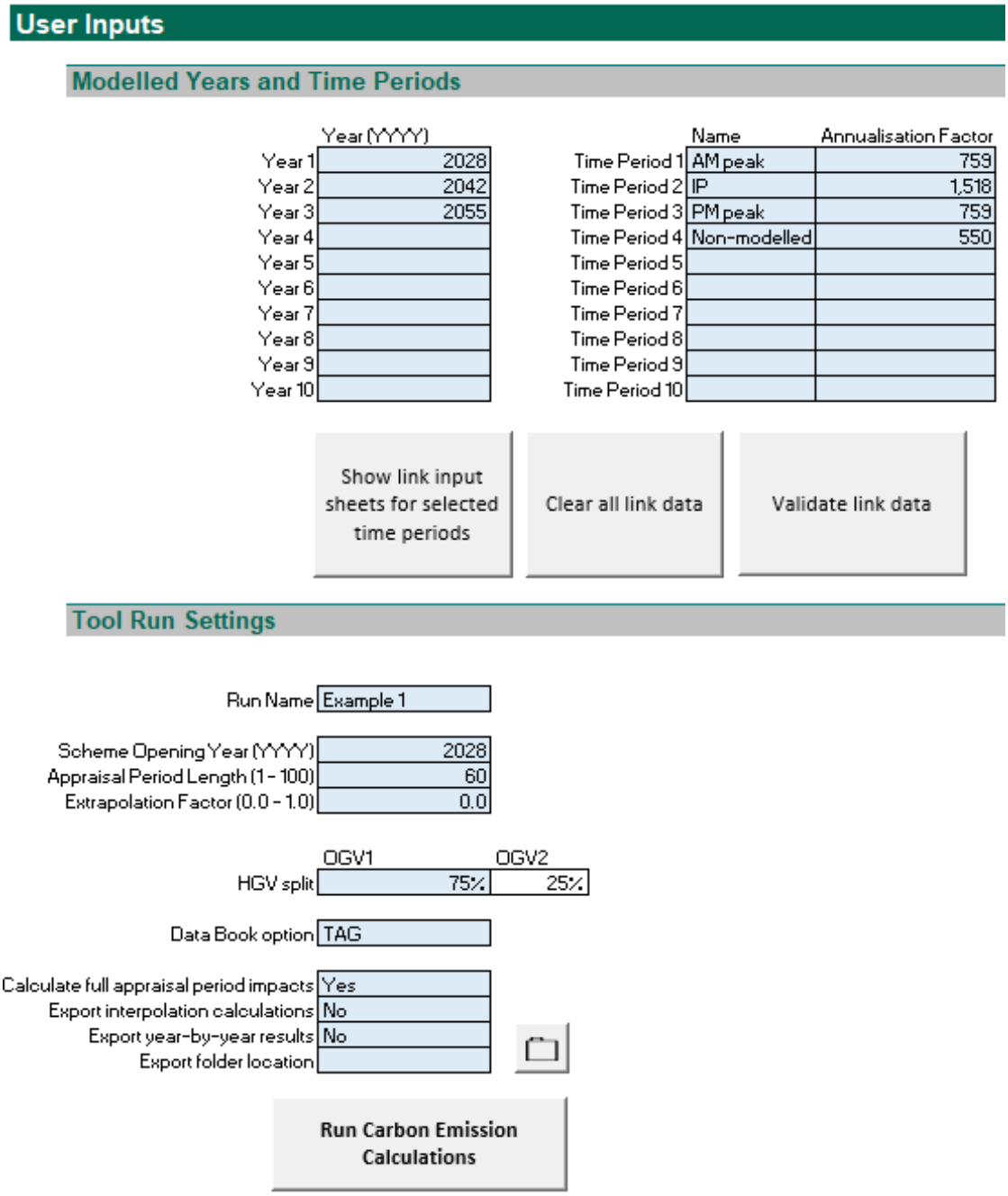

Figure 23 - Example 1 use case inputs

Example 2

7.5 VECAT is being used to assess the carbon impacts of a scheme. The strategic model has been run for two forecast years – 2030 and 2052. Within each forecast year the model has four weekday time periods – AM Peak average hour, Inter-peak average hour, PM Peak average hour and Off-peak average hour. The annualisation factors respectively for these periods are 759, 2,500 (with Inter-peak being used as a proxy for some weekend hours, and factored accordingly), 759 and 4,100 (with Off-peak being used as a proxy for the rest of the weekend hours and factored accordingly).

7.6 The CAS Data Book is used for the parameters. Only the impacts in the modelled years themselves will be calculated. The CSV files for the carbon emissions in these modelled years will be exported.

7.7 Figure 24 shows the completed *I- User Inputs* for this example scheme.

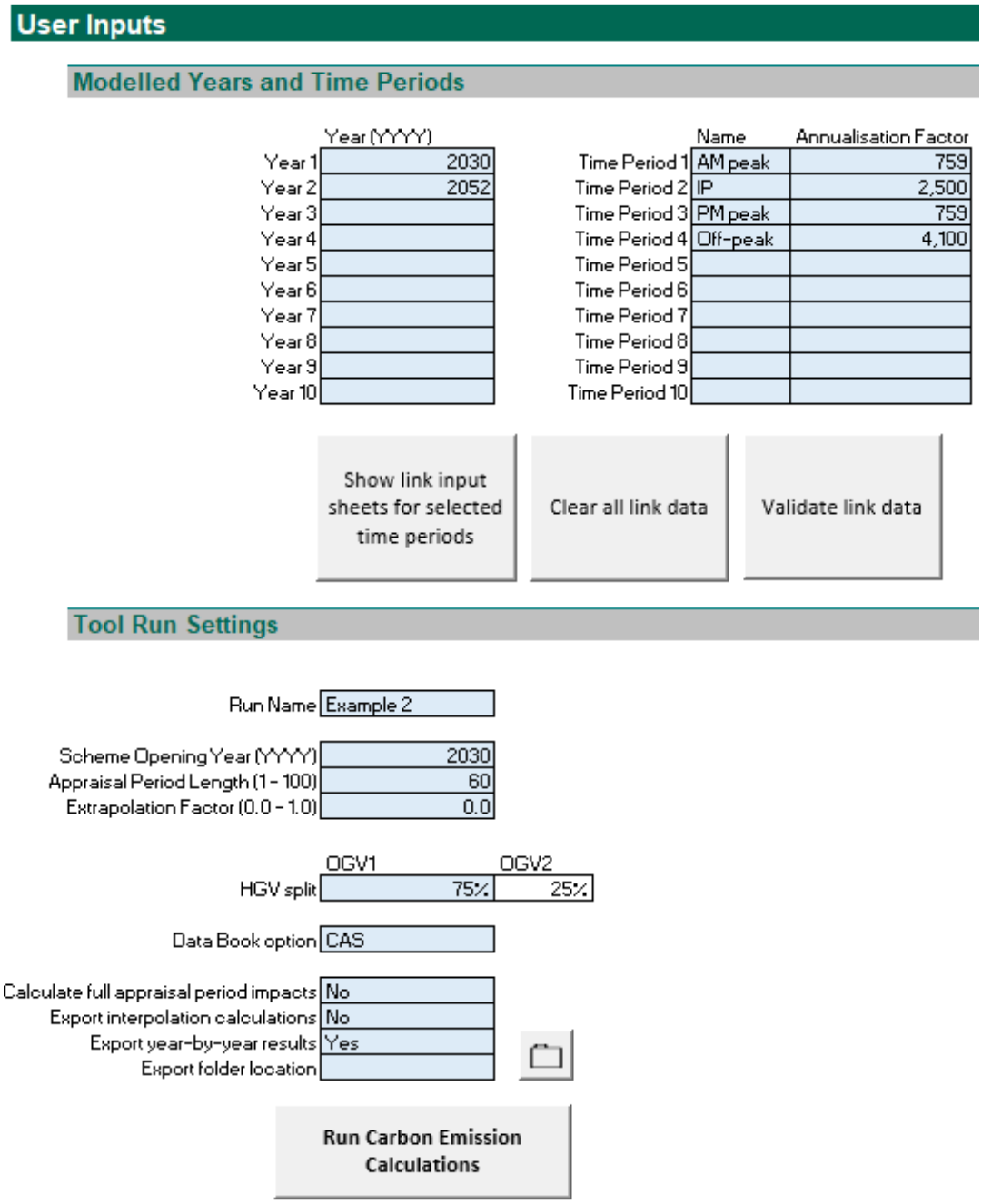

Figure 24 - Example 2 use case inputs

Example 3

7.8 VECAT is being used with all day data (i.e. AADT flows) in the scheme opening year (2030), and 2050. The input is defined as time period 1 on *I- User Inputs* and an annualisation factor of 365 is applied. The link data input on the *I- With and Without Scheme TP1 Links* sheets should include the AADT flows and speeds.

7.9 The TAG Data Book is used for the parameters. Only the impacts in the modelled years themselves will be calculated, and no detailed results will be exported to CSVs.

7.10 Figure25 shows the completed *I- User Inputs* for this example scheme.

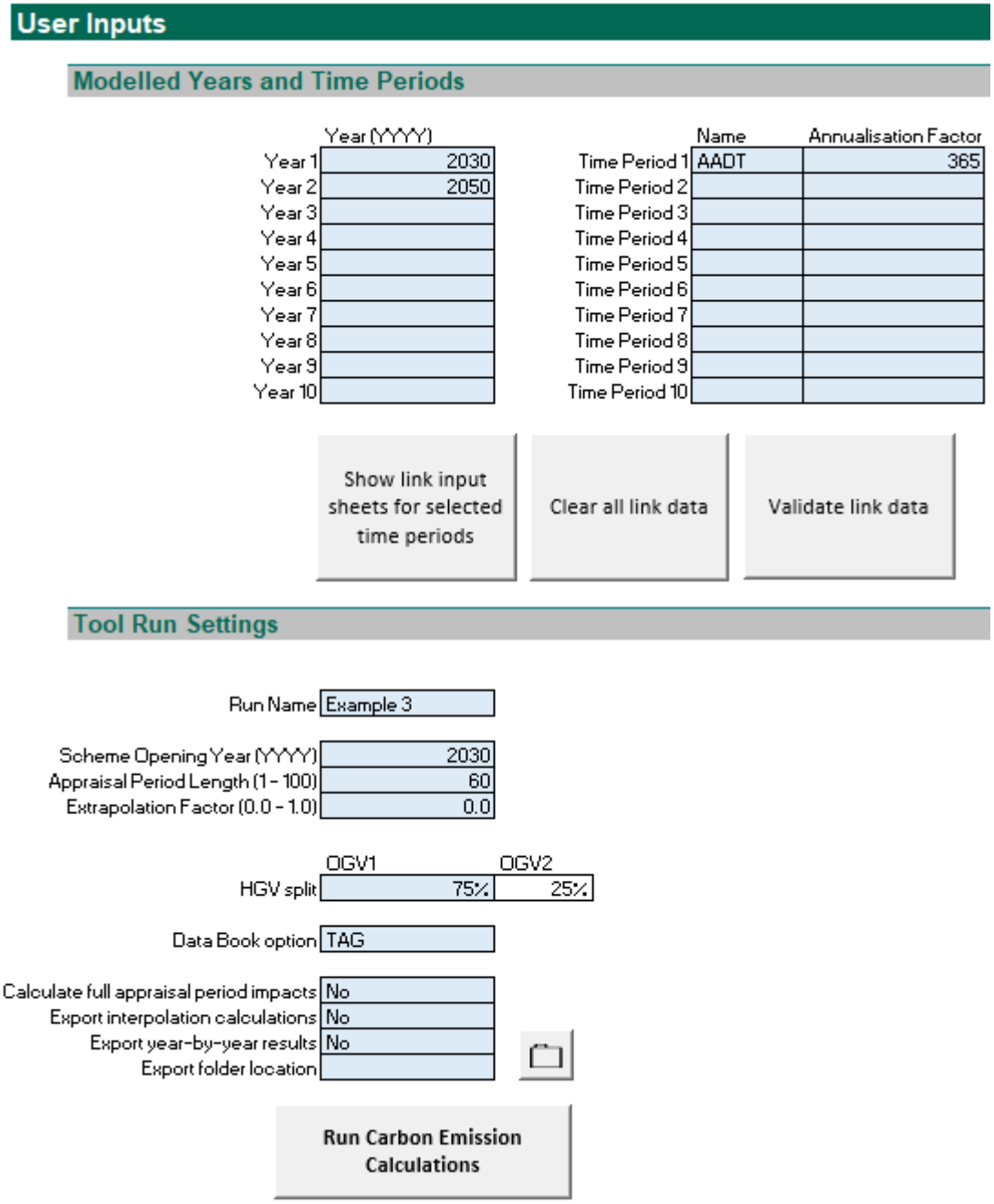

Figure 25 - Example 3 use case inputs

Example 4

7.11 The Tool requires inputs for both the Without Scheme and With Scheme scenarios to run. If the user only wanted to run VECAT for one scenario (for example only running Without Scheme as a baselining exercise), then the user would need to input their Without Scheme data and also dummy data for the corresponding With Scheme link input sheets (which can be just a single Link ID and no further data). The *I- User Inputs* Sheet would be unaffected by this application.