TRAFIKVERKET

REPORT
Samgods 1.2.2 - User manual

Instructions 2024-04-01
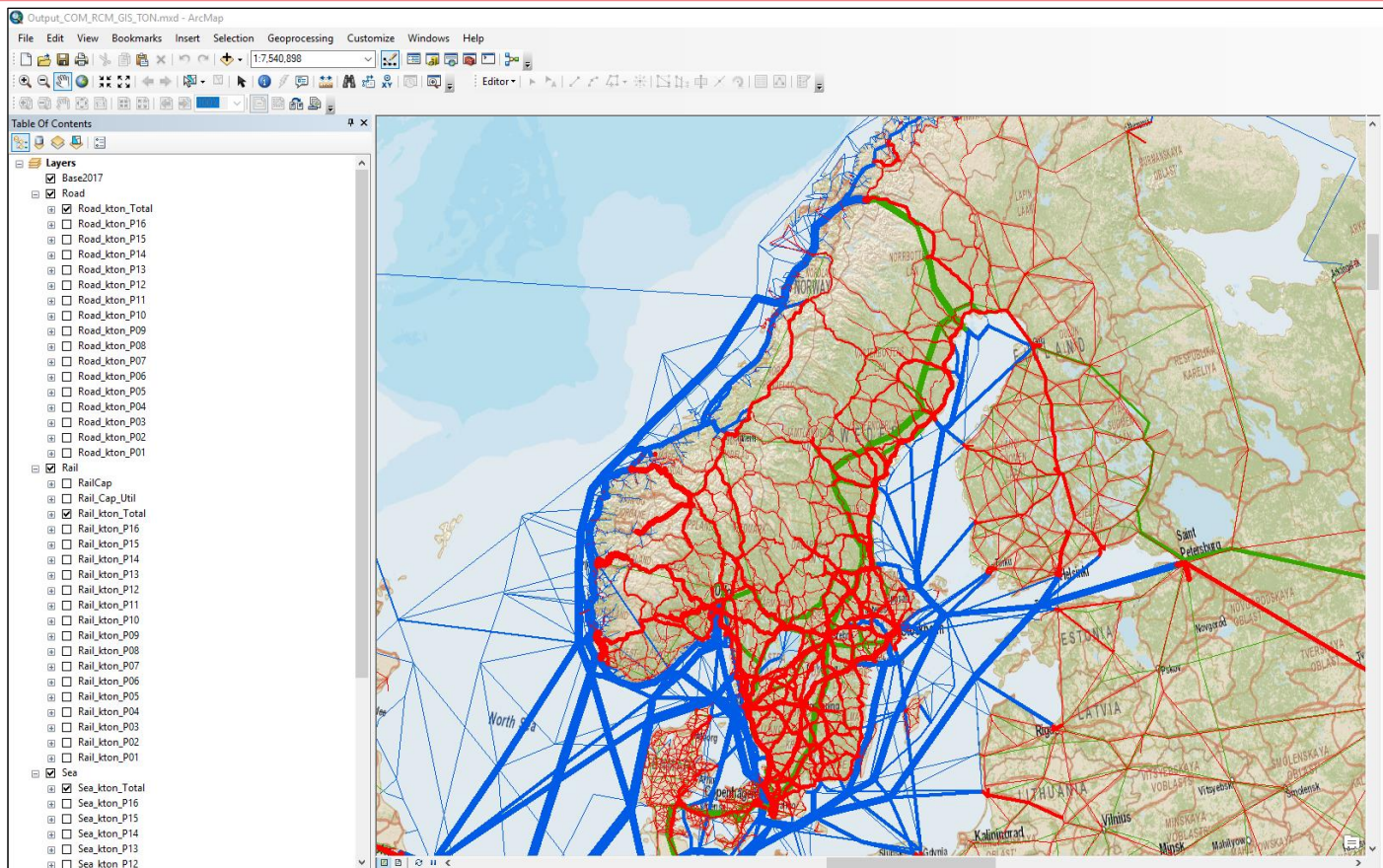
1 Table of Contents

1. Abstract

The main changes introduced in Samgods version **1.2.2** are:

- Revised setup for calibration, introducing separate databases incuding calibration prameters for the base and prognosis year. These databases holds all the factors and terms used to calibrate the model. All values present in Input_Data.mdb are the actual ASEK values without any manipulation.

- A new base year 2019 and forecasting year 2045, including costs, networks, PWC-matrices etc.

- Simplification of the scenario setup and CBA in relation to the first point. The user does not need to create parallel ASEK scenarios anymore

- New reports Report 9 and 10 for Outputs_Calibration_Template_rev10.xlsm, also new functionalities to report both absolute and relative numbers for the calibration targets.

- Road vehicles are no longer described by an intervall of load weight, instead the total weight of the vehicle is is used to describe the vehicles.

2. Preface

The national model for freight transportation in Sweden is called Samgods. The model is aimed to provide a tool for forecasting and planning of the transport system in Sweden. Samgods can be used for forecasting of possible future scenarios, such as the evaluation of the effects of transport policies. Samgods consists of several parts, where the logistics module is the core of the model system. In the logistic module, different types of commodities are assigned to different types of transport chains based on minimization of the total logistics cost.

To make Samgods more user-friendly, a graphical user interface (GUI), incorporated in Cube, has been developed.

This document is the manual for how to use the model system where Samgods has been implemented. For more information about the Samgods model, please refer to[1]:

- Method report of the logistics model in the Swedish national freight model system [1]
- Program documentation for the logistics model for Sweden [2]
- Railway capacity management for Samgods using linear programming with a stochastic approach [3]
- Samgods PWC-matriser 2019 och 2045
- Technical documentation [4]
- Representation report [5]
- Kalibrering [6]
- MPS documentation [7]
- SelectDirect documentation [8]

SYSTRA has incorporated Samgods in Cube and has produced this manual.

For questions regarding the system, please contact Petter Hill at Trafikverket or visit the webpage www.trafikverket.se/samgods.

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[1] See 13 References for a full reference list.

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3. Introduction

This document is the manual for how to use of the graphical user interface (GUI) of the Samgods model in Cube. It describes how to setup input files to run the Logistics Module and Rail Capacity Management procedure of the Samgods model, how to visualize the output (modal split, traffic work, etc.), and how to compare the output from different scenarios. Moreover, the manual aims to show how to use different tools developed to facilitate the handling of the large amounts of data produced by the model.

The system consists of a set of main software components:

- The Logistic module, which is the core of the system.
- The Rail Capacity module, which is a feature to manage rail link flow volume constraints.
- Cube Base, where the graphical user interface of Samgods is incorporated.
- Cube Voyager, which is a transport modelling software used to implement supply and assignment models.
- Cube GIS, which is the geographical information system where the network of the model is implemented.

This is the outline of the manual:

Chapter 4: Glossary, explaining important glossaries used in this manual.

Chapter 5: Practical instructions for how to install the Samgods GUI in Cube, together with system requirements.

Chapter 6: General description of the structure of the GUI, the different windows and how to work with the applications. It also contains a table with all data that can be accessed via the Data Section window in the GUI.

Chapter 7: Detailed description of all applications, in terms of input data, possible actions and choices for how to use the different applications in the system and how to set up the results. This chapter should be used more as a look-up guide per application, rather than to be read from start to end.

Chapter 8: General instructions for how to use the graphical user interface, listed after the kind of action the user wants to do. A new user to the system is advised to start reading here, after having read Chapter 7.

Chapter 9: Instructions for how to make different kinds of scenario setups.

Chapter 0: Advanced user options

Chapter 11: Log reports from the Samgods GUI and Check-list when errors occur.

Chapter 12: Examples of maps on outputs

Chapter 13: References

Chapter 14: Appendices

For all the users, it is strongly recommended to follow instructions on file naming conventions and coding listed in subsection 11.4.

For the reader who is interested in getting started quickly and who already has some knowledge of the Cube system, it is recommended to make sure that the system is properly installed as described in Chapter 5 and then jump to Chapter 8 and 9 for the specific analysis that he/she wants to carry out.

For the reader without previous knowledge of the Samgods GUI or Cube, it is recommended to start with Chapter 6 and then read Chapter 8 and 9 from the beginning and refer to Chapter 7 for more information on the specific applications. The appendix (Chapter 0) also contains explanations on some parts of the model.

The use of Cube Base and Cube Voyager is described in the reference guides RG_CubeBase.pdf and RG_CubeVoyager.pdf, which can be found where Cube is installed (under Citilabs\Cube folder).

Finally, a technical description of Samgods is available, please see [4].

4.   Glossary

Below some important glossaries used in this manual are collected. Observe that for some glossaries the explanation is specific for this context.

Application – a group of programs

Assignment model – a model where the transport demand is assigned to the network. In this context, Voyager is used as an assignment model. The automobile and lorry assignments are based on generalized time for route choices and all-or-nothing solution.

Base scenario (or base) – the scenario that is used as reference scenario. See Scenario.

Commodity or Product group - commodity type in the model.

Catalog – the folder where the Samgods model and its set of scenarios are stored. Several catalogs, with their corresponding base scenarios, can be included in a project.

Demand model – a model of the transport demand in terms of OD matrices. In this context, the Logistics Module in the Samgods model is a demand model. The Logistics Module has the purpose to produce the OD matrices (demand for vehicle movements on legs) from the fixed transport demand provided in the PWC matrices (PWC = Production Warehouse Consumption).

Domestic – transport volumes between domestic zones.

EOQ - Economic Order Quantity

Feature class - used in ArcGIS. This is a collection of geographic features with the same geometric type (such as point, line or polygon), the same attributes and the same spatial reference. Feature classes can be stored in geodatabases, shape files, coverages or other data formats. Feature classes allow homogeneous features to be grouped into a single unit for data storage purposes.

Geodatabase (or short: gdb) – a database designed to store and handle geographic information and spatial data.

Keys – a varying input into an application (i.e., parameter settings). Catalog keys are used to specify settings for the applications etc.

MAT - extension for matrix file produced in Cube (binary format)

Layer – used in GIS. This is the visual representation of a geographic dataset in any digital map environment.

LOS (Level Of Service) matrix (or **skim matrix**) – a matrix where a particular measure, such as time, distance, cost, are summarized link-by-link along the minimum cost path for each OD pair (OD = Origin Destination). The distance, domestic distance, fee/toll, and extra cost LOS matrices (defined per vehicle type) are mandatory input to the Samgods model.

Program – a single task or an instance.

regional diff DT – Reference to regional differentiation by domestic and total domestic.

regional diff DTI – Reference to regional differentiation by domestic, total domestic and international.

RCM - Rail Capacity Management module.

S/A user - Standard User / Advance User.

Scenario – refers to a set of input files or values. A scenario can be a base scenario, or it can be an alternative scenario that is studied in relation to the base scenario, e.g., a child to the base

scenario. An *existing scenario* means that the scenario-specific tables are included in the main geodatabase.

Scenario folder – the folder containing all the data for a specific scenario, located in the Scenario_Tree folder.

Skim matrix – see LOS matrix

Standard outputs/reports – the outputs/reports that the Samgods GUI always produces.

STD - STanDard logistics module.

Supply model - In this context, a supply model (or network model) is the model of the network where the transport infrastructure, such as nodes and links (i.e., ports, railways, roads, etc.), are implemented. In this context, Voyager is used as supply model.

TOC – Table Of Content, see Section 8.15.

Total domestic (or Tdomestic) – same as domestic + domestic part of international transports

V/C – flow volume over capacity ratio for rail flows.

#LEA-vehicles – Reference to loaded, empty and all vehicles respectively.

NORIG – the Emme node number and its specification comes from a set of rules when edits are made in GIS interface

5.   Installation Instructions

This chapter describes the installation requirements, required programs for the Samgods GUI and their download locations and the installation procedures for each required program. It also describes how to setup the Samgods model in Cube.

5.1.   Minimum system requirements

Cube Base will run on any Intel Pentium 4-compatible personal computer (including Pentium 4, Centrino, Xeon, AMD, and Cyrix chips) running the Windows XP/7/8/10 or Windows Server 2003/2008 operating system. The requirements for processor speed, amount of RAM and hard disk space are directly related to the operating system, the network, and other file sizes. At a minimum, Citilabs recommends:

- Intel Pentium 4, AMD Athlon
- At least 4 GB of RAM to run the full Samgods model but 1 GB to run Cube.
- 10 GB for the application and supporting applications and data (like GIS); ATAPI IDE, 5,400 rpm
- 100+ GB for output files
- 24 bit capable graphics accelerator OpenGL version 2.0 runtime and Shader Model 3.0 or higher is recommended; ATI or Nvidia GPU is strongly recommended for any 3D GIS work or Cube Dynasim micro simulation
- 17-inch monitor, 1024 x 768 higher at Normal size (96dpi); 24 bit color depth
- Mouse or other pointing device
- Colour printer or plotter

A system with additional resources may be more appropriate for certain applications of this software.

Running the Samgods model at an acceptable performance puts a demand on the hardware as well as on the operating system. The hardware should preferably have several processors available for parallel executions and several GB of RAM to support the allocation of memory to each execution and must be based on 64-bit technology. The operating system needs to be able to allocate a certain amount of memory to the different processors, see the list below.

In tests, the Samgods group has lowered the total execution time from over 24 hours to just above 4 hours by using a laptop with 8 processors and 16 GB of RAM on a 64-bit Windows 10 Operating System, instead of a laptop with a single processor.

The graphical interface of the Samgods model allows the user to set the number of commodity groups to run simultaneously, in order to have an optimal performance of the system (note that this option is available only if Java runtime environment is installed see Section 5.4 below). The monitoring of the parallel executions is done by a Java program underneath the GUI, but the actual work of allocating memory and tasks to each processor is done by the operating system itself.

There is an upper limit on how many processors that may be used simultaniously:

- It is strongly recommended never to use more parallel executions than the number of available processors

- Each processor should in average have at least 2 GB of RAM available, or the program may encounter out-of-memory problems

- It is mandatory to run the model on a 64-bit system for the RCM procedure to function.

- The model has 16 commodity groups and this number constitutes the upper limit for the number of parallel processes for the main part of the logistics model (should the hardware allow it). One task involves construction of OD-matrices for 40 vehicle type, and this can in principle be parallelized into 40 parallel processes.

5.2. Cube Software

For the Samgods GUI to function, certain Cube software is required. They are:
- Cube Base: 6.4.5
- Cube Voyager: 6.4.5
- Cube GIS: ArcGIS 10.6.1

This software is available at http://citilabs-website-resources.s3.amazonaws.com/release/cube645setup.exe .

For the above Cube software, Citilabs License 2019 is required (newer software and license versions may be available later on). Please contact Citilabs for further information regarding this.

The installation also requires some custom-built programs developed specifically for Samgods 1.1. They are available by contacting Petter Hill at Trafikverket and will be distributed over ftp.

5.3. Cube Installation

To install and run the model full administration rights are required on the PC, or more specifically on the model folder, the Citilabs program folder, the ArcGIS program folder and the user folder. Do the following steps to install Cube (observe that these steps can be slightly different depending on previous installations, newer software versions, etc.):

Attach the dongle to the back of the machine

- Install Citilabs License 2019 (or later available license versions)
- Install Cube Base (double-click on the cube645setup.exe file)
- When requested, install ArcGIS Runtime 10.6.1 (it is mandatory to use this ArcGIS version)
- Restart the computer
- Set the properties for Cube program accordint to Figure 1. Please as support from IT if requires special administration rights or the settings changes when restarting the machine.
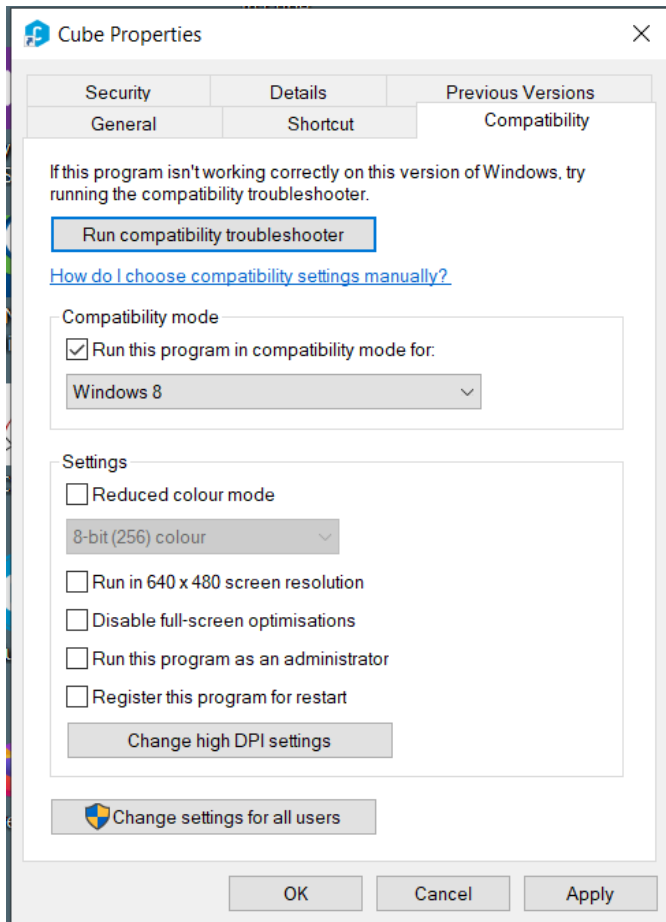
Figure 1 Compatibility mode "Windows8" for Cube

5.4.   Other programs

The model uses the programming language Java, therefore it is required to have:

- ○ Java runtime environment (jre). Platform: 1.8.0 Product: jre1.8.0_341(later program versions are also possible to use)

Location for the above programs: http://www.java.com/sv/download/.

- ○ For RCM the following CLP software is provided, *CLP64.exe*. So far, it is a superior alternative for RCM-problems according to experience.

5.5.   Samgods GUI installation

Unzip the zipped file Samgods_V1.2.2.7z, and select a destination folder. The default folder is C:\Models\, however, any other folder works as well. It is recommended to select a folder name without any blank value neither special characters (å, ä ö). Moreover, an advice is to put the folder close to the root. The folder structure for the GUI is displayed in Table 1.

Table 1 Folder structure

Path	Content	Type
C:\Samgods\	Samgods.cat	Catalog file
C:\Samgods\	01_Programs	Folder
C:\Samgods\	02_Applications	Folder
C:\Samgods\	03_GIS_Data	Folder
C:\Samgods\	04_Media	Folder
C:\Samgods\	05_Input_Data	Folder
C:\Samgods\	06_Reports	Folder
C:\Samgods\	07_Python	Folder
C:\Samgods\	Scenario_Tree	Folder

The scenario folder for a specific scenario is in the Scenario Tree folder.

For the complete list of folders and files, see the technical documentation [4] of the Samgods GUI.

To properly install all the programs connected to the model (GIS tools, user programs), do the following:

1) Open the catalog file (Samgods.cat) in Cube Base (double click on the catalog file or double click on the Cube icon on the desktop -> welcome screen -> open an existing catalog -> browse to Samgods.cat)

2) To update the paths for the application, double click on each application (in total 11 applications) under "Applications" window, and click "Yes" to the following question (11 times):

"The base path of this Application has been moved from {Old folder} to {Selected folder}. Do you wish to update the path for all Application (.APP, .PRJ) and Control (.CTL) files in the Application structure? (Note the same subdirectory structure as in the original Applications will be assumed)"

3) To set the properties of the catalog file, go to "Scenario" menu on the toolbar and select "Properties". On the Catalog Properties window, select the "Model User" tab, and set the Model User as "Model Applier". Under Model Applier section select "Developer" as shown in Figure 2.
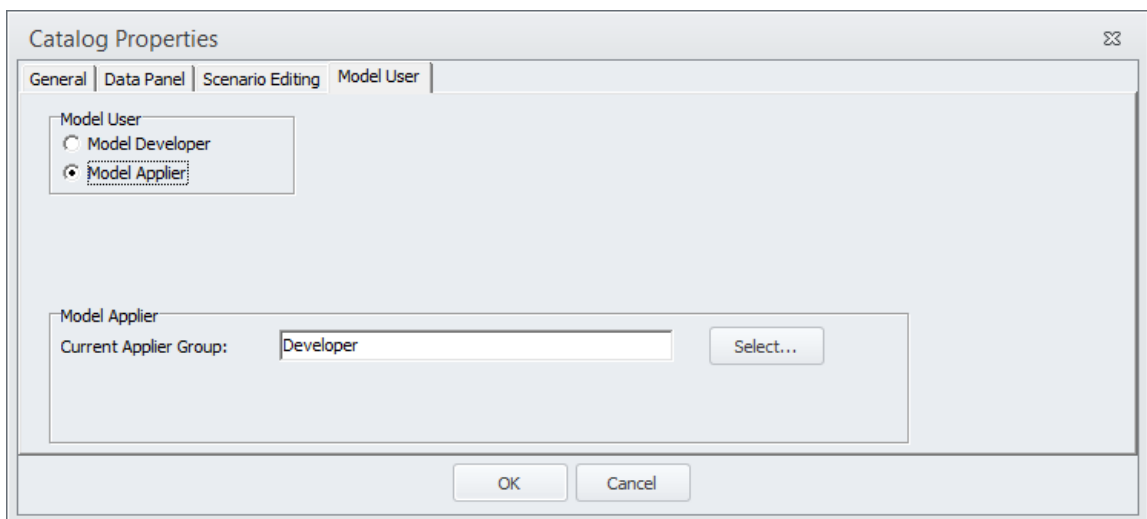
Figure 2 Correct settings for the catalog file

Then, select the "Data Panel" tab, and set the values as in Figure 3.
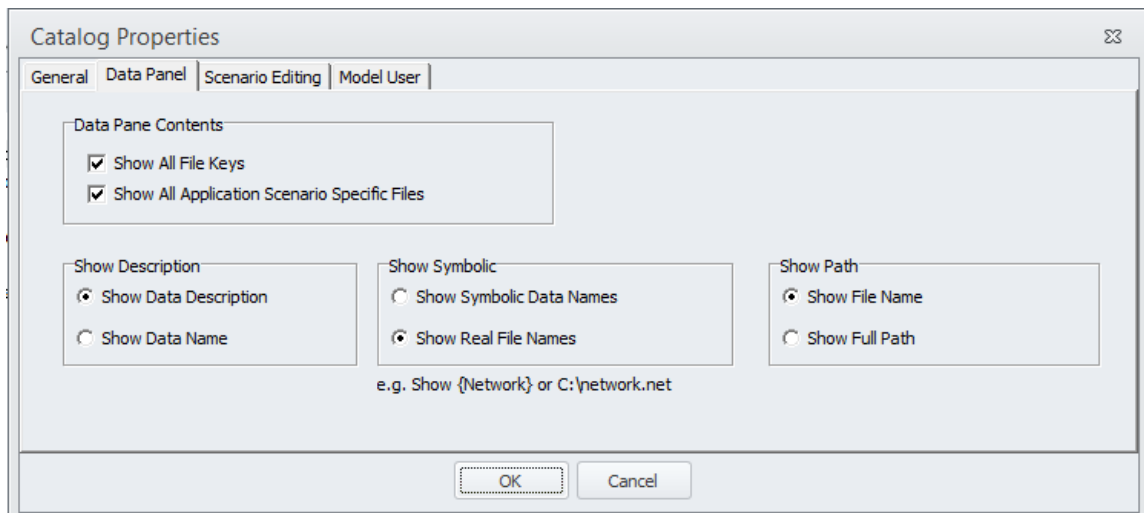
Figure 3 Property setting for the catalog file

4) Click "OK" to continue

5) Modify the catalog keys (i.e., parameter settings) below from the interface in the following manner:

   a) Select Scenario_Tree scenario

   b) Select the *Installation* application

   c) Double-click on the Scenario_Tree scenario

   d) For the following catalog keys, change to its corresponding installed version if needed[2] (see Figure 4 for an example):

      i) "Hard Drive where the model resides" (pre-defined: C:)

      ii) "Cube Software" (pre-defined: version 6.4.5)*

      iii) "ArcGIS Software" (pre-defined: 10.6.1)*

      iv) "Python Software" (pre-defined: version 27)

      v) "Logistics Model Software" (1.2.2)

For the catalog key "Location of Python program" change if needed the folder where Python 27 is installed (pre-defined: C:\Python27\ArcGIS10.6)

      vi) For the catalog key "Location of Java program" change if needed the folder where Java is installed (pre-defined: C:\ProgramData\Oracle\Java\javapath)

      vii) For the catalog key "Path to cmd.exe:" change if needed the folder where cmd.exe resides

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[2] If you are using Swedish Windows 7/8, the system name of the standard *Program* folder is *Program Files.* So in the keys in the *Installation* application, use "C:\Program Files\...", not "C:\Program\...".
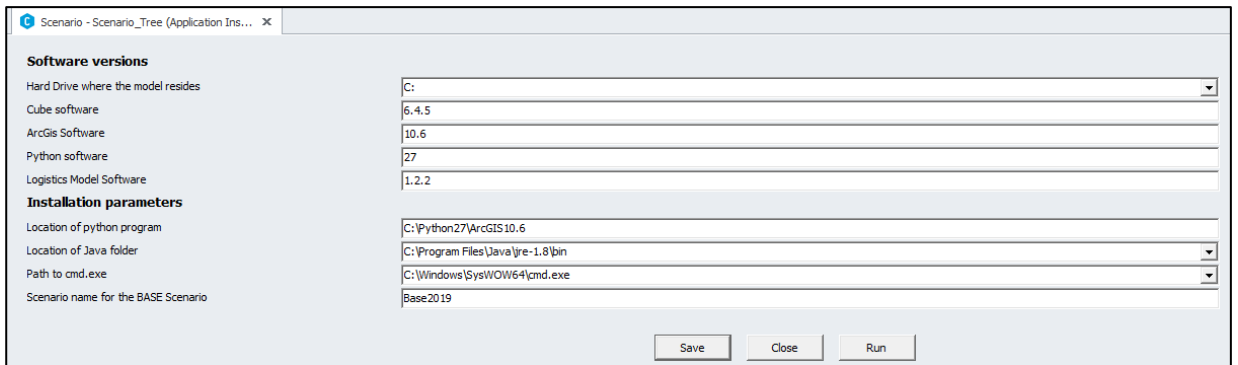
Figure 4 Example of catalog key values for the Installation application

For the catalog key "Scenario name for the BASE scenario" point to the scenario that should be used as base scenario (pre-defined: Base2019)

    e) Run the Installation application by clicking "Run" in the scenario interface, or by selecting Application -> Run Application -> OK on the main toolbar. (If "OK" is clicked instead of "Run", the application will not run – the changes in the settings will only be saved.)

    f) Save the model catalog clicking on save in the top right corner, see Figure 5.
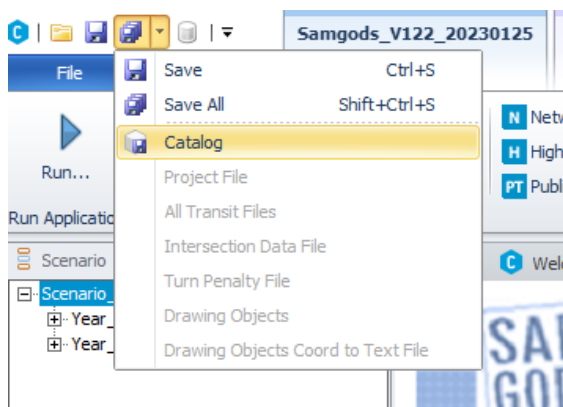
Figure 5 Save the catalog file in the graphical user interface in Cube

Now the GUI is installed.

* To properly set the values for the catalog keys indicated with *, see the information under the Menu Bar; Help -> About (see Figure 5 and Figure 6 below for an example).

Figure 6 How to access the "About …" information

Figure 7 Example of the "About …" window

6. Cube Interface components

This chapter outlines the main components of the Cube Interface and explains their functions. The Cube Interface has five different windows as shown in Figure 7. When opening the model, three different user types can be selected – *Model developer* or *Standard user* or *Advanced user*. The *Model developer* role is mainly used when setting up or installing the system, while the *Standard* and *Advanced user* roles typically are used when running the model and for scenario handling. The set of active windows depends on the user role, and this manual is relevant to all user types.

The large area to the right is a workspace where manager windows and messages are shown, i.e., when the user wants to manage a scenario, the Scenario manager window is shown here. There are also Application manager windows and Data section manager windows. The manager windows are opened from the corresponding window on the left hand side.

For more information on the Cube interface, please refer to the Cube Help, accessed from the main toolbar: Help -> Cube Help.
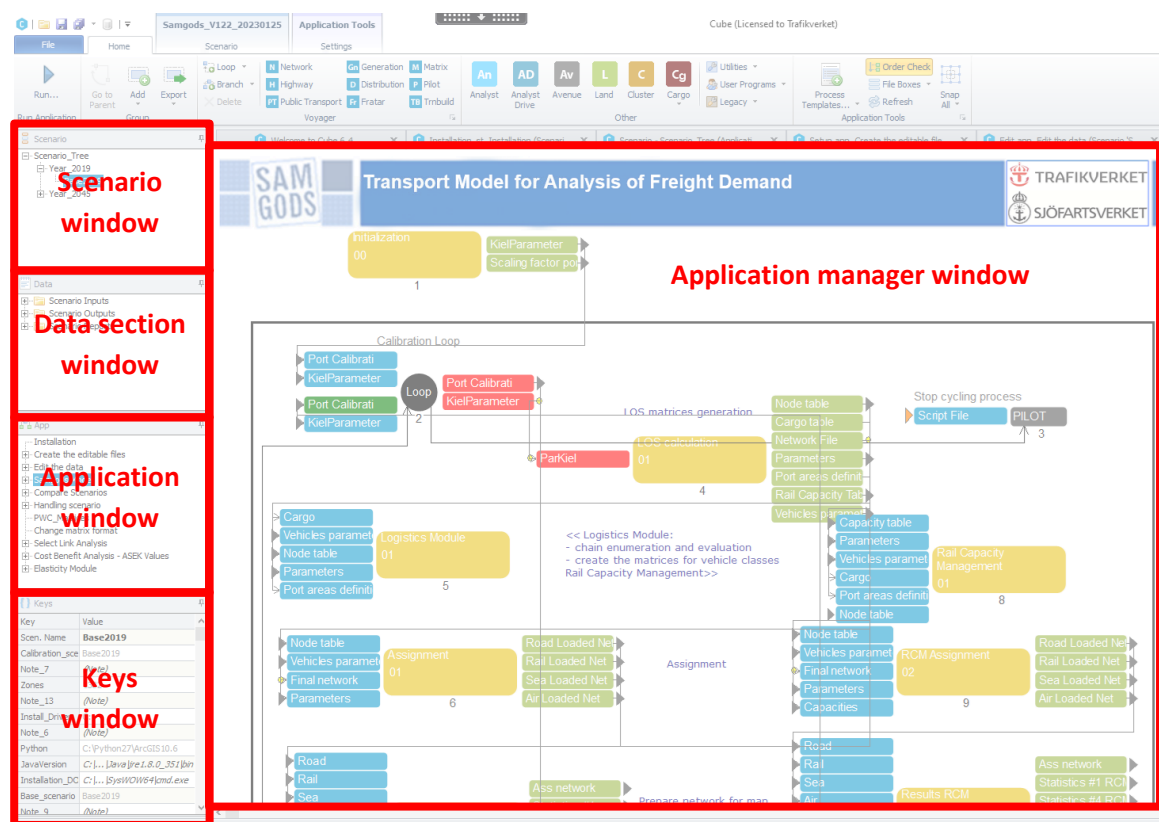
Figure 8 Example of Scenario manager window

6.1. Scenarios window

The purpose of the Scenarios window is to list the scenarios that exist in the model.

A *scenario* refers to a set of specific input files/values. An *application* is a group of programs. In the Samgods GUI a set of applications are defined with different types of functionalities. Different scenarios can be set up in the GUI by using the set of available applications. A scenario can be

opened and managed using different applications by double-clicking on the scenario name in the Scenarios window (in *Standard user/Advanced user* mode). For example, the input data and parameters to the scenario can be displayed or edited. When the scenario is open in the Scenario manager window, it is possible to select the application you want to use by the scroll down menu. Another way to open the application you want to use is to select the application in the Applications window and then double-click on the scenario in the Scenarios window. The application is then run by clicking "Run".

The tree structure of the scenarios included in the Samgods GUI is visualized in the Scenario_Tree in the Scenarios window. The Scenario_Tree is used for scenario management.

The default base scenario is included in the Scenario_Tree and is called Base2019. In the base scenario all the input data is defined and it represents the parent for future sibling and child scenarios.

An example of a Scenario manager window for the application *Edit the data* is given in Figure 9 below.
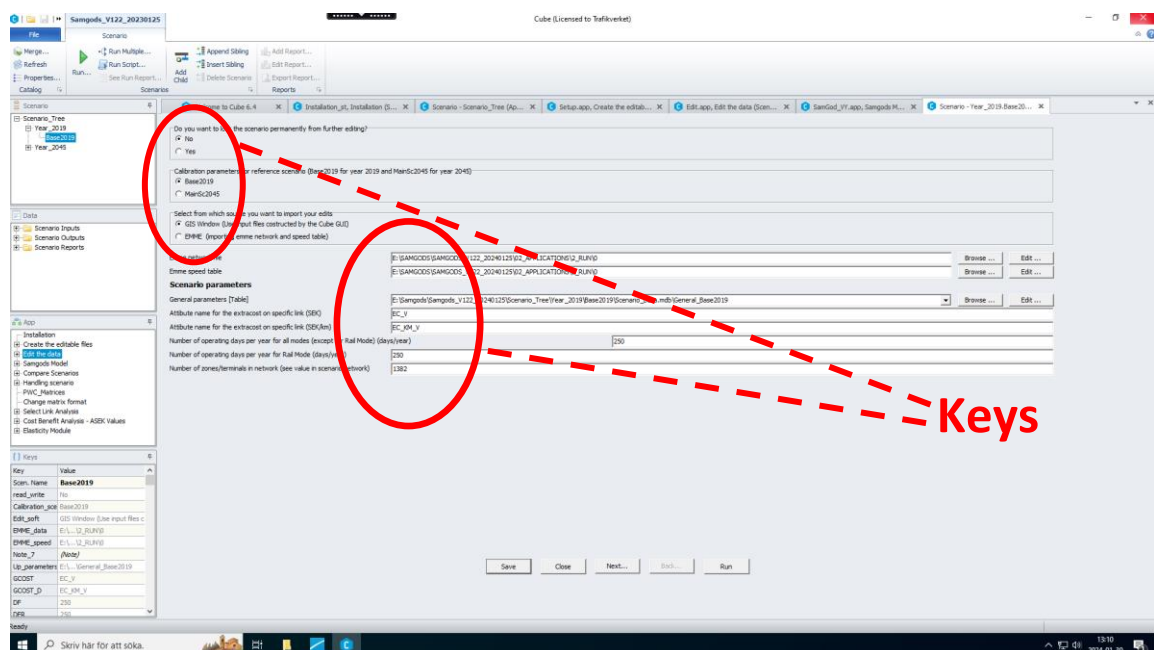
Figure 9 Example of Scenario manager window

The keys which are possible to set values for in the Scenario manager window are strictly connected to the application selected in the Applications window. In Chapter 7, tables of keys connected to the respective applications are presented.

Tip. Open an application (in model applier mode) to set the parameters for a scenario by double-clicking on the scenario and select the application in the scroll down menu.

6.1.1.   Implication in scenario setup for new scenarios

In the following paragraphs will be explained the rules in Cube spftware and the ones specifically designed for Samgods Model under scenario setup. To avoid wrong catalog definitions in specific scenarios is sufficient to:

- identify which is the model year we want to run
- create a child scenario under Year_2019 or Year_2045

If a specific scenario holds catalog key values that we want to preserve in the next runs (without the need to change again all the modified catalog keys), it would be sufficient to create child scenarios from that scenario.

6.1.2. Catalog key values definitions in Cube

The catalog key value for any catalog key in a specific scenario is based on the following four rules:

- Rule 0: no default value is specified in the catalog key. The catalog key is empty
- Rule 1: Default value of the catalog key: the default value is specified during the creation of the catalog key
- Rule 2: Specific value changed by an intentional action of the user
- Rule 3: Value from father scenario: creating a child scenario, all the values for all catalog keys will derived from father scenario

Which of the above rules is applied depends on the actions performed by the use and their order.

Rule 0: no default value

Looking at a simple example in which is present only one scenario (Base) and only one catalog key (numerical) "Example", see Figure 10.
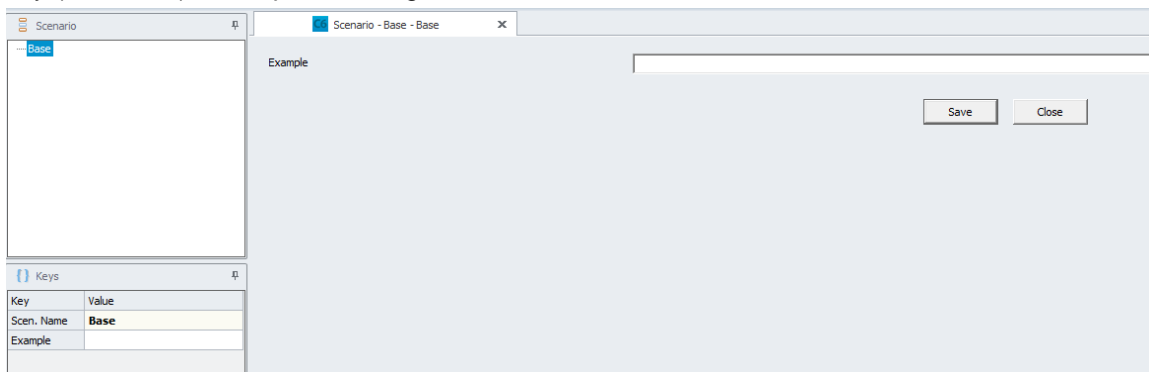
Figure 10 Example of scenario and key

The value for the scenario is empty, since no default value has been applied. (Rule 0). For all child scenarios created, "Example" will be always empty. See Figure 11.
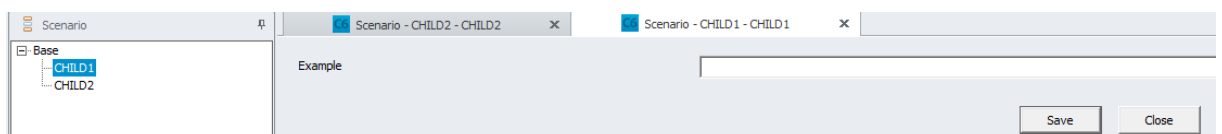
Figure 11 Example of inherited key Rule 0

Rule 1: default value

The catalog key can be created with a default value. Each new scenario will have the default value in it without any action. For instance, in "Example", defining a default value of 99, will result in getting 99 in all scenarios (Base and children), see Figure 12.
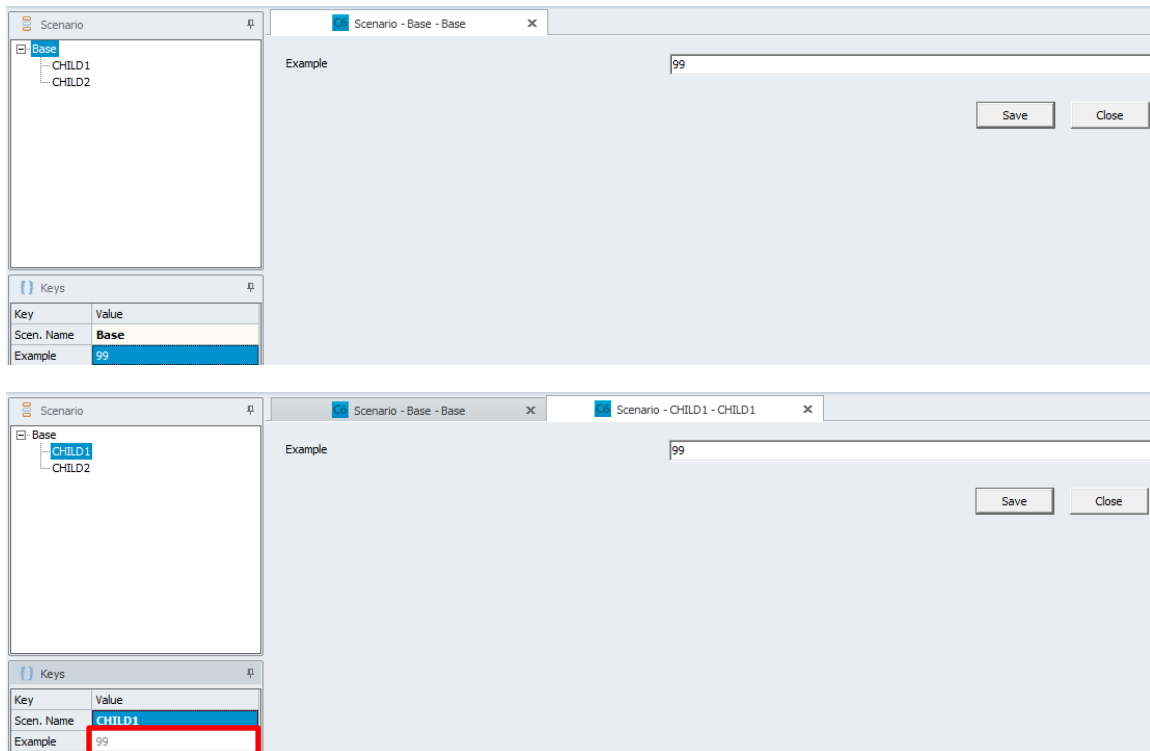
Figure 12 Example of inherited key value according to Rule 1

From the GUI, it is also possible to understand that the value is derived from the default value by the form of the element under Keys window. If is grey, (as in our example above - see red rectangle), the key has a default value and neither the current scenario nor its parent defines a value for the key. In our example, it means we can understand that both CHILD1 and Base are using a default value, otherwise a different form will be used.

Rule 2: User changes the value intentionally for a specific scenario

Suppose that for CHILD1 we want to apply a value of -100 rather than the default value. This change will affect CHILD1 and all the future child scenarios created under CHILD1. The form of the element under Keys window (red rectangle) will be bold, see Figure 13.
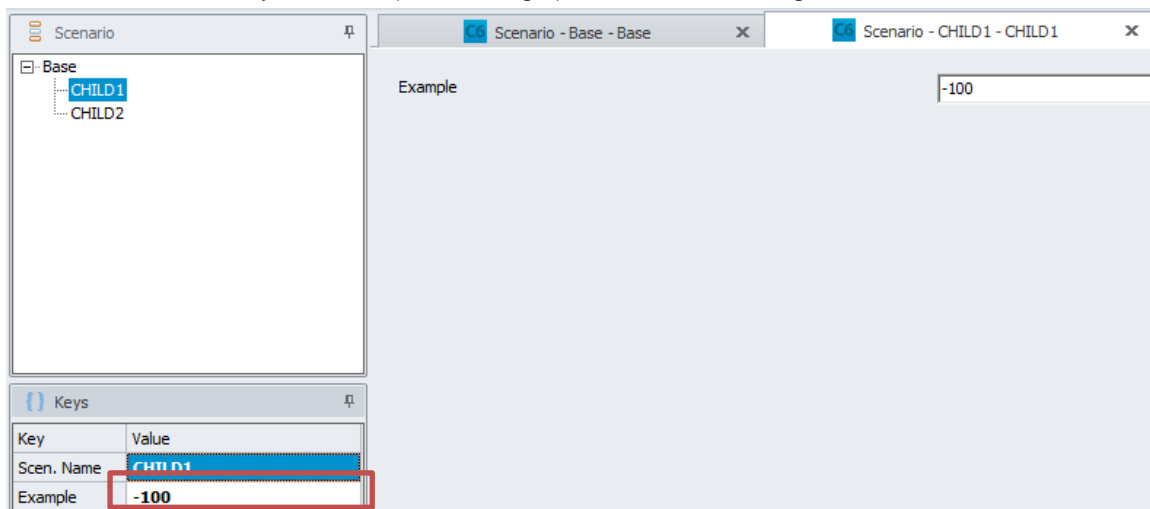
Figure 13 Changed value of inherited key, Rule 2 (see value in bold)

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In other words, every time the form is **bold**, means the rules from father scenario or default value are broken. What is specified in the current scenario has been intentionally changed from the father scenario.

Rule 3: Value from father scenario

Rule 3 is the standard rule which does not require any action from the used. But which is the final value depends if the father scenario has Rule 0, Rule 1 or Rule 2 in place. In the examples above, CHILDOFCHILD1 has -100, since father scenario has Rule 2 in place (modified value from default). Form under "Example" is in Italics, see Figure 14.
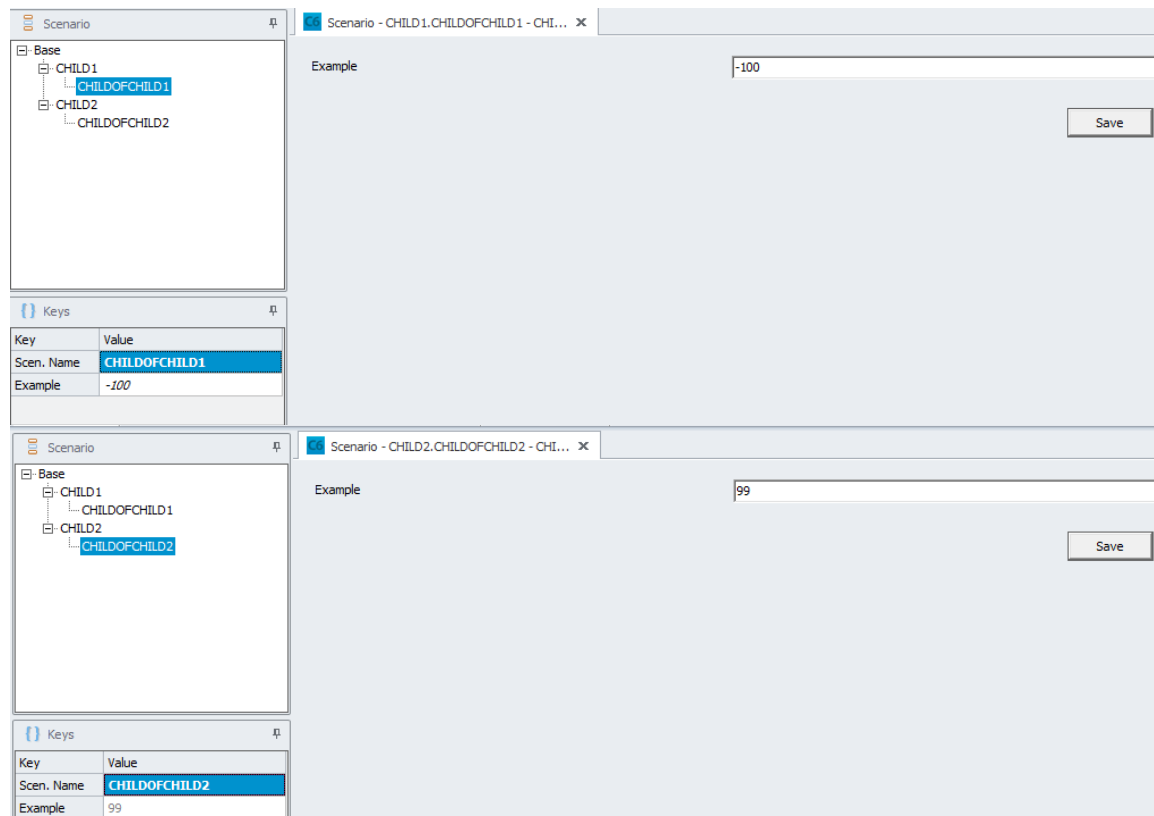
Figure 14 Illustrates inherited key for second child scenario

CHILDOFCHILD2 has 99 since father scenario and base have Rule 1 in place. Form under "Example" is still in grey.

Suming up what is the content of "Keys window":

- The first row of the key grid gives the name of the currently selected scenario
- Subsequent rows list each key in the catalog

The value of the key for the current scenario is shown in the Value column. It may appear in one of the following forms:

- Blank if the key value is undefined for the selected scenario
- **Bold** if the value is defined explicitly for the selected scenario
- *Italics* if the value is inherited from the parent scenario
- Grey if the key has a default value, and neither the current scenario nor its parent defines a value for the key

6.1.3.   Catalog key values definitions in Samgods model

The scenario tree structure in Samgods model follows the rules explained in previous paraghap and each catalog key can follow one of the rules. Scenario Tree holds all the default values for all catalog keys, see Figure 15. In the initial installation only the catalog keys related to program folder location or version must be modified.

Key	Value
Scen. Name	**Scenario_Tree**
Note_7	*(Note)*
Zones	1382
Note_13	*(Note)*
Install_Driver	C:
Note_6	*(Note)*
Python	C:\Python27\ArcGIS10.6
JavaVersion	C:\...\Oracle\Java\javapath
Installation_DC	C:\windows\sysnative\cmd.exe
Base_scenario	Base2019
Note_9	*(Note)*
Step_By_Step	All steps
Year	2019
Select_cal_cos	All
Select_commoc	0
Note_11	*(Note)*
log_out	None
CON_RATE_SE	No
FOLDER_CR	...\LogMod_1\ChainChoi\OUTPUT\
Note_4	*(Note)*
CSTVARI	C:\...\Input_Data.mdb\CSTVARI
N_flows	16
Cluster_P	Yes
Cluster_nodes	2
Cluster_nodes_	1
scal_factor	Thousands
RescLOS	No
Note_2	*(Note)*
UTIL_PERCENT	30
maxiters_EA	1
SpeedFlowCur\	2*10000*(MAX(0,VOLC[LI.ID_LINK]-
Save_Output_F	No. This option will save results only f
RCM_Loop	1

Key	Value
Note_11	*(Note)*
log_out	None
CON_RATE_SE	No
FOLDER_CR	...\LogMod_1\ChainChoi\OUTPUT\
Note_4	*(Note)*
CSTVARI	C:\...\Input_Data.mdb\CSTVARI
N_flows	16
Cluster_P	Yes
Cluster_nodes	2
Cluster_nodes_	1
scal_factor	Thousands
RescLOS	No
Note_2	*(Note)*
UTIL_PERCENT	30
maxiters_EA	1
SpeedFlowCur\	2*10000*(MAX(0,VOLC[LI.ID_LINK]-
Save_Output_F	No. This option will save results only f
RCM_Loop	1
Lock_file	2019
SHIPCUT	1
CAPCOST	998801
EXTRA_CAPCO	1000000000
Debug_checklis	342
RAILMODES	GHhIITUDdEFf
RAILVHCL	201,202,203,204,205,206,207,208,:
Chains	Chain_List_2019
Note_14	*(Note)*
OverallLoopMa:	1
Resume_optior	1
ConsolTable	C:\...\BuildChain_CONSOL
Note_21	*(Note)*
Waittime	600

Figure 15 Default values of scenario tree keys

"Year_2019" and "Year_2045" Scenarios are functional in keeping in place the right values for the following catalog keys:

Maximum number of zones: Year_2019 has the default value (1382 grey), Year_2045 has default value (1382 grey), seeFigure 16

Year of PWC matrices: Year_2019 has the default value 2019 (grey), Year_2045 has value 2045 (bold), see Figure 17

Figure 16 Default key values for scenario Base2019

Figure 17 Default key values for scenario MainSc2045

<u>Lock solution table (Table with list of locked solutions)</u>: Year_2019 has value "2019", Year_2045 has value "2045".

6.2.   Applications window

In the Applications window all applications defined in the model catalog can be found. An *application group* is the collection of programs and sub-groups belonging to the respective application. When an application is selected (by clicking on it in the Applications window) the application group is shown in the Application manager window. In the Application manager window you can see Program boxes (e.g. MATRIX, HIGHWAY, NETWORK, and PILOT) and/or other applications (called sub-groups) belonging to the application group (see Figure 18). In the Applications window, you can see the main application at the highest level, and go through the tree structure down to lower levels.
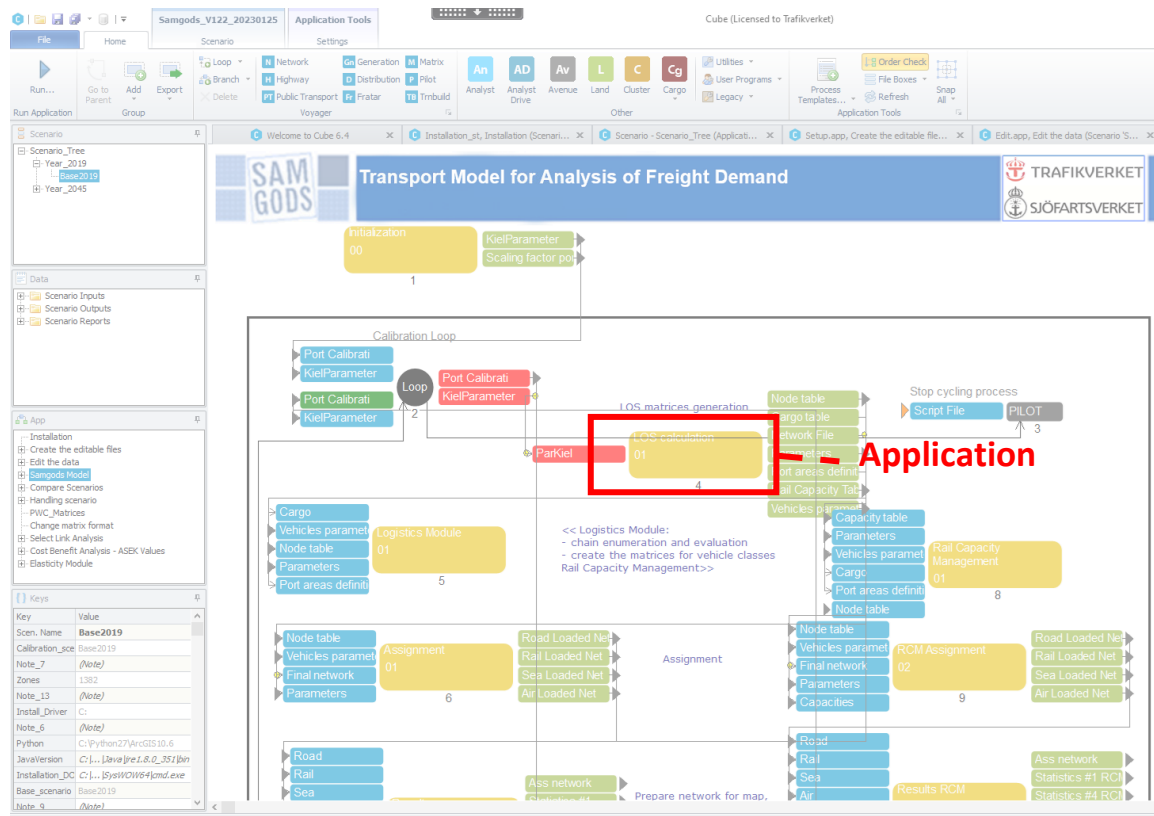
Figure 18 View of an application and its corresponding application groups.

In the Samgods GUI, the defined applications are (see the Applications window in model developer mode):

- Installation
- Create the editable files
- Edit the data
- Samgods Model
- Compare Scenarios
- Handling scenario
- PWC_Matrices
- Change matrix format
- Select Link Analysis
- Cost Benefit Analysis - ASEK Values

- Elasticity Module

6.3.   Data Section window

The Data Section window provides direct access to the main input and output files, which can be utilized when working with the model (editing, controlling, etc.). It allows the user to display and edit the input data, as well as to display the outputs and reports for specific scenarios and runs. In conjunction with the Scenario manager window, it enables the user to easily access all data, without needing to know where it is actually stored. The structure of the Data Section window is described in Table 55 in the appendices section 14.7, which also shows the location of the files, the names of the tables/maps, a short description of its contents and which application that produces or uses the files.

There are three main folders in the Data Section window: Scenario Inputs, Scenario Outputs and Scenario Reports. The General tables under Scenario Inputs are always accessible from the Data Section window. The Editable data (also found under Scenario Inputs) is accessible only during the edit phase or if the user has selected not to delete the temporary geodatabase (see explanation for the *Edit the data* applications in Section 7.4).

The available output in the Scenario Outputs folder depends on the choices made when running the *Samgods Model* application. The available outputs in the folder *Scenario Outputs\Samgods Report* are always listed in the log report *Scenario Outputs\Samgods Report\Existing Outputs*. There are two other log reports except Existing Outputs: *Report for the import phase* and *Report for the edit phase*, which state any error messages or other messages from the applications *Handling scenario* and *Edit the data.* For more information on the log reports see Chapter 12 Chapter.

Moreover, the Data Section window includes the 21 standard reports per Standard Logistic Module, 22 standard reports for Rail Capacity Management and 15 standard reports for Cost Benefit Analysis also called summary reports, which summarize the output from running the Samgods GUI, in Word format. The summary reports are found in the Scenario Reports folder and are listed in Table 55. To browse to different pages in the reports, use the arrows in the main toolbar. It is possible to export the tables to Excel, by selecting the table in the Word format report, right-clicking and selecting "Export" and type in a name with an Excel file format ending. Some of the standard reports are also available as spreadsheet reports in the Scenario Outputs folder, where they are marked with the same report number as in Scenario Reports (see, e.g., Scenario Outputs\Samgods Report\Logistic Module\OD Covered).

For some of the data files, the variable names that appear in the headings are explained in tables in the appendix.Before using and analyzing any output data regarding empty vehicles/vehicle kilometres or the total number of vehicles (i.e. loaded + empty vehicles), please read the Section 14.2 about empty vehicles in the appendices.The GUI allows producing different aggregations in the results for Standard Logistic Module. The model could produce the total number of loaded, empty and tonnes for all the commodity groups, or just for a specific commodity group. The outputs will be saved with different name files ending with a number of a suffix. Depending on the user choice, the possible values could be:

- 0 (zero): all the commodities are aggregated, so the volumes and tonnes represent totals
- A number among 1 and 16: a single commodity has been run

In order to access to the different aggregations, e.g. different files, it is requested to set the value for catalog key "Select commodities for the Logistics module (…)" in the *Samgods Model* application to the commodity or commodity group number you want to view and clicking "Save" (please refer to Section 7.5 for more information).

For Rail Capacity Management Module (RCM) and Cost Benefict Analysis there are no options and the only available choice is 0. That is related to the matter that the process requires all the volumes to properly assess the congested level on the rail network, therefore a run for a specific commodity would show inconsistent results to a full run with all commodity group.

6.4.   Keys window

The model is based on Scenario Manager and Application Manager. Applications represent the flow chart of the model containing calculation and specific programs, while the purpose of Scenario Manager is to allow an application to be conveniently executed with a varying set of inputs. This allows the user to compare the effects that different input values have on the results. A set of input values is a scenario and the varying inputs to the applications are called "keys". Catalog keys define items that vary each time an application in a catalog is run. They may represent a file, number, character string, or Boolean flag. For instance, using a key it is possible to specify different values for parameters, different networks for LOS calculation and assignment, different control parameters for the Logistics Module or more.

In general terms the keys may serve different purposes; in summary:

- To manage input data
- To give general settings for the model
- To enable different ways to run the model

A key can for example be:

- The name of an input data file
- A directory
- A check box with true or false value
- A check list to choose a specific value
- A constant
- A radio button

Different kinds of keys appear in applications and other places where it is possible to select the settings (for rules applied see section 6.1.1 and 6.1.3).

In Chapter 7, the available catalog keys for each specific application are listed. Catalog keys are defined as keys for setting up parameters in the applications. The Keys window is available in developer mode and it is also possible to display from Main toolbar -> Scenario -> View -> Show Keys.

The following keys in the Cube interface are called system keys:

- {CATALOG_DIR} is the directory where the .cat file is located
- {SCENARIO_DIR} is the directory where the scenario folder is located {SCENARIO_CODE}, {SCENARIO_SHORTNAME) are defined in the Scenario Properties, see Figure 20.
- {SCENARIO_FULLNAME} = {SCENARIO_SHORTNAME_PARENT}.{SCENARIO_SHORTNAME}, where {SCENARIO_SHORTNAME_PARENT} is the base scenario to the current scenario

These keys are important components in each scenario. Please refer to the online Cube Voyager help available from the menu bar for further information (see for instance Scenario Manager > Working with applications and catalogs > Cube Voyager and TP+ scripts). "Scenario properties" is accessed by right-clicking on the topical scenario in the Scenarios window and select "Properties" (see Figure 19).

Each time a scenario is created all catalog keys should be given a value. Some of the keys have a default value. If the default value is changed by the user, it will become specific for that scenario. When a scenario is created as the child to another scenario, it will inherit all the catalog key settings from the parent.

In the Keys window information on the origin of the keys can be found. The keys for a specific scenario and application can be viewed by selecting the scenario in the Scenarios window by clicking on it, and selecting the application in the Applications window in the same way. The keys marked in black in the Keys window are undefined. The keys are shown in bold font if they have been explicitly defined by the user and in italics if they have been inherited from the parent scenario. If the value is in grey font, it is a default value that has not been changed by the user, neither for the current scenario, nor for its parent.

More information about the keys and the scenarios can be found in the Cube Help, accessed from the main toolbar (Help -> Cube Help -> Cube Base -> Scenario Manager -> Keys/Scenarios).
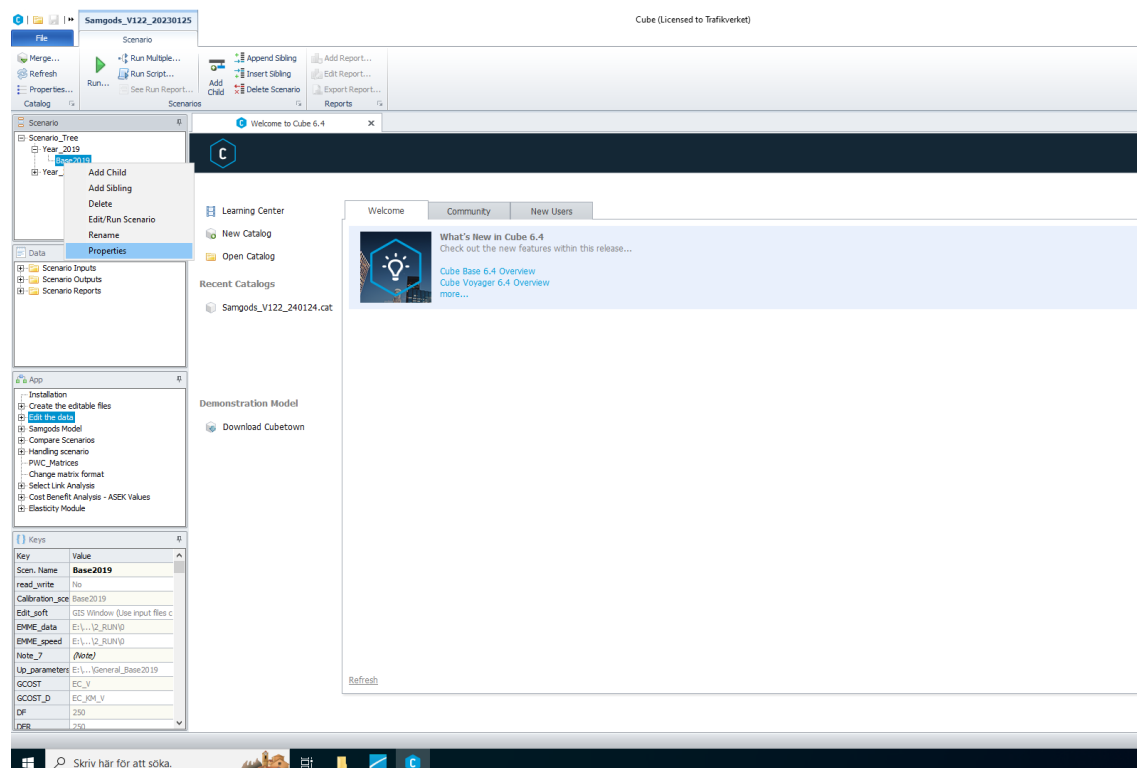
Figure 19 How to open the "Scenario Properties" window
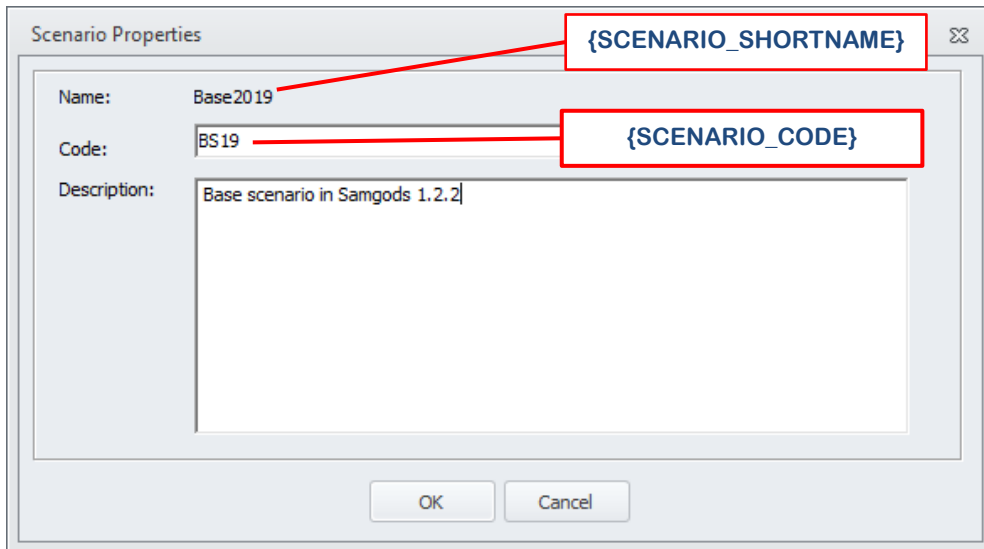
Figure 20 Set {SCENARIO_SHORTNAME} and {SCENARIO_CODE} in "Scenario Properties"

6.5. Application manager window

The Application manager window is accessed by double-clicking on an application in the Applications window, and it provides a flow chart of a transportation modelling process, see Figure 21. The view is in a hierarchical flow style that offers:

- a view of the individual processes, the flow of data from one application to another, the sequence in which the processes are run
- a clear structure of what the input data and the output data are in each process
- a convenient interface for running specific parts of the process or the whole model
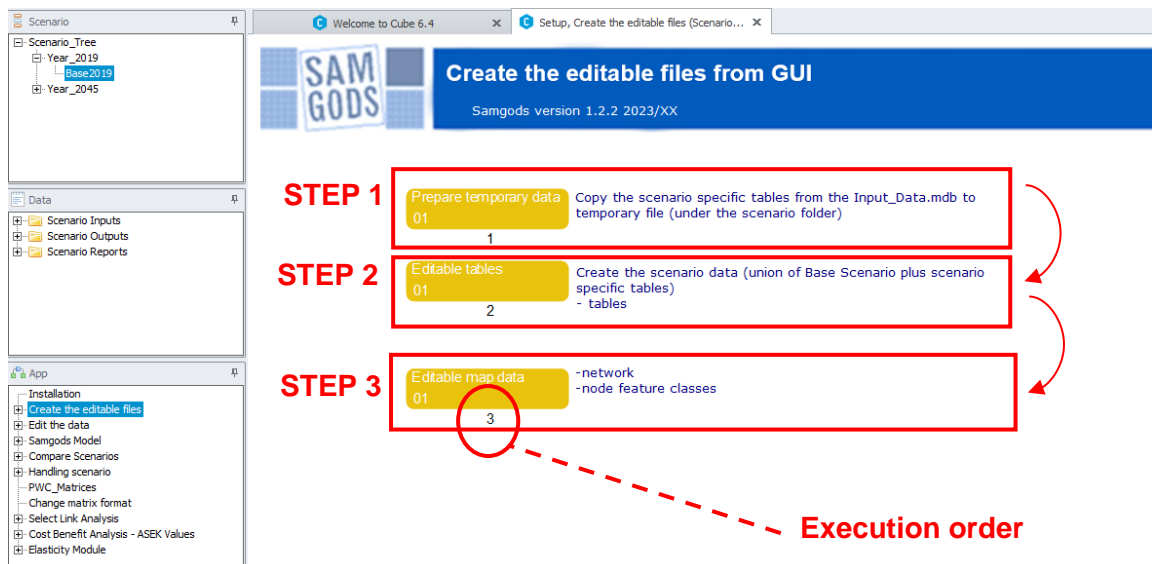
Figure 21 Application manager window

6.6. Task Monitor program and the help function

The *Task Monitor program* starts automatically from the Application manager when the user runs either a single program or an application. The main purpose of the Task Monitor is to report the

progress of the program/application execution, and to allow control of the run by pausing or abandoning it. When a run finishes successfully, a message box will indicate that the run is finished without any problem. If a failure occurred, a dialog box, showing the return code and error information, will appear.

The return code from the process gives the information on how the run completed. The codes are shown below.

Return codes:

Return code = 0 – the run completed successfully

Return code = 1 – along the process, a few warning messages were printed but the run was completed successfully

Return code = 2 – the run ended with a fatal error

Return code = 3 – the user aborted the process

There are facilities that allow showing:

- The report for the whole run
- The report for the step that failed, if the run ended with a fatal error

For more details on the Task Monitor, see reference guide RG_CubeBase.pdf under Citilabs\Cube folder, Chapter 16.

When the user needs help about the Cube Interface, the help function can be consulted. It is found on the Menu Bar; Help -> Cube Help.

7.   Description of the applications

This chapter introduces the different applications in the Samgods GUI, how they are used and how the settings are made. The chapter is written as a catalog with detailed descriptions of the applications and should be consulted for the specifications of the applications rather than for instructions on how to use the entire Samgods model. For instructions on how to get started with Samgods, how to create and use scenarios etc., we refer to Chapter 8. The chapter commences with an explanation of the different Model User roles, followed by the description of the applications in the Samgods model GUI.

7.1.   Model User roles

In the Samgods model GUI, three Model User roles are available:

- Standard user - should be used by the normal user when setting up scenarios and running the model
- Advanced user - should be used when it is requested to manage some general parameters and values such as wait time for the prompt command or for running RCM process
- Developer - should in general be used when advanced system settings are made, for instance when administrating the system by making installations and setting up the system

As mentioned earlier, in order to set the Model User roles, to go Scenario menu on the toolbar and select "Properties". On the Catalog Properties window, select the "Model User" tab, where the settings for the Model User roles are made, as described below:

- Standard User – set the Model User to "Model Applier" and Current Applier group to "Standard User"
- Advanced User – set the Model User to "Model Applier" and Current Applier group to "Advanced User"
- Model Developer – set the Model User to "Model Applier" and Current Applier group to "Model Developer"

More details for when the Model User roles are used are given in the catalog key tables. Most of the catalog keys for the respective applications are described; however, not all keys are explicitly explained.

General guidelines for which Model User role to use:

Standard user – should be used by the normal user when running different scenarios

Advanced user – should be used by an experienced user of the model that would control some specific settings and parameters

Model developer – should be used when setting system keys, no restrictions are applied in this case

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7.2. Installation application

The *Installation* application is only enabled in developer mode. A screenshot of the application is displayed in Figure 22. The purpose of the *Installation* application is to set the general information to properly run different programs involved in the model. In particular we have the following programs:

- Logistics module (executable programs buildchain.exe, chainchoi.exe and ConsolidRateMode.exe)
- Rail Capacity Management module (executable programs LP2CC.exe, MPS.jar, CLP64.exe)
- Citilabs Cube Software
- ArcGIS Esri Software
- Python software
- DOS command location

See the installation instructions in Section 5.5 for further details on how to access the keys and set the right values.

The first group of catalog keys, called "Software versions", is introduced to avoid inconsistency of version problems over time. Different versions of the programs can be implemented (typically when a software is updated to a newer version), and it is important to know which software versions that were used for a particular scenario study to enable proper analysis and consistency of the outcome. The keys are displayed in Table 2.

Table 2 "Software versions"

Text field name in template	Example of value
Cube Software	6.4.5
ArcGIS Software	10.6
Python software	27
Logistic Model software	1.2.2

The second group of catalog keys, "Installation parameters", handles the possible problem of having different installation folders on different PC's by setting the path of the programs. Since the path for the ArcGIS program is used by Python, the "\" signs must be replaced by "/" or "\\" in this key, see Table 3 for an example. The first catalog key in the second group indicates the harddisk in which the model is installed.

Table 3 "Installation parameters"

Text field name in template	Example of value
Hard Drive where the model resides	F:\
Location of Python Program	C:\Python27\ArcGIS10.6
Location of Java folder	C:\Windows\System32
Path to cmd.exe	C:\windows\sysnative\cmd.exe

The last key in the second group, see Table 4, defines the base scenario that is used in the current model. The base scenario is used as a reference when storing the data for other scenarios. Only the differences between the base scenario and other scenarios are stored in the database. The value of this key is related to the *Handling scenario* application; please refer to Section 7.7 for more information.

Table 4 Base scenario definition

Text field name in template	Example of value
Scenario name for the BASE scenario	Base2019
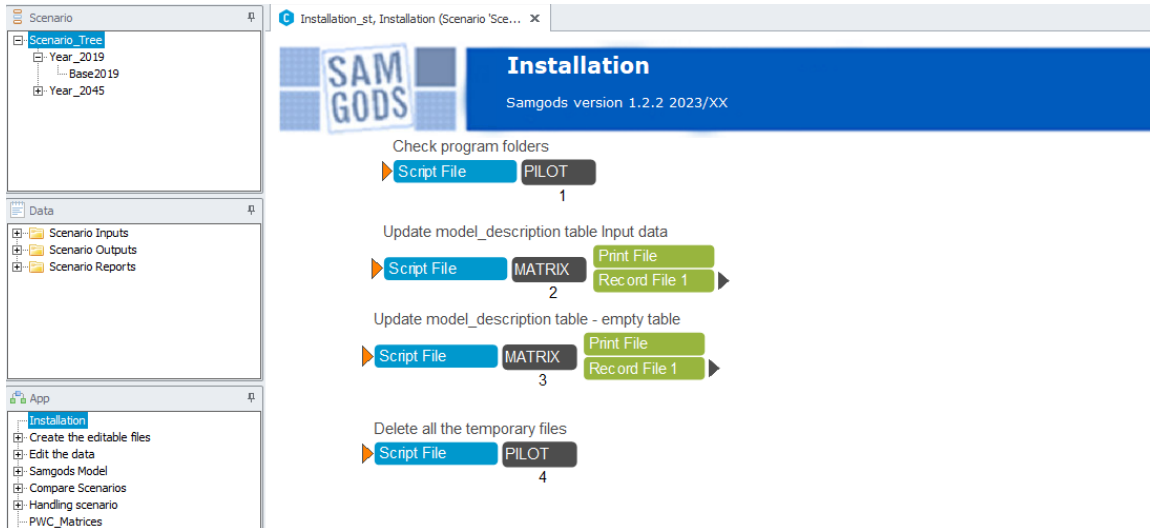
Figure 22 The Installation application

To open the overview of the application as illustrated in Figure 22, double-click on the application. To access the catalog keys of a specific scenario, mark the application, and double-click on the specific scenario in the Scenario window. Please refer to Chapter 1.0 for further instructions on how to use the Samgods GUI.

7.3.   Create the editable files application

A view of the *Create the editable files* application can be seen in Figure 24. The purposes of this application are to:

- Create the essential files for visualizing or editing the input data from the graphical user interfaces (Cube GIS window, DBI editor)
- For a new scenario, allow to copy all the parent scenario data to the new scenario

The concept of this is that all the input data connected to a specific scenario is stored in the database as the differences between the current scenario and the base scenario (i.e., the reference scenario). The benefits of this are:

- A smaller amount of data is stored, that is, only the differences between the base scenario and the alternative scenario(s)
- It makes different alternative scenarios independent of each other, by letting the alternative scenarios having only the base scenario as a reference. The only redundancy of the system occurs when children are added to an alternative scenario since all scenarios (including child and parent scenarios) are independent of each other and only have the base scenario as a reference
- When changes are made to the base scenario, there is no need to change all the other scenarios. This facilitates the handling of the overall scenarios. Furthermore the changes

and edits will be done only once, in the base scenario, avoiding risk of mistake when updating the correlated scenarios

To create the editable files for a specific scenario and the scenario specific tables, two applications work in conjunction:

- the *Create the editable files* application, that merges the base scenario with the scenario specific tables to view and edit a scenario, and
- the *Edit the data* application, that stores the scenario-specific tables into the database after any edits have been made
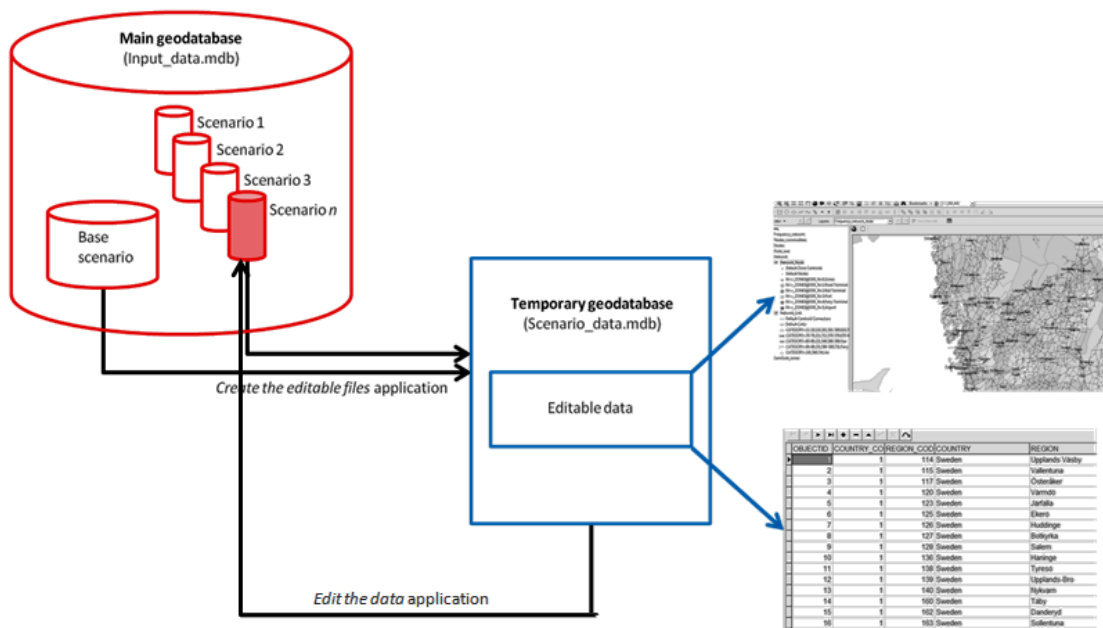
Figure 23 Database structure and scenario data of the Samgods GUI.

The main database is always present in the model, in the 05_Input_data folder (see Table 1 in Section 5.5). The temporary database (Scenario_data.mdb) is created in the scenario folder in each run of this application and is deleted on request by the user. The temporary database can also be viewed in the GUI.

The catalog keys available in the *Create the editable files* application are shown in Table 5 below.

Table 5 Create the editable files catalog keys

	Text field name in template	Example of value	Model User's rights
1	Which scenario do you want to copy as new scenario?	Base2019	S/A user
2	Location of Python program	C:\Python27\ArcGIS10.2	Developer
3	Scenario name for the BASE scenario	Base2019	Developer
4	Wait time for prompt messages during execution (default 10 minutes = 600 seconds)	600	Developer Advanced user

The first key is relevant during the creation of a new scenario. When the scenario already exists, no action is needed. Keys number 2 and 3 are for installation purposes only. The last key represents a model run setting, specifying the wait time for prompt message during execution.

For a normal user its value is set to 10 minutes, only for an expert user (advanced user right) it is possible to change the definition to a small value (for instance 10 secs). A different setting is required when several scenarios must be run since it is desiderable to minimize the interaction with the user.

To create a new scenario, the application copies the scenario-specific tables from the scenario (as indicated in the first catalog key in Table 5) and stores them in the temporary database. The *Edit the data* application will then store them back to the main database.

Figure 24 The Create the editable files application

When the application has been executed, the output (i.e., the editable files) can be found in the folder Scenario Inputs\Editable data in the Data Section window. If the *Create the editable files* application has been executed before and the user after that has not selected to delete the temporary geodatabase, all the data will be available without the need to run the application again. If the temporary database has been deleted, it may always be reconstructed by running the *Create the editable files* application.

Please note: This application **must** be run at least **once for each scenario**, including the base scenario. Otherwise, the necessary files for using the scenario will not be created.

The *Create the editable files* application is the only application that is necessary to run for *each* scenario - including the base scenario. For all other scenarios except the base scenario it is also necessary to run the *Edit the data* application.

Tip: The date and time of the last modification of the temporary and the main geodatabase are checked by the application to avoid inconsistencies between the two datasets. If any differences are found, the user is asked to choose whether the execution should be completed (the temporary geodatabase will then be overwritten) or cancelled, so that the temporary geodatabase could be saved to the main geodatabase by the user.

> **Please also note:**
>
> - The location of the main database is under 05_Input_data folder (Table 1 in Section 5.5).
>
> - The location of the temporary database, Scenario_data.mdb, is under scenario folder, which can be found in the Scenario_Tree folder (see Table 1 in Section 5.5). It is available after each run. It can also be viewed from the GUI.

7.4. Edit the data application

The *Edit the data* application is used to store the scenario-specific tables into the database after any edits have been made.

A view of the application is shown in Figure 25 The purposes of the application are to:

- Enable editing of the scenario data by using the Scenario manager window or the Data Section window. All georeferenced data is visualized using the GIS Cube window and the other data is displayed in a database window. See the reference guide for Cube Base (RG_CubeBase.pdf under Citilabs\Cube folder) for further information on these tools

- Check the changes made are consistent with the calibration tables present under Input_data_calibration.mdb (Base2019 and MainSc2045) . If elements belonging to the calibration tables are deleted in the input data[3], the process will terminate and the changes ammended.

- Store the modified data (the scenario-specific tables) to the main database after editing

The catalog keys are ordered in two groups. The first group is shown under Table 6 below.

Table 6 Scenario parameters and handling keys

Nr	Text field name in template	Example of value and explanation of values	Description	Model User's rights
1	Do you want to lock the scenario from further editing?	Yes	This key is introduced due to data security reasons, where the user can choose to lock the scenario from further editing. Further explanation is given below	S/A user
2	Calibration parameters for reference scenario (Base2019 for year 2019 and MainSc2045 for year 2045)	Base2019 or MainSc2045	This key is introduced since scenario specific calibration parameters are available. Scenarios for 2019 should use settings Base2019 in order to point out the right calibration parameters	Developer

---

[3] It is required that the calibration parameter values (factors and/or terms) actually exists in the original database, else calibration adjustments are not possible. For example, introduction of calibration taxes requires that original taxes exist in the main-database, this explains why elements of zeros are presents in main-database tables.

Nr	Text field name in template	Example of value and explanation of values	Description	Model User's rights
3	Select from which source you want to import your edits	GIS Window (Use input files constructed by the Cube GUI)	This key indicates if the edits are saved in a Voyager Network or in an EMME Network. If the option "GIS window" is selected, the next two catalog keys (no. 3 and 4 below) do not need to be specified	S/A user
4	Emme network file	C:\Temp\EMME_NET_Emme2019.211	The network data can be edited by importing Emme data (format: .211). The file should be specified here. It is necessary that the network file exists in the specified folder, otherwise the system will prompt the user with a message during the execution	S/A user
5	Emme speed table	C:\EMME\NetworkBase2011\V101_1_02_SPEEDS.DAT	See key no. 3, except for the format, which is .DAT for speed table file	S/A user
6	General parameters [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\General_Base2019	This is the scenario data for the scenario, generated by the system	Developer
7	Attribute name for extra cost on specific link (SEK)	EC_V	Please refer to Section 9.2 for further explanation	S/A user
8	Attribute name for extra cost on specific link (SEK/km)	EC_KM_V	Please refer to Section 9.2 for further explanation	S/A user
9	Number of operating days per year for all modes (except for Rail Mode) (days/year)	250	This key represents a value used to convert the annual flows into daily flows and is expected to be changed rarely	Developer
10	Number of operating days per year for Rail Mode (days/year)	250	This key represents a value used to convert the annual flows into daily flows and is expected to be changed rarely	Developer
11	Number of zones/terminals in network (see value in scenario network)	1382	Maximum number of zones plus terminals in the network	S/A user
12	General parameters for Logistic Module [Table]	C:\SamGods\Scenario_Tree\Base2019\Scenario_Data.mdb\LogMod_Base2019	This is the Logistic Module data for the scenario, generated by the system	Developer
13	Interest rate used in cost calculation (%/year)	0.1	Interest rate used in cost calculations (%/year)	S/A user
14	Stuffing cost (SEK /tonne)	60	Stuffing cost (SEK/ tonne)	S/A user
15	Number of transport chain solutions for the Logistics module	1: the optimal solution 2: the second best solution … 5: the fifth best solution	The output is found in the Data Section window, in Scenario Inputs/Editable data/ General parameters table, in the field DATA. In the current implementation the optimal solution and up to the fifth solution are considered. [2] For the current RCM implementation, it is strongly recommended to leave the number of alternatives set to 5.	S/A user

Nr	Text field name in template	Example of value and explanation of values	Description	Model User's rights
16	Output variables for the optimal transport solution [e.g.,1,2,3, max is 8]	1: direct access 2: (un)loading costs 3: wait time costs 4: main utilization rate 5: number of vehicles 6: detailed information (total cost, total distance, total times, commodity, etc.) per f2f-solution 7: detailed information (transport cost share, total distance, total times, mode, etc.) per OD-leg. This table is linked to table 6 8: Statistics of the avail function Max is 8	See [2]. The output files are found in the scenario folder (see Table 1), in LogMod\ChainChoi\ OUTPUT and could be consulted by the advanced user. To reduce the amount of output files and produce meaning full reports it has been suggested to use reports 6 and 7.	S/A user
17	Initial consolidation factor in BuildChain (First iteration - from 0 to 1)	0.75	This key concerns which consolidation factor (for all modes) that should be used in BuildChain.	S/A user
18	Allow consolidation for all lorry types	Yes	This key will enable the consolidation of all lorries if the value is Yes. With No unconsolidated lorry transports will be enabled	S/A user
19	Evaluate transport chains one leg at a time	Yes	If Yes then each chain is evaluated one leg at a time, and the lowest cost vehicle is chosen. This can be done since the OD-legs are independent. The exception is OD-legs for vehicles rolling on and off a RoRo vessel, where a recursive optimization method is used for the three OD-legs (roll on vehicle – RoRo – rolloff vehicle).	S/A user
20	Lower bound for frequency optimization (Annual Tonnes/Shipement)	100	If (Annual Demand / Nr Relations) < MINIMUM_ANNUAL_TONNE _DEMAND_4_FREQ_OPTIMI ZE ChainChoi will exit 20 step frequency optimization loop after the first iteration, where frequency corresponds to EOQ.	S/A user
21	Lower bound for consolidation factor (applied to all commodities - from 0 to 1)	0.05	Lower bound for the consolidation factors ranking output	S/A user
22	Upper bound for consolidation factor (applied to all commodities from 0 to 1)	0.95	Upper bound for the consolidation factors ranking output	S/A user

Nr	Text field name in template	Example of value and explanation of values	Description	Model User's rights
23	Calculation for demand affecting shipment size	DYNAMIC_AVERAGE	Parameter to control how the demand shall be used in the calculation of the shipment sizes in BuildChain. The following values are allowed: DYNAMIC DYNAMIC_MAX DYNAMIC_AVERAGE DYNAMIC_GEOMEAN	S/A user
24	Do you want to log parameters from control files?	Yes	If true, the parameters from control file are logged in a log file (under LOG folder).	S/A user
25	Do you want to log reading of input data?	Yes	If true, the input data phase is logged in a log file (under LOG folder).	S/A user
26	Do you want to log cost values from vehicles files?	Yes	If true, the cost values read from LOS files are logged in a log file (under LOG folder).	S/A user
27	For which logistic solutions do you want to produce output data? (0=none, 1=Best solution, 2=Best + Second)	Number: 0 no output 1 only for best solution	This key limits the output files controlled by Key #16 for a subset of solutions (best one or suboptimal)	S/A user
28	Do you want to delete the temporary geodatabase? (Tick=yes)	Tick =yes	This key gives the user the possibility to save hard disk space by deleting the temporary geodatabase (Scenario_Data.mdb). However, by keeping the temporary files, there is no need to run the *Create the editable files* application again (for the current scenario)	S/A user

The first key (lock the scenario or not) is introduced due to data security reasons. The user can choose to lock the scenario from further editing. A new scenario is always editable, because it is expected that the user will make some changes to the scenario tables. To lock a scenario means that after the run, all the scenario data can be visualized in the interface, but if any edits are made, these edits will not be saved in the main geodatabase. The base scenario is locked by default and it should always be locked to enable comparison of the scenarios. In the database, only the relative differences between the base scenario and the scenarios alternatives are stored, this is why it is important not to change the base scenario when new scenario alternatives have been introduced. A prompt window gives information on whether the scenario has been locked or not during the execution of the following applications: *Create the editable files*, *Edit the data*, *Samgods Model*.

The 11th key (Number of zones/terminals in network (see value in scenario network) must be updated accordingly the number of zones in the EMME or Voyager network. The Emme network, in conjunction with the speed table, could be provided as input network and converted by the application. In this case the number of zones has specified as the record number in the Emme node table for nodes starting with *. In Voyager the number could be identified and modified in the GIS window selecting the network in TOC and right clinking on that. For more details on the EMME network please refer to paragraph 9.1.

The key (no.27) controls the number of report files specified by key 16, those reports can be produced for the best solution, second or third etc. Its number specifies which set of results that will be produced (only the best solution or the others as well, see [1] for further details).

The last key no. 28 gives the user the possibility to delete temporary files. By deleting the temporary geodatabase, hard disk space could be saved. On the other hand, by keeping the files, run time can be saved since the *Create the editable files* application does not have to be run again for the specific scenario. The *Create the editable files* application needs about 5-10 minutes to merge all scenario specific tables with the base scenario.

To avoid inconsistencies between the temporary and the main geodatabase, it is recommended to always control whether the two data sets have the same date and time of last modification, before running the *Samgods Model.* If they differ, there could be edits in the temporary geodatabase that have not been saved to the main geodatabase and those edits will not be included in the execution of the model. In order to save edits in the main geodatabase, it is necessary to run the *Edit the data* application. For the *Create the editable files* application, this check is done by the application, in order not to overwrite any not saved edits in the temporary geodatabase by mistake (see Section 7.3).

When "Next" is clicked in the *Edit the data* application in the *Standard user Advanced user* mode, a second set of catalog keys is displayed, see Table 7. These keys give access from the interface to all the input data for the specific scenario. The model Standard user / Advanced user does not need to do anything to define the key values. The tables and geodata can be edited by clicking on the "Edit…" button in *Standard user Advanced user* mode. All these files are also accessible from the Data Section window, under Scenario Inputs\Editable data. In Section 6.3 a brief explanation of all files in the Data Section window is given.

Table 7 Editable data

Text field name in template	Example of value	Model User's rights	Name of file in Data Section window
ArcMap GIS Project File	C:\Samgods\Scenario_Tree\Base2019\Input_Data.mxd	S/A user	Input_Data.mxd
Commodity data [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Cargo_Base2019	S/A user	Cargo Table
General parameters of Vehicle Classes [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Vehicles_Parameters_Base2019_PartA	S/A user	General Vehicles Parameters (by vhcl class only)
Specific parameters of Vehicle Classes by commodity group [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Vehicles_Parameters_Base2019_PartB	S/A user	Specific Vehicles Parameters (by vhcl class and commodity group)
Table with tax by country (SEK/km) [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Tax_Country_Base2019	S/A user	Tax by country Table
Tax by Category (SEK) [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Tax_Category_Base2019	S/A user	Tax by Link class
Tax by Link (SEK) [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Tax_Link_Base2019	S/A user	Tax by link
Toll for bridges (SEK) [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Toll_Link_Base2019	S/A user	Toll bridges
Network specific of scenario [Geodata]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Network	S/A user	Scenario Network

Text field name in template	Example of value	Model User's rights	Name of file in Data Section window
Port terminals (pilot fees values) [Geodata]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Ports_Swe	S/A user	Ports Sweden
Zones and terminals attributes [Geodata]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Nodes	S/A user	Nodes
Nodes commodities (interchanges allow) [Geodata]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Nodes_commodities	S/A user	Nodes commodities
Frequency data (# transport /week) [Geodata]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb\Frequency_network	S/A user	Frequency network
Table with Rail Capacity [Table]	C:\Samgods\Scenario_Tree\Base2019\Scenario_Data.mdb \Rail_Capacity_Base2019	S/A user	RailCapacity Table

The last three catalog keys are only accessible in model developer mode with the exception for Wait time (that could be also specified by the Advanced user). They define the base scenario, the folder for the Python program and the wait time for prompt message during execution, see Table 8.

Table 8 Developer and advanced user keys

Text field name in template	Example of value	Model User's rights
Location of Python Program	C:\Python27\ArcGIS10.2	Developer
Scenario name for the BASE scenario	Base2019	Developer
Wait time for prompt messages during execution (default 10 minutes = 600 seconds):	600	Developer Advanced user
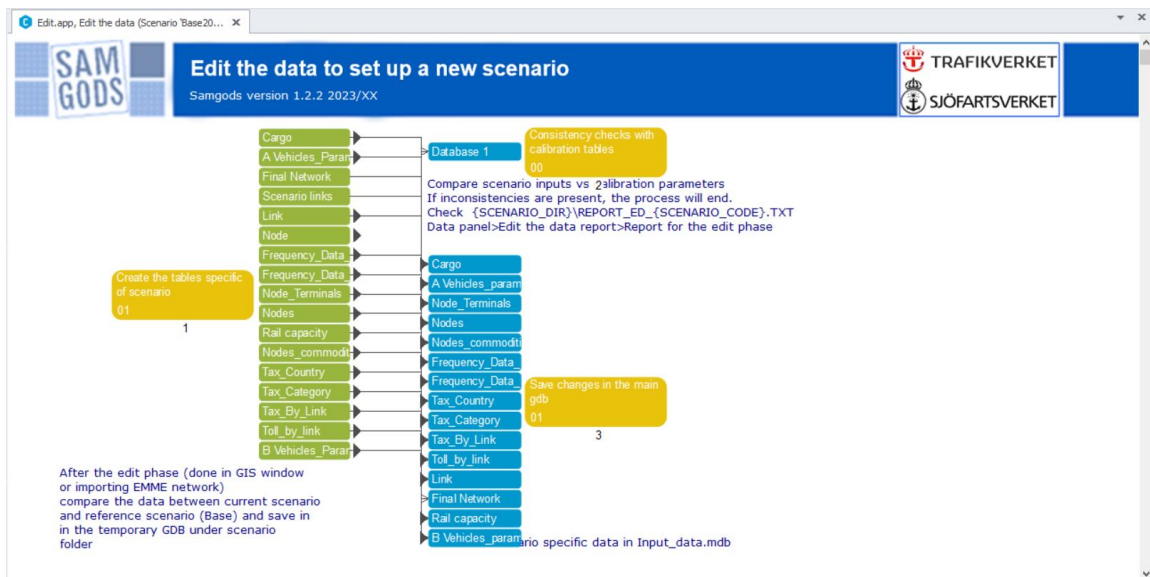
Figure 25 The *Edit the data* application

The output of the *Edit the data* application, a log report containing information on the execution of the application, can be found in the folder Scenario Outputs\Edit the data Report in the Data

Section window. This file contains a list of numbered messages giving information on, e.g., whether any data is missing in the input data (e.g. a missing port in the ports_swe table). For a list of messages, see Chapter 11.

7.5. Samgods Model application

A schematic picture of the *Samgods Model* application is outlined in Figure 26. The *Samgods Model* application is the core of the system, since it has the purpose to:

- run the Samgods model
- make sure that all required input data exists (in the main geodatabase or created along the process)
- save all the outputs in the right places (depending on the request of the user)

The Samgods Model application provides three different processes integrated in a unique application:

- The logistics module (in the document it could be referred to as Standard Logistics Module or STD - steps 4,5,6,and 7): the transport solutions are produced considering all the available chains and the results are summarized in vehicle, tonne and empty vehicle matrices assigned to the transport network. The solution considered for each firm-to-firm relationship is one and only one in the deterministic method. Applying the variable VARI the stochastic approach will be invoked, in this case the probability of usage between Stochastic approachbest choice and second/third/fourth and fifth choice will be estimated. The lambda parameter (VARI) can specified by commodity group and F2F segment using a table in access database.

- The Rail Capacity Management module (steps 8, 9 and 10): in an iterative process the transport chains solutions using rail infrastructure are modified with the goal to redistribute the flows and reduce the congestion on the rail network. In each iteration a new alternative per each firm-to-firm using rail links may be added. It may be added if it represents a new alternative since possibly existing alternatives are already in the list of alternatives, to the capacity problem manager (called LP since it involves the definition of a linear programming problem). The variables in the LP model are the usage split of the available solutions per f2f-relation. The initial step is denoted LP0 and considers the best solution from the logistic module and the second best choice. In principle new alternatives are successively added in step LP1, LP2 etc. until the total LP model cost is minimized, i. e. when the solution has converged according to defined stopping criteria, or no new columns have been found. In the current setup the stopping criteria applied is when the maximum number of iterations is met (catalog key Maximum number of loops for Linear Programming process (LP) has this purpose). Should any rail links still be overloaded after stopping, the best option to adress the issue is to run yet one LP-iteration. In cases with severe overload / tight capacity it may be necessary to run RCM with a higher cost for acquisition of extra capacity (parameters CAPCOST and EXTRA_CAPCOST in the contol file MPS_LP.ctl to force usable alternatives to appear).

- The calibration module (steps 1,2,11 and 12): details will be provided in the documents listed in Section 13. It has been used to calibrate the current version. The standard and advanced user are not allowed to access to the catalog keys that control this process.

The steps related to the Logistics Module are:

- LOS calculation (step 4) – the step where the Level Of Service matrices are calculated. There is one LOS matrix for each vehicle type providing transport time, transport

distance, infrastructure fees/charges and the domestic distance for zone-to-zone relations. The LOS matrices are mandatory input to the Samgods model, see [1].

- Logistics module (step 5) – the step where the freight flows of the different commodities are assigned to transport chains
- Assignment (step 6) – the step where the freight flows are assigned to the infrastructure network
- Reports (step 7) – the step where all standard reports (also called summary reports) from the *Samgods Model* application are produced

The steps related to the RCM module are:

- Rail Capacity Management (step 8): using the results from standard logistics module sets up the LP and provides a new revised set of vehicle and tonne OD matrices.
- Assignment RCM (step 9) – the step where the freight flows are assigned to the infrastructure network. The empty rail assignment considers the congestion on rail links by applying a vehicle-delay function that depends on bidirectional link flows, the other modes maintain the standard all-of-nothing assignment.
- Reports RCM (step 10) – the step where all standard reports (also called summary reports) from the *Samgods Model* application are produced with results for RCM

We refer to the reference material listed in Section 13, for further information of the Samgods model.
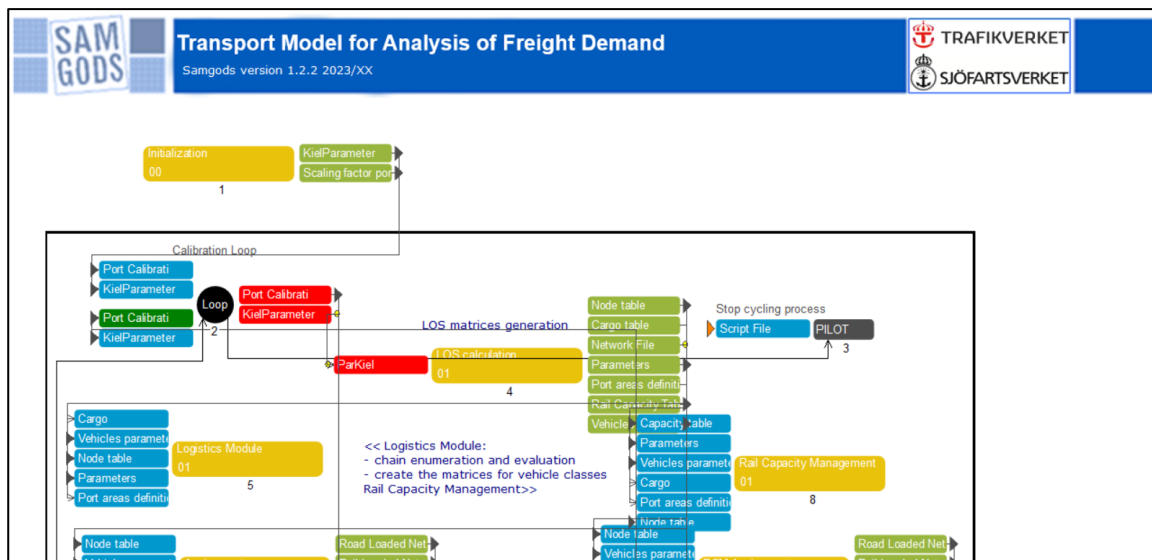
Figure 26 The *Samgods Model* application

7.5.1. Standard Logistic Module

The first four steps of the application represent the "standard" module where the capacity and congestion on rail links are not considered. This "standard logistic" module has different choice dimensions, depending on the results that the user wants to simulate (as showed in Figure 27).
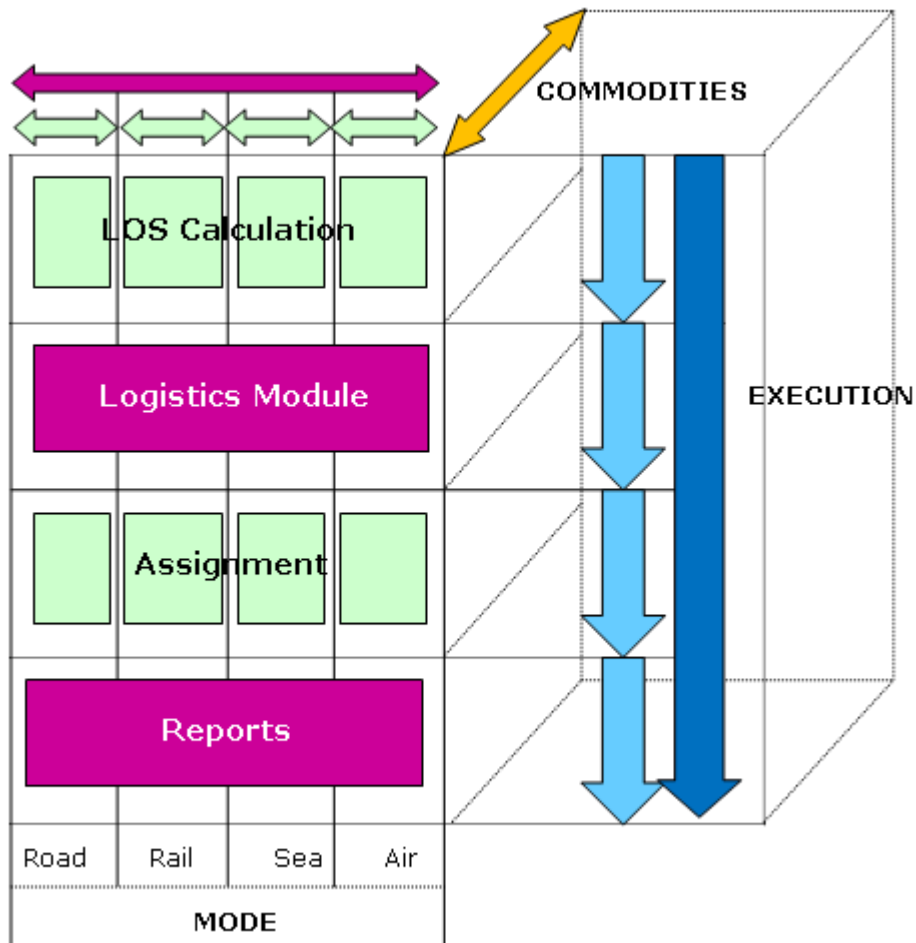
Figure 27 Different ways to run the *Samgods Model* application for the standard part

All the possible dimension are:

- The model could be run as an uninterrupted process or step-by-step (illustrated in the figure by the blue arrows to the right)
- It is possible to run all the commodities at once or one commodity at the time (illustrated by the yellow arrow at the top of the figure)
- For the steps *LOS Calculation* and *Assignment* is it possible to run all the modes or only a specific mode (illustrated by the green boxes to the left in the figure)
- It is possible to select which specific outputs to save from running the Samgods model

Not all combinations of these choices are allowed. Details are given in the following paragraph. During the run, the user will be informed with a prompt window whether the selections made are coherent with each other.

The option to run the model for one mode at a time is allowed only for the steps highlighted in green, i.e. *LOS Calculation* and *Assignment*. This is due to the fact that the Logistics module needs LOS matrices for all modes. A reason for running only a specific mode could be that the differences in the input data are related only to one mode. For instance, if no other changes have been made in the input data, there is no need to rerun the whole scenario in the *LOS Calculation* step. Regarding the *Assignment* step, the user may be interested in examining the assignment of the freight to the network for only one mode.

The fourth step, *Reports*, produces summary reports from running the *Samgods model* application. Since this step summarizes the three previous steps, a full run of all four modes needs to be done to obtain complete reports.

It is allowed to run all steps related the standard logistic module in the *Samgods model* application for only one specific commodity group (as illustrated by the blue arrows). With the new setting of empty add-on factors for empty rail flows, these will be correct at any level of disaggregation. For other vehicle types the empty flow distributions are not separable, i. e. the sum of individual commodity based empty flow generations will not sum to the empty flow generation from the combined set of commodities.

If changes in the input data are detected after the LOS matrices have been created, the program will prompt the user with a message in the report file in the folder Scenario Outputs\Samgods report\Existing Outputs in the Data section window. During the execution, the user is provided with the option to cancel the run (by ticking the answer "Do you want to check data and skip the process?"). See Chapter 11 for further information on the log reports.

The last step of the application represent the "Rail Capacity Management" module where capacity and congestion on rail links are taken into account. This module has several sub-steps:

- Rail Capacity Management – the step where the freight flows of the different commodities are assigned to transport chains considering link congestion on rail
- RCM Assignment – the step where the freight flows are assigned to the infrastructure network considering link congestion on rail
- Results RCM – the step where all reports for the Rail Capacity Management module are produced

For the "rail capacity management" it is not possible to select which commodity and mode to run, it is mandatory run all the commodities and all the modes. In fact, the rail capacity management module considers the congestion on the rail links, and to do this properly you have to consider all the commodities and modes simultaneously. Like Standard Logmod, you can select which step to run:

- Rail Capacity Management (all below steps togethar)
- RCM: only LP steps
- Assignment RCM: assign final matrices
- Reports RCM: produce RCM reports

For the *Samgods Model* application there are several groups of catalog keys.

The first group is "Scenario parameters" and it contains only two key that specifies calibration database to b used and the number of zones\terminals in the network.

Table 9 "Scenario parameters" key

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Calibration parameters for reference scenario (Base2019 for year 2019 and MainSc2045 for year 2045)	Base2019 or MainSc2045	This key is introduced since scenario specific calibration parameters are available. Scenarios for 2019 should use settings Base2019 in order to point out the right calibration parameters	Developer
2	Number of zones/terminals in network (see value in scenario network)	1382	Number of zones plus terminals in the network	S/A user

The next group of catalog keys is only available in developer mode and it contains installation parameters.

Table 10 "Installation Parameters" keys

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Location of python program	C:\Python27\ArcGIS10.6	It specifies the installation directory for Python program	Developer
2	Location of Java folder	C:\Windows\System32	It specifies the installation directory for Java	Developer
3	Path to cmd.exe	C:\windows\sysnative\cmd.exe	Location of cmd.exe program	Developer
4	Scenario name for the BASE scenario	Base2019	It specifies the name of the base scenario	Developer
5	Hard Drive where the model resides	C:	Hard drive on which the model resides	Developer

The next group of catalog keys, "Run Selections", refers to the execution order specifying which steps to run (see Table 11).

Table 11 "Run Selections" keys

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Run only one step, or run all steps	All steps	It specifies which step that is to be run for Standard Logistic Module; it is possible to specify only one application or all the steps	S/A user
2	Choose PWC matrices	2019	It specifies the year for the PWC demand matrices	S/A user
3	Select the mode for the LOS Calculation and the Assignment steps	All	It specifies which mode that is to be run; it is possible to specify only one or all the modes NOTE: if you run RCM, you need to consider all the modes	S/A user
4	Select commodities for the Logistics Module (for all commodities, select 0)	0	It specifies which type of commodity that is to be run; it is possible to specify only one commodity type (value from 1 to 16 or all the commodities (value 0) NOTE: if you run RCM, you need to consider all the commodities	S/A user

Possible input values for the first key listed in Table 11 are:

- STD LOS calculation: it indicates to run only "LOS calculation" step (#4)
- STD Logistics module: it indicates to run only "Logistics Module" step (#5)
- STD Assignment: it indicates to run only "Assignment" step (#6)
- STD Reports: it indicates to run only "Results" step (#7)
- STD All steps: it indicates to run all the "Standard LogMod" steps (LOS calculation + Logistic module + Assignment + Reports) (#4+5+6+7)
- RCM Rail Capacity Management Module: it indicates to run "Rail Capacity Management" step (#8)
- RCM Assignment: it indicates to run "RCM Assignment" step (#9)
- RCM Results: it indicates to run "Results RCM" step (#10)

- RCM All steps: it indicates to run all the "Rail Capacity Management" steps (RCM + RCM Assignment + Results RCM) (#8+9+10)
- All steps: it indicates to run all the steps

Note that, when running Standard Logistic Module, the input for Rail Capacity Management procedure is created in the scenario folder. Therefore the Rail Capacity Management procedure must be run after a full run of Standard Logistic Module.

Output is produced from all steps in the *Samgods model* application. Together with the Microsoft Office tools (such as Access and Excel) this output can be analyzed in-depth in various ways. The purpose of the standard reports produced in the Report step is to give the user a quick overview of the results from running the *Samgods model* application.

Possible input values for the second key (Year of PWC matrices) in Table 11 are:

- 2019: PWC matrices for year 2019
- 2045: PWC matrices for year 2045
- 2045_S0: PWC matrices for year 2045
- Any other value inserted by the user. Follow the general rule to create a folder under 01_Programs\LogMod\Input\PWC\, for instance "2045IRONORE", and give the same name to the catalog key

Possible input values for the third key listed in Table 11 are:

- All
- Road
- Rail
- Sea
- Air

The last key has a more general function. It is used in all the applications where the output data is filtered by commodity. It is the most important catalog key of these three keys. If the Samgods model first is run for commodity type 1 (for instance), then for all the commodity types (key set to zero), then both the results for commodity type 1 and for all the commodities will be saved. In the scenario folder (under Scenario_Tree, see Table 1), the name of the specific output database is OutputX_{SCENARIO_SHORTNAME}.mdb, where X is the commodity group. Switching from one set of output to another in the interface is easily made by changing the value of this catalog key and click "Save". The possible values for this key are the numbers representing different commodities or zero, representing all commodities. The possible commodities are the commodity types (1-16). See the Appendix or for instance the Program Documentation [2] for more information.

The report "Existing Outputs" (in the folder Scenario Outputs\Samgods Report in the Data Section window) is updated during each run and it gives information on the output and the commodity class.

The next set of catalog keys, "Other options", refers to the optional outputs which can be saved in the scenario folder, see Table 12.

Table 12 Other options keys

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Do you want to produce buildchainxx.log files?	None	It indicates if you want to generate a log file containing any warning that can occur during the execution of the Buildchain program	S/A user
2	Do you want to use exogenous consolidation rates?	Yes	It provides the ability to choose between the two cases: • Providing the consolidation rates from another run (exogenous) • Producing the consolidation rates during the run (endogenous)	S/A user
3	If yes in previous catalog key, provide location of consolidation rates folder	C:\Samgods\Scenario_Tree\Year_2019\Base2019\LogMod_1\ChainChoi\output\	It works if they are provided exogenously, letting the user to define a folder where reside the consolidation files.	S/A user

The first key lets the user to select whether the Buildchain program will produce log files or not. The log files (*.log) contain any warnings that can occur during the execution. Please see the Program documentation for the logistics model [2] for more information.

The second and third keys represent a specific enables the user to inherit consolidation rates from another scenario (exogenious), this settings has impact on "Samgods model" and "Elasticity module" scenario setup is provided below.

Consolid Rate by Mode and endogenous consolidate rates by Mode

Use

The major development in current version 1.2.2 focuses in provide stable solutions when assessing forecasting scenarios , where stable means sensible results when comparing costs across different alternatives. For the way the optimization problem was previously formulate, every scenario was creating their own alternative and solutions in relation to consolidation factors, ending up in controintuitive and hard to hanlde results.

To stabilise the consolidation process, the following functionalities are now in place:

- ○ A new input table which provides a Lower Bound Ratio for the consolidatin level
- ○ A list of exceptions on consolidation rates and maximum capacities for specific OD's movements , MODE and commodity
- ○ The option to start the optimisation from a set of consodlitation rates produced exogeously from another scenario. The process will evaluate this set in conjunction with a new set of solutions rather start to generate a complitely new set.

The first two are tables present in the Input_Data.mdb (respectively LBD_Ratio and MaxCapAndConsolExcept) , while the third is delivered through the use of the second and third key in Table 12.

In absence the user can select the option to provide external consolidation rates by mode using the catalog key "**Do you want to use exogenous consolidation rates**?" sets to "**Yes**" or alternatively to generate the consolidation rates by mode during the "Samgods model " run.

The catalog key "**If yes in previous catalog key, provide location of consolidation rates folder**" is active, i.e. will effect the model run, only if the previous key has "Yes" as anwer. In this even the user must provide the phisical location of the LogMod\ChainChoi\Output\ folder where the consolidation files are stored from a previous run.

If the folder provided does not exist or the expected files (see discussion below) are not present the user will reseave the following warning:
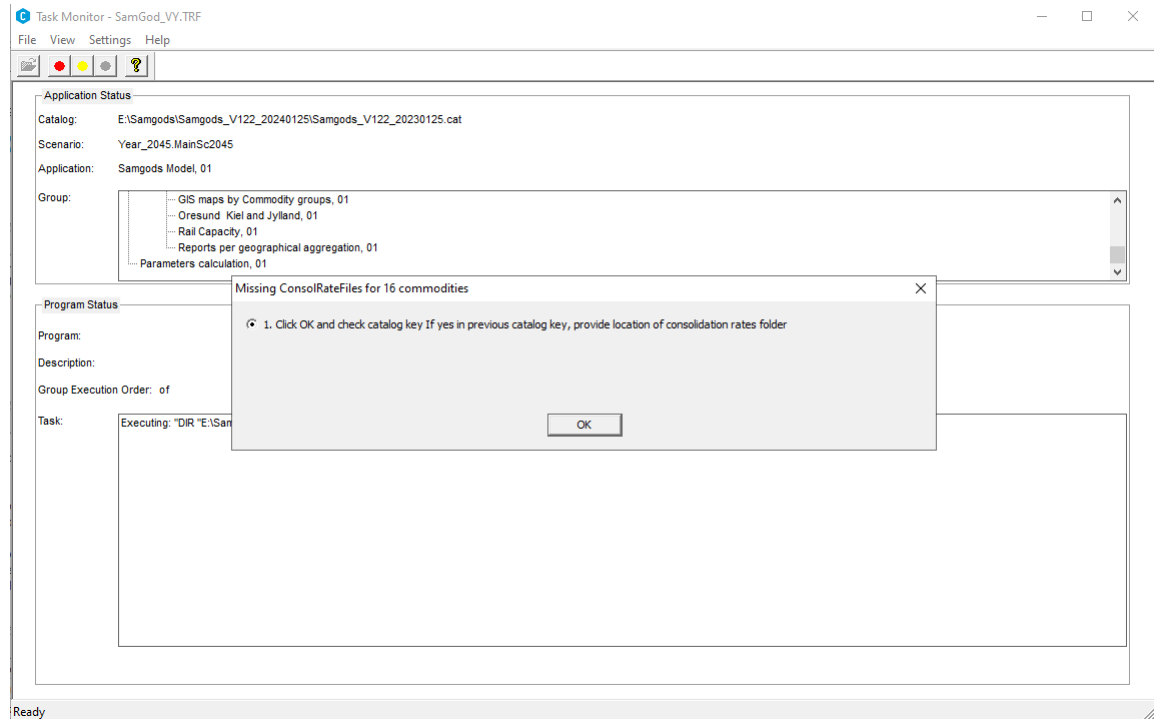
Figure 28 *Warning message*

The program is expecting 64 (16 commodity groups per 4 modes) files under the folder provided via the thrid catalog key with the following names:

- CONSOLX-ROAD.314
- CONSOLX-RAIL.314
- CONSOLX-SEA.314
- CONSOLX- AIR.314

Where X is the commodity number.

For all existing and new scenarios the default setting is "**Do you want to use exogenous consolidation rates**?" sets to "**No**". If the user wants to provide exogenour factors has to change the key to "**Yes**".

The second key has a default setting, i.e. refers to the specific reference scenario for each model year, i.e.:

- in model year 2019 to Base 2019:
  {CATALOG_DIR}\Scenario_Tree\Year_2019\Base2019\LogMod_1\ChainChoi\OUTPUT\
- in model year 2045 to MainSc2045:
  {CATALOG_DIR}\Scenario_Tree\Year_2045\MainSc2045\Logmod_1\ChainChoi\output\

> **Rule:** The general rule is: any child scenario (i.e. alternative scenario in the specific model year) should derive its consolidation rates from the parent scenario. The user has still the ability to provide a different set of consolidation rates from an unrelated scenario. Seek advice from Trafikverket if this option would be suitable for your specific study.

"Samgods model" scenario setup

The above rule has been reflected in the scenario setup providing by defaul the parent scenario for the consolidation rates. The user MUST rebember to activate the functionality setting "**Do you want to use exogenous consolidation rates**?" to "**Yes**"!! No other actions are required since the folder location is provided by default.

"Elasticity module" scenario setup

In the "Elasticity module" the above stated rule has an impact on the way it should be run.

The "Elasticity module" must have in place all the output files from the full "Samgods model" run, where the choice to use esogenous or endogenous consolidation rate is made. All the sensitivity tests produced under the "Elasticity module" will have in place the exogenous consolidation rates from the parent scenario, i.e. what has been produced under "Samgods model" run. Futher details on the operation of the module are provided in its dedicated section 7.12. It is reccomended to read in conjunction with this section.

The next group of keys allows the user to set the advanced options for the logistics module (heading "Logistics module settings – advanced") and is made up by seven catalog keys, see Table 13 below.

Table 13 "Logistics module settings – advanced" keys

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Stochastic approach: parameter for logit distribution (0=no stochastic approach used or actual value i.e. 0.1) by commodity and f2f type	{CATALOG_DIR}\05_Input_Data\Input_Data.mdb\CSTVARI	Table with lambda parameters by commodity group and f2f cells.	Developer
2	Total number of commodities (excluding empty commodities):	16	Total number of product groups in the setup (16 in Samgods 1.2). N_Flows is always 16 – number of product groups listed in catalog key 1	S/A User
3	Do you want to run the Logistics module on several processors?	Yes	It indicates if you want to run the model on several processors	S/A user
4	How many processors would you like to run simultaneously?	4	It specifies the number of processes to run simultaneously for all programs except LP2CC	S/A user

Nr	Text field name in template	Example of value	Description	Model User's rights
5	How many processors would you like to run simultaneously for LP2CC?	4	Specific limit for LP2CC since extremely RAM demanding. Each processor should, in average, have at least 2 GB of RAM available.	S/A user
6	Scaling factor for outputs	Thousands	It specifies the scaling factor for outputs – fixed at Thousands	Developer
7	Do you want to produce rescaled LOS and MC matrices per commodity group?	No	Produces extra outputs with LOS and Marginal Cost matrices rescaled with scaling parameters used for calibration	S/A user

If the computer has more than one CPU available, it is possible to split up the processes between the CPUs to speed up the run time of the model, using the catalog keys above. The seventh key enables the user to define the scale of the output that will be presented in the reports. If the value is thousands, the output value (for instance 2.000.000 vehicle kilometers) will be presented as the value divided by thousand (i.e., 2.000 vehicle kilometers in the example).

7.5.2. Rail Capacity Management

Next group of catalog keys, specifies several parameters for Rail Capacity Management (see Table 14). For a complete comprehension, we refer to documentation [7] and [3].

Table 14 "RCM Parameters" keys

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Cut off criteria for RCM process (will consider links with Number of vehicles over Capacity > XX% where XX is the value defined)	30	It specifies a percentage value for exclusion of link flows. According to experience, railway links with flow to capacity rates (V/C) at this or lower levels will not have any impact on the solution	Advanced user
2	Maximum number of iterations in Rail assignment	1	It specifies the maximum number of iterations in the empty train rail assignment (considering link congestion)	Advanced user
3	Delay function for Empty assignment (Derivate)	2*10000*(MAX (0, VOLC[LI.ID_LINK]-C))	It specifies the delay function used for the assignment of empty vehicles	Advanced user
4	Options to save output files from RCM process	Yes, for all iterations	It indicates you want to save output file from Rail Capacity Management process for all the iterations (for instance LP0, LP1, LP2 etc.) or only in the last iteration.	S/A user
5	Maximum number of loops for Linear Programming process (LP)	1	It specifies the maximum number of loops for the linear programming process (LP). The 0 value means that only LP0 will be perform. A different number between 1 and 9 will iterate the process until that number (or earlier if convergence will be reach).	S/A user

Nr	Text field name in template	Example of value	Description	Model User's rights
6	Table with list of locked solutions:	2019	Table under Input_Data_Calibration.mdb\ Lock_2019 Refer to the year to select different tables (2019, 2045)	Advanced user
7	Shipment size cut-off (tonnes)	1	Cut-off for shipment size in kg. For transports with shipment sizes below this level, alternative transport solution is not generated after iteration 0	S/A user
8	Marginal cost limit in MPS.jar (SEK)	998801	Limit of marginal cost to include extra capacity	S/A user
9	Acquisition of extra capacity (SEK)	1000000000	Cost to buy extra capacity. If set to 0, consistent with 1.1 implementation	S/A user
10	Link number to use in debug mode CheckLinkN_itXX.dat Max 10 links (Comma s, ex. 1,25,182,164)	51,82,84,234,272,274	Providing the ID_Link list an extra report will be produced under RCM folder.	Advanced user
11	List of rail modes in RCM:	GHhIiTUDdEFf	Switch between 35 to 40 vehicle types. List of associated modes of rail (see Logistic module documentation) Current setup allows only the full set of vehicle types. (The user may alter the use of rail modes by either forbidding modes in the network or by raise costs until modes are not chosen.)	Developer
12	List of vehicle types on Rail mode:	201,202,203,204,205,206,207, 208,209,210,211,212	List of vehicle types in rail mode (12 or 9). Current setup allows only 12 vehicle types (The user may alter the use of vehicle types by either forbidding modes in the network or by raise costs until modes are not chosen.)	Developer
13	List of chains for different numbers of vehicle classes:	Chain_List_2019	List of available chains (The user may select a different list of accepted chains)	Advanced user

The first key in the table above will filter the transport chain solutions for rail links where the ratio between total vehicle flows and capacity is greater or equals the value specified in the catalog key. Since the linear programming problem could be huge (millions of records), this limit could cut down the dimension of the problem. It is recommended to keep the default value. Links with lower capacity utalization than the defined threshold will not be considered in the RCM-module.

The second key specifies the maximum number of iteration for the rail assignment with capacity constraints.

The third key specify the delay function used for the assignment of empty vehicles; possible choices are:

- $2*10000*(MAX(0,VOLC[LI.ID\_LINK]-C))$
- $4*10000*(MAX(0,VOLC[LI.ID\_LINK]-C)^3)$

The fourth key indicates if you want to save output files from RCM process and possible choices are:

- Yes, for all iteration
- No, This option will save results only for the final iteration and the previous one

The options for key five are:

Run only LP0

  ○ Maximum number of loops for Linear Programming process (LP) = 0

Run only LP1

  ○ Maximum number of loops for Linear Programming process (LP) = 1

Run only LP2

  ○ Maximum number of loops for Linear Programming process (LP) = 2

The Samgods model could be run in several different ways. The current setup allows the following choices (using "Run only one step, or run all steps" catalog key and catalog keys 1 and 4 in Table 11:

- All: an interrupted run from LOS to reports for RCM. The number of LP and Adjust LP will be specified by catalog keys 5 and 6
- Logistics Module or Assignment or Reports: a single step for standard log mod
- Standard LogMod: all the steps related to Standard Logistic module (LOS +Logistic Module +Assignment +Reports)
- RCM or RCM Assignment or Reports RCM: a single step for Rail Capacity Management
- Rail Capacity Management: all RCM steps running the number of LP loops specified via key 5

For instance, in a previous step LP1 has been run, and it is required to run LP2, it will be sufficient set the model in the following manner:

- Run only one step, or run all steps=Rail Capacity Management
- Maximum number of loops for Linear Programming process (LP) =2

The last catalog keys allow different setup regarding the available vehicle classes, their minimun shipment size, costs associated to buy extra capacity and chain types. Samgods 1.2.2 provides 40 vehicle classes:

- Vehicle classes 106 (heavy trucks), 210, 211, 212 (longer trains), 322 (inland waterway) are forbidden to be used in the network in the standard setup. To activate them it is sufficient to open in the input network the set of links that should use the specific vehicle class. Also make sure the vehicles are included in the chain list.
- Vehicle class 209 is not used in the model. All the input data and settings for it could be used to describe a new vehicle type

7.5.3.   Calibration

Next group of catalog keys specifies parameters and table for calibration and they are available for developer users only (see Table 15). The calibration procedure should be not used at all by standard user. The following keys should not be changed, except catalog key 7.

Table 15 "Parameters and tables for calibration" key

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Maximum number of loops in calibration process	1	It specifies the maximum number of loops to run in the process	Developer
2	Restart process from loop	1	The calibration procedure could be run for a fix number of loops. If the run crashes at a specific loop or it is required to run an extra loop, this catalog key sets the loop number to restart with.	Developer
3	Consolidation factors table	C:\Samgods\05_Input_Data\Input_Data.mdb\BuildChain_CONSOL	Individual consolidation bounds for all sub modes [LB, HB] Default values and specific values by commodity group.	Developer Advanced user

In addition to the available keys within the graphical user iterface, several settings for the calibration is now avaliable within the calibration database (in earlier versions they were available in the graphcial user interface as well). See Table 16 for those settings.

Table 16 Settings for the calibration listed in the Calibration Database

ID	Location	Description
4	C:\Samgods\05_Input_Data\Calibration\Input_Data_Calibration_Base2019.mdb\PortAreaParams_16_Comm_Base2019[4]	It specifies a text file containing the initial values of factors for port areas; these values are specific by port area and commodity group. These scaling factors are applied to time for sea vessels 301 – 322.
5	C:\Samgods\05_Input_Data\Calibration\Input_Data_Calibration_Base2019.mdb\KielCanal_Parameter_Base2019[5]	It specifies the initial values of factor for Kiel canal. This scaling factor is applied to the canal toll
6	C:\Samgods\05_Input_Data\Calibration\Input_Data_Calibration_Base2019.mdb\Parameters_portcalibration	Step length, minimum value, cat off value and default minimum value for calibration procedure on port areas
7	C:\Samgods\05_Input_Data\Calibration\Input_Data_Calibration_Base2019.mdb\Parameters_Kielcalibration	Step length, minimum value, cat off value and default minimum value for calibration procedure on Kiel canal

The calibration procedure uses a set of initial values specified via ID 4 and 5 in Table 16, and progressively changes those values comparing the results with statistics. It applies a revision to the values using a step length search specified in ID 6 and 7. For further details on this please see [3].

Catalog keys 1 and 2 are used to manage and control the calibration process. The first sets the maximum number of loops for the process, the second allows to run extra loops after a completed run. The catalog key 3 allows specification of a different consolidation factors table and could be used in setting up sensitivity tests for the lower and upper bounds for each submode. The last catalog key is only accessible in model developer or advanced user mode and it defines the wait time for prompt message during simulation running (see Table 17).

---

[4] Scenario specific and is also available for the prognosis year 2045
[5] Scenario specific and is also available for the prognosis year 2045

Table 17 Settings key

Text field name in template	Example of value	Model User's rights
Wait time for prompt messages during execution (default 10 minutes = 600 seconds)	600	Developer Advanced user

For a standard user the model will prompt window messages along the run and wait for the reaction from the user for 10 minutes. After that time it will apply the first choice available in each message and the run will continue to the next prompt window. The advanced user could decide to reduce the wait time to a small value. This choice, in other words, is suitable when several scenarios must be run in a sequence, since it will not require any action from the operator.

7.5.4.   Outputs

Based on the selections made by the user, different outputs are created – one set of outputs for each specific setting of the catalog key "Select commodities for the Logistics Module (…)" for Standard LogMod. The output files and their locations are listed in the file Scenario Outputs\Samgods Report\Existing Outputs in the Data Section window.

Regarding empty vehicle calculations, the reader is referred to the appendix section 14.2 for further details.

The available outputs from the respective steps in the *Samgods model* application that can be accessed from the graphical user interface are:

LOS Calculation step

- LOS matrices by mode showing distance, time, extra cost, domestic distance and generalized cost summarized link-by-link along the minimum cost path (if the *LOS Calculation* step or the whole run was selected)

Logistics module step

- The loaded vehicle matrices (number of vehicles) by vehicle type (if the *Logistics module* step or the whole run was selected)

- Tonnes flow matrices – tonnes of freight by vehicle type (if the *Logistics module* step or the whole run was selected)

- The empty vehicle matrices (number of empty vehicles) by vehicle type (if the *Logistics module* step or the whole run was selected and the attribute "EMPTY_V" in the Vehicles Parameters table was set to 1 for the specific vehicle type, see Section 9.4).

- OD covered – various output reports per vehicle type, chain type, zone, and commodity – all the output used to create summary reports no. 5-8,6b, 10,11,12 and 19 (see Table 55)

Assignment step

- All freight flows in tonnes, number of loaded vehicles and number of empty vehicles assigned to the network by vehicle type (if the *Assignment* step or the whole run was selected).

Report step

- The freight flows in tones, number of loaded and empty vehicles assigned to the network with all modes in the same network (if the *Report* step or the whole run was selected).

- Summary report no. 1. Summary table of number of vehicle kilometres per vehicle type (domestic and in total) and per mode in the assigned network (if the *Report* step or the whole run was selected).

- Summary report no. 3. Summary table of number of tonne kilometres per vehicle type (domestic and in total) and per mode in the assigned network (if the *Report* step or the whole run was selected).
- Summary report no. 4. Summary table of tonne kms per vehicle type (domestic, international and total) and per mode (if the *Report* step or the whole run was selected)
- Summary report no. 9. Summary table of vehicle kms, tonne kms, empty vehicle kms, and total vehicle kms per geographic region and mode (road and rail only) (if the *Report* step or the whole run was selected).
- Summary report no. 13. Summary table of tons per port area and commodity group and comparison with statistics (if the *Report* step or the whole run was selected)
- Summary report no. 14. Summary table of results on Oresund bridge, Kiel Canal and Jylland and comparison with statistics (if the *Report* step or the whole run was selected)
- Network with bidirectional tonnes per rail vehicle type
- Summary report no. 16. Summary table of vehicle kms per county and vehicle type and their distribution on all the roads (if the *Report* step or the whole run was selected)
- Summary report no. 17. Summary table of vehicle kms per county and vehicle type and their distribution on E10 (category 11) (if the *Report* step or the whole run was selected)
- Summary report no. 18. Summary table of vehicle kms per county and vehicle type and their distribution on all the roads except E10 (if the *Report* step or the whole run was selected)
- Report Tons per commodity groups and total (Ktons): GIS network with Ktons per commodity group and totals. For its visualization under Report\GIS maps is present a standard map (GIS map with Ktons by Commodity group)
- Report Loaded and empty vehicles per commodity groups and total (Vhcl): GIS network with Loaded Vhcl per commodity group and totals, plus emtpy totals. For its visualization under Report\GIS maps is present a standard map (GIS map with vhcl by Commodity group)

RCM Logistic Module step (if the *Rail Capacity Management* step, *RCM* step or the whole run was selected)

- The loaded vehicle matrices (number of vehicles) by mode and vehicle class
- Tonnes flow matrices – tonnes of freight by mode and vehicle type
- The empty vehicle matrices (number of empty vehicles) by mode and vehicle type
- OD covered – various output reports per vehicle type, chain type, zone, and commodity – all the output used to create summary reports no. 2, 5-8, 6b,10,11,12 and 19 (see Table 55)

RCM Assignment step (if the *Rail Capacity Management* step, *Assignment RCM* step or the whole run was selected)

- All freight flows in tones, number of loaded vehicles and number of empty vehicles assigned to the network by mode

RCM Report step (if the *Rail Capacity Management* step, *Report RCM* step or the whole run was selected)

- The freight flows in tones, number of loaded and empty vehicles assigned to the network with all modes in the same network

- Summary report no. 1. Summary table of number of vehicle kilometres per vehicle class (domestic and in total) and per mode in the assigned network. See appendix section 14.2 for details
- Summary report no. 3. Summary table of number of tonne kilometres per vehicle type (domestic and in total) and per mode in the assigned network (if the *Report* step or the whole run was selected).
- Summary report no. 4. Summary table of tonne kms per vehicle type (domestic, international and total) and per mode
- Summary report no. 9. Summary table of vehicle kms, tonne kms, empty vehicle kms, and total vehicle kms per geographic region and mode (road and rail only) See appendix section 14.2 for details
- Summary report no. 13. Summary table of tonnes per port area and commodity group and comparison with statistics
- Summary report no. 14. Summary table of results on Öresund bridge, Kiel canal and Jylland and comparison with statistics
- Summary report no. 15. Summary table of bidirectional number of trains and tonnes per day
- Summary report no. 15b. Summary table of bidirectional number of trains and tonnes per day indicating capacity and train flows above the capacity level
- Network with bidirectional tons per mode
- Summary report no. 16. Summary table of vehicle kms per county and vehicle type and their distribution on all the roads
- Summary report no. 17. Summary table of vehicle kms per county and vehicle type and their distribution on E10 (category 11)
- Summary report no. 18. Summary table of vehicle kms per county and vehicle type and their distribution on all the roads except E10
- Comparison Ml Tons RCM vs Standard per mode: GIS network with differences between RCM and standard results in million of tonnes per each mode
- Report Tons per commodity groups and total (Ktons): GIS network with Ktons per commodity group and totals. For its visualization under Report\GIS maps is present a standard map
- Report Tons per commodity groups and total (Ktons): GIS network with Ktons per commodity group and totals. For its visualization under Report\GIS maps is present a standard map (GIS map with Ktons by Commodity group)
- Report Loaded and empty vehicles per commodity groups and total (Vhcl): GIS network with Loaded Vhcl per commodity group and totals, plus emtpy totals. For its visualization under Report\GIS maps is present a standard map (GIS map with vhcl by Commodity group)

7.6.   Compare scenarios application

A view of the application can be seen in Figure 18. The purpose of this application is to compare model outputs between two scenarios. Each scenario can be compared with any other scenario present under the Scenario Tree structure. There are four catalog keys (five for a model developer) to handle this application, see Table 18.

Table 18 *Compare Scenarios* **application catalog keys**

Nr	Text field name in template	Example of value	Description	Model User's rights
1	Location of Python program	C:\Python27\ArcGIS10.2	It specifies the installation directory for Python program	Developer
2	Select commodities for the Logistics Module (for all commodities, select 0)	0	It specifies which commodity type result must be compared; it is possible specify only one commodity type (value from 1 to 16), or all the commodities (value 0)	S/A user
3	What do you want to compare?	LOS Matrices	It specifies which set of result to compare; it is possible to specify a single step or all the steps	S/A user
4	Scenario's name to use in comparison (ex. Test19)	Base2019	It specifies the name of the scenario to compare with the current scenario	S/A user
5	Scenario folder for comparison (ex. C:\Samgods\Scenario_tree\Year_2019\Test19\)	C:\Samgods\Scenario_Tree\Base2019\	It specifies the directory of the scenario to compare with. It requires the full path (C:\....), not the relative path (Scenario folder)	S/A user

The user needs:

- to select the scenario name that he/she wants to compare with the current scenario using the forth catalog key;

- to identify the folder location for the scenario used for comparison (e.g. folder where the outputs for scenario selected with previous catalog key are located., usually under Scenario_Tree folder plus short scenario name) and to update accordingly the fifth catalog key value;

- to select which commodity type results to compare (select the commodity number or 0 for all in the second catalog key) between different scenarios. It is the user's responsibility to verify that the same outputs exist for both scenarios. This could be done by looking in the Existing Outputs file for the respective scenario, found in the folder Scenario Outputs\Samgods Report in the Data section window. If the requested files do not exist for any of the scenarios, the process will be terminated with return code 2 from the Task Monitor program, see Section 6.6.

- With the third catalog key the user has the option to compare only a specific set of output (among the ones listed below) or all of the results

Three sets of output will be produced by this application:

- The LOS matrix comparison: the difference values with sign between the base scenario and the selected scenario for each matrix by mode

- Logistics Module output comparison: The OD matrices with number of vehicles (totals and empties) and the tonnes are analyzed as well as the margins of the matrices for the vehicle OD matrices (TRIPEND) (the margin is the sum of each row and column respectively, i.e., the totals of attraction and generation): the absolute differences between the base scenario and the selected scenario.
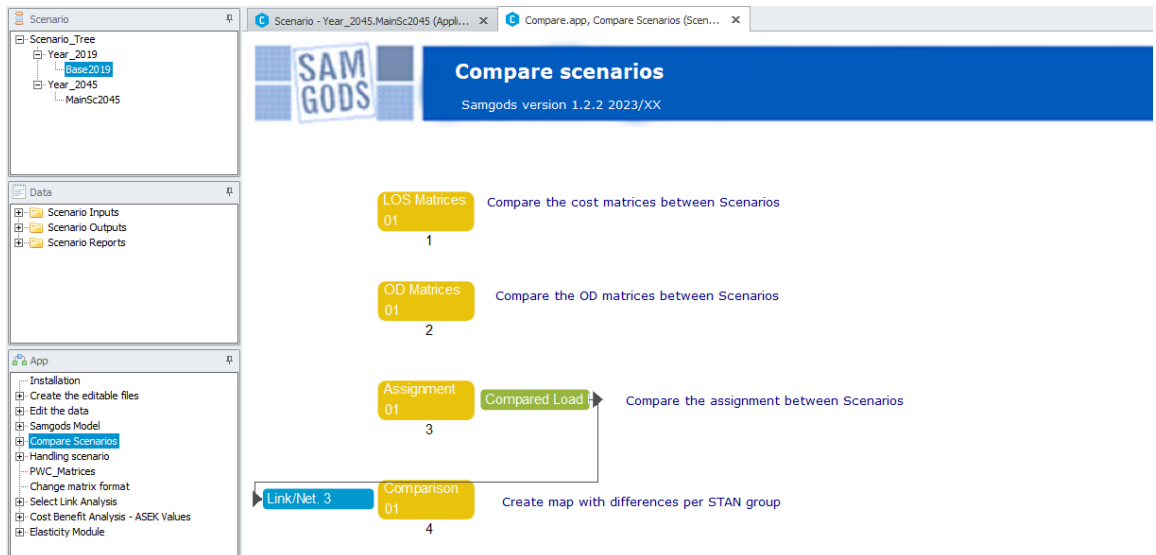
- The Assignment comparison: the differences between the assigned network for the base scenario and the selected scenario in absolute values
- Under Compare\GIS Maps exists the standard GIS map with differences (Ktons) on totals and by commodity group

7.7. Handling scenario application

Figure 29 shows an outline of the *Handling Scenario* application. As described earlier, the scenario data is stored in the main geodatabase as a group of scenario specific table\s, so managing this group of files requires dedicated tools to avoid creating any inconsistencies in the input data between scenarios. This application allows the user to delete all no longer required data, to easily import or export scenarios from or to other catalogs, to set up a new structure with a new base scenario, etc.

This application has different subgroups with specific purposes, all of them related to handling the scenario data. The structure can be seen in the applications tree in the Applications window.
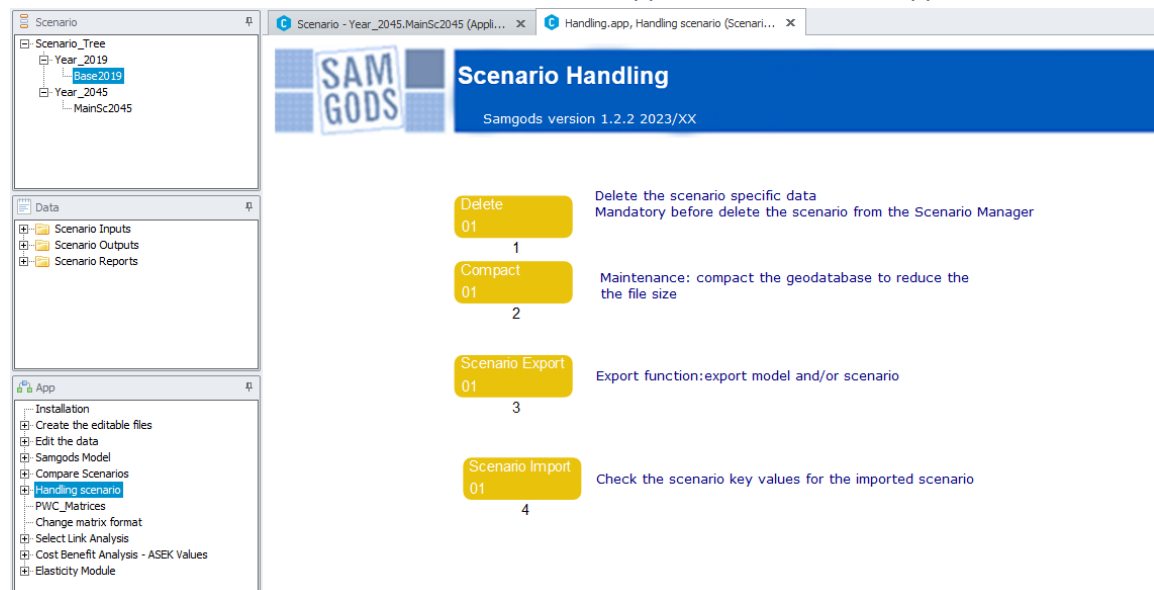

Figure 29 *Handling scenario* application

Each subgroup corresponds to a specific operation:

- **Delete**: delete the scenario-specific tables completely in the main geodatabase
- **Compact**: compress the geodatabase files to save disk space (see Section 8.9 for further information)
- **Scenario Export**: This subgroup has two main purposes:
  1. One is to enable the setup of a new catalog, using the current scenario (i.e., the scenario that the application is executed for) as the base scenario in the new catalog. One case where it may be appropriate to create a new catalog with a new base scenario is if one of the scenarios in a catalog is being used as the base scenario in a new project. Another reason could be that the database becomes too large (with too many alternative scenarios, for instance), since it has a physical limit for its size. Then it may be appropriate to create a new catalog with a base scenario that is a copy of the original, where more alternative scenarios (belonging to the same overall project) may be stored
  2. Another one is to enable to export the scenario-specific tables for a specific scenario into another, already existing catalog with a different base scenario. The exported scenario can never become the base scenario in the destination catalog – if the user wants this, then alternative 1. above must be used. This function is useful e.g. when the user wants to set up a scenario in a new catalog with a certain base scenario, and already has a similar scenario in another catalog with another base scenario. Then the old scenario can be exported to the new catalog and the user only has to change some of the input data, instead of starting all over again
- **Scenario Import**: When the scenario-specific tables have been exported to another catalog using the previous subgroup (Scenario Export), the Scenario Import tool is used to control whether the scenario parameters in the new catalog have the same values as those in the imported scenario.

As showed in the Table 19, the first two groups of catalog keys specify scenario parameters and parameters for the logistics module. These keys are used only by the Scenario Import subgroup; no editing is required for these keys otherwise.

Table 19 Catalog keys for the Import subgroup

Nr	Text field name in template	Example of value	Model User's rights
1	Attribute name for extra cost on specific link (SEK)	EC_V	S/A user
2	Attribute name for extra cost on specific link (SEK/km)	EC_KM_V	S/A user
3	Number of operating days per year for all modes (except for Rail Mode) (days/year)	250	A user
4	Number of operating days per year for Rail Mode (days/year)	250	A user
5	General parameters for Logistics Module [Table]	C:\SamGods\Scenario_Tree\Base2019\Scenario_Data.mdb\LogMod_Base2019	A user/ Developer
6	Interest rate used in cost calculations (%/year)	0.1	S/A user
7	Stuffing cost (SEK/tonne)	60	S/A user
8	Number of transport chain solutions for the Logistics Module	5	S/A user
9	Output variables for the optimal transport solution [e.g.1,2,3, max is 8]	6,7	S/A user
10	Initial consolidation factor in BuildChain (1° iteration)	0.75	S/A user
11	Allow consolidation for all lorry types	Yes	S/A user

Nr	Text field name in template	Example of value	Model User's rights
12	Evaluate transport chains one leg at a time	Yes	S/A user
13	Lower bound for frequency optimisation (Annual Tonnes/Shipment)	1000	S/A user
14	Lower bound for consolidation factor (applied to all commodities – from 0 to 1)	0.05	S/A user
15	Upper bound for consolidation factor (applied to all commodities – from 0 to 1)	0.95	S/A user
16	Calculation for demand affecting shipment size	DYNAMIC_AVERAGE	S/A user
17	Do you want to log parameters from control files?	Yes	S/A user
18	Do you want to log reading of input data?	Yes	S/A user
19	Do you want to log cost values from vehicle files?	Yes	S/A user
20	Do you want to produce DATA for option? (0=no, 1=Best solution, 2=best + 2°)	1	S/A user

The second group of catalog keys is "Installation parameters", and it is only available in developer mode, see Table 20. It defines the location of the Python program and the name of the base scenario.

Table 20 "Installation parameter" keys

Nr	Text field name in template	Example of value	Model User's rights
1	Location of Python program	C:\Python27\ArcGIS10.2	Developer
2	Scenario name for the BASE Scenario	Base2019	Developer

The next group, "Run Selections", contains only one key that is for defining the commodity type(s), see Table 21. It is only used when the user wants to compress the geodatabase files.

Table 21 "Run Selections" key

Nr	Text field name in template	Example of value	Model User's rights
1	Select commodities for the Logistics Module (for all commodities, select 0)	1	S/A user

The fourth group of keys (which is actually listed as initial group in the graphical user interface) is related to which subgroup the user wants to use, and how to use it, see Table 22.

Table 22 Catalog keys for selecting actions

Nr	Text field name in template	Example of value	Model User's rights
1	Select how you want to use Handling Scenario application	(2) COMPACT the geodatabase files (Input_data.mdb, Scenario_data.mdb and Output.mdb)	S/A user
2	For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)	C:\Samgods_V20191001\	S/A user
3	For choice 3 or 4 provide the name of the base scenario in the destination model	Base2019	S/A user

The first catalog key in Table 22 enables the application:

- to delete the scenario specific tables for the current scenario. During the execution, a prompt window will ask the user to confirm the selections made to avoid mistakes.

- to compact all the geodatabase files for the scenario, for both the input and output data. It is recommended to do this regularly, especially after tables etc. have been deleted. Please refer to Section 8.9 for more information.

- to export the model or a specific scenario in another model. When using " (3) EXPORT the model in a new folder using the current scenario as Base" a folder location must be provided in the second catalog key and a new name should be given to the new base scenario in the third catalog key. If the user wants to export only the selected scenario to another catalog (" (4) EXPORT the current scenario in another model" option for first catalog key), the folder where the .cat file for this catalog is located should be indicated in the second key. The name of the base scenario in the destination catalog should be specified in key no. 3.
- If the user wants to delete or compact a scenario (i.e. has selected " (1) DELETE the current scenario tables under Input_data.mdb (mandatory if you want to delete the scenario)" or " (2) COMPACT the geodatabase files (Input_data.mdb , Scenario_data.mdb and Output.mdb)" for key no. 1), it does not matter what is typed in for keys no. 2 and 3, but since no keys can be left undefined, something must be put there because of the construction of the software (just typing in a random character will work).
- The last value " (5) CHECK the imported scenario in terms of catalog key definitions" in catalog key no.1 enables the application to control the scenario parameters for an imported scenario. The scenario parameter values in the new catalog must be identical to the ones in the imported scenario. The execution of this subgroup produces a report, *Report for the import phase*, accessible from the Data Section window in the interface, in the folder Scenario Outputs\Import function report. The report provides a list of the scenario parameters that need to be changed. The parameters are changed by editing the catalogue keys for the imported scenario according to the report, under "Scenario Parameters" in the *Handling Scenario* application and then run the application again.

Finally, there is a key for the consolidation factors, see Table 23.

Table 23 "Parameters and tables for calibration" keys

Nr	Text field name in template	Example of value	Model User's rights
1	Consolidation factors table	{CATALOG_DIR}\05_Input_Data\Input _Data.mdb\BuildChain_CONSOL	A user/ Developer

Regarding output or reports from these functions:

- No outputs are produced by the Delete and Compact choices, because they work on the tables inside the geodatabase or on the geodatabase itself
- The Scenario Export function creates a new catalog with a new base scenario, or a new scenario in an existing catalog, depending on the selections made
- The Import Scenario subgroup will create a report, *Report for the import phase*, as described above

7.8. PWC_Matrices application

A screenshot of the *PWC_Matrices* application is shown in Figure 30. The purpose of the application is to create the PWC matrices in Voyager format in order to enable visualization in the interface.

In Standard user mode there are only two catalog keys to specify the number of zones in the network and the year of the PWC matrices. In Advanced user and developer mode there is also a key to identify the base scenario, and a key to set the total number of commodities.

Possible input values for the first key (Year of PWC matrices) in Table 24 are:
- 2019: PWC matrices for year 2019
- 2045: PWC matrices for year 2045

Table 24 Catalog keys for the PWC_Matrices application

Nr	Text field name in template	Example of value	Model User's rights
1	Number of zones/terminals in network (see value in scenario network)	1382	S/A user
2	Scenario name for the BASE Scenario	Base2019	A User/ Developer
3	Year of PWC matrices	2019	S/A user
4	Total number of commodities (excluding empty commodities):	16	A User/ Developer

It is only necessary to run the *PWC_Matrices* once in order to create the matrices, since they are a fixed input for the model. PWC matrices for all commodities will be produced when running the application – 1 matrices in Voyager format are created in the folder 01_Programs\LogMod\Input\PWC\{YEAR}\VY_F\, found in the Samgods folder (see Table 1 in Section 5.5). In order to access the matrices from the Data Section window (in Scenario Inputs\PWC_Matrices\PWC matrix for commodity), open the *Samgods Model* application in the Scenario Manager window and select a commodity using the catalog key "Select commodities for the Logistics Module (…)". In this step, the application should not be run, just save the settings by clicking "Save" and the matrices can be found in the Data Section window. The value 0 (for all commodities) is not allowed for this application. This is because the *PWC_Matrices* application only allows showing one commodity at a time.
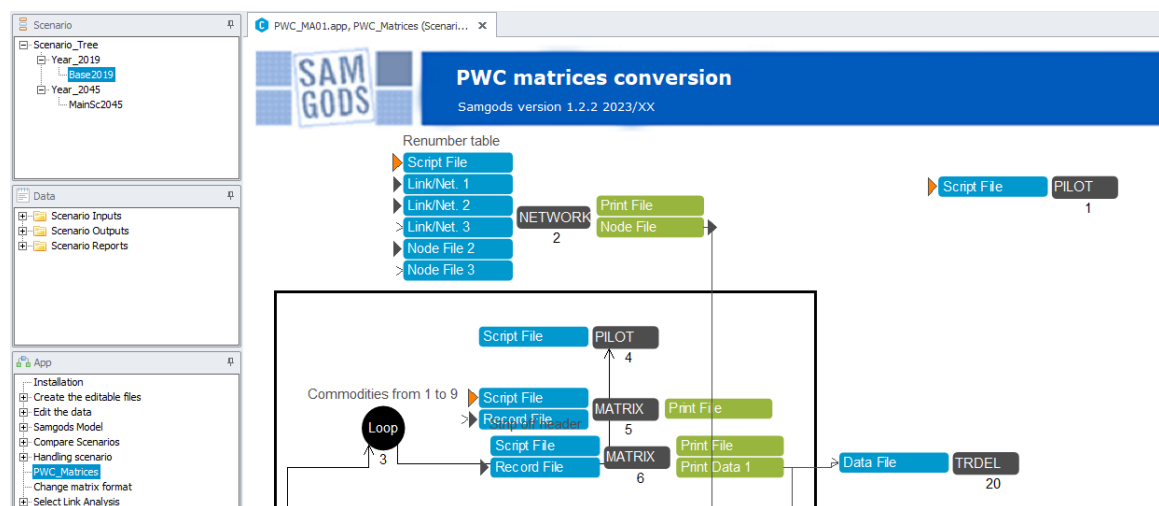
Figure 30 *PWC matrices conversion format* **application**

7.9. Change matrix format application

In Figure 31 below, the *Change matrix format* application is outlined. The purpose of the application is the following. All the data in a catalog is accessible using Microsoft Office Access

(2003 or later) (all data except the geodatabases could also be accessed using Excel or Notepad). The only exception is the data related to the matrix structure, which has a binary Voyager format. The matrix files have a .mat extension. There are two ways to export these files in order to use them in Access, Excel or a text editor. The first way is to use the functions in the Cube Interface. For further details, see the reference guide RG_CubeBase.pdf in Chapter 10 – *Exporting matrix cell values*. In short, this is done by choosing "Export…" from "File" on the menu bar and selecting the appropriate file format.
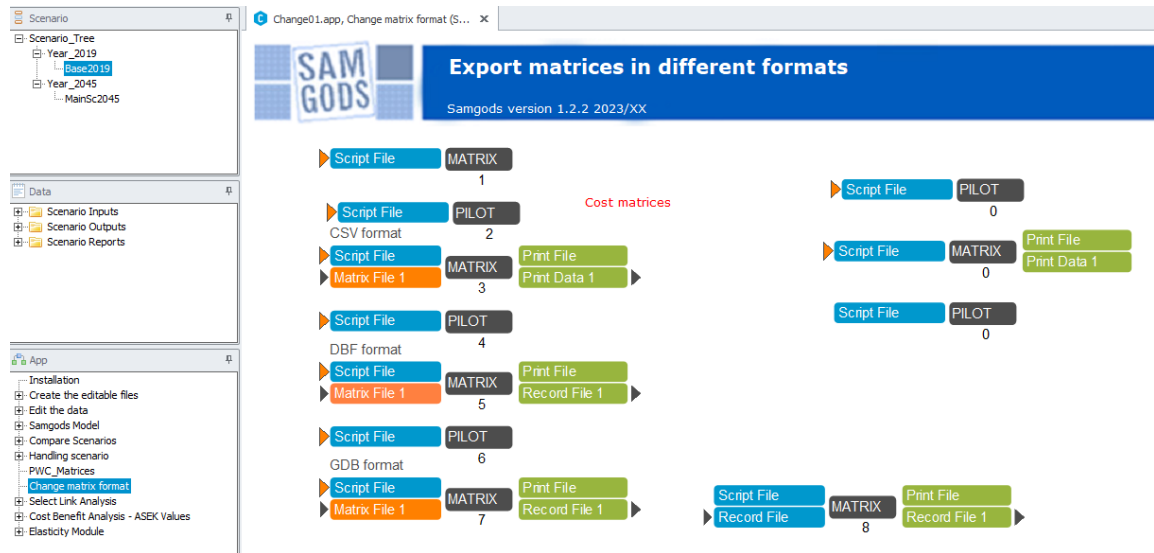
Figure 31 *Change matrix format* **application**

The second way is provided by this application, as follows. The catalog keys in Table 25 handle the export of Voyager format matrix files.

Table 25 *Change matrix format* **application catalog keys**

Nr	Text field name in template	Example of value	Model User's rights
1	Select commodities for the Logistic Module (for all commodities, select 0)	0	S/A user
2	Do you want to export to CSV, DBF or GDB format?	CSV	S/A user
3	Do you want to create a new geodatabase or use an existing one?	Existing	S/A user
4	Define the GDB where the matrix should be exported.	C:\Samgods\Scenario_Tree\ Base2019\Matrices_Base2019.mdb	S/A user
5	What kind of matrix do you want to export?	COST	S/A user
6	What vehicle class do you want for the LOS matrices?	317	S/A user
7	What is the mode that you want for the matrices?	ROAD	S/A user
8	Do you want the distance, time, domestic distance or extra cost LOS matrix?	Time	S/A user
9	What type of vehicle class (or total) do you want for the VEHICLES and TONNES matrices?	Road	S/A user

Regarding key no. 2, CSV format refers to Comma Separated Values, DBF refers to Database Format and GDB refers to Geodatabase format (mdb). If the matrix is exported to a geodatabase, it will be created as a table inside an existing geodatabase or a new geodatabase containing this table will be created, depending on the choices made by the user.

To understand the usage of the keys 5-9, and how to export the correct values, an explanation of the size and the structure of the matrices is required.

The following table (Table 26) presents how the LOS matrices are saved in the scenario folder, how many matrices that are saved in each matrix file and what their names are. For the OD matrices, see the next table (Table 27).

Table 26 Matrix table: LOS matrices

Folder	Name of matrix file	Name of matrix	Description	Total number of matrices
{Scenario_Dir}	COST_ROAD_{SCENARIO_SHORTNAME}.MAT	D101_{SCENARIO_SHORTNAME}, D102_{SCENARIO_SHORTNAME}, D103_{SCENARIO_SHORTNAME}, D104_{SCENARIO_SHORTNAME}, D105_{SCENARIO_SHORTNAME}, D106_{SCENARIO_SHORTNAME}	Distance (km) for vehicle type 101-106	30
		T101_{SCENARIO_SHORTNAME}, …, T106_{SCENARIO_SHORTNAME}	Time (hours) for vehicle type 101-106	
		X101_{SCENARIO_SHORTNAME}, …, X106_{SCENARIO_SHORTNAME}	Extra costs for vehicle type 101-106	
		CG101_{SCENARIO_SHORTNAME}, …, CG106_{SCENARIO_SHORTNAME}	Generalized cost for vehicle type 101-106	
		DD101_{SCENARIO_SHORTNAME}, …, DD106_{SCENARIO_SHORTNAME}	Domestic distance (km) for vehicle type 101-106	
{Scenario_Dir}	COST_RAIL_{SCENARIO_SHORTNAME}.MAT	D201_{SCENARIO_SHORTNAME}, D202_{SCENARIO_SHORTNAME}, D204_{SCENARIO_SHORTNAME}, D205_{SCENARIO_SHORTNAME}, D206_{SCENARIO_SHORTNAME}, D207_{SCENARIO_SHORTNAME}, D208_{SCENARIO_SHORTNAME}, D212_{SCENARIO_SHORTNAME}	Distance (km) for vehicle type 201, 202, 204-212	55
		T201_{SCENARIO_SHORTNAME}, T202_{SCENARIO_SHORTNAME}, T204_{SCENARIO_SHORTNAME}, …, T212_{SCENARIO_SHORTNAME}	Time (hours) for vehicle type 201, 202, 204- 212	
		X201_{SCENARIO_SHORTNAME}, X202_{SCENARIO_SHORTNAME}, X204_{SCENARIO_SHORTNAME}, …, X212_{SCENARIO_SHORTNAME}	Extra costs for vehicle type 201, 202, 204-212	

Folder	Name of matrix file	Name of matrix	Description	Total number of matrices
		CG201_{SCENARIO_SHORTNAME}, CG202_{SCENARIO_SHORTNAME}, CG204_{SCENARIO_SHORTNAME}, …, CG212_{SCENARIO_SHORTNAME}	Generalized cost for vehicle type 201, 202, 204-212	69
		DD201_{SCENARIO_SHORTNAME}, DD202_{SCENARIO_SHORTNAME}, DD204_{SCENARIO_SHORTNAME}, …, DD212_{SCENARIO_SHORTNAME}	Domestic distance (km) for vehicle type 201, 202, 204-212	
{Scenario_Dir}	COST_SEA_{SCENARIO_SHORTNAME}.MAT	D301_{SCENARIO_SHORTNAME}, D302_{SCENARIO_SHORTNAME}, …, D322_{SCENARIO_SHORTNAME}	Distance (km) for vehicle type 301-322	110
		T301_{SCENARIO_SHORTNAME}, T302_{SCENARIO_SHORTNAME}, …, T322_{SCENARIO_SHORTNAME}	Time (hours) for vehicle type 301-322	
		X301_{SCENARIO_SHORTNAME}, X302_{SCENARIO_SHORTNAME}, …, X322_{SCENARIO_SHORTNAME}	Extra costs for vehicle type 301-322	
		CG301_{SCENARIO_SHORTNAME}, CG302_{SCENARIO_SHORTNAME}, …, CG322_{SCENARIO_SHORTNAME}	Generalized cost for vehicle type 301-322	
		DD301_{SCENARIO_SHORTNAME}, DD302_{SCENARIO_SHORTNAME}, …, DD322_{SCENARIO_SHORTNAME}	Domestic distance (km) for vehicle type 301-322	
{Scenario_Dir}	COST_AIR_{SCENARIO_SHORTNAME}.MAT	D401_{SCENARIO_SHORTNAME}	Distance (km) for vehicle type 401	5
		T401_{SCENARIO_SHORTNAME}	Time (hours) for vehicle type 401	
		X401_{SCENARIO_SHORTNAME}	Extra costs for vehicle type 401	
		CG401_{SCENARIO_SHORTNAME}	Generalized cost for vehicle type 401	
		DD401_{SCENARIO_SHORTNAME}	Domestic distance (km) for vehicle type 401	

Table 27 presents how the Vehicle, Tonne, and Empty Vehicle OD-matrices are saved in the scenario folder, how many matrices that are saved in each matrix file and their names .The matrices in Table 27 have an index (0 in the table) that represents the commodity class number (e.g. ROAD_VHCLFLOW0_{SCENARIO_SHORTNAME}.MAT). The value 0 refers to all commodities, and a specific number represents the respective commodity selection.

Table 27 Matrix table with file structure for OD matrices for number of vehicles (loaded and empty) and tonnes

Folder	Name of matrix file	Name of matrix	Description	Total of matrices
{Scenario_Dir}	ROAD_VHCLFLOW0_{SCENARIO_SHORTNAME}.MAT	101_{SCENARIO_SHORTNAME}, … 106_{SCENARIO_SHORTNAME}, Road_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 101-106 and total for road mode	7
{Scenario_Dir}	RAIL_VHCLFLOW0_{SCENARIO_SHORTNAME}.MAT	201_{SCENARIO_SHORTNAME}, 202_{SCENARIO_SHORTNAME}, 204_{SCENARIO_SHORTNAME},... 212_{SCENARIO_SHORTNAME}, Rail_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 201, 202, 204-212 and total for rail mode	12
{Scenario_Dir}	SEA_VHCLFLOW0_{SCENARIO_SHORTNAME}.MAT	301_{SCENARIO_SHORTNAME}, … 322_{SCENARIO_SHORTNAME}, Sea_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 301-3212 and total for sea mode	23
{Scenario_Dir}	AIR_VHCLFLOW0_{SCENARIO_SHORTNAME}.MAT	AIR_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 401 and total for air mode	1
{Scenario_Dir}	ROAD_TON0_{SCENARIO_SHORTNAME}.MAT	101_{SCENARIO_SHORTNAME}, … 106_{SCENARIO_SHORTNAME}, Road_{SCENARIO_SHORTNAME}	OD tonnes by vehicle type 101-106 and total for road mode	7
{Scenario_Dir}	RAIL_TON0_{SCENARIO_SHORTNAME}.MAT	201_{SCENARIO_SHORTNAME}, 202_{SCENARIO_SHORTNAME}, 204_{SCENARIO_SHORTNAME}, … 212_{SCENARIO_SHORTNAME}, Rail_{SCENARIO_SHORTNAME}	OD tonnes by vehicle type 201, 202, 204-212 and total for mode rail	12
{Scenario_Dir}	SEA_TON0_{SCENARIO_SHORTNAME}.MAT	301_{SCENARIO_SHORTNAME}, … 322_{SCENARIO_SHORTNAME}, Sea_{SCENARIO_SHORTNAME}	OD tonnes by vehicle type 301-322 and total for sea mode	23
{Scenario_Dir}	AIR_TON0_{SCENARIO_SHORTNAME}.MAT	AIR_{SCENARIO_SHORTNAME}	OD tonnes by vehicle type 401 and total for air mode	1
{Scenario_Dir}	ROAD_EMP0_{SCENARIO_SHORTNAME}.MAT	101_{SCENARIO_SHORTNAME}, … 106_{SCENARIO_SHORTNAME}, Road_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 101-106 and total for road mode	7
{Scenario_Dir}	RAIL_EMP0_{SCENARIO_SHORTNAME}.MAT	201_{SCENARIO_SHORTNAME}, 202_{SCENARIO_SHORTNAME}, 204_{SCENARIO_SHORTNAME}, … 212_{SCENARIO_SHORTNAME}, Rail_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 201, 202, 204-212 and total for mode rail	12
{Scenario_Dir}	SEA_EMP0_{SCENARIO_SHORTNAME}.MAT	301_{SCENARIO_SHORTNAME}, … 322_{SCENARIO_SHORTNAME}, Sea_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 301-322 and total for sea mode	23
{Scenario_Dir}	AIR_TON0_{SCENARIO_SHORTNAME}.MAT	AIR_{SCENARIO_SHORTNAME}	OD vehicles by vehicle type 401 and total for air mode	1

Potentially, as many as 2759 matrices with different level of aggregation could exist in the scenario folder. See Table 28 for which values to set in the keys in order to print out a specific matrix.

Table 28 Choice order

Text field name in template	Choices available	Description	Refer to matrix table
Select commodities for the Logistics Module (for all commodities, select 0)	0	All commodities	
	1-16	Single commodity	
Do you want to export in CSV, DBF or GDB format?	CSV	Comma Separated Values	
	DBF	Database Format	
	GBD	Geodatabase table	
Do you want to create a new geodatabase or use an existing one?	Create		
	Existing		
Define the gdb where export matrix:		An existing or new geodatabase, depending on choice for previous key	Table 25
What kind of matrix do you want to export?	COST	LOS matrix	Table 26
	VHCLFLOW	OD Vehicles matrix	Table 27
	TON	OD Tonnes matrix	Table 27
	EMP	OD Empty Vehicles matrix	Table 27
Which vehicle class do you want to select for the LOS matrices?	101-106, 201, 202, 204-212, 301-322, 401	Vehicle type for the LOS matrices	Table 26
What is the mode that you want for the matrices?	ROAD, RAIL, SEA, AIR	Mode for the LOS matrices	Table 26
Do you want the distance, time, domestic distance or extra cost LOS matrix?		Specification for the LOS matrix	Table 26
	Distance	D101-D106, D201, …	
	Time	T101-T106, T201, …	
	Domestic Distance	DD101-DD106, DD201, …	
	Extra cost	X101-X106, X201, …	
What type of vehicle class (or total) do you want for the VEHICLES and TONNES matrices?		Specification for the OD matrix	Table 27
	101-105, 201, 202, 204-209, 301-321	Select a specific vehicle type	
	Road, Rail, Sea, Air	Select a mode	

Based on the choices made in the catalog keys described above, the *Change matrix format* application creates a CSV or DBF file, or a table inside an existing or a new geodatabase, with the structure Origin zone, Destination zone and matrix value. The matrix file is found in the scenario folder and will have a name that gives the specifications made in the catalog keys, e.g.:

{Scenario_DIR}\COST_RAIL_DD202_VOY.CSV

Where the first part (COST) defines the type of matrix (COST, VHCLFLOW, TONNES or EMPTYVEHICLEFLOW), the second part (RAIL) the mode (RAIL, ROAD, SEA or AIR), the third part (DD) the type of matrix for the LOS matrices (DD, D, T or X), the fourth part (202) the vehicle type and the fifth part gives whether the user is an Emme or a Voyager user.

7.10. Select link analysis

Figure 32 shows an outline of the Select link analysis application. Due to the huge amount of output files produced by Standard Logmod and RCM and either the level of their disaggregation, this application provides different tools to analyze and show the results with different aggregation levels and for specific movements.
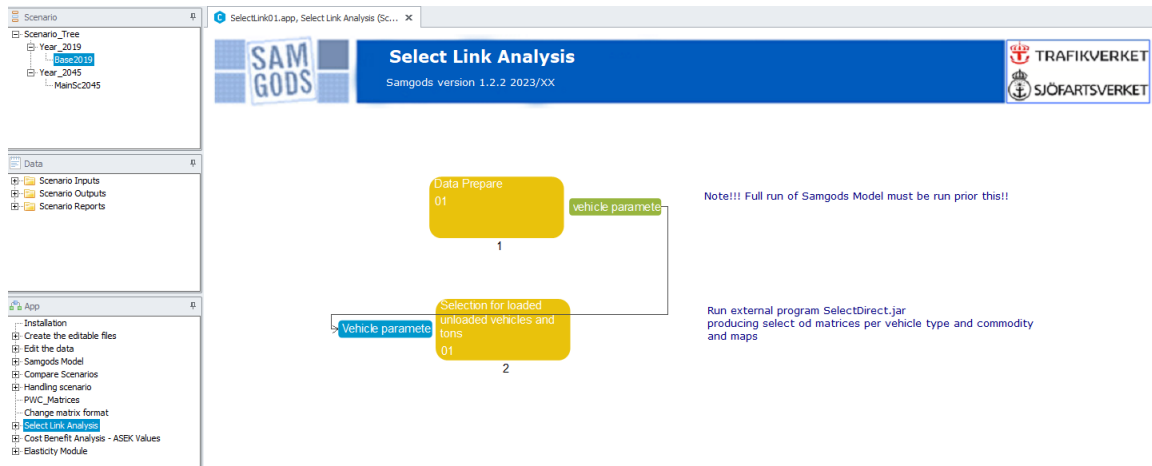
Figure 32 *Select Link Analysis* **application**

The application produces the following outputs that depend on the choices made via the catalog keys:
- Network containing loaded vehicles and tons for specific commodity (and total) and the empty vehicles
- Maps with loaded, empty vehicles and tons per commodity group when all the commodities option is chosen
- The loaded and empty vehicles and tons could be filtered based on a selection of:

    ○ Links in the network: the list provided will filter the chains in which the list of links is part of the path.

    ○ Nodes in the network: with the same criteria all the chains having one or more nodes in their path will be selected
- The OD Loaded, empty vehicles and tons that are derived by filtering the chains by the list of links or nodes

The catalog keys could be classify in six different groups:
- Output location
- List of commodities to use in the analysis and rules in applying different selections
- List of links for the selection
- List of nodes for the selection
- Traversal matrices
- General parameters
- Standard maps

The output location by default is:
- {Scenario_Dir}\SelectLink\{FolderSelectLink}: Since for the same scenario several select link analysis could be occur, per each run the user should provide a name for the selection (e.g. Oresun, SL1, anything but without special or black characters). Each run will be saved in a subfolder in which the name is provided by \{ FolderSelectLink }

The catalog key designed for this purpose is represented in Table 29.

Table 29 Select link run name

Nr	Text field name in template	Example of value	Model User's rights
1	SelectLink analysis name (max 6 characters)	Test1	S/A user

The selection could be filtered by specific product groups or a list of them. The first catalog key in Table 30 is designed for this purpose. The criterion can be also combined in different manner, based on the rule applied throught the second catalog key:

- only node selection (regardless what is under link selection)
- only link selection (regardless what is under node selection)
- node OR link selection (one or the other)
- node AND link selection (both met)

Table 30 Selections

Nr	Text field name in template	Example of value	Model User's rights
1	List of commodities for Select Link Analysis (0 for All)	1,5,9,12	S/A user
2	Select the method being applied for conditions on nodes and links	only node selection (regardless what is under link selection)	S/A user

These catalog keys are specific for this application. The link list for the selection is specified via the following catalog keys in Table 31.

Table 31 Link selection options

Nr	Text field name in template	Example of value	Model User's rights
1	Numbering system for link list	Voyager ; (Example 1-2049,2-2083,3-2039)	S/A user
2	List of links	1-2049	S/A user
3	Selection criteria for links:	ANY ;any of the given links must be used	S/A user

The interface provides different ways to specify the link list in terms of numbering systems:

- Using Voyager nodes (specifing "Voyager" under catalog key 1)
- Using Emme nodes (specifing "Emme" under catalog key 1)
- Using the Link identified specified in file Links_List.txt under {Scenario_Dir}\LogMod_{Loop}\RCM folder (Internal_Link_Nbr in the table) (specifing "ID_Link" under catalog key 1)

For "Voyager" a link must be reprinted with A-B notation, in which A is the starting node number and B is the ending node number for the link. For "Emme" " a link must be reprinted with AORIG-BORIG notation, in which AORIG is the starting emme node number and BORIG is the ending emme node number for the link.

The last catalog keys controls how the list of links will be interpreted during the selection. Four possible options are implemented:

- SINGLE; visit exactly one
- ANY; any of the given links must be used
- ALL; all of the given links must be used
- ORDER; all nodes and links must be used, and nodes must be visited in order they are listed under catalog key 2

The node list for the selection is specified via the following catalog keys in Table 32.

Table 32 Node selection options

Nr	Text field name in template	Example of value	Model User's rights

1	Numbering system for node list	Voyager (Example 1,2049,2083,2039)	S/A user
2	List of nodes	2049,2039	S/A user
3	Selection criteria for nodes	ANY ;any of the given links must be used	S/A user

The interface provides different ways to specify the node list in terms of numbering systems:
- Using Voyager nodes (catalog key 1 set to Voyager)
- Using Emme nodes (catalog key 1 set to Emme)

The last catalog keys controls how the list of nodes will be interpreted during the selection. Four possible options are implemented:
- SINGLE; visit exactly one
- ANY; any of the given links must be used
- ALL; all of the given links must be used
- ORDER; all nodes and links must be used, and nodes must be visited in order they are listed in catalog key 2.

The Road traversal matrices can be produced using the following specific combination of catalog keys with the exact values shown in Table 33 only. Reason is to produce traversal matrices (e.g. trips crossing Swedish boarders) for transfer in the SAMPERS model. They are fixed and the list of EMME nodes depends on the current Base2019/MainSc2045 coded networks.

Table 33 Traversal matrices settings

Nr	Text field name in template	Example of value	Model User's rights
1	List of nodes	207904,207823,206989,205840,206593,187836,200680,197767,156054,181993,178637,188705,181993,190612,205895,207871,206724,196653,199640,193196,158978,171090,155434,103288	S/A user
2	Numbering system for node list	Emme (Example 711400,171695,711401)	S/A user
3	Selection criteria for nodes:	ANY ;any of the given links must be used	S/A user
4	Do you want to produce traversal matrices? (Untick=no Tick=yes)	Tick (yes)	S/A user

- The standard location for the output matrices (in Emme format *.314) is specified under ScenarioOutput\DataPanel\Select Link\TraversalMatrices:
- STD: {SCENARIO_DIR}\SelectLink\{FolderSL}\STD*.314
- RCM: {SCENARIO_DIR}\SelectLink\{FolderSL}\RCM*.314

To produce standard maps with results classified by commodity group the following catalog key in Table 34 should be tick.

Table 34 GIS Maps option

Nr	Text field name in template	Example of value	Model User's rights
1	Do you want to produce GIS Maps per commodity group?	Yes	S/A user

The last group of catalog keys is related to general settings and parameters used in the creation of empty path files, in Table 35.

The empty vehicles do not belong to any specific chain, therefore the select link analysis is based on the used paths produced during the assignment. The first run will produce by default the full set of path files (and therefore it will takes around 30 minutes). In the subsequent runs the process will be skip since the required path files are already present. No selections are possible for the user since they are produced by default.

Table 35 "Scenario parameters" and "Installation parameter" keys

Nr	Text field name in template	Example of value	Model User's rights
1	Number of zones/terminals in network (see value in scenario network)	1382	Developer
2	Location of Python Program	C:\Python27\ArcGIS10.2	Developer
3	Location of Java folder	C:\Windows\System32	Developer
4	Path to cmd.exe	C:\Windows\SysWOW64\cmd.exe	Developer
5	Scenario name for the BASE Scenario	Base2019	Developer
6	Choose PWC matrices	2019	S/A user
7	List of rail modes in RCM	GHhliTUDdEFf	Developer
8	Maximum number of loops in calibration process	1	Developer

Tip: For normal select link or node analysis, it is better to select:

- all the commodities under "List of commodities for Select Link Analysis (0 for All):0" (or just keeping the default value).

- The production of GIS maps, ticking the catalog key "Do you want to produce GIS Maps by commodity group? Yes" (or just keeping the default value)

The results will be already produced with commodity disaggregation for loaded vehicles and tons.

In the event of a deeper analysis for specific commodity groups (or just one), the default of the above catalog keys should be revised with the appropriate commodity number. For instance, selecting commodity 8 the two catalog keys will take the following values:

- "List of commodities for Select Link Analysis (0 for All):8"

- "Do you want to produce GIS Maps by commodity group? No"

In fact, the maps will be produced with several empty fields (all commodities that are not included in the analysis) and with values for commodity 8 only.

7.11. Cost Benefit Analysis – ASEK Values

The existing standard transport and cost data derived from the model are based on calibrated cost data and system performance parameters (such as loading times, transport times, link toll values, country toll values etc). The split of data into domestic and international transports are based on domestic distances as a fraction of total distances for the OD-legs. This is valid for distance related items on links (travel costs and times), but not for times or costs related to link/node usage (loading times and costs, holding costs, interest costs, transfer times, etc.)

The *Cost Benefit Analysis – ASEK values* application is specifically designed to calculate socio-economic input from the Samgods model, primarily related to ASEK-valued data for transports taking place on Swedish territory (including coastal waters along the coast).

The main differences between *Samgods* and *Cost Benefit Analysis-ASEK values* applications are related to cost and time values in which:

- All the calibration parameters such as port area commodity parameters, transoceanic values, technological factors on time and cost per ports, rescaled values of vehicle costs, Tax_category, Tax_country, Tax_link and Toll_link are excluded to get the actual values

- Total domestic and international costs and times are produced. The different components of costs and time (loading and unloading, transfer, transfer) have the same characterization. This implies that the application must provide LOS total domestic matrices also for time and cost and not only for time as in the main model.

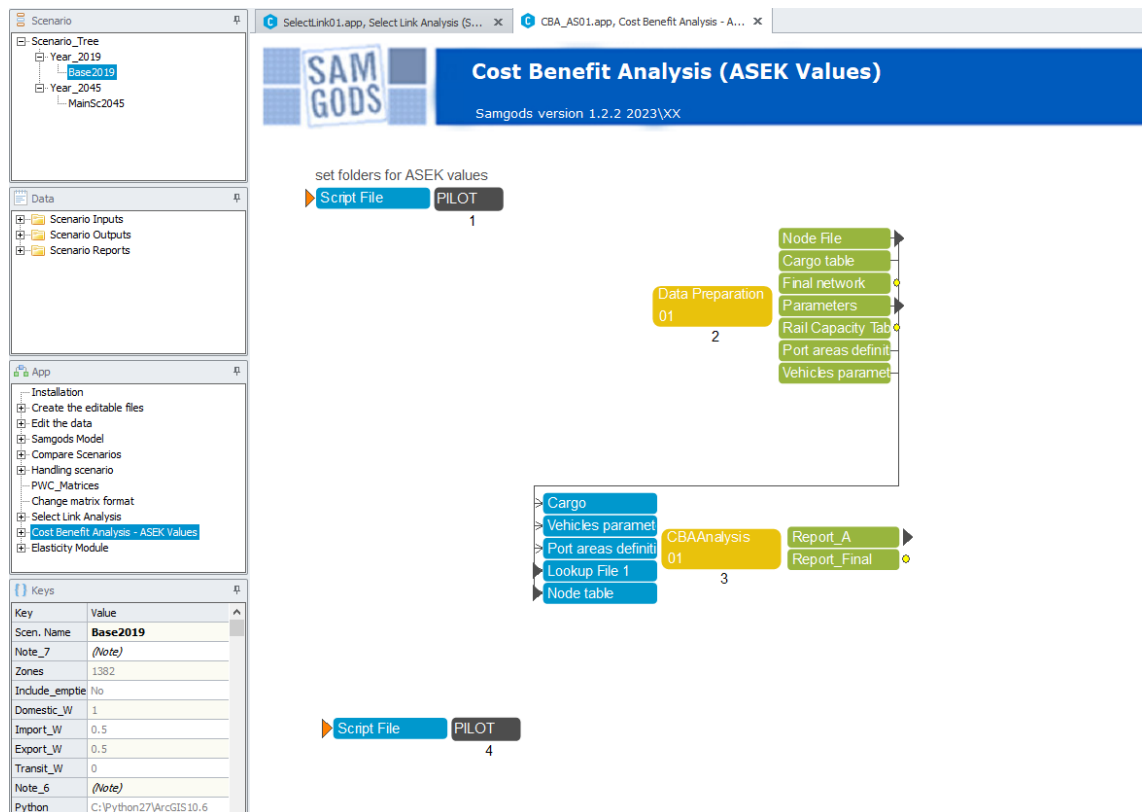The application has the following simplified structure presented in Figure 33.

Figure 33 *Cost Benefit Analysis – ASEK Values* **application**

To use the application the following catalog keys in Table 36 must be used:

Table 36 Main catalog key for the cost benefit analysis module

Nr	Text field name in template	Example of value	Model User's rights
1	Number of zones/terminals in the network (see value in scenario network)	1382	S/A user
2	Include the cost of empty transports in the calculation of system costs	No	S/A user
3	Weighting factor Domestic	1	S/A user
4	Weighting factor Import	0.5	S/A user
5	Weighting factor Export	0.5	S/A user
6	Weighting factor Transit	0	S/A user
7	Full scenario folder for comparison (JA- reference scenario - before investment) (Base2019 folder if Year_2019, MainSc2045 folder if Year_2045)	C:\Models\Samgods_V12D_20190531\Scenario_Tree\Year_2019\Base2019\	S/A user
8	Scenario's name to use in comparison (JA- reference scenario – before investment) (Base2019 if Year_2019, MainSc2045 if Year_2045)	Base2019	S/A user

The user needs:

- to select current scenario in which CBA analysis must be run under scenario window;

- set the number of terminals/zones within the network

- the second key let the user select the combination of costs included in step 3 and 4 in the CBA calculation (See Figure 34) – basically the ratio calculated in Step 4: Ratio_SYS_UA_JA = SYS_K_UA / SYS_K_JA can use: all costs (Transport Cost (Loaded vehicles, emtpy vehicles) + Inventory Cost (storage cost, capital cost, order cost) or Transport Cost (Loaded vehicles) + Inventory Cost (storage cost, capital cost, order cost). When **No** is selected empty vehicle costs are excluded, viceversa when it is selected Yes

- the third to sixth key under Table 36 should not be modified based on the methodology specify by Trafikverker. Each cost (Domestic, Import, Export and Transtit) will be weighted by this factor in accordance to the Trafikverket methodology. The user has the ability to change them for their own analysis and testing (values are between 0 and 1 with decimals)

- to change **eighth catalog** key under table 36 with name of scenario he/she wants to use as JA (reference scenario – before investment):
  - if current scenario is in Y_2019, catalog key " Scenario's name to use in comparison (JA- reference scenario – before investment) (Base2019 if Year_2019, MainSc2045 if Year_2045):" will have Base2019,
  - if current scenario is in Y_2045, catalog key " Scenario's name to use in comparison (JA- reference scenario – before investment) (Base2019 if Year_2019, MainSc2045 if Year_2045):" will have MainSc2045,

- to identify the folder location for the scenario used for comparison (e.g. folder where the outputs for scenario selected with previous catalog key are usually found in Scenario_Tree folder plus short scenario name) in the eighth catalog key value and update accordingly **the seventh catalog** key:
  - if current scenario is in Year_2019, catalog key Full scenario folder for comparison (JA- reference scenario – before investment) (Base2019 folder if Year_2019, MainSc2045 folder if Year_2045):" will be C:\Samgods\Year_2019\Base2019\,
  - if current scenario is in Year_2045, catalog key Full scenario folder for comparison (JA- reference scenario – before investment) (Base2019 folder if Year_2019, MainSc2045 folder if Year_2045):" will be C:\Samgods\Year_2045\MainSc2045\,

All the other catalog keys are derived from "Samgods model" run and they should be not modified for the specific run. Notice that the structural change of calibration parameters with separate databases, excludes the need of separate ASEK-scenarios. All listed costs within the Input_Data.mdb are now ASEK-related and are used when running the CBA-analysis application within Samgods 1.2.2.

All the outputs are then stored and saved under the main scenario, with suffix CBA on the folder and file names. The outputs are identical to those produced under *Samgods Model* application, all the costs and times are recalculated without the scaling factors, and therefore they represent the actual values that can be used in CBA.

The following reports are present in the data panel for *CBA* output:

- Vehicles, loaded and empty, within Swedish territory: first table used for CBA analysis in evaluating the externalities (emmissions, noise, accidents, infrastructural damage, etc.). It containes VhclKm and tonkm by vehicle type within Sweden territory divided by loaded and emtpies and distinction between vehicles on ferry and ferry vehicles. For definition and name of each attribute please refer to Techinal Manual (section 3.4.3.26).

- Logistic Cost Changes used for CBA: the report contains step by step the calculation defined under "Samhällsekonomisk kalkyl baserad på Samgods Bilaga 1". An example is presented in Figure 34.

```
JA: Reference scenario (Base2019 or MainSc2045)
UA: Forecasting scenario(current scenario) Base2019

Step 1: Make an assessment of how the model reacts, by comparing goods flows in JA and UA.

Step 2: SYS_K_JA sum of Domestic, Import, Export and Transit costs by their weigth (Domestic=1.0 Import=0.5 Export=0.5 Transit=0 ) RCM Values
Step 2: Original Costs = Transport Cost (Loaded vehicles) + Inventory Cost (storage cost, capital cost, order cost)
Step 2:  Type          Factor    Original Costs(kSEK)  Final costs (kSEK)
Step 2:  Domestic         1.0     86934394                   86934394
Step 2:  Import           0.5     76393412                   38196706
Step 2:  Export           0.5     67542135                   33771067
Step 2:  Transit            0      8463316                          0
Step 2:  SYS_K_JA                                      158902168

Step 3: SYS_K_UA sum of Domestic, Import, Export and Transit costs by their weigth (Domestic=1.0 Import=0.5 Export=0.5 Transit=0 ) RCM Values
Step 3: Original Costs = Transport Cost (Loaded vehicles) + Inventory Cost (storage cost, capital cost, order cost)
Step 3:  Type          Factor    Original Costs(kSEK)  Final costs (kSEK)
Step 3:  Domestic         1.0     86934394                   86934394
Step 3:  Import           0.5     76393412                   38196706
Step 3:  Export           0.5     67542135                   33771067
Step 3:  Transit            0      8463316                          0
Step 3:  SYS_K_UA                            158902168

Step 4: Ratio_SYS_UA_JA = SYS_K_UA / SYS_K_JA                         1.00000

Step 5: ASEK_K_JA: sum of Domestic, Import, Export and Transit costs by their weigth (Domestic=1.0 Import=0.5 Export=0.5 Transit=0 ) CBA Values
Step 5: Original Costs = Transport Cost (Loaded vehicles, emtpy vehicles) + Inventory Cost (storage cost, capital cost, order cost)
Step 5:  Type          Factor    Original Costs(kSEK)  Final costs (kSEK)
Step 5:  Domestic         1.0    104120637                  104120637
Step 5:  Import           0.5     83720838                   41860419
Step 5:  Export           0.5     74110385                   37055192
Step 5:  Transit            0      8811732                          0
Step 5:  ASEK_K_JA                                    183036248

Step 6: ASEK_K_UA = (SYS_K_UA / SYS_K_JA) * ASEK_K_JA (Step 4 * Step 5)
Step 6:  ASEK_K_UA                                    183036248

Step 7: Calculate the difference between JA and UA according to ASEK: ASEK_K_JA - ASEK_K_UA (step 6 - step 5)
Step 7:                         Cost differences (kSEK)
Step 7:                                   0
----------------------------------------------------------------------------------------------------------------------
```

Figure 34 General report on cost benefit analysis

For a detailed description on how to setup and run a CBA with the Samgods model, please see the memo "Samgods och CBA – en exempelanalys av lägre kostnader för bantrafik" on Samgods web page www.trafikverket.se/samgods. Below a stepwise summary of the description is given:

1) Run the reference scenario JA e.g., Base2019 with the Samgods model application
2) Create and run the child scenario UA with the Samgods model application.
3) Analyze and compare the outputs from the two scenarios JA and UA.
4) Create the first dataset for the CBA analysis by running the application "Cost Benefit Analysis - ASEK Values" from the reference scenario (JA). This means that the

scenario will point at itself, for example scenario: Base2019 and reference scenario JA: Scenario_Tree\Year_2019\Base2019.

5) Create the second dataset for the CBA analysis by running the application "Cost Benefit Analysis - ASEK Values" from the child scenario (UA). Make sure to set the same reference scenario as in step 4 JA i.e. Scenario_Tree\Year_2019\Base2019.

6) Collect the output data. For transport costs, used for estimating the benefit, please see report "Logistic Cost Changes used for CBA" under CBA Report > Main Reports in the data window of the child scenario UA[6]. For traffic and transport work, used for estimating externalities and financial effects, use the file "Vehicles, loaded and empty, within Swedish territory" under CBA Report > Main Reports in the reference and child scenario, respectively. You may find this data in the access database table "Vehicles_loaded_and_empty_witin_swedish_territory_CBA" as well.

---

[6] The reference scenario JA also produce this file. The purpose of this is to prepare data for the second run of the CBA application. For the reference scenario the "cost differences" should sum to 0 since the comparison is made with the same scenario.

7.12.   Elasticity module

Samgods model is used in setting up different scenarios (through changes in the input network, vehicle costs and PWC matrices) and analysing the results at various levels of aggregation. (assignment level, OD level, etc.).

To perform a sensitivity analysis, i.e. variation of fixed percentage of some input variables and deriving the arc elasticity on the costs, the standard setup would require:

- the setup of several scenarios changing minor components of the inputs (vehicle parameters and tolls)
- To run in sequence Samgods producing a significative amount of results, most of which will be useless for the sensitivity analysis. In fact it focuses on vehicle and ton performance indicators (vehiclekm, tonkm, vehicles, tons, etc) only.
- To spend runtime not required in producing the not desired outputs (see point above)
- To assemble the results in a meanful manner, calculating the arc elasticity of the cost differences for each vehicle class.

The "Samgods Model Elasiticy" has been developed specifically to overcome all these limitations and has the following features:

- to run several scenarios modifying specific attributes against the **reference scenario** (initial scenario with neutral values) without user intervention
- to skip the irrelevant modules to produce just the required outputs, cutting the runtimes
- to consolidate the results in a unique database for an easy access and create the elasticity report that contains already the final values.

7.12.1.   Cube implementation

The Samgods model has complemented by an application called "Elasticity module", seen in Application Panel in Figure 35 and the flow chart in Figure 36.
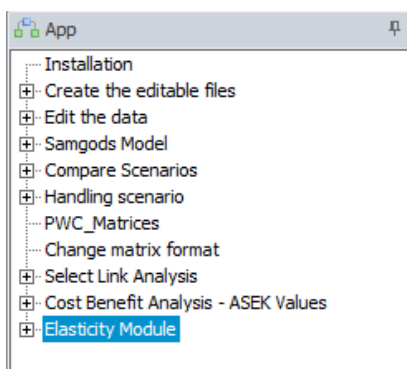
Figure 35 Application window

The "Elasticity module" differs in terms of structure from the standard one having excluded all the assignment and reporting steps, except the following ones (where {Select_commodity} represets catalog key "Select commodities for the Logistics Module (for all commodities, select 0)" which by default is 0, i.e. all commodities)[7]:

---

[7]Both {Scenario_ShortName} and {Select_commodity} are catalog keys, please see Technical documentation [4] for more information.

- Output by vehicle class – Table VHCL_OD_COV_{SCENARIO_SHORTNAME}_{Select_commodity}_X

- Output by chain – Table CHAIN_OD_COV_{SCENARIO_SHORTNAME}_{Select_commodity}_X

- Loaded Demand – table COM_L_D_{SCENARIO_SHORTNAME}_{Select_commodity}_X

- Output by vehicle class – Table VHCL_OD_COV_{SCENARIO_SHORTNAME}_RCM_X

- Output by chain – Table CHAIN_OD_COV_{SCENARIO_SHORTNAME}_RCM_X

- Loaded Demand – table COM_L_D_{SCENARIO_SHORTNAME}_RCM_X

- Where X is the ID_SCENARIO for the specific elasticity test (see details in the next section)

That implies that only those tables are present under data panel.
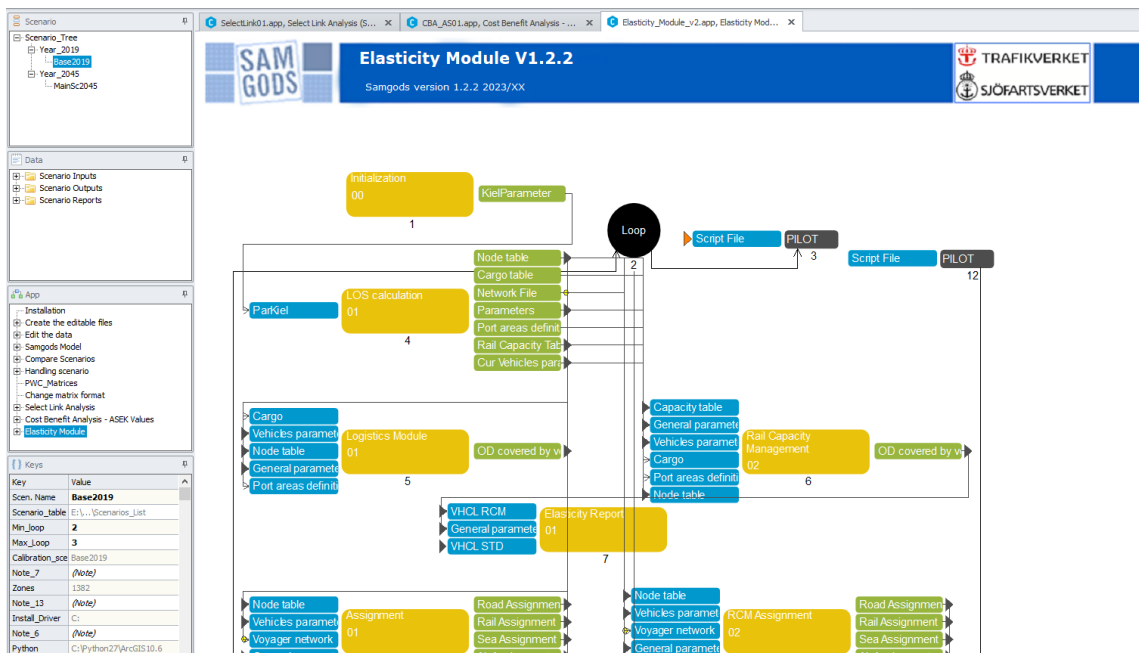
Figure 36 Elasticity Module application flow chart structure

7.12.2. Scenario preparation

Prior the "Elasticity module" run, a scenario must be already present with all the results from a sucessfull "Samgods model" run.

7.12.3. Scenarios

As anticipated in the introduction, the elasticity module facilitates the setup of several runs using a unique scenario modifying specific parameters. The list of scenarios is available in Scenario_List table within Input_Data.mdb. It is also accessible from GUI interface through a catalog key "Table with scenarios want to run for the elasticity calculation:", see Figure 37, or under the Data Panel, Scenario Inputs > List of scenarios, see Figure 38.

Figure 37 The *Scenario list* catalog key

Figure 38 Data panel and list of scenarios location

Now lets explain the variables in scenario list, a sample is seen in Figure 39. The module produces results modifying the base KM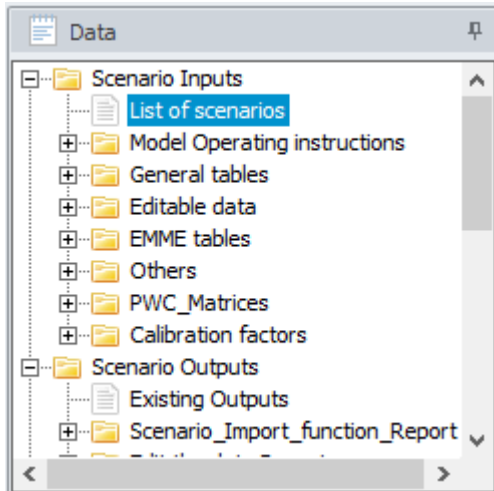_COST and HOURS_COST (plus related attributes NC_LTI, NC_LTIT, CONT_LTI, CONT_LTI_T) in each mode (or subset of vehicle types in rail).

A second set of modified parameters refer to:

- TOLL: for road tolls on bridges and rail fees on bridges;
- TRACK_F: track fees in Sweden (working on base table COUNTRY_TAX and ID_Country=1);
- F_DUES_VH and F_DUES_TON: Fairway Dues per Vehicle and tonnes on sea mode.

Each scenario is denoted with **ID_SCENARIO** and this code will identify the specific set of outputs produced for the specific run and the values should be used under catalog keys (as explained later in the document).

ID	ID_SCENARI	Mode	Scenario	KM_COST	HOURS_COST	NC_LTI	NC_LTIT	CONT_LTI	CONT_LTI_T	TOLL	TRACK_F	F_DUES_VH	F_DUES_TON	ID_VEHICLES
1	1	All	Reference	1	1	1	1	1	1	1	1	1	1	0.00000
2	2	Road	KM_1	1,1	1	1	1	1	1	1	1	1	1	101-106
3	3	Road	KM_2	1,05	1	1	1	1	1	1	1	1	1	101-106
4	4	Road	KM_3	1,02	1	1	1	1	1	1	1	1	1	101-106
5	5	Road	KM_4	0,98	1	1	1	1	1	1	1	1	1	101-106
6	6	Road	KM_5	0,95	1	1	1	1	1	1	1	1	1	101-106
7	7	Road	HR_1	1	1,1	0,9090909	0,9090909	0,90909091	0,9090909091	1	1	1	1	101-106
8	8	Road	HR_2	1	1,05	0,952381	0,952381	0,95238095	0,9523809524	1	1	1	1	101-106
9	9	Road	HR_3	1	1,02	0,9803922	0,9803922	0,98039216	0,9803921569	1	1	1	1	101-106
10	10	Road	HR_4	1	0,98	1,0204082	1,0204082	1,02040816	1,0204081633	1	1	1	1	101-106
11	11	Road	HR_5	1	0,95	1,0526316	1,0526316	1,05263158	1,0526315789	1	1	1	1	101-106
12	12	Rail	KM_1	1,1	1	1	1	1	1	1	1	1	1	201-212
13	13	Rail	KM_2	1,05	1	1	1	1	1	1	1	1	1	201-212
14	14	Rail	KM_3	1,02	1	1	1	1	1	1	1	1	1	201-212
15	15	Rail	KM_4	0,98	1	1	1	1	1	1	1	1	1	201-212
16	16	Rail	KM_5	0,95	1	1	1	1	1	1	1	1	1	201-212
17	17	Rail	HR_1	1	1,1	0,9090909	0,9090909	0,90909091	0,9090909091	1	1	1	1	201-212
18	18	Rail	HR_2	1	1,05	0,952381	0,952381	0,95238095	0,9523809524	1	1	1	1	201-212
19	19	Rail	HR_3	1	1,02	0,9803922	0,9803922	0,98039216	0,9803921569	1	1	1	1	201-212
20	20	Rail	HR_4	1	0,98	1,0204082	1,0204082	1,02040816	1,0204081633	1	1	1	1	201-212
21	21	Rail	HR_5	1	0,95	1,0526316	1,0526316	1,05263158	1,0526315789	1	1	1	1	201-212
22	22	Sea	KM_1	1,1	1	1	1	1	1	1	1	1	1	301-322
23	23	Sea	KM_2	1,05	1	1	1	1	1	1	1	1	1	301-322
24	24	Sea	KM_3	1,02	1	1	1	1	1	1	1	1	1	301-322
25	25	Sea	KM_4	0,98	1	1	1	1	1	1	1	1	1	301-322
26	26	Sea	KM_5	0,95	1	1	1	1	1	1	1	1	1	301-322
27	27	Sea	HR_1	1	1,1	0,9090909	0,9090909	0,90909091	0,9090909091	1	1	1	1	301-322
28	28	Sea	HR_2	1	1,05	0,952381	0,952381	0,95238095	0,9523809524	1	1	1	1	301-322
29	29	Sea	HR_3	1	1,02	0,9803922	0,9803922	0,98039216	0,9803921569	1	1	1	1	301-322

Figure 39 Elasticity scenario definition

ID_VEHICLES represents the list of vehicle types where rescaling factors will be applied.

KM_COST, HOURS_COST and the others attributes express the increase/decrease of the base costs as percentage.

For instance, considering ID_SCENARIO=97 ID_VEHICLES=102,205 KM_COST=1.1, this will effect vehicle types 102 and 205, KM_COST for the rispective vehicle type will be increased by 10% since KM_COST=1.1.

While ID_SCENARIO controls the outputs and which test must be run from the interface, ID_VEHICLES gives the full list of vehicle types in which modification will occur. The list follows the Voyager syntax:

- "**-**" symbol is used for range of values. For instance, 101-106 represents 101,102,103,104,105 and 106. Basically, all road vehicle types.
- "**,**" symbol is used to provide a list of values one by one: 102,205 represent vehicles 102 and 205
- Symbols above can be combined to produce a full list. Some examples are:
  - 207-209,212
  - 101-105,201,211-212,311

The changes can be applied within the same mode (207-209,212) or across different modes (102,205). There is no limitation in that sense.

The other attributes are:

- ID: record identifier (row number). Not connected to any function or purpose in the model. When records are deleted or added ID keeps always a unique number (primary key) within the table
- Mode: description purposes on type of vehicles included in the test. Not used in the model but useful to remember the type of scenario ran
- **Scenario:** Each scenario can alter one compoent of the cost at the time. Under scenario attribute, **the firt two letters** represent what cost will be altered and it is **mantadory** they are from Table 37. The second part can contain anything (for instance **KM**_TO_ANALYSE_THIS). The first two characters of scenario are carried over the run and printed out in the final results (to help user remembering scenario type) but also **effect the elasticity calculation** in the elasticity table Elasticities_{SCENARIO_SHORTNAME}_{ID_SCENARIO} under Output.mdb. It will NOT influence the results from the LogMod and RCM run (where how to alter costs are derived from the combination of KM_COST and other attribute values and ID_Vehicle list).

> **Tip**. The Scenario_List table covers standard sensitivity tests. If you need to specify different elasticity tests, ask for advice in setting them up under Scenario_List.

Table 38 Abbreviations for cost changes in the elasticity module

FIRST TWO LETTERS for SCENARIO attribute	Attribute
KM	KM_COST
HR	HOURS_COST (plus related attributes NC_LTI_DRY, NC_LTI_LIQ, NC_LTI_GC, CONT_LTI)
TO	TOLL;
TF	TRACK_F
FD	F_DUES_VH
FT	F_DUES_TON

The same ID_SCENARIO code is appended to the six output tables saved during the run of each scenario ones (where {Select_commodity} represets catalog key "Select commodities for the Logistics Module (for all commodities, select 0)" which by default is 0, i.e. all commodities) :

- Output by vehicle class STD – Table VHCL_OD_COV_{SCENARIO_SHORTNAME}_{Select_commodity} _{ID_SCENARIO}
- Output by chain STD – Table CHAIN_OD_COV_{SCENARIO_SHORTNAME}_{Select_commodity}_{ID_SCENARIO}
- Loaded Demand STD – table COM_L_D_{SCENARIO_SHORTNAME}_{Select_commodity}_{ID_SCENARIO}
- Output by vehicle class RCM – Table VHCL_OD_COV_{SCENARIO_SHORTNAME}_0_RCM_{ID_SCENARIO}
- Output by chain RCM – Table CHAIN_OD_COV_{SCENARIO_SHORTNAME}_0_RCM_{ID_SCENARIO}
- Loaded Demand RCM – table COM_L_D_{SCENARIO_SHORTNAME}_0_RCM_{ID_SCENARIO}.

The tables are NOT accessible via Cube GUI but using Office Access.

7.12.4. Usage

Catalog keys

The three catalog keys in Figure 40 controls the process in the elasticity module. The first key "*Table with want to run for the elasticity calculation*" points to table with the list of default sensitivity tests. See Table 37.

Table with scenarios want to run for the elasticity calculation:	C:\105812_Samgods_Model\Samgods_V111_20170512\05_Input_Data\Input_Data.mdb\Scenarios_List
Lowest scenario in sensitivity run:	21
Highest scenario in sensitivity run:	22

Figure 40 Catalog keys for scenario setup in the elasticity module

In the table the first entry (ID_SCENARIO=1) represent the "Reference scenario" that has been run under "Samgods model" application. All costs and times will be altered from the inputs present in this scenario. The table has a fixed number of default sensitivity tests (100). If you need to alter, add new element please contact Trafikverket for advice.

"*Lowest scenario in sensitivity run:*" and "*Highest scenario in sensitivity run:*" work in pair and represent the lower and upper scenario ID_SCENARIO the user wants to run in sequence. Usages are:

- Run a single scenario: both will be set to the same value (for instance 15 and 15)
- Run a range of scenarios: lowest value will be the first scenario (15) and the second one the highest scenario (20). All the scenarios from 15 to 20 will be run without any manual action from the user.
- It is not allowed to run a list of scenarios that is not sequential, for instance if the user wishes to run 1, 8 and 15, they must be set up as single runs.

Please note there is no catalog key to set however the model should use endogenous or exogenous consolidation rates. By default, the elasticity module uses exogenous consolidation rates inherited from the reference scenario.

IMPORTANT NOTE 1: Scenario denoted as 1 is the **reference scenario**. All the other scenarios will derive the definition of control files, batch files, etc. from the reference scenario.

To run any sensitivity test the reference scenario **MUST** be in place.

The reference scenario is produced running "Samgods model" application first with the unaltered costs and times.

IMPORTANT NOTE 2: In relation to the new functionality for exogenous/endogenous consolidation rates, all the sensitivity tests will use the consolidation rates from the **reference scenario**. This is due the rule state in pg. 80 **Rule:** The general rule is: any child scenario (i.e. alternative scenario in the specific model year) should derive its consolidation rates from the parent scenario. In the context of the elasticity module, parent is the reference scenario and child is the sensitivity test.

If the user has to provide a distinct set of consolidation rates from an unrelated scenario does not want to use the rule above, they should seek advice from Trafikverket.

Any run – LogMod_1 produced by "Samgods model" application MUST be present

To run "Samgods Elasticity":

- ○ Define the "*Lowest scenario in sensitivity run*" = the ID_SCENARIO for the first scenario that needs to be run (>1) and
- ○ "*Highest scenario in sensitivity run*" to the ID_SCENARIO of last scenario the user wishes to run in one-go (>1)

IMPORTANT NOTE: under some unforeseen circumstances writing from/to mdb files leads to run failure since mdb gets lock. To avoid failure, it is recommended to run NO MORE than four scenarios in a row. When completed, close down Cube catalog and Cube software and start it again.

7.12.5. Output

Output tables will be produced under same output mdb as Samgods Model standard run. In detail under Output0_{SCENARIO_SHORTNAME}.mdb will be present the following tables demarked by ID_SCENARIO. In Figure 41 five elasticity scenarios has been evaluated (5, 6, 7, 8 and 9).

Figure 41 Output examples within Output0_{Scenario_Name}.mdb

Under scenario folder the rep files from STD and RCM procedures the files illustrated in Figure 42.

Figure 42 Listed output files from the elasticity module in the main folder of the reference scenario

It's the same for the DBF tables with vehicle parameters in each run. In the example Vh_base_BS12.DBF is the initial table with original values, it is coincident to VH_Par_Loop_A_1.DBF. Vh_Par_loop_PartA.DBF is a working table connected to the last run. VH_Par_Loop_A_{ID_SCENARIO}.DBF the specific table for the scenario. Vh_Par_Loop_A_2.dbf is the vehicle table used in ID_SCENARIO = 2. See example of listed files in Figure 43.

Figure 43 Vehicle parameters database file generated in the main folder of the reference scenario when running the elasticity module

7.12.6. Specific elasticity output

Two output tables summarizing the elasticities for each scenario is available:

- Elasticities_{SCENARIO_SHORTNAME}_{ID_SCENARIO} table under Output0_Base2019.mdb
- Elasticities_{ID_SCENARIO}.CSV under scenario folder.

They have the following content as listed in Table 39. The attributes have the following meaning:

- PART: Which part of the model produced the output (Standard Logistic Module (STD) or RCM)
- LABEL: describes the unit for the values present in the line under V101-V401
- RATIO TDOM VHKM: Ratio between vehicle km total domestic of current scenario vs scenario 1
- RATIO TDOM TONKM: Ratio between total domestic ton km of current scenario vs scenario 1
- RATIO TOT VHKM: Ratio between vehicle km total where total = total domestic plus international, current scenario vs scenario 1
- RATIO TOT TONKM: Ratio between ton km total (international plus total domestic) current scenario vs scenario 1
- **TF** RATIO: First part denoted in bold is defined by the Scenario_List Scenario attribute and list of values are shown in Table 37.

As per the scenario list:

- **TF** ELAS VHkm TDOM: elasticity values for vehicle km TDOM[8]
- **TF** ELAS Tonkm TDOM: elasticity values for ton km TDOM
- **TF** ELAS VHkm TOT: elasticity values for vehicle km TOT
- **TF** ELAS Tonkm TOT: elasticity values for ton km TOT
- ID_SCENARIO: scenario id listed in scenario list table;
- V101,V102,….V401 : values for a specific output, defined under LABEL attribute.

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[8] The definition of TDOM is found in the MERGEREP/OUTPUT/-files, where TDOM is connected to Dtotal and TOT is connected to DTonneKm + ITonneKm. This is also seen in the script.

Table 39 Elasticities_{SCENARIO_SHORTNAME}_{ID_SCENARIO} table

PART	LABEL	ID_SCENARIO	V101	V102	...	V201	V202	V204
STD	RATIO TDOM VHKM	66	1	1.00053	0	0.99416	0.9911	1
STD	RATIO TDOM TONKM	66	1	1.00069	0	0.99405	0.99088	1
STD	RATIO TOT VHKM	66	1	1.00023	0	0.99407	0.9911	1
STD	RATIO TOT TONKM	66	1	1.00031	0	0.99398	0.99088	1
STD	TF RATIO	66	1	1	1	1.1	1.1	1.1
STD	TF ELAS VHkm TDOM	66	0	0.00053	-1	-0.09622	-0.099	-0.09091
STD	TF ELAS Tonkm TDOM	66	0	0.00069	-1	-0.09632	-0.0992	-0.09091
STD	TF ELAS VHkm TOT	66	0	0.00023	-1	-0.0963	-0.099	-0.09091
STD	TF ELAS Tonkm TOT	66	0	0.00031	-1	-0.09638	-0.0992	-0.09091
RCM	RATIO TDOM VHKM	66	1	0.99901	0	0.98978	0.99749	0.98123
RCM	RATIO TDOM TONKM	66	1	0.9989	0	0.99161	0.99754	0.98406
RCM	RATIO TOT VHKM	66	1	0.99952	0	0.99387	0.99749	0.98125
RCM	RATIO TOT TONKM	66	1	0.99943	0	0.99534	0.99754	0.98408
RCM	TF RATIO	66	1	1	1	1.1	1.1	1.1
RCM	TF ELAS VHkm TDOM	66	0	-0.00099	-1	-0.1002	-0.09319	-0.10797
RCM	TF ELAS Tonkm TDOM	66	0	-0.0011	-1	-0.09854	-0.09315	-0.1054
RCM	TF ELAS VHkm TOT	66	0	-0.00048	-1	-0.09648	-0.09319	-0.10796
RCM	TF ELAS Tonkm TOT	66	0	-0.00057	-1	-0.09515	-0.09315	-0.10539

7.12.7. Elasticity formulation

The elasticity formulation refers to the approach outlined in UK TAG Unit 2.1 Variable Demand Modelling [9][9] and has the form of:

$$e = \frac{\log(T1) - \log(T0)}{log(C1) - \log(C0)} = \frac{\log\left(\frac{T1}{T0}\right)}{\log\left(\frac{C1}{C0}\right)}$$

Where:

- ○ T1 and T0 are respective values of tonkm, VhclKm, etc in each scenario
- ○ C1 and C0 the specific costs modified in the two scenarios

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[9] Paragraph 6.4.5 pg. 45

8. General instructions

This chapter gives instructions for how to start using the Samgods GUI. Please note that the procedure is described for Standard user or Advanced user mode since the available parameter settings are different if developer mode is used.

8.1. Open the model

- Open Cube by clicking on the icon on the desktop[10]
- On the Welcome Screen select "Open catalog"
- Browse to Samgods catalog (file name: Samgods.cat – default folder C:\Samgods)
- Click on "Open"

8.2. Set the model to Standard user or Advanced user mode

- Select "Properties" on the menu bar under section "scenario (see Figure 44)
- In the Catalog Properties window, select the "Model User" tab (see Figure 45)
- Select "Model user" to "Model Applier" mode
- Select "Current Applier Group" among "Developer", "Standard User" or "Advanced User"
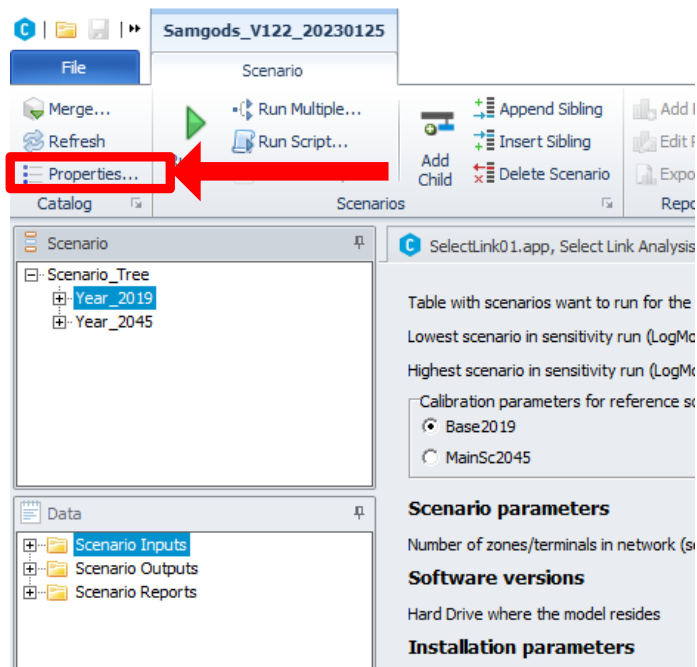
Figure 44 How to access "Catalog Properties"

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[10] Alternatively, double click on the Samgods catalog file.
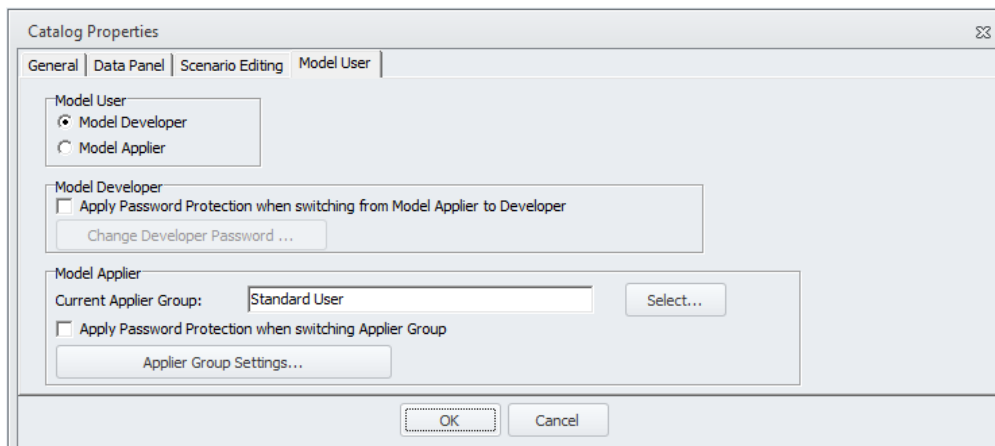
Figure 45 How to set the model to Model Applier>Standard user mode

> **Tip:** Each time changes have been made to the catalog, such as creating a new scenario, creating new output data by running the model or deleting data, the catalog must be saved. This is done by clicking the "save catalog" icon (see Figure 46) or going to "File" menu and choosing "Save" -> "Catalog" (see Figure 47). It is recommended to do this often when working with the model.
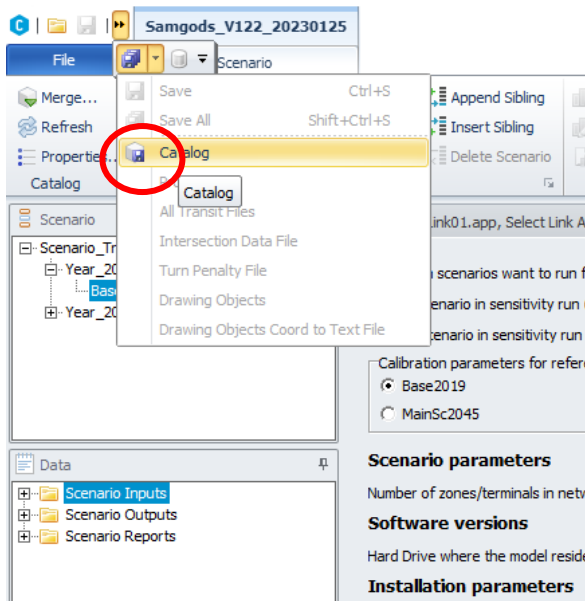
Figure 46 How to save catalog file using icon
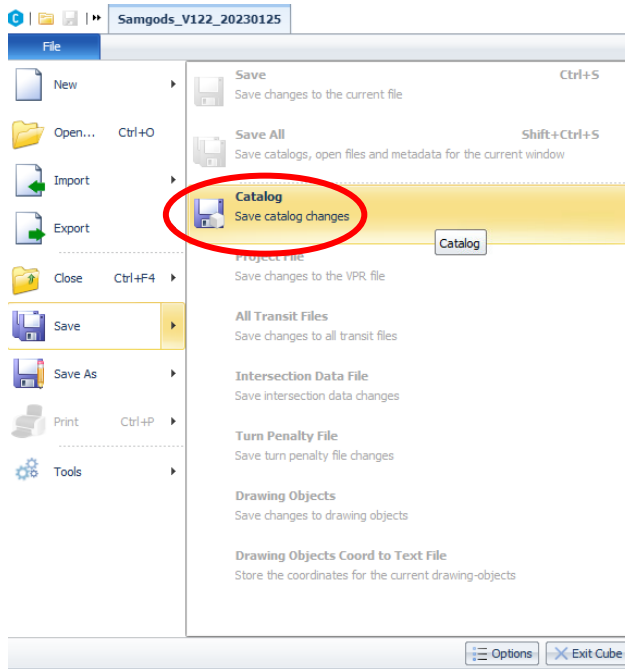
Figure 47 How to save the catalog file using the menu bar

8.3.   General guidelines for how to work with the model

After having opened the model and set it to Standard User mode, the user can start working with the model. Instructions for each specific action can be found in Chapter 9. However, it is necessary to also know which actions that should be taken and what to look for in the manual. This section gives some guidelines for the order of doing different things.

Working with the model is done by using the different applications and via the Data Section window. In order to use an application for a specific scenario:

- Double-click on the scenario name in the Scenarios window and select the application in the window that opens

- When using the Data Section window, select the scenario you want to work within the Scenarios window by clicking on it and then open the file you want to use from the Data Section window

In order to work with the input data, i.e. to set up a scenario, the input data must be made editable. This is done by:

- Running the *Create the editable files* application, see Section 8.5 for instructions. This must be done also if you just want to view the input data and it is mandatory to run the application at least once for every scenario you want to use in the model

- When the editable data has been created, it could be edited according to the instructions in Chapter 9 (for example). This is done by **using** the *Edit the data* application. Via the application, the editable data can be accessed (see Section 8.5 for instructions). An alternative to use *Edit the data* application to access the editable data, is to use the Data Section window

- When all edits to the input data have been made, the edits must be saved before running the actual Samgods model. This is done by **running** the *Edit the data* application (until this point the application has only been used to access the editable data, but it has not been run). For a locked scenario, such as the base scenario, no edits can be saved. However, the application can still be used to view the data

At this point the Samgods model can be executed, by running the *Samgods Model* application (see Section 8.6). By doing that, the output data is produced and can be compared or exported according to the instructions in the following chapters.

Different sets of output could be produced for different runs for the same scenario, for example if the model is run for two different commodity groups for the Standard Logistics module. In order to run the same scenario for different commodities, first run the *Create the editable files* application and then *Edit the data* as described above (the *Edit the data* application doesn't have to be run for a locked scenario as e.g. the Base2019 scenario). Then select the commodity group and run the *Samgods Model* application. After this another commodity can be selected and the *Samgods Model* can be run again. The different sets of outputs will be saved separately.

In the scenario folder (under Scenario_Tree, see Table 1), the name of the specific output database is OutputX_{SCENARIO_SHORTNAME}.mdb, where X is the commodity group. In the interface, just one set of output for one scenario can be accessible at the time. In order to access a specific set of output, double-click on the specific scenario, select the *Samgods Model* application and select the specific commodity group in the catalog key "Select commodities for the Logistics Module (…)". Click "Save" (not "Run"). In this way the correct set of output is activated and can be accessed from the Data Section window. The scenario selected under scenario window always filter the data shown under data panel. This is a peculiar characteristic of Cube and catalog file. All the logical relations are maintained in a coherent frame. The selection of a particular scenario will specify the values of catalog keys, the folder where results will be saved, and the data will be shown under data panel.

Whenever a scenario has been deleted or several runs have been made, the geodatabase files should be compressed in order to save disk space – see Section 8.9 for instructions. When working with the model and making changes to the catalog, such as adding a scenario or making changes to the geodatabase, it is recommended to save the catalog often. This is done by clicking the save button (the black floppy disk icon above the Scenarios window.

An exception is the output for Rail Capacity Management, since it can be run only with all the commodities (X=0 always) and its results will be always produced in Output0_{SCENARIO_SHORTNAME}.mdb.

8.4. Create a new scenario

To create a new scenario it is necessary to copy the scenario specific tables from another scenario, then merge the scenario specific tables with the base tables and finally visualize them in the graphical interface. To create a new scenario, do the following:

1) In the first step, create the scenario name in the catalog:

   a) In the Scenarios window, right-click on "Year_2019" or "Year 2045" (depending on model year for new scenario) and select "Add Child"

   b) Type the scenario name (it is neither allowed to use blank entries or to start with a number, nor to start with the following letters **n f t**) and press "Enter"

   c) In the Scenario Properties window, which then is opened, set a scenario code (or use the default one) and click "OK". It is recommended to use a short code that can be associated with the scenario name

   d) The Scenario manager window is opened automatically

2) In the second step, run the *Create the editable files* application as described below:

   a) Select *Create the editable files* in the Application window

   b) Open the scenario that you want to run by double clicking on it

c) Define from which scenario to copy the scenario specific tables from (e.g., Base2019) by typing the scenario name in the catalog key "Which scenario do you want to use? (Default is Base2019)"

d) Click "Run"

e) At the end of the run, click "OK"

The temporary geodatabase is now available in the scenario folder (located in the Scenario_Tree folder, see Table 1 in Section 5.5) with all the scenario data. To visualize the tables and the layers of the scenario, change the application from *Create the editable files* to *Edit the data* in the Scenario manager window. In Figure 48 and Figure 38 the default values of the catalog keys are displayed. The first set of catalog keys (Figure 50) lists the scenario parameters and each catalog key has an editing box (a box where a numerical value or label is expected), a scroll down menu, or a check box.
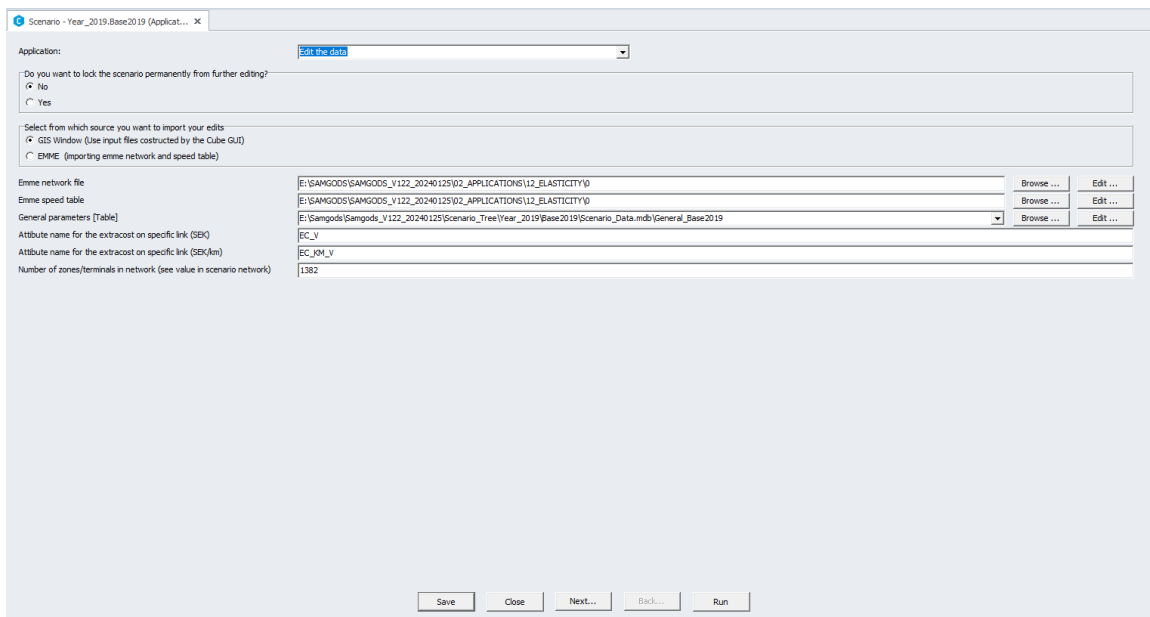
Figure 48 Catalog keys in first window for *Edit the data* application

The second set of catalog keys (Figure 49), accessed by clicking ""Next…" in the window in Figure 48 consists of tables and layers of scenario data. By clicking the "Edit..." button on the right, the data is opened in the correct format (i.e., a table in a database window or a layer in a GIS window). Descriptions of the keys and of how to use them for editing and displaying the data are given in Section 7.4.
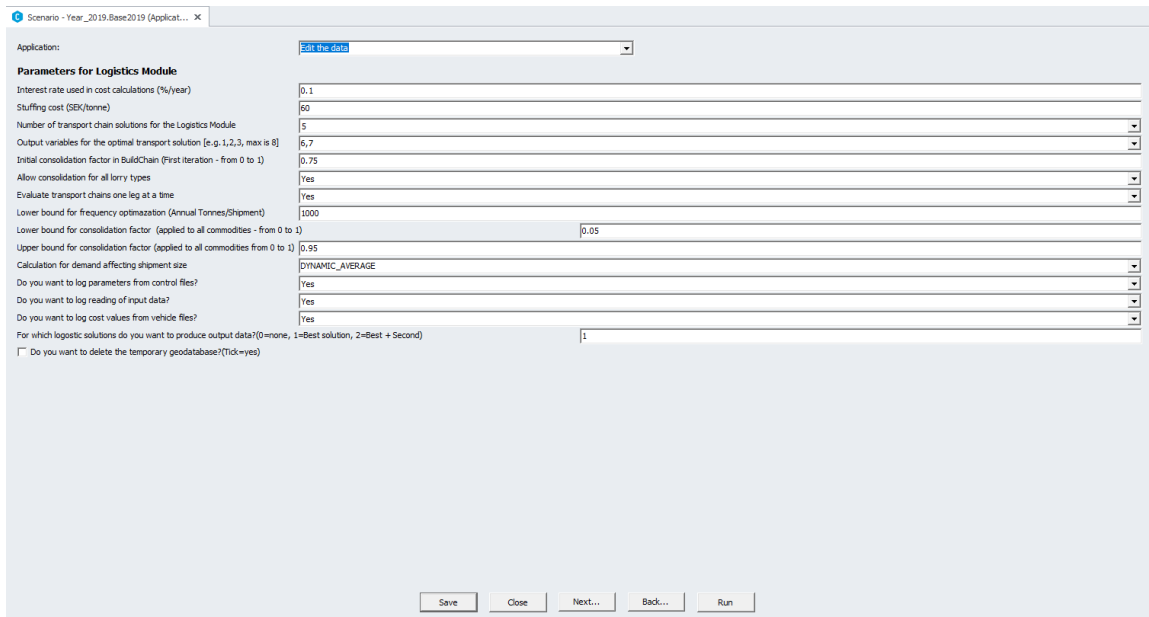
Figure 49 Catalog keys in second window for *Edit the data* application
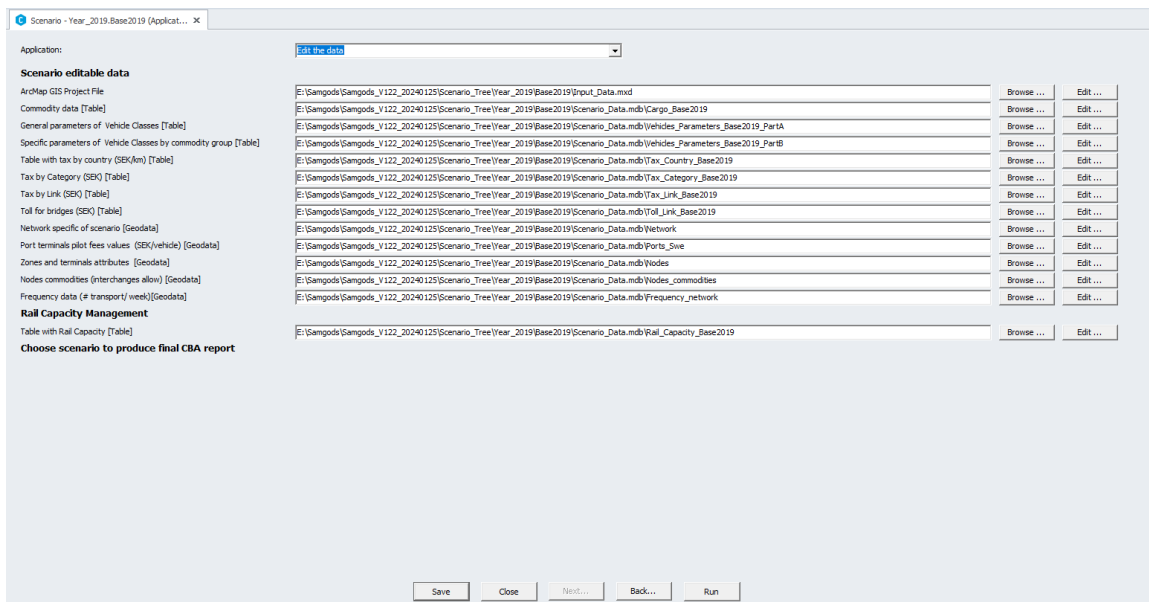
Figure 50 Catalog keys in third window for *Edit the data* application

Tip: To visualize all the layers in a map, click the "Edit..." button, next to the ArcMap GIS Project File catalog, key shown in Figure 50 pointing at the file Input_Data.mxd. All the geographical data will be loaded with a few default legends. The same file is available via Scenario Inputs\Editable Data\ Input_Data.mxd in the Data Section window.

3) Set the catalog keys according to the instructions in Section 7.4 and edit the data. For instructions on how to edit the scenario data, see Chapter 9.

4) To save the edits that have been made in the temporary geodatabase, the *Edit the data* application must be run. During this phase the scenario specific tables will be created and saved into the main geodatabase. Also, the report file "Report for the edit phase" with information or errors from running the *Edit the data* application will be created in Scenario Outputs\Edit the data Report in the Data Section window.

a) Click "Run"

b) During the execution, the program will prompt with the question: "Do you really want to save the scenario {SCENARIO_SHORTNAME}?". If "No" is selected, the temporary geodatabase will be deleted. No changes will then be made to the main geodatabase. If "Yes" is selected, the scenario specific tables will be saved into the main geodatabase. Whether the temporary geodatabase is deleted or not depends on the choice made for the catalog key "Do you want delete the temporary geodatabase?"

c) At the end of the run, click "OK"

d) Close the Scenario Manager window. To the question "Do you want to create the scenario {SCENARIO_SHORTNAME}?", click "Yes"

Tip: Information on errors or results from running the *Edit the data* application is available in *Scenario Outputs\Edit the data Report\Report*[11] for the edit phase in the *Data Section* window. For information on this and other log reports, please refer to Chapter 11. It is recommended to consult the reports to make sure no errors have occurred in the input data.

When changes have been made to the catalog, such as adding a new scenario, the catalog file should be saved. This is done by clicking the black floppy disk icon to the left above the catalog in the interface.

8.5.   Visualize and/or edit an existing scenario

In terms of the general structure and terminology of the Samgods GUI, an *existing scenario* means that the underlined scenario specific tables are already included in the main geodatabase. To visualize the data, the scenario-specific tables must be merged with the base scenario tables, and the appropriate layer (or feature class) for the data that is graphically represented in a map needs to be created. A layer can be described as the visual representation of a geographic dataset in any digital map environment. More information on the layers is given in Section 10. We have already introduced how the applications *Create the editable files* and *Edit the data* work together to guarantee consistence and coherence in the input data (see Sections 7.3 and 7.4).

Please note that **it is not allowed to rename a scenario**, due to the way input and output data are handled in the model.

There are two possible statuses of a scenario (see Section 7.4 for further explanation):

- The scenario is still editable (the key "Do you want to lock the scenario from further editing?" in Edit the data was set to "No" when Edit the data was run and the scenario was saved)

- The scenario is locked, either because it is the base scenario or because the user has locked it (the key "Do you want to lock the scenario from further editing?" was set to "Yes" when the scenario was saved by the *Edit the data* application)

Editable Scenario

To visualize and edit an existing scenario, two steps must be performed.

First, the *Create the editable files* application should be run:

1) Select *Create the editable files* in the Application window

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[11] The information is also available in the text file REPORT_ED_{SCENARIO_CODE}.txt located in the folder of the actual scenario.

2) Double-click on the scenario name in the Scenarios window

3) Click "Run"

4) Click "OK" at the end of the run

After the run, the temporary geodatabase is available in the scenario folder (located in the Scenario_Tree folder, see Table 1 in Section 5.5) containing all scenario data. To visualize the tables and the layers of the scenario, switch the application from *Create the editable files* to *Edit the data* in the Application scroll down menu in the Scenario manager window.

The first set of catalog keys (Figure 48) lists the scenario parameters and each catalog key has an editing box (a box where a numerical value or label is expected), a scroll down menu, or a check box. The second set of catalog keys (Figure 49) accessed by clicking "Next…" in the window in Figure 48) consists of tables and layers of scenario data. By clicking the "Edit..." button on the right, the data is opened in the correct format (i.e., a table in a database window or a layer in a GIS window). Another way to access the data is to use the Data Section window, where the scenario data can be found in the folder Scenario Inputs\Editable data.

Tip: To visualize all the layers in a map, use the first catalog key ("ArcMap GIS Project File") shown in Figure 50, pointing at the ***Input_Data.mxd*** file. Click the "Edit…" button and all the geographical data will be loaded with only a few default legends. The same file is also available via the *Data Section* window, in ***Scenario Inputs\Editable Data\ Input_Data.mxd***.

The second step to edit an existing scenario is to save the scenario data into the main geodatabase. This is done by running the *Edit the data* application. During this phase, the scenario specific tables are created and saved into the main geodatabase. Also, the report file "Report for the edit phase" is created in the folder Scenario Outputs\Edit the data, which is found in the Data Section window.

5) If the scenario still should be editable, select "No" in the first catalog key (first group of catalog keys, Figure 48) (to lock the scenario, select "Yes)

6) Select whether the temporary geodatabase should be deleted or not in the scenario folder

7) Make any edits in the scenario data (see Chapter 9 for instructions)

8) Click "Run"

During the execution, the program will prompt with the question: "Do you really want to save the scenario {SCENARIO_SHORTNAME}?". If "No" is selected, the temporary geodatabase will be deleted. No edits will then be saved into the main geodatabase. If "Yes" is selected, the scenario specific tables will be saved into the main geodatabase. Whether the temporary geodatabase is deleted or not depends on the choice made for the catalog key "Do you want delete the temporary geodatabase?".

9) At the end of the run, click "OK" and close the Scenario Manager window.

Tip: In the log report in Scenario Outputs\Edit the data Report\Report for the edit phase in the Data Section window, information is given on any errors or on the results of the process during the execution of the *Edit the data* application. This report also includes if any inconsistence exists with the calibration parameters listed in the separate calibration databases.

For information on this and other log reports, please see chapter 11. It is recommended to consult these reports to make sure no input data errors have occurred.

For a locked scenario, the first step (i.e., running the *Create the editable files* application and visualizing the data using the *Edit the data* application) is the same as for an editable scenario. It is sufficient to run the *Create the editable files* application once and leave the temporary geodatabase in the scenario folder so that it is accessible each time the user wants to display the input data. It is only necessary to run the *Edit the data* application if the temporary geodatabase should be deleted.

8.6. Run the Samgods model

The different ways to run the Samgods model are described in Sections 7.5 and Section 10. The following paragraph describes the procedure to run the Samgods model as a Standard user. Please note that it is required to run the applications *Create the editable files* and *Edit the data* before running the Samgods model, otherwise the error message ReturnCode=2 will be displayed. Please refer to Section 8.5 for an explanation on how this should be done

1) Select the *Samgods Model* application in the Application window.

2) Open the scenario that you want to run by double clicking on it in the Scenarios window.

3) Make sure that the correct calibration database[12] is selected in and that the and the number of zones/terminals are consistent with the input network and its value should be modified in *Edit the data.*

4) Under "Run Selections", make appropriate selections for the keys below:

    a) "Run only one step, or run all steps"; choices: All (full run), LOS Calculation, Logistics Module, Assignment, Reports, Standard LogMod, Rail Capacity Management

    b) "Year of PWC matrices", choices: 2019, 2045 or any user-defined set of matrices

    c) "Select the mode for the LOS Calculation and Assignment steps"; choices: All, Road, Rail, Sea, Air (Choice available only for LOS Calculation, Assignment, Reports)

    d) "Select commodities for the Logistics Module"; choices: 0 for all the commodities or the commodity number for a specific commodity (1-16) (Choice available only for Logistics Module, Assignment, Reports)

5) Under "Other options", make appropriate selections for the keys below:

    a) For the key "Do you want to produce buildchainxx.log files?", choose whether to produce the log files from the Buildchain program, containing any warnings from the execution

    b) Select if exogenous consolidation rates will be used. Tick the box and add the path in the next catalog key. The default setting is not (this option should be used for all base cases), the instruction from Trafikverket is to use exogenous consolidation rates (inherited from the reference scenario) when running analysis/investigations (UA).

6) Under "Logistics Module settings – advanced", make appropriate selections for the keys below:

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[12] Base2019 for all scenarios related to year 2019 and MainSc2045 for scenarios related to year 2045.

a) "Do you want to run the Logistics Module on several processors?"; tick "Yes" or "No"

b) "How many processors would you like to run simultaneously?"; indicate 1-16 processors

7) Under "Rail Capacity Management – settings", make appropriate selections for the keys below:

a) "Cut off criteria for RCM process (will consider links with capacity utalization > XX% where XX is the value defined)". In setting up the linear programming problem all links with capacity utalization equal to or above this threshold will be enter in the problem.

b) "Options to save output files from RCM process:", each LP produces a full set of files (see [3]) that could be saved in specific folders under LogMod. This catalog key will control the option to save all the performed loops or just the last one

c) "Maximum number of loops for Linear Programming process (LP)": number of LP loops the user would like to perform. Provide an integer value between 0 and 9. 0 will perform only LP0. The LogMod process will produce the best solutions and the suboptimal solutions (in terms of transport chains), the number of suboptimal solutions is controlled by the catalog key " Number of transport chain solutions for the Logistics Module". It is recommended to not change these settings and leave the default value

8) Click "Run"

9) A message window appears that informs whether the scenario is locked or still editable – click "OK"

10) A message window appears with working on Java installation if the path is wrong. Process will terminated and user needs to revise "Location of Java folder:" catalog key accordingly to settings on the computer. Example of pop-up message window is in Figure 51.

11) At the end of the run, the message window "Task Run Result" indicates that "VOYAGER Run of Application Samgods Model, 01 is complete" (or a corresponding message for the Emme user). Click "OK".

Tip: The run time for the Samgods model varies depending on the selected options. If a full run with all commodities and modes is selected together the RCM, it may be proper to use multiple processors to reduce the run time.

In the current model version, the program used to solve the Linear Programming Problem can use only a single processor. Therefore, this is the only part that will not have any benefit.

Tip: Each time changes have been made to the catalog, such as creating a new scenario, creating new output data by running the model or deleting data, the catalog should be saved. This is done by clicking the save icon (the black floppy disk above the Scenarios window). It is recommended to do this often when working with the model.
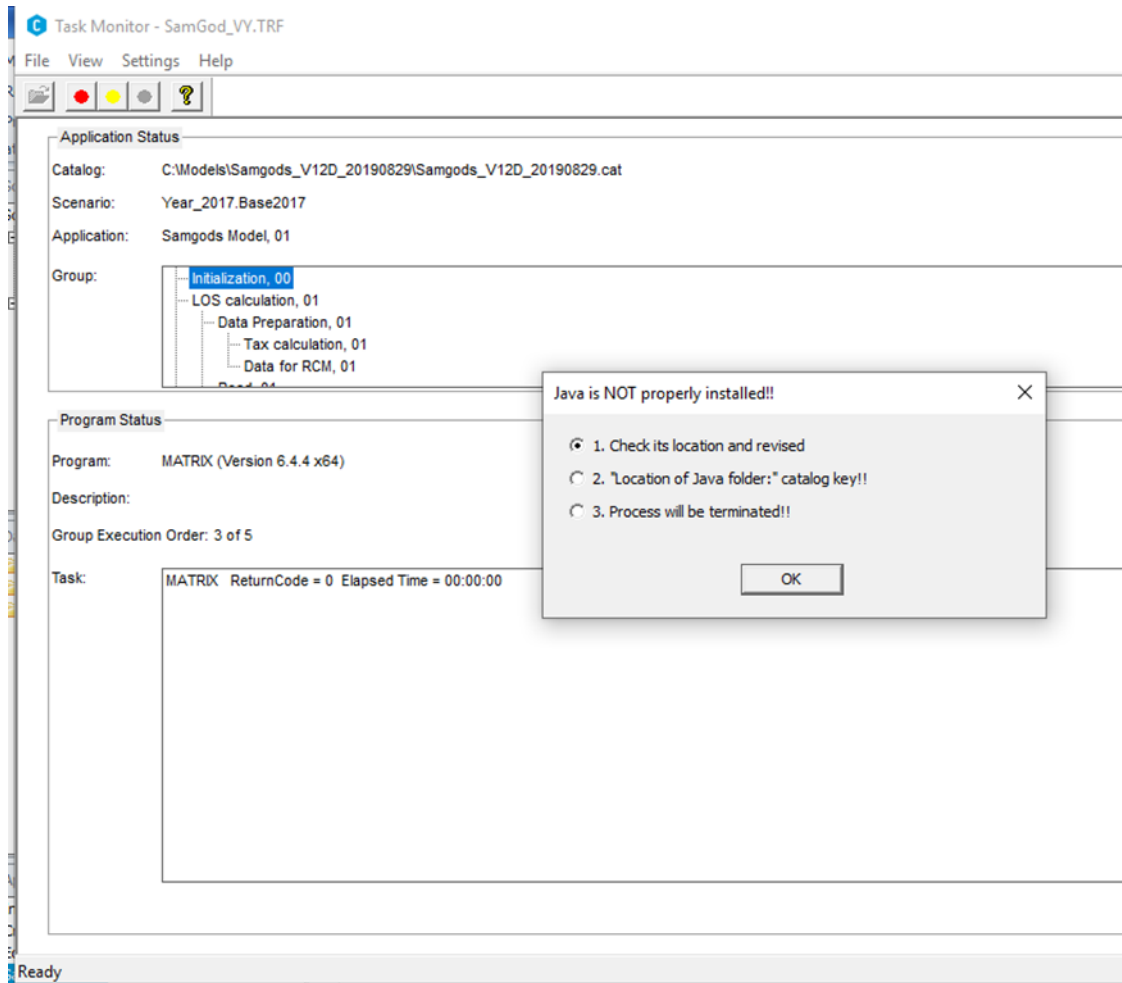
Figure 51 Warning message on Java installation

8.7. Compare scenarios

The comparison of outputs from scenarios is always made between the current selected scenario and an alternative scenario. The comparison encompasses the following results:

1. differences in LOS matrices (dist, ddist, time and extracost) for all modes and vehicle types
2. differences in OD tonnes, empty and loaded vehicles for all modes and vehicle types for STD
3. differences in tonne flows per mode rail, road and sea for STD and RCM
4. differences in vehicle flows in terms per mode rail, road and sea for STD and RCM
5. differences in tonne flows per commodity group for RCM

The *Samgods Model* application must be run for the specific commodity for both the current scenario and the scenario selected for comparison before it is possible to compare the outputs. To run the *Compare scenarios* application, do the following:

1) Select the *Compare Scenarios* application in the Applications window

2) In the Scenarios window, open the current scenario that you want to use by double clicking on it

3) Select the commodity class that you want to compare. It is mandatory to select a commodity class (0 for all commodities or the commodity number (1-16) for a specific commodity)

4) Select what you want to compare. The alternatives are *LOS matrices*, *Logistics Module*, *Assignment* or all of them

5) Update "Scenario's name to use in comparison:" catalog key with the name you want to use in the comparison against the current scenario

6) Update "Scenario folder for comparison:" giving information of folder and geodatabase name containing the scenario you want to compare

7) Click "Run". At the end of the run, click "OK".

The results from the comparison between scenarios are saved in their corresponding scenario folders, with the commodity class number indicated in the file name. The .MAT files for the OD matrices from the Logistics Module and LOS matrices will be saved directly in the scenario folder, while the networks from the Assignment step will be saved inside the output geodatabases. All output can be visualized from the Data section window, in Scenario Outputs\Compare (Table 55). An example of values for the different catalog keys is shown in Figure 52.
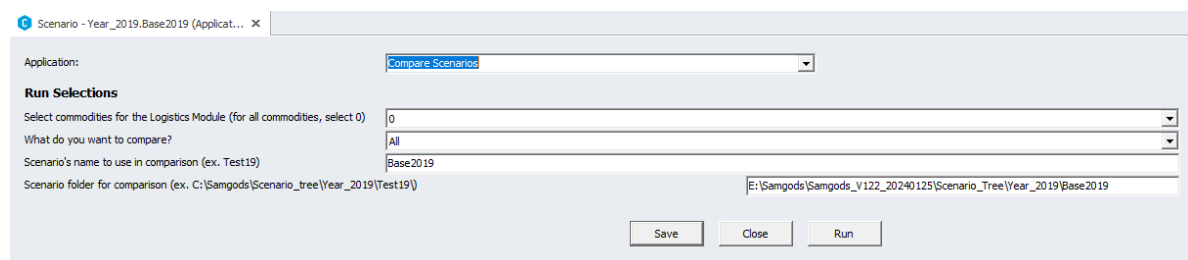
Figure 52 Catalog key values example

8.8. Delete a scenario

Deleting a scenario requires two steps in different windows.

1) First step: Scenario manager window

    a) select the *Handling scenario* in the Applications window

    b) Select the scenario that you want to delete in the Scenarios window by double click on the scenario name

    c) Select option "(1) DELETE the current scenario tables under Input_data.mdb (mandatory if you want to delete the scenario)"

Because of software settings, all catalog keys must be set. However, the key "For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)" will not be used in this case. A random character could be typed in

    d) Click "Run"

    e) During the execution, a warning window will prompt: "Do you really want to delete the scenario {SCENARIO_SHORTNAME}?". Selecting "No" means that the scenario will not be deleted. If "Yes" is selected, the scenario will be deleted

    f) At the end of the run, click "OK"

g) Close the Scenario manager window by clicking "Close"

2) Second step: Scenarios window

    a) Right-click on the scenario name in the Scenarios window and select "Delete"

    b) To the question "Ok to delete the data directories for this scenario and its children?", click "Yes";

    c) Run the *Compact* function, see Section 8.9 below.

3) Save the catalog by clicking on the saving icon (black floppy disk, above the Scenarios window)

Please note: If the scenario is in read-only mode (i.e., the scenario is locked), this step will have no effects on the scenario regarding the scenario specific tables. The scenario specific tables will remain in the main geodatabase.

8.9. Compress the geodatabase files

The *Compact* function compresses the files and deletes all the temporary edits stored in the geodatabase. Data that has been deleted previously are permanently deleted when the *Compact* function is run. This reduces the size of the geodatabase and cleans among the files that are stored in the geodatabase by only keeping the necessary data. Running the *Compact* function is required every time that a scenario is deleted or when several runs have been made, and it will influence:

- The main geodatabase containing all the **input** data (i.e., Input_data.mdb)
- The geodatabase containing all the **outputs** of a specific scenario in the scenario folder (i.e. OutputX_{SCENARIO_SHORTNAME}.mdb, where X is the commodity group – 0, 1-16).

The choice to compact a specific **output** geodatabase is only related to the selected scenario. However, when the *Compact* function is employed, the **input** data (main geodatabase, Input_data.mdb) will also be compacted. Run the *Compact* function in the following way:

1) Select the *Handling scenario* in the Applications window

2) In the Scenarios window, double click on the scenario that you want to compact or any scenario if you want to compact input data

3) Under the "Handling scenario" catalog key group, on catalog key "Select how you want to use Handling Scenario application" select "(2) COMPACT the geodatabase files (Input_data.mdb , Scenario_data.mdb and Output.mdb)" option

4) Because of software settings, all catalog keys must be set. However, the key "For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)" will not be used in this case. A random character could be typed in

5) Click "Run", at the end of the run, click "OK"

Tip: Run the *Compact* function every time a scenario is removed, or several runs have been made, to reduce the amount of data stored in the geodatabase. Just choose any scenario under scenario tree.

8.10. Export and import a catalog

The Scenario Export function can be used to export a catalog into a new catalog, including a scenario that will be the base scenario in the new catalog. It can also be used to export a single scenario into an existing catalog – see the next chapter.

To export the entire catalog into a new catalog directory and create a new base scenario, the following is required:

1) Select the *Handling scenario* in the Applications window

2) In the Scenarios window, double click on the scenario that you want to use as the base scenario in the new catalog

3) Under the "Handling scenario" catalog key group, on catalog key "Select how you want to use Handling Scenario application" select "(3) EXPORT the model in a new folder using the current scenario as Base" option

To set the value for the catalog key "For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)", type in the destination folder in the editing box (for instance C:\Models\Samgods_New_Version\)

4) To set the value for the catalog key "For choice 3 or 4 provide the name of the base scenario in the destination model", type in the new name you want to use for the current scenario, when it has been exported as the base scenario in the new catalog, in the editing box (for instance Base2019Corr)

5) Click "Run"

6) At the end of the run, click "OK"

Please note: A new folder must be defined for the Scenario export function. If the destination catalog already exists, the user will be informed by a prompt saying, "The model already exists"; "This might be an error. The process will be terminated. Check the folder". In the Samgods GUI, it is never possible to overwrite an existing catalog.

To complete the export of a catalog properly by controlling that the scenario parameters in the new catalog correspond to the imported ones, the *Scenario Import* function must be run. The required actions are:

1) Close the old catalog

2) Open the new catalog created during the export

3) Update the paths for the applications as described in Section 5.5 and run the *Installation* application (type in the new base scenario name according to the name specified in the *Scenario Export* function in the corresponding catalog key; please refer to Section 5.5 for further instructions)

4) The Scenario_Tree in the Scenarios window in the new catalog only contains seven scenarios, which have the orginal structure when model is istalled. If the new scenario requires renaming, please right-clicking on the scenario name and rename it accordingly. The code should also be updated, which is done by right-clicking and selecting "Properties". Define a short code that is similar to the scenario name

5) Under the "Handling scenario" catalog key group, on catalog key "Select how you want to use Handling Scenario application" select "(5) CHECK the imported scenario in terms of catalog key definitions" option

6) Because of software settings, all catalog keys must be set. However, the key "For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)" will not be used in this case. A random character could be typed in

Click "Run"

7) At the end of the run, click "OK"

8) Check the report in **Scenario Outputs\Scenario_Import_function_Report\Report** for the Import Phase in the Data Section window

9) If any scenario parameters need to be changed according to the report, change those catalog key values for the imported scenario, under "Scenario Parameters" in the *Handling scenario* application and run the application again. Check the report again and repeat if necessary.

Tip: Each time changes have been made to the catalog, such as creating a new scenario, creating new output data by running the model or deleting data, the catalog should be saved. This is done by clicking the save icon (the black floppy disk above the Scenarios window). It is recommended to do this often when working with the model.

8.11. Export and import a scenario

To export a scenario into an existing catalog already containing a base scenario, the following actions are required:

1) Select the *Handling scenario* in the Applications window
2) In the Scenarios window, double click on the scenario that you want to export
3) Under the "Handling scenario" catalog key group, on catalog key "Select how you want to use Handling Scenario application" select (4) EXPORT the current scenario in another model" option
4) To set the value for the catalog key "For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)", type in the destination folder in the editing box (for instance C:\Models\Samgods_New_Version\)
5) To set the value for the catalog key "For choice 3 or 4 provide the name of the base scenario in the destination model", type in the new name you want to use for the current scenario, when it has been exported as scenario in the new catalog, in the editing box (for instance MainSc2045Corr)
6) Click "Run"
7) At the end of the run, click "OK"

Please note: The exported scenario will have the same scenario name in the new catalog as in the catalog from which it was exported.

To complete the export of a scenario properly by controlling that the imported catalog key values correspond to the ones in the new catalog, the *Scenario Import* function must be run. The required actions are:

1) Close the catalog from where the scenario was exported (i.e., the one that is open)
2) Open the catalog to where the scenario has been exported

3) Create a new scenario, with the same name as set in the export phase, in the catalog (right-click on Scenario_Tree in the Scenarios window and select "Add child", type in the name and press Enter. Define the scenario code and click "OK")
4) Under the "Handling scenario" catalog key group, on catalog key "Select how you want to use Handling Scenario application" select "(5) CHECK the imported scenario in terms of catalog key definitions" option
5) Because of software settings, all catalog keys must be set. However, the key "For choice 3 or 4 provide an absolute path to the location of the destination model (ex. C:\Samgods_New_version\)" will not be used in this case. A random character could be typed in
6) Click "Run"
7) At the end of the run, click "OK"
8) Control the report *Scenario Outputs\Scenario_Import_function_Report\Report* for the Import Phase in the Data Section window to see if any edits are necessary
9) Change any catalog key values listed in the report for the imported scenario, under "Scenario Parameters" in the *Handling scenario* application and run the application again. Check the report again and repeat if necessary

> **Tip:** Each time changes have been made to the catalog, such as creating a new scenario, creating new output data by running the model or deleting data, the catalog should be saved. This is done by clicking the save icon (the black floppy disk above the Scenarios window). It is recommended to do this often when working with the model.

8.12.   Produce PWC Matrices in Voyager format

To produce the PWC matrices in Voyager format, do the following:
1) Select the *PWC_Matrices* application in the Applications window
2) Double click on a scenario (it does not matter which scenario) in the Scenarios window
3) Select the year you want to convert in Voyager format among 2019 or 2045 using " Year of PWC matrices" catalog key
4) Click "Run"
5) At the end of the run, click "OK"

The matrices are now available in the folder 01_Programs\LogMod\Input\PWC\{Year}\VY_F\, found in the Samgods folder (see Table 1 in Section 5.5). In order to display the matrices for a commodity via the Data Section window, do the following:
1) Select the *Samgods Model* application in the Application window and double click on a scenario (it does not matter which scenario) in the Scenarios window
2) Select a commodity using the catalog key "Select commodities for the Logistics Module (…)". Only the numbers 1-16 are allowed here (not 0 for all commodities);
3) Click "Save" to save the settings;
4) The matrices for the selected commodity are now available in the Data Section window, in Scenario Inputs\PWC_Matrices\PWC matrix for commodity.

8.13.   Change matrix format

To export a matrix in CSV or DBF format, or as a table in a geodatabase (GDB format):

1) In the Scenarios window, double click on the scenario corresponding to the matrix you want to export

2) In the Scenario manager window, select the *Change matrix format* application and make appropriate selections for the desired matrix (see the details in Section 0)

3) Click "Run"

4) At the end of the run, click "OK"

The output is found in the scenario folder with a CSV or DBF extension or as a table inside a geodatabase, depending on the selections made.

8.14. Visualize the outputs

In the Data Section window, the results that are produced in all steps are available. Please refer to Section 6.3 for details.

8.15. General information on the GIS Window

The ArcMap GIS Project file (Input_data.mxd) is opened from the Data Section window by opening the folder Scenario Inputs\Editable data and double-clicking on the Input_Data.mxd file. The .mxd file can also be visualized from the *Edit the data* application, by opening the scenario, clicking the "Next…" button to reach the second set of catalog keys and finally clicking the "Edit…" button for the ArcMap GIS Project File key. The map document (.mxd) contains the following information:

1) Details of all input data that can be visualized in a map (data with [Geodata] label) with the following layers (where the default values are indicated in parenthesis):

    a) Frequency_network (i.e., frequencies of services between terminals, for more information on this network, see the appendix section 14.3)

    b) Nodes_commodities (i.e., which commodities that can be handled at the terminals)

    c) Nodes

    d) Ports_swe

    e) Network – Link and Node layer

    f) Samgods_zones

A set of default legends () for the node and the link attributes for the layers:

    a) Nodes_commodities: Type of terminal

    b) Nodes: Type of terminal

    c) Ports_swe: Swedish Ports

    d) Network:

        a. Network_Node: Terminal type (shown in Figure 53)

            i. Node type – Road

            ii. Node type – Rail

            iii. Node type – Sea

            iv. Node type – Ferry

            v. Node type – Air

        b. Network_Link: Modes

e) Samgods zones
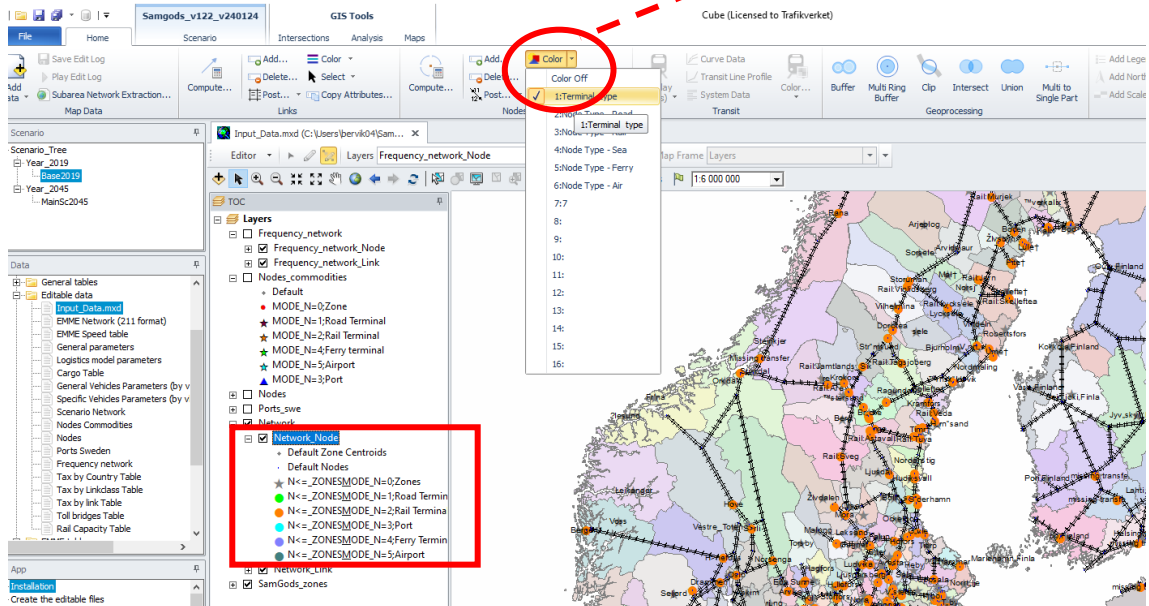
Figure 53 Enable the layer and select the set of legends as in the figure. Example of default legends, for the Network_Node layer
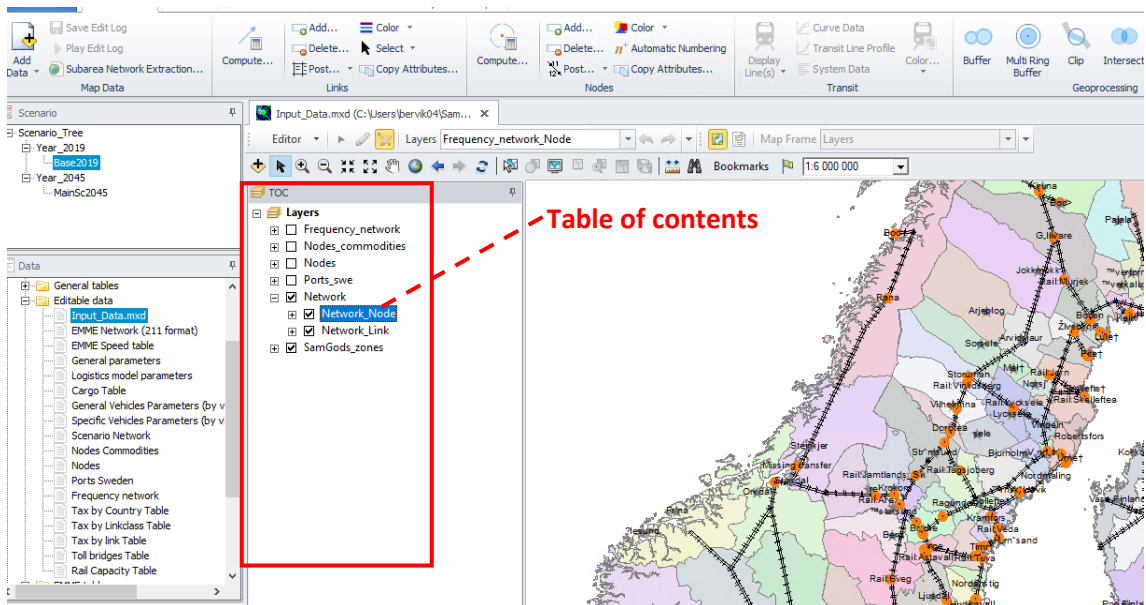
Figure 54 Table of contents (TOC)

2) For the network node and link layers, a set of filter conditions to switch on/off specific modes are also available. To enable/disable the filters, right-click on the node/link layer

in the Table Of Content (TOC) and select "Properties". In the scroll down menu "Selection Group", select the desired group and then tick the "Active" check box to activate the option. The filters are by default set as in the last session, which means that a filter can be active even if no check boxes are ticked. To be sure to turn all filters off, tick and then un-tick an "Active" check box. The available groups for the network node layer are:

a) Road Network

b) Rail Network

c) Sea Network

d) Ferry Network

e) Air Network

f) Zones

The same groups are available for the link layer, except the last one. The advantages of enabling a filter are the possibilities to:

- visualize only the selected entities

- select and edit only the visualized entities (and thereby avoid selecting the wrong links)

The best way of using these filters is in conjunction with the default legends: First activate the desired filter(s) for the layer(s) you want to work with and then enable and/or edit the corresponding set(s) of default legends using the icons shown in Figure 53. The layers ticked in the TOC in Figure 54 are the ones that are visualized in the GIS window. A layer is selected by clicking on it in the TOC. By selecting "Datasets -> Set Selectable Layers" it is possible to set which layers that allow selecting elements. E.g., if the Samgods_zones layer is selected in the TOC but not set as selectable, the zones are shown in the GIS map but cannot be selected with the Select features tool (see below). The default is that all layers are selectable. When editing the GIS data, the layer containing the data that is edited must be selected in the "Layers" drop down menu in the Editor toolbar (see below).

Each layer has an attribute table, which is accessed by right-clicking on the specific layer in the TOC. In the attribute table it is possible to view the attributes of each layer, but not to edit any values. Any edits must be made in the Feature Explorer window (or using the Compute function) and in Edit mode (see below for explanations).

More information on the GIS window can be found in the help section, accessed from the main toolbar: Help -> Cube Help -> Cube Base -> GIS Window.

Tools in the GIS window

To select/edit/modify the layers, the following tools are available from the interface:

- Select elements, (fixed) zoom in/out in the map, pan, full extent, refresh view, select features, see Figure 55
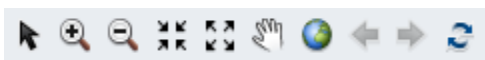
Figure 55 Tool in GIS window

- Select/view elements via SQL queries based on the attributes in the layers: On the menu bar, select Datasets -> Select by Attributes… and type an SQL syntax, for example all railway nodes in the Stockholm region, in a node layer, see Figure 56.
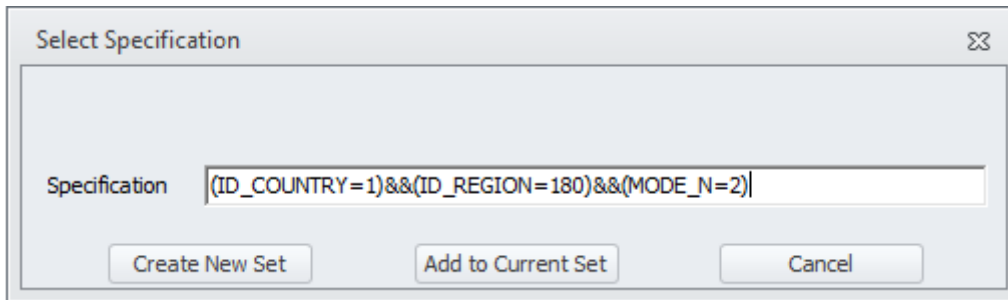
Figure 56 Select/view elements via SQL

- The Editor toolbar, which is used when editing the network, see Figure 57.

Figure 57 Editor toolbar

- Add/remove attributes in the layer's table (node or link table) by selecting Node (or Link) -> Attribute -> Add/Delete on the menu bar;

- Visualize the attributes for a specific selected element – after an element has been selected using the "Select Features" tool (see first bullet above), the attributes will be displayed in the Feature Explorer window, see Figure 58. In the Edit mode, it is also possible to edit and save the new values directly in the Feature Explorer window. To change to Edit mode, click on Editor -> Start Editing on the Editor toolbar;
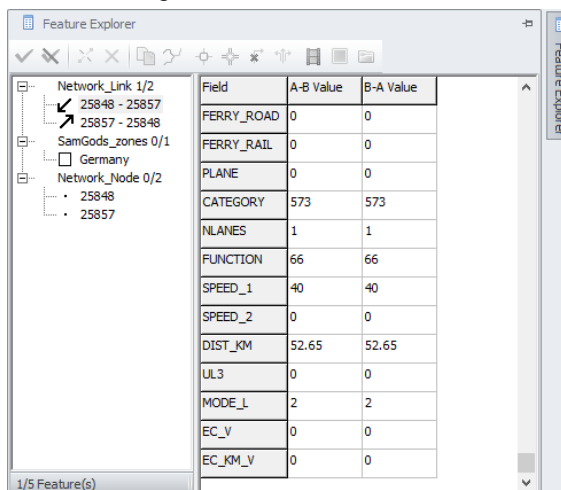
Figure 58 Feature Explorer window

- Modify values based on a condition. Under Link or Node (depends on the type of layer) on the menu bar, the "Compute" option is available when the session is in Edit mode. By selecting "Compute", access is given to the Feature Class Attribute Calculation window, shown in Figure 59. In this window, it is possible to edit the values and apply a condition (in the example in Figure 59, the capacities for all ports in the Lysekil region are updated, more details on this specific example can be found in Section 9.6).

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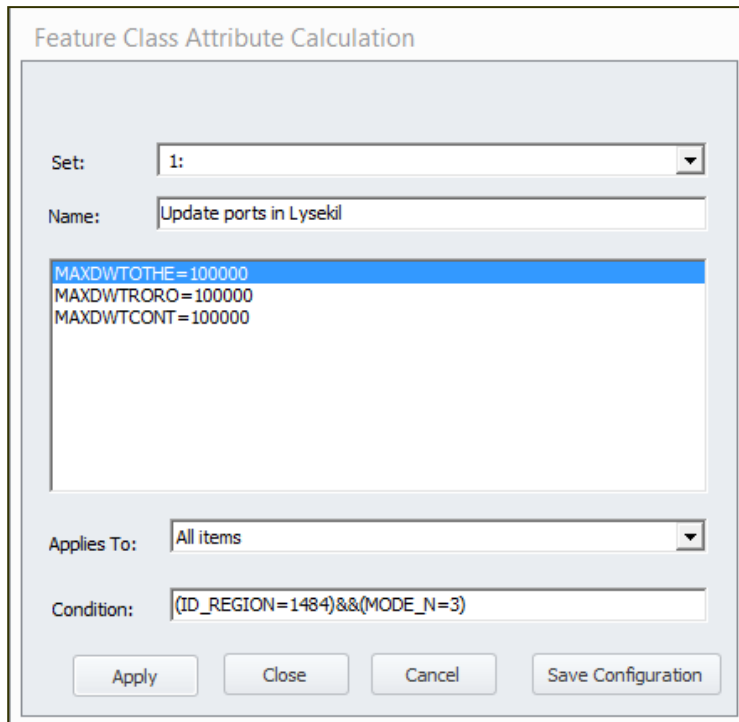
Figure 59 The Feature Class Attribute Calculation window

Attributes available in the node and link layers

It is possible to select an element in a node layer using the following attributes:

- ID_COUNTRY;
- ID_REGION (primary key if used in combination with ID_COUNTRY). A list of the country and region codes can be found in the Data Section window, under Scenario Inputs\General tables\Zoning System;
- MODE_N (1 – Road terminal, 2 – Rail terminal, 3 – Port, 4 – Ferry terminal, 5 – Airport).

For example, to select all the nodes in a region, the user only needs to select the layer in the TOC and then specify the ID_REGION attribute using Select -> Select by attribute… on the main toolbar in Figure 60.
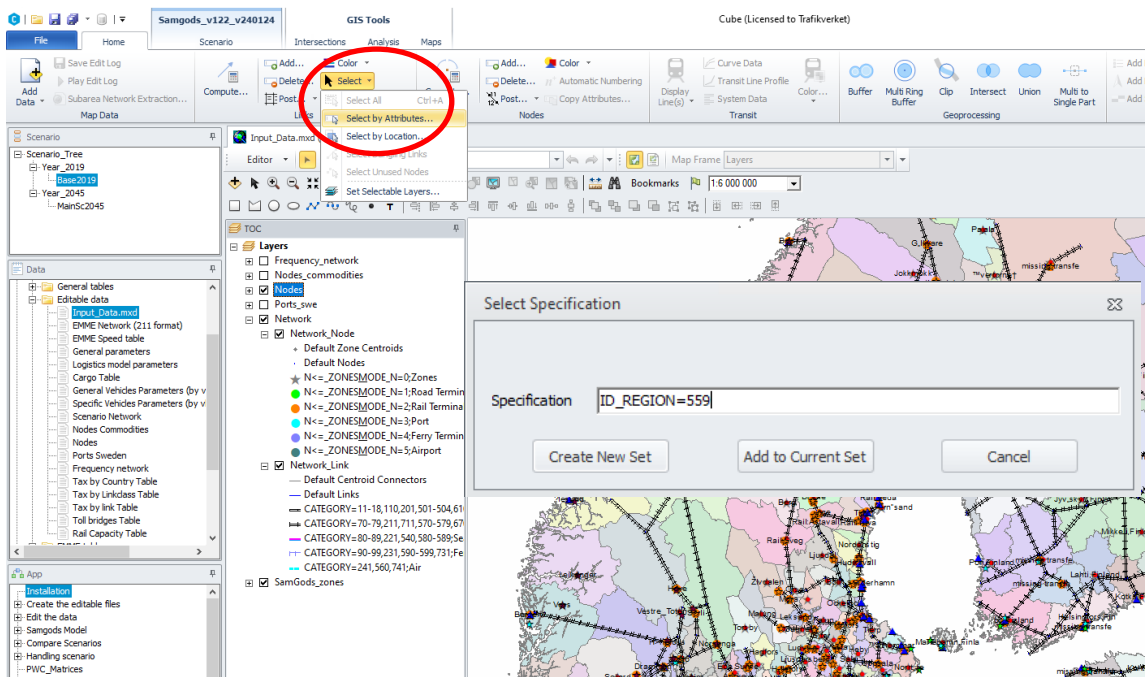
Figure 60 Select by attribute tool

To view all available attributes, right-click in the blank field in the Select Specification window.

For the network link layer the attribute corresponding to MODE_N is MODE_L. To select all the links in a region, do the following:

1) Select the desired region in the map using the Select Features tool (as a suggestion, the Samgods_zones layer should be ticked in the TOC so that the regions are visible)

2) Activate the layer where you want to select elements, in this case the "Network_Link" layer, by clicking on it in the TOC

3) On the menu bar, Select -> Select by Location…

4) In the Select by Location window, set the values indicated in Figure 61

5) Click "Apply", and then "Cancel" when all specifications have been made
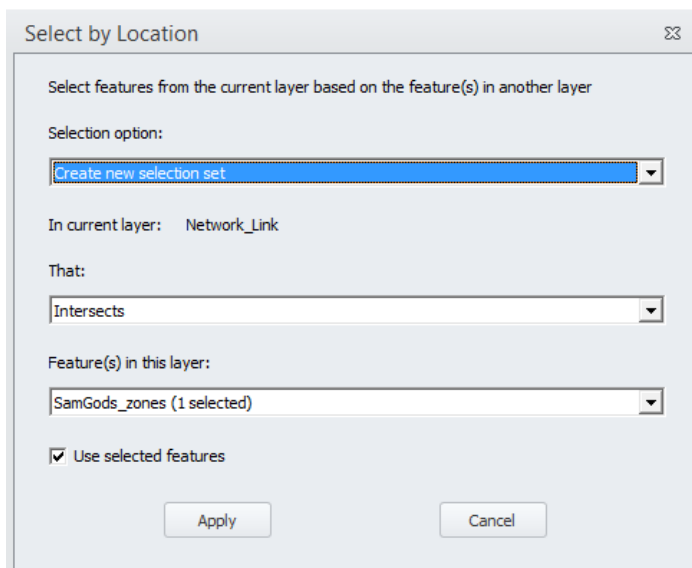
Figure 61 The Select by Location tool

9. Scenario setup

As for Chapter 8, this chapter describes how to use the Samgods GUI in Voyager Standard user mode. The parameter settings etc. that are described are visible in Standard user mode – e.g. in developer mode all catalog keys are possible to set, in Advance Mode some extra catalog keys but not all as per developer mode.

After edits have been made to the scenario according to the instructions below, the changes must be saved to the main geodatabase before running the model. This should be done according to the instructions in Section 8.5, i.e. by running the *Edit the data* application.
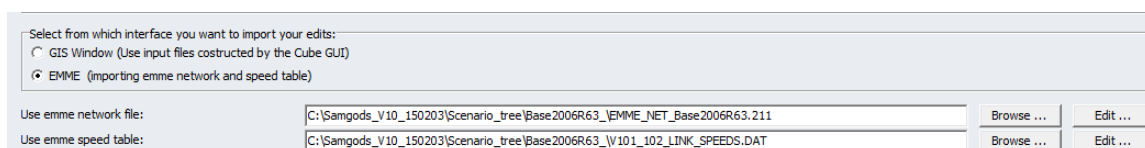
If you are not sure on how to use the GIS window, the layers, filters and legends, see Chapter 8 for a short introduction.

9.1. Import EMME network

An option to make edits on the network in Emme environment is available in the GUI interface. In this paragraph the actions that must be performed are outlined and general suggestions on how to avoid inconsistencies in the model are provided.

In order to import an Emme network together with the speed definition for links, do the following:

1) Select "Edit the data" in the Application window and double click on scenario under Scenario Window;

2) Set the values for the following catalog keys, see Figure 62

   a) Change "Select from which interface you want to import your edits:" to "EMME (importing Emme network and speed table)

   b) Specify the location for Emme network using "Use Emme network file:" catalog key The file must have *.211 extension to be recognized by the system

   c) Specify the location for link speed file using "Use Emme speed table:" catalog key The file must have *.DAT extension to be recognized by the system

   d) From Emme network *.211 identify the number of zones present in the table (see below for details on this) and set the catalog key "Number of zones in network (see value in scenario network):" to that value

3) Click on "Run".

Figure 62 Catalog keys to import Emme network

The main elements in this import are the number of zones and the file structure for the Emme network and the speed link table.

The Emme network in *.211 has two distinct parts, **t nodes init** and **t links init**. The records

```
1    c VOYAGER NETWORK  Date: 10-Feb-15 11:14 AM
2    c Project: Base2006R63
3    c Scenario   1
4    t nodes init
5    a*711400  1620.00  6601.00      1    114     0 0000
6    a*711401  1620.25  6599.62      1    114     1 0000
7    a*711402  1617.90  6600.30      1    114     1 0000
8    a*711403  1618.65  6601.87      1    114     1 0000
9    a*711500  1628.00  6603.00      1    115     0 0000
10   a*711700  1641.00  6598.00      1    117     0 0000
11   a*712000  1647.00  6581.00      1    120     0 0000
12   a*712300  1616.00  6589.00      1    123     0 0000
```
Figure 63 Node table

between those two strings represent the node table. An example has shown in Figure 63.

The values present in each record has a similar meaning to the attributes present in a Voyager network:

- a: just a label used in Emme program, not relevant for the system
- *: if present the record refers to a zone, if not present it is a regular node
- 711400: Emme number
- 1620.00: x coordinate
- 6601.00: y coordinate
- 1: ID_COUNTRY
- 114: ID_REGION
- 0: MODE_N
- 0000 : user field not relevant for the model.

During the import ID_COUNTRY, ID_REGION and MODE_N will be verified in terms of consistency with the base scenario. If one or all of them is missed, in {SCENARIO_DIR}\REPORT_ED_{SCENARIO_CODE}.TXT will be listed the errors (see Chapter 11 for list of messages and possible actions). The errors must be corrected in the *.211 and the process must be rerun until no messages will be displayed in the report.

To identify the maximum number of zones in the Emme network browse along the node table until a first record without "*" in the second position has identified. For instance see Figure 64.

Since the text window in Cube gives the row number (number on the left hand side grayed), the

```
1380    a*961511     88.32  6466.59     518    2615     2 0000
1381    a*960111    262.46  6646.67     518    2601     2 0000
1382    a  64541   -218.72  5809.60     550    9999     3 0000
1383    a  64547   -408.27  5911.51     550    9999     3 0000
```
Figure 64 Last zone in node table

number of zones will be simply identified as difference of the current row number and 5 (first record in the table containing a node record) plus 1. In the example 1381-5+1 =1378. This is the value that must be provided to the catalog key "Number of zones in network (see value in scenario network):".

The system **will not perform checks** on the link table rather than consistency with the node table. Therefore before using the network in Samgods the categories associated to the links must be checked and corrected. The CATEGORY attribute (6th field in the Emme link table, denoted link type) must be consistent to the list of allowed categories in A_LinkGategories.

The UL3 attribute (user link data number 3) in the link table (11th field in the Emme link table) has been used to specify a **capacity constraint** in sea mode. Therefore those sea links for which the user wants to apply a constraint, a number must be coded.

The UL2 attribute (user link data number 2 – 10th field in the Emme link table) is not anymore required. Originally it was holding distance information, but it has replaced by DIST attribute (4th field in the Emme link table). DIST holds maximum 3 digits precision. Any more decimals will be NOT imported in the Cube Interface. Same rule is applied in exporting the network from Voyager format to Emme. Maximum 3 digits are exported in the DIST field.

It is worth noting that the nodes and links are **not sorted in normal Emme** output order from a Cube/Voyager export.

9.1.1.   Edit EMME network after importing in GIS Network window

When "Edit the data" has been run providing EMME files the tables under Scenario_Data.mdb and Input_Data.mdb are updated accordingly. The network under Scenario_Data.mdb **is not used** within the import process and **keeps the original definition from the parent scenario**.

To edit the revised EMME network the following extra steps are required:

1) Select "Create the editable files" and double click on scenario under Scenario Window;
2) Click on "Run";
3) When finished Input_data.mxd and network under Scenario_Data.mdb is updated to Emme network
4) Proceed with edits in Cube GIS window;
5) When made the intended changes, select "Edit the data" application and double click on scenario under Scenario Window;
6) Amend the catalog key in the following manner:
7) Set the values for the following catalog keys in Figure 54.
8) Change "Select from which interface you want to import your edits:" to "GIS Window (Use input files constructed by the Cube GUI)
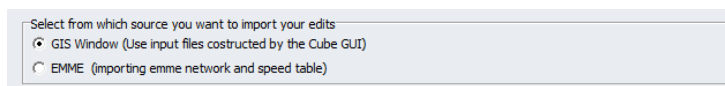
Figure 65 Catalog keys to edit after import of Emme network

9) Click on "Run".

9.2.   Introducing a link-based cost

There are different ways to add taxes, tolls and extra costs to one or several links. All of them are added for each vehicle class separately. Six attributes with different purposes are defined:

- Extra fixed cost per link or set of links (SEK)
- Extra kilometres based cost per link or set of links (SEK/km)
- Country tax: kilometres based tax per country (SEK/km)
- Link class tax: fixed tax per link, per link category (SEK)
- Link tax: fixed tax per link (SEK)
- Toll for bridges, fixed tax per link (SEK)

How to edit each one of them is described in the following paragraphs. The three types of taxes (country tax, link class tax and link tax) work together, so that only one of them can be applied to a specific link at once. In short the priorities are the following:
COUNTRY TAX < LINK CLASS TAX < LINK TAX

How the different taxes are prioritized in detail is described below, namely in the section about the link tax. The toll for bridges is added to any tax on a link. It can also be applied to road and rail links that are not bridges. All these four attributes (the three taxes together with the toll for bridges) are edited via tables.

Then there are the two extra cost attributes. They could represent any fee, tax or other cost and are added to any other taxes or tolls for the links where they are defined. They are edited via a GIS layer.

9.2.1.   Extra cost on a specific link or set of links

In order to add a specific cost to a specific link in the network for a specific vehicle class, do the following:

1) Open the GIS file (Input_Data.mxd), in one of the two possible ways:

   e) Open the Scenario manager window by double clicking on the scenario name in the Scenarios window. In the Scenario manager window, select the *Edit the data* application. Click the "Next…" button and then "Edit…" for the catalog key "ArcMap GIS Project File";

   f) Alternatively, select the scenario by clicking on it in the Scenarios window and open the file from the Data Section window, under Scenario Inputs\Editable data\Input_Data.mxd;

2) Select the Network_Link Layer in the TOC window;

3) On the menu bar, select Link -> Attribute -> Add;

4) In the first popup window, enter the name for the new attribute by considering the following:

   a) If you want to add an attribute as a fixed cost (independent of distance), the label name EC_VXXX, where XXX represents the vehicle type, should be used (in the network all the attributes depend on the vehicle type);

   b) If you want to add an attribute as a parametric cost depending on the distance, the label name EC_KM_VXXX should be used;

5) In the second popup window, fill in the variable type (numerical (N) or text (T));

6) Enter the specification for the next new attribute as in 5) and 6). When all attributes have been added, continue to 8);

7) Leave the attribute name blank (without typing anything) and click "OK".

Please note: The label names for the two attributes are managed by two catalog keys in the *Edit the data* application:

- "Attribute name for the extra cost to a specific link (SEK)" – default: EC_V;

- "Attribute name for the extra cost to a specific link (SEK/km)" – default: EC_KM_V.

To change the defaults the user only needs to type the new label names in these catalog keys. If the defaults are changed, the new label names must be used when setting the attributes as described above, the vehicle type code must be placed at the end of the attribute name, e.g.

- COST_KM101;

- FEES_201.

So, if the user e.g. wants to use the attribute name "COST_KM101" for vehicle type 101, the catalogue key should be set to "COST_KM".

Examples of erroneous definitions (beginning with a number or containing blank entries) are:

- 105COST;

- 204 test;

- 204test.

Each link in the network will now have the structure displayed in Figure 66 below. The user can see this in the Feature Explorer window by selecting a link using the "Select Features" tool.
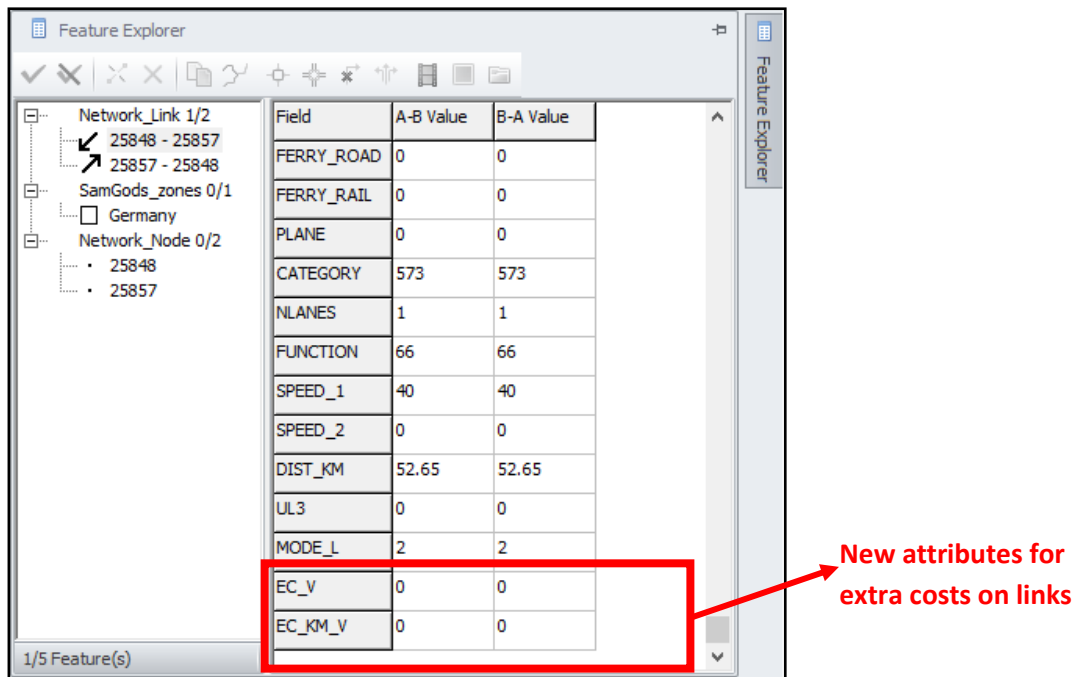
Figure 66 Feature Explorer window.

8) In the Editor toolbar, select Editor -> Start editing. In the "Layers" drop down menu select the "Network_Link" layer

- To edit a single link, do the following:

    1) Use the "Select features" tool [icon] to select the specific link

    2) In the Feature Explorer window, type in the value of the tax or cost in the new attribute cell

    3) Save the edit by clicking the green icon on the top left

    4) Close the Feature Explorer window

    5) In the Editor toolbar select Editor -> Stop Editing

6) To the question "Do you want to save your edits?", click "Yes"

7) Close the GIS window by clicking on the X icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

- To edit a list of links based on attribute conditions, do the following:

  1) Under the main toolbar, select Datasets -> Select by Attributes…

  2) In the Select Specification window, right click in the blank field to see the attribute list (note: it only shows attributes from the active layer – to access other attributes, select another layer in the TOC), select the attribute for applying the condition (in the example in Figure 67, select all the links on mode 5 – air)
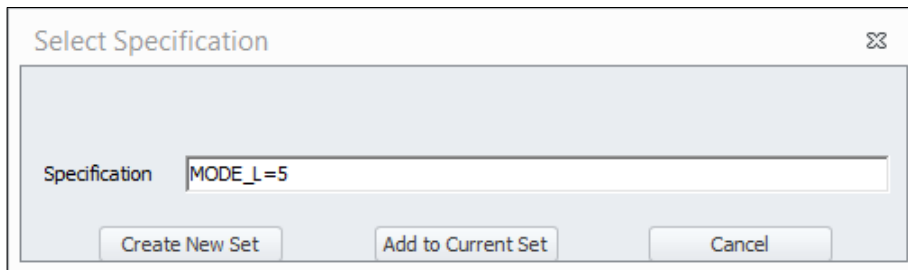
Figure 67 The Select Specification window.

3) Click "Create New Set"

4) Select Link -> Compute... in the menu bar to access the Link Attribute Calculation window, see Figure 68
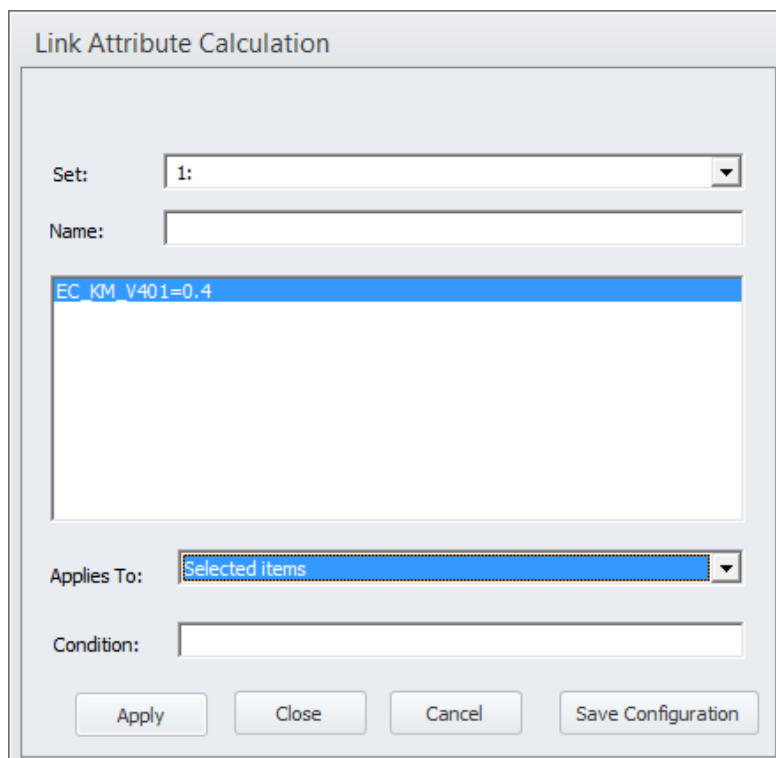
Figure 68 The Link Attribute Calculation window.

5) Fill in the fields, see Figure 68. To insert edits in the main field in the middle, right click and select "Insert". A window, "Insert Equation", pops up – right-click in the blank field and select the attribute you want to edit, e.g. EC_KM_V401 as in

Figure 68, and type in "=" followed by the value. More attributes could be edited by repeating the procedure. In the "Applies To:" drop down menu, select "Selected items"

6) Click "Apply". An information window shows the total number of links updated. Click "OK" and then "Close"

7) Under the Editor toolbar, select Editor -> Stop Editing

8) To the question "Do you want to save your edits?", click "Yes"

9) Close the GIS window by clicking on the X icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

To edit a list of links based on a geographical selection, do the following:

1) Select the "Samgods_zones" layer in the TOC

2) In the main toolbar, select Datasets -> Select by Attributes…

3) In the Select Specification window, right click in the blank field to see the attribute list (note: it only shows attributes from the active layer – to access other attributes, select another layer in the TOC), and select the attribute for applying the condition (in the example in Figure 58, select the Stockholm region). For a list of the region and country codes, open the table *Scenario Inputs\General tables\Zoning Systems* in the Data Section window
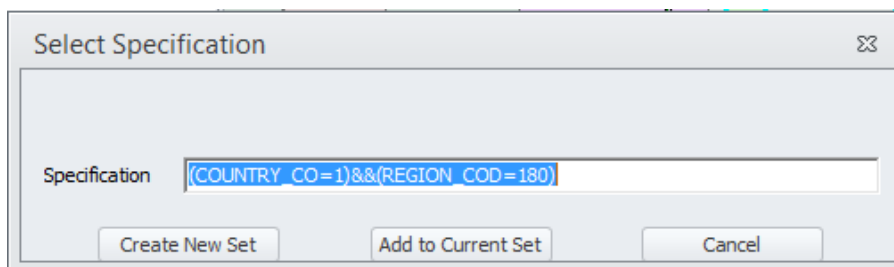
Figure 69 The Select Specification window.

4) Click "Create New Set"

5) Select the "Network_link" layer in the TOC

6) On the main toolbar, select Datasets -> Select by Location... to access the window in Figure 70 where appropriate changes can be done
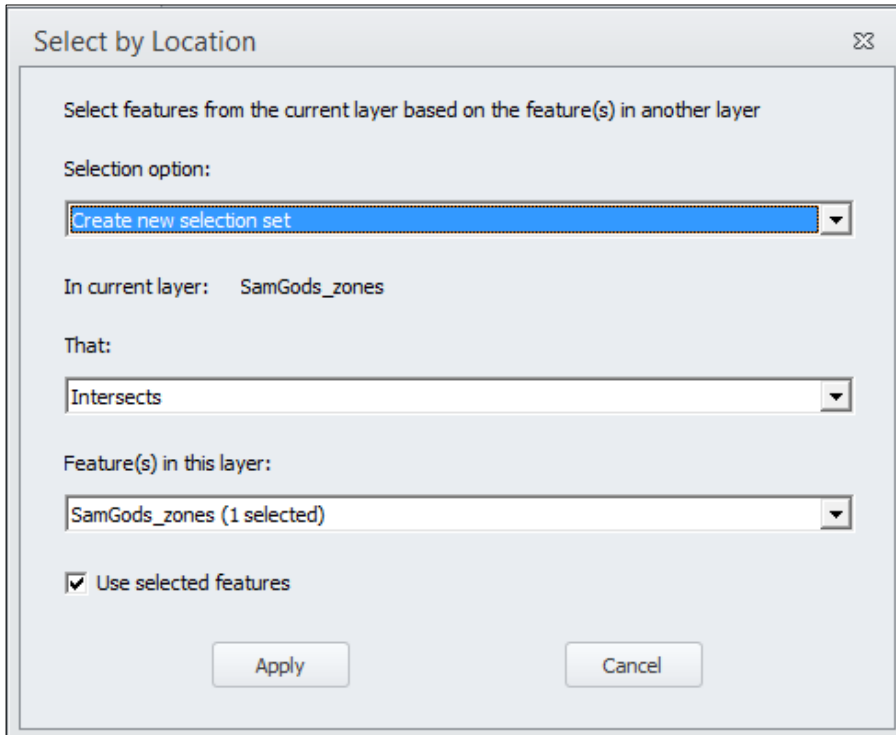
Figure 70 The Select by Location window.

7) Click "Apply". An information window shows the total number of links selected. Click "OK" and then close the window by clicking "Cancel"

8) Select Link -> Compute on the main toolbar to access the Link Attribute Calculation window, see Figure 71
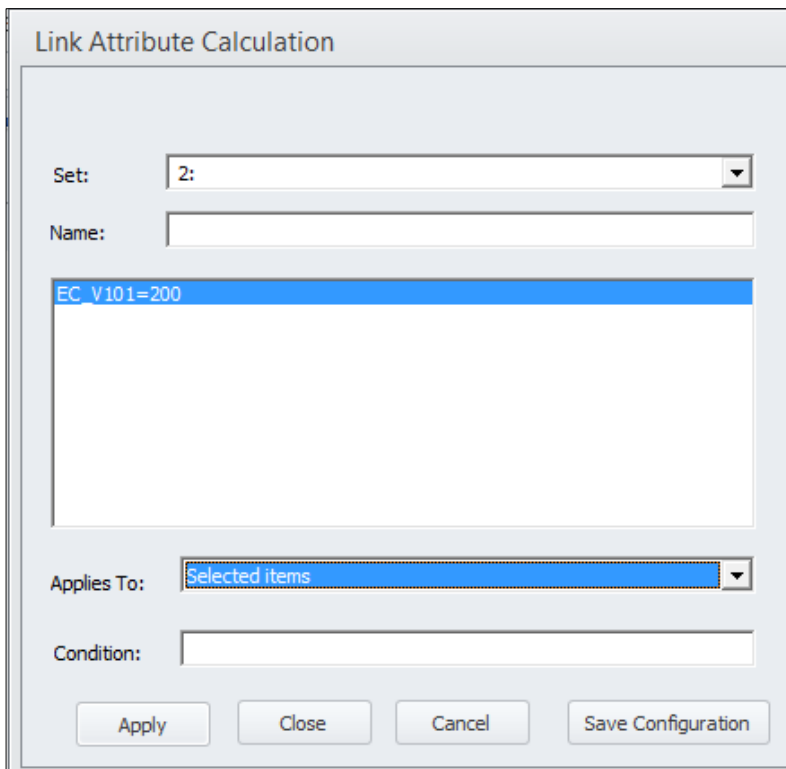
Figure 71 The Link Attribute Calculation window.

9) Fill in the fields. To insert edits in the main field in the middle, right click and select "Insert". A window, "Insert Equation", pops up – right-click in the blank field and select the attribute you want to edit, e.g. EC_V101 as in Figure 71, and type in "=" followed by the value. More attributes could be edited by repeating the procedure. In the "Applies To:" drop down menu, select "Selected items"

10) Click "Apply". An information window shows the total number of links updated. Click "OK" and then "Close"

11) On the Editor toolbar, select Editor -> Stop Editing

12) To the question "Do you want to save your edits?", click "Yes"

13) Close the GIS window by clicking on the X icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

9.2.2. Country tax – kilometer-based

The user can apply a country tax for road and rail modes, differentiated by vehicle type. For the other modes (sea, ferry and air), the tax can only be differentiated between inside and outside of Sweden, since the links for these modes are not divided between other countries in the Samgods model. To edit the country tax, do the following:

1) Click the "Edit…" button for the "Table with tax by country (SEK/km) [Table]"catalog key in the *Edit the data* application, or open the Scenario Inputs\Editable data\Tax by country Table from the Data section window, for the selected scenario

2) To modify existing values, just type a new value in the SEK_KM attribute and press Enter

3) To add a new tax, the user must know the country code (ID_COUNTRY). To access the country codes, please refer to the table ***Scenario Inputs\General tables\Zoning*** system in the Data section window

   a) Add a new row in the Tax by Country table by clicking the "+" icon;

   b) Type in the country code, the vehicle type and the SEK_KM value (the country name is not required)

4) Close the Tax by Country table by clicking on the X icon in the top right corner and click "Yes" to the question, see Figure 72.
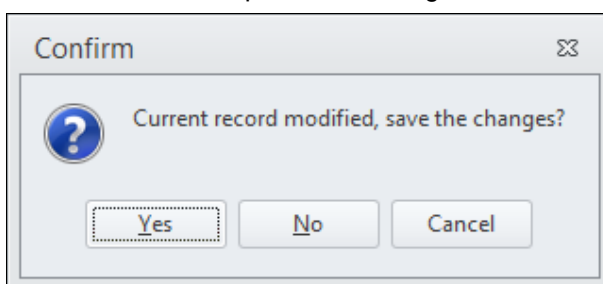
Figure 72 Country tax modification

> ***Please note:*** For sea, ferry and air modes (vehicles class numbers greater than 212) the user can only apply two country codes:
>
> - ID_COUNTRY=1 for Sweden (as above);

> - ID_COUNTRY=-1 for all countries outside Sweden.
>
> For road and rail (vehicles class numbers less than 301) if a specific country is not listed in the input table, the default value will be derived from the entries with ID_COUNTRY=-1.

9.2.3. Link class tax

The user can apply a tax per link for a specific category of links in the network. This is done in the following way:

1) Click "Edit" for the "Tax by Category (SEK) [Table]" catalog key in the *Edit the data* application or open Scenario Inputs\Editable data\Tax by Linkclass from the Data Section window for the specific scenario;

2) To modify existing values, just type in a new value in the SEK attribute and press Enter;

3) To add a new tax, the user must know the category (LINKTYPE). To access the category codes, open Scenario Inputs\General tables\LinkCategories values from the Data section window;

   a) Add a new row in the Tax by Link class table by clicking the "+" icon;

   b) Type in the LINKTYPE value, the vehicle type and the SEK value;

4) Close the Tax by Link class table by clicking on the "X" icon in the top right corner and click "Yes" to the question, see Figure 73.
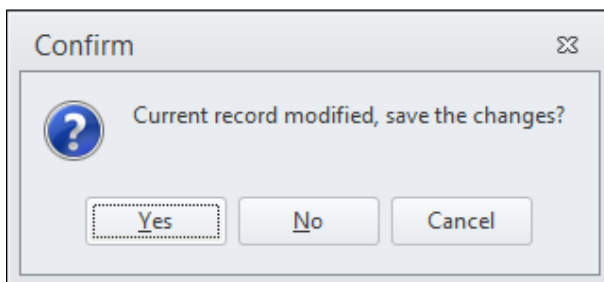
Figure 73 Link class tax modification

9.2.4. Link tax

The user can apply a tax for a specific link in the network. This is done in the following manner:

1) Click "Edit…" for the "Tax by Link (SEK) [Table]" catalog key in the *Edit the data* application, or open Scenario Inputs\Editable data\Tax by Link from the Data section window for the specific scenario

2) To modify an existing value, just type in a new value in the SEK attribute and press Enter

3) To add a new tax, the user must know the start (A) and end (B) node for the link in the network. To visualize the network, open the Input_Data.mxd file, e.g. from the Data Section window. The A and B node numbers can be accessed e.g. by selecting the link with the Select Features tool and looking in the Feature Explorer window;

   a) Add a new row in the Tax by Link table by clicking the "+" icon

   b) Type in the A and B values (start and end node for the link), the vehicle class and the SEK value. In order to have the tax in both directions of the link, the link must be added twice, one row for each direction (where the A and B nodes are exchanged in the second row)

4) Close the Tax by Link table by clicking the "X" icon in the top right corner and click "Yes" to the question, see Figure 74.
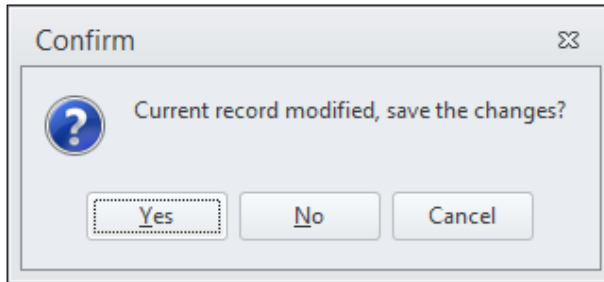
Figure 74 Link tax modification

> **Please note:** Introducing a link with a zero tax value for a specific vehicle type has the effect that all the extra costs (in term of taxes) are set to zero on that link. The same principle applies to the Tax by Link class table regarding the Country tax value.
>
> The general rule applied in the model follows the prioritized order according to:
>
> 1. TAX_LINK (overrides TAX_LINKCLASS and TAX_COUNTRY)
>
> 2. TAX_LINKCLASS (overrides TAX_COUNTRY)
>
> 3. TAX_COUNTRY
>
> If several tax values are assigned to a specific link, e.g. one from the country table, another one from the link class table and a third one from the link table, each value will be overwritten by the subsequent value in the order above, i.e. the smaller scale always overrides the larger (disregarding the actual value of the tax).
>
> Please observe that this rule does not apply to the Toll bridges table or the extra cost values in the network – they are added to any other taxes.

9.2.5. Toll bridges

In the network, there are a few bridges with fixed tolls. The Toll bridges table contains the values of the tolls. The user can modify them or add new bridge tolls in the following manner:

1) Click "Edit…" for the "Toll for bridges (SEK) [Table]" catalog key in the *Edit the data* application, or open Scenario Inputs\Editable data\Toll bridges from the Data section window for the specific scenario

2) To modify an existing value, just type in a new value in SEK attribute and press Enter

3) To add a new toll, the user must know the start (A) and end (B) node for the link in the network. To visualize the network, open the Input_Data.mxd file, e.g. from the Data Section window. The A and B node numbers can be accessed e.g. by selecting the link with the Select Features tool and looking in the Feature Explorer window

   a) Add a new row in the Toll bridges table by clicking the "+" icon

   b) Type in the A and B values (start and end node for the link), the vehicle class and the SEK value. In order to have the tax in both directions of the link, the link must be added twice, one row for each direction (where the A and B nodes are exchanged in the second row)

4) Close the Toll bridges table by clicking the "X" icon in the top right corner and click "Yes" to the question, see Figure 75.
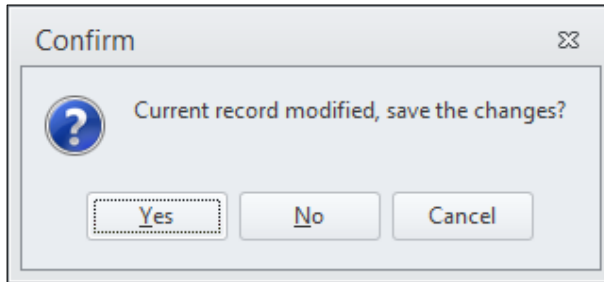
**Figure 75 Toll bridges modification**

9.3. Change the loading costs and times in terminals

The costs and times for loading cargo inside the terminals are specified for different types of cargo – containers and non containers by commodity group.

1) Open the vehicle parameters table by clicking "Edit…" for the "Specific parameters of vehicle classes by commodity group [Table]" catalog key in the *Edit the data* application, or open "Specific Vehicles Parameters (by vhcl class and commodity group)" from the Data section window for the specific scenario

2) For each vehicle class and commodity group, edit the values for the attributes below by typing in the new value and the press Enter:

- load time containers in hours/vehicle (not divided by type of commodity) – attribute CONT_LTI
- load cost containers in SEK/tonne (not divided by type of commodity) – attribute CONT_LCO
- load time non containers in hours/vehicle – attribute NC_LTI
- load cost non containers in SEK/tonne – attribute NC_LCO
- transfer load time containers in hours/vehicle (not divided by type of commodity) – attribute CONT_LTI_T
- transfer load cost containers in SEK/tonne (not divided by type of commodity) – attribute CONT_LCO_T
- transfer load time non containers in hours/vehicle – attribute NC_LTIT
- transfer load cost non containers in SEK/tonne – attribute NC_LCOT

3) Close the table by clicking the "X" icon in the top right corner

4) On request, click "Yes" to save the edits

9.4. Change vehicle data

Change vehicle parameters (e.g. cost per km and hour, capacity, etc,) in the Vehicles Parameters table the following way:

1) Open the Vehicles Parameters table by clicking the "Edit" button on the "General parameters of Vehicle classes [Table]" catalog key using the *Edit the data* application, or open "General Vehicles Parameters (by vhcl class only)" from the Data section window for the specific scenario (same table as in Section 9.3);

2) Edit the values for any attribute(s) by vehicle class;

3) Close the table by clicking the "X" icon in the top right corner;

4) On request, click "Yes" to save the edits.

In the vehicles Parameters table is also the parameter that governs whether the empty vehicle matrices will be produced or not. For each vehicle class it is possible to set the parameter "EMPTY_V" to 1 (i.e. produce empty vehicle matrices) or 0 (i.e. not produce empty vehicle matrices). If the user chooses not to produce the empty vehicle matrices, the matrices will instead be filled out with zeroes. For more information on the computation of empty vehicles, see appendix section.14.2.

9.5. Change the average value (SEK) of the commodities

1) Open the commodity table by clicking on "Edit" on the "Commodity data [Table]" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Cargo Table from the Data section window, for the specific scenario
2) Edit the values by commodity class for: VALUE_SEKT (SEK/Tonne)
3) Close the table by clicking the "X" icon in the top right corner
4) On request, click "Yes" to save the edits.

9.6. Change capacity in ports

The user can change the values for the following port parameters:
- MaxDwtCont (maximum deadweight tonnage, container vessel)
- MaxDwtRoRo (maximum deadweight tonnage, ro/ro vessel)
- MaxDwtOthe (maximum deadweight tonnage, other vessels)

This is done in the following way:

1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario
2) Select the "Nodes" layer in the TOC window and tick the check box if it is not already ticked
3) Start an Edit session (select Editor -> Start Editing on the Editor toolbar)
4) Select the "Nodes" layer in the "Layers" scroll down menu on the Editor toolbar
5) Select the terminal(s) by using the Select Features tool, or by setting a selection condition (e.g., rail terminals: MODE_N=2 in Sweden). For instructions on how make a selection based on attributes, please refer to Section 8.15.
6) Select Node -> Compute and type in the equations by right-clicking in the largest field (in the middle) and select "Insert" (e.g., MAXDWTRORO=100000, see Figure 76 The Feature Class Attribute Calculation window. To see the available parameters, right-click in the blank field in the Insert Equation window) and select which items the edits should apply to (all or selected). Click "Apply". When finished, click "Close"
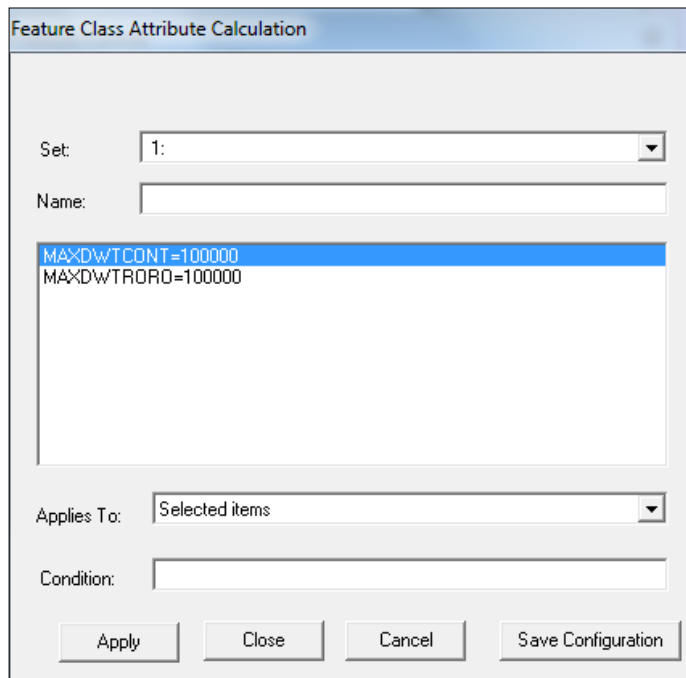
Figure 76 The Feature Class Attribute Calculation window

7) On the Editor toolbar, select Editor -> Stop Editing

8) To the question "Do you want to save your edits?", click "Yes"

9) Close the GIS window by clicking the "X" icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

9.7. Change capacity in Trollhätte canal (also denoted Vänern canal)

The user can change the values for the following port parameters specifically for Vänern canal:

- MaxDwtCont (maximum deadweight tonnage, container vessel);
- MaxDwtRoRo (maximum deadweight tonnage, ro/ro vessel);
- MaxDwtOthe (maximum deadweight tonnage, other vessels).

This is done in the following way:

1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario

2) Select the "Nodes" layer in the TOC window and tick the check box if it is not already ticked

3) Start an Edit session (select Editor -> Start Editing on the Editor toolbar)

4) Select the "Nodes" layer in the "Layers" scroll down menu on the Editor toolbar

5) Select the terminal(s) by using the Select Features tool, or by setting a selection condition (e.g., Varner ports: PORTAREANR=14). For instructions on how make a selection based on attributes, please refer to Section 8.15.

6) Select Node -> Compute and type in the equations by right-clicking in the largest field (in the middle) and select "Insert" (e.g., VANERNCAN=4001. To see the available parameters, right-click in the blank field in the Insert Equation window) and select which items the edits should apply to (selected). Click "Apply". When finished, click "Close"

7) On the Editor toolbar, select Editor -> Stop Editing

8) To the question "Do you want to save your edits?", click "yes"

9) Close the GIS window by clicking the X icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).
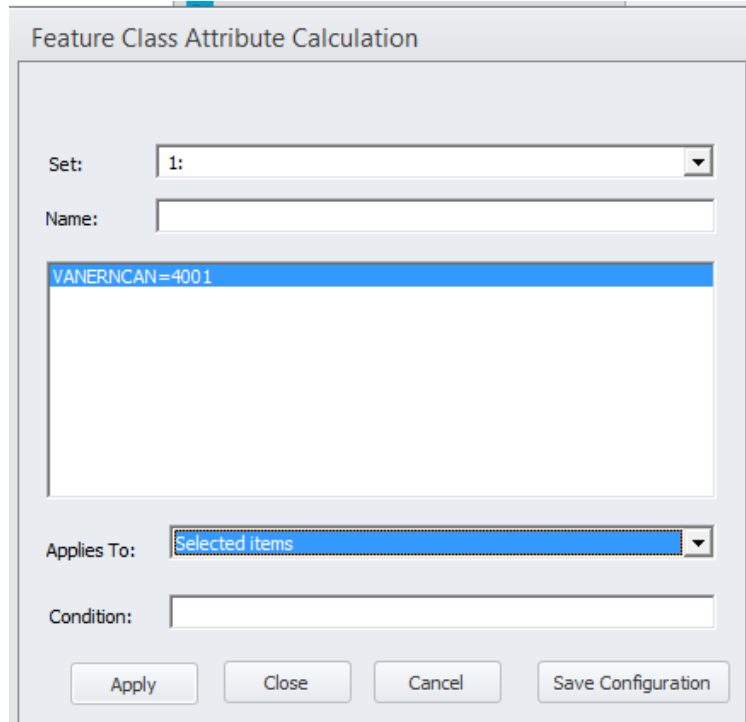
Figure 77 The Feature Class Attribute Calculation window

9.8.   Transoceanic impedances for small ports

The current model provides a tool to avoid transshipments between small domestic ports and international ports. The nodes table has a new attribute, called TRANOCEFAC, that has a value 10 for domestic ports that represent an impedance applied to the times in case a movement between the small port and a transoceanic port is selected. For details on the implementation refer to document listed in [4]. To modify the set of ports or the default value (10) the following steps could be performed:

1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the Edit the data application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario

2) Select the "Nodes" layer in the TOC window and tick the check box if it is not already ticked

3) Start an Edit session (select Editor -> Start Editing on the Editor toolbar)

4) Select the "Nodes" layer in the "Layers" scroll down menu on the Editor toolbar

5) Select the terminal(s) by using the Select Features tool, or by setting a selection condition (e.g. MODE_N=3&ID_COUNTRY=1 will select all the domestic ports). For instructions on how make a selection based on attributes, please refer to Section 8.15.

6) Select Node -> Compute and type in the equations by right-clicking in the largest field (in the middle) and select "Insert" (e.g., TRANOCEFAC=10, see Figure 78. To see the available parameters, right-click in the blank field in the Insert Equation window) and select which items the edits should apply to (selected). Click "Apply". When finished, click "Close"
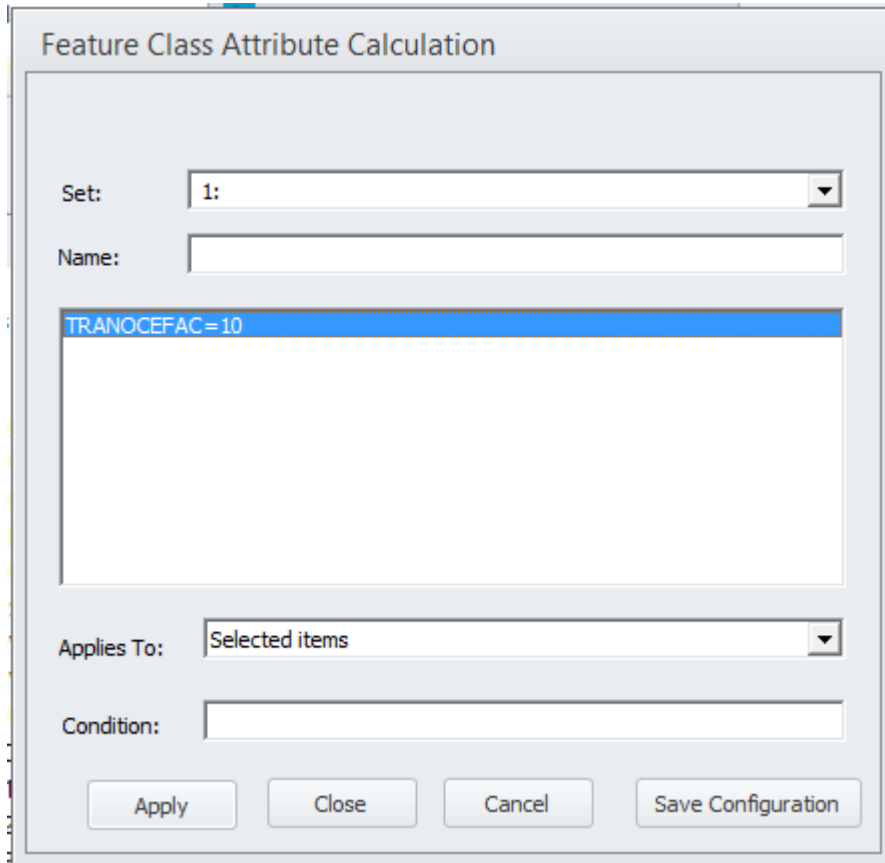
Figure 78 The Feature Class Attribute Calculation window

7) On the Editor toolbar, select Editor -> Stop Editing

8) To the question "Do you want to save your edits?", click "Yes"

9) Close the GIS window by clicking the "X" icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary)

9.9. Close links

When we need to close links , they can be kept within the network without deletening them. It is sufficent to set to **0** all the following attributes:

- LORRY_40T
- LORRY_60T
- LORRY_74T
- CAR
- COMBI
- FEEDER1

- FEEDER2
- WAGONLOAD
- STAX225
- STAX25
- STAX30
- KOMXL
- SYSXL
- WGEXL
- SHIP_SMALL
- SHIP_LARGE
- FERRY_ROAD
- FERRY_RAIL
- INW
- PLANE

9.10. Introduce new infrastructure

When adding new infrastructure it is recommended to use the filter function as described below. Then only links and nodes with specific modes and/or categories are shown in the GIS window. However, a new link has category = 0. When having created a new link, the attributes, including the link category, could be edited directly as described below. However, if the editing of the link is interrupted, e.g. by selecting another element or closing the Feature Explorer window before the edits are finished, the new link can become invisible in the map because of the filter. In order to be able to select it again and continue the edits, the filter must be disabled.

The edits made are not always visible at once in the Feature Explorer. In order to see exactly which edits that have been made for a selected link, close the Feature Explorer and open it again to refresh it.

9.10.1. New roads

1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario
2) Activate the filter for the road mode both in the network node and the link layers by right-clicking on the respective layer in the TOC, selecting "Properties" and tick the "Active" check box for road mode
3) Select the Network_Link layer in the TOC
4) Select the node default legend "2:Node type – Road" in the menu accessed by clicking on the left downwards-pointing arrow:

5) Start an edit session (click Editor -> Start editing)
6) Select the Network_Link layer in the "Layers" drop down menu

> **Tip:** Instead of specifying the new link from the beginning, as described in this paragraph, it is possible to select an existing nearby link, with attributes like the new link, and in the Feature Explorer window use the copy function. Click [copy icon], and then create the new link as described below and change only the attributes that differ from the other link. In this way, it is easier to avoid making mistakes when specifying the attributes.

7) Select the pencil icon

8) Draw the new link. This is done by clicking where the new link should start and for each new click on the map, a new vertex is created. At the end of the link, double-click

9) The following window in Figure 79 will appear if new a node is added (i.e. if the link does not start and end in existing nodes):
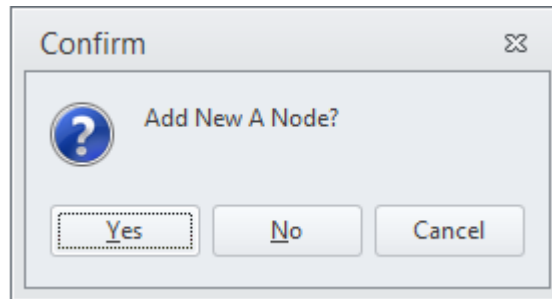
Figure 79 Add new node

10) Click "Yes" and then select a node value greater than 2000 (values up to 1999 are only for terminals and zones), see Figure 80

11) Click "OK"
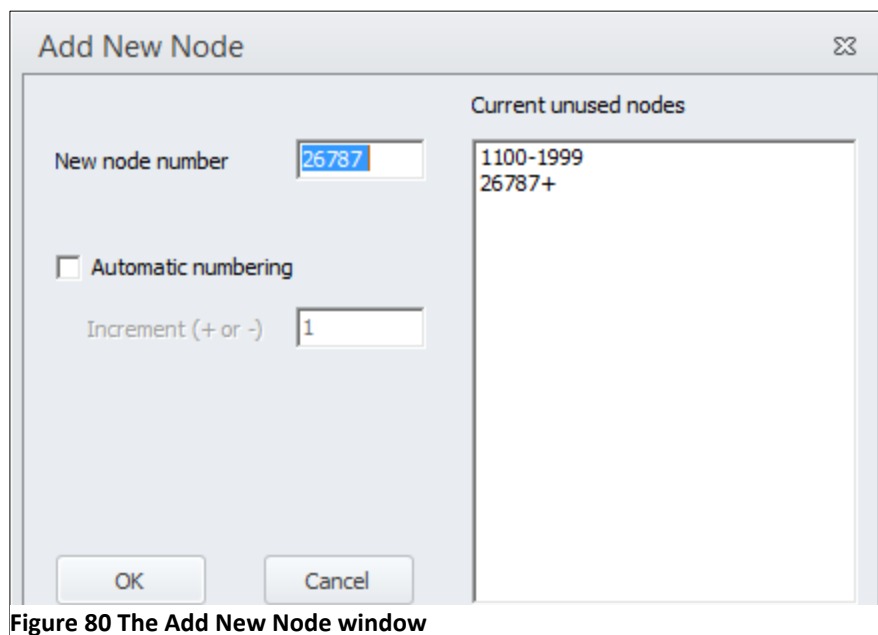
Figure 80 The Add New Node window

12) In the Feature Explorer window (see Figure 81), specify the following values. In order to assign the same values to both directions (A to B aand B to A), make sure that both ways are selected in the Feature Explorer window.

128
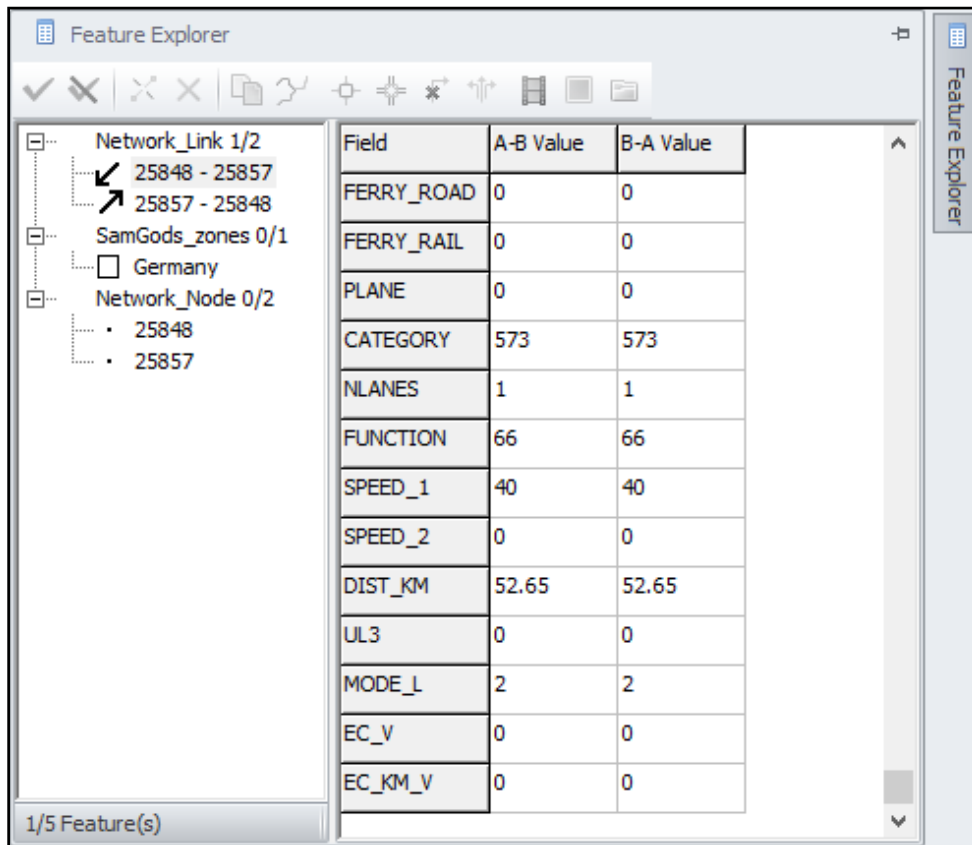
Figure 81 Feature explorer window

a) ALL_M=1 (always equal to 1, which means that it is an open link)

b) LORRY_40T=1 (1 if open for vehicle types 102, 103 and 104, 0 otherwise)

c) LORRY_60T=1;(1 if open for vehicle type 105, 0 otherwise)

d) LORRY_74T=0;(1 if open for vehicle type 106, 0 otherwise)

e) CAR=1 (1 if open for vehicle type 101, 0 otherwise)

f) Leave all the other modes as zero

g) CATEGORY: type the category number – see available numbers and descriptions in the Data Section window, under Scenario Inputs\General tables\Link Categories

h) NLANES: number of lanes in each direction

i) FUNCTION: speed flow curve – see V101/102 tables in the Data Section window under Scenario Input/General tables (values between 1 and 50, 61 only for connectors and other modes)

j) SPEED_1:speed in km per hour for vehicle class 101

k) SPEED_2: speed in km per hour for vehicle classes 102, 103, 104, 105 and 106

l) DIST_KM: update using the SHAPE_LENGTH value using Link -> Compute tool as displayed Figure 82 (note that "Selected items" must be selected in the "Applies To:" field)

m) MODE_L=1, because it is a road link
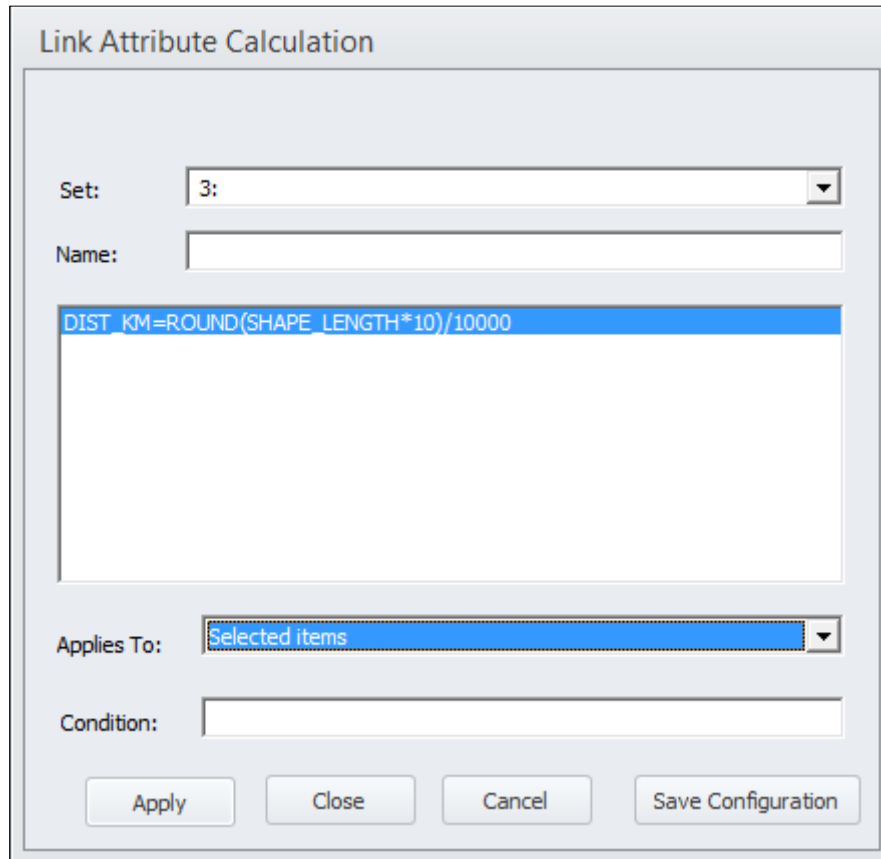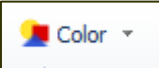
Figure 82 The Link Attribute Calculation window

> **Please note:** It is recommended to round the distance values to avoid excessive number of digits after the comma.

13) Select in the Feature Explorer window the node or nodes created (they can be found to the left of the table of attributes). Answer "Yes" to the question whether the edits should be saved. Edit the following attributes:

   a) ID_COUNTRY and ID_REGION: the values are easily identified using the zoning system feature class. Select the zone and it will be visualized in the Feature Explorer window with the attributes for the zone (this is preferably done before starting to edit the new link/node, since selecting the zone will un-select the new link and node). As an alternative, the table "Zoning System", found in Scenario Inputs\General tables in the Data Section window, can be consulted

   b) MODE_N=1 because it is a road node

   c) All the other attributes will be filled in automatically by the model

14) On the Editor toolbar, select Editor -> Stop Editing

15) To the question "Do you want to save your edits?", click "Yes"

16) Close the GIS window by clicking the "X" icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

9.10.2. New railroad

1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario

2) Activate the filter for the rail mode, both in the network node and the link layer by right-clicking on the respective layer in the TOC, selecting "Properties" and tick the "Active" check box for rail mode

3) Select the Network_Link layer in the TOC

4) Select the node default legend "3:Node type-Rail", in the menu accessed by clicking the left downwards pointing arrow:

5) Start an edit session (select Editor -> Start Editing)

6) In the "Layers" drop down menu, select the Network_Link layer

> **Tip:** Instead of specifying the new link from the beginning, as described in this paragraph, it is possible to select an existing nearby link, with attributes like the new link, and in the Feature Explorer window use the copy function. Click , and then create the new link as described below and change only the attributes that differ from the other link. In this way, it is easier to avoid making mistakes when specifying the attributes.

7) Select the pencil icon

8) Draw the new link. This is done by clicking where the new link should start and for each new click on the map, a new vertex is created. At the end of the link, double-click

9) The window in Figure 83 will appear if a new node is added (i.e. if the link does not start and end in existing nodes):
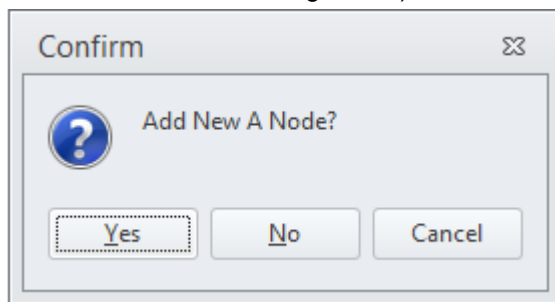
Figure 83 New railroad

10) Click on "Yes" and then select a node value greater than 2000 (values up to 1999 are only for terminals and zones), see Figure 84
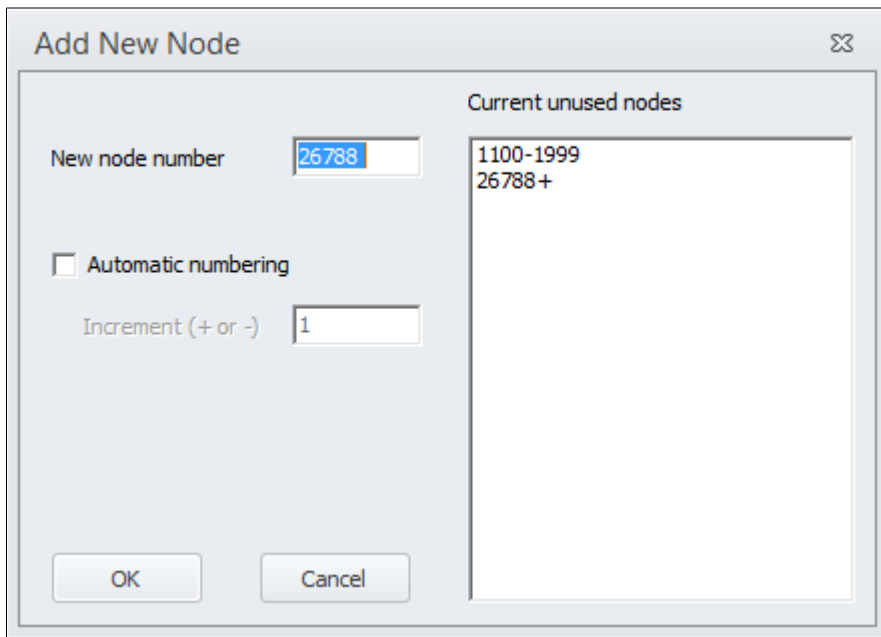
Figure 84 The Add New Node window

11) Click "OK"

12) In the Feature Explorer window, specify the following values. In order to assign the same values to both directions (A to B and B to A), make sure that both ways are selected in the Feature Explorer window.

  a) ALL_M=1 (always equal to 1, which means that it is an open link)

  b) COMBI=1 (1 if open for vehicle type 201, 0 otherwise)

  c) FEEDER1=1 & FEEDER2=1 (1 if open for vehicle type 202, 0 otherwise)

  d) STAX225=1 (1 if open for vehicle type 204, 0 otherwise)

  e) STAX25=1 (1 if open for vehicle type 205, 0 otherwise)

  f) STAX30=1 (1 if open for vehicle type 206 , 0 otherwise)

  g) WAGONLOAD=1 (1 if open for vehicle type 207,208,209, 0 otherwise)

  h) KOMXL=1 (1 if open for vehicle type 210, 0 otherwise)

  i) SYSXL=1 (1 if open for vehicle type 211, otherwise)

  j) WGEXL=1 (1 if open for vehicle type 212, 0 otherwise)

  k) CATEGORY: type the category number – see available numbers and descriptions in the Data Section window, under Scenario Inputs\General tables\Link Categories

  l) NLANES: number of lanes in each direction

  m) FUNCTION=61 (always this value except for road mode)

  n) SPEED1: Speed in km/h

  o) SPEED2=0

  p) DIST_KM: update using the SHAPE_LENGTH value using Link -> Compute tool as displayed in Figure 85 (note that "Selected items" must be selected in the "Applies To:" field)

  q) MODE_L=2, because it is a rail link
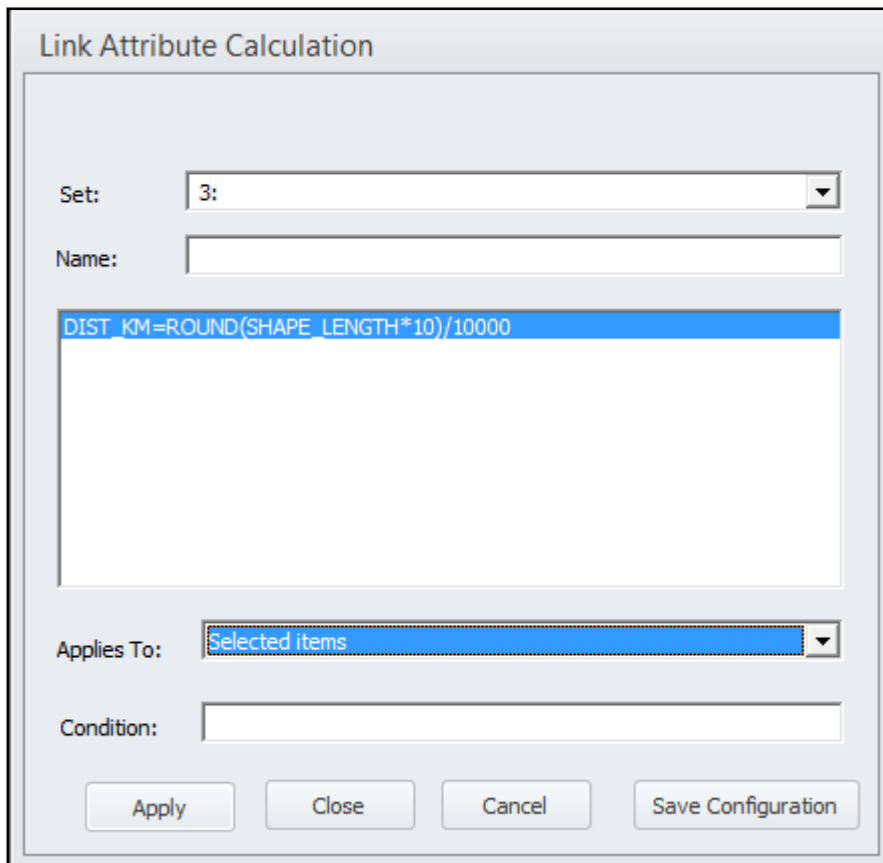
Figure 85 The Link Attribute Calculation window

> *Please note:* it is recommended to round the distance values to avoid excessive number of digits after the comma.

13) Select in the Feature Explorer window the created node or nodes (they can be found to the left of the table of attributes). Answer "Yes" to the question whether the edits should be saved. Edit the following attributes:

   a) ID_COUNTRY and ID_REGION: the values are easily identified using the zoning system feature class. Select the zone and it will be visualized in the Feature Explorer window with the attributes for the zone (this is preferably done before starting to edit the new link/node, since selecting the zone will un-select the new link and node). As an alternative, the table "Zoning System", found in Scenario Inputs\General tables in the Data Section window, can be consulted

   b) MODE_N=2 because it is a rail node

   c) All the other attributes will be automatically filled by the model

14) On the Editor toolbar, select Editor -> Stop Editing

15) To the question "Do you want to save your edits?", click "Yes"

16) Close the GIS window by clicking the "X" icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

9.10.3. New sea, ferry and air links

New links for these modes could also be added, in a similar manner as for the road and rail links. An important exception is about the UL3 link attribute for sea and ferry links. UL3 represents the maximum vessel capacity allowed on a sea or ferry link. The value coded in this attribute will ban vessel types where the capacity of the vessel exceeds the value UL3. The vessel capacity is recorded in the general parameters for vehicles (attribute CAPACITY) and it will compare with UL3 prior the LOS calculation. Two cases are possible:

- ○ If UL3 $\geq$ CAPACITY: the specific vessel type will be able to use the link;
- ○ if UL3 < CAPACITY the specific vessel type will not use the particular link.

9.10.4. New terminals

The terminals are represented inside the network as zones[13]. They could be distinguished from the actual zones by their node number, which does *not* end with 00 ("actual" zones here means Production, Attraction or Warehouse points for trips, whereas terminals are intermediate steps. Actual zones could also be terminals, in the case of Direct Access. The actual zones have NORIG numbers that end with 00. From Emme network it is the value already present).

To add a new terminal, different actions are required depending on the mode of the terminal. The new terminal needs to be added in three layers: the Network layer, the Nodes_commodities layer, and the Nodes layer.

Road terminal

Network layer:
1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario
2) Activate the filter for road mode both in the network node and link layer (please refer to Section 8.15 for instruction on how to do this)
3) Select the node default legend "2:Node type – road" (see Section 8.15)
4) Select the Network_Node layer in the TOC
5) Start an edit session (on the Editor toolbar, select Editor -> Start Editing)
6) In the "Layers" drop down menu, select the Network_Node layer
7) Select the pencil icon
8) Add the new node by clicking on the location and selecting a node number between the highest zone number and 2000 (select a number less than 2000 in the range specified in the window "Current Unused Numbers")
9) Click "OK"
10) In the node table in the Feature Explorer window, type in the following information:
    a) ID_COUNTRY and ID_REGION: the values are identified using the zoning system feature class. Select the zone and it will be visualized in the Feature Explorer window with the attributes for the zone (this is preferably done before

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[13] The zone numbering referred to are Swedish zone number system used in Emme networks and in the logistics model. For a conversion to Cube/Voyager node number a node-to-node map is required. All zone numbers in Emme format starts with node numbers above 700000, whereas all corresponding node numbers in Cube/Voyager are less than 2000.

starting to edit the new node, since selecting the zone will un-select the new node). As an alternative, the table "Zoning System", found in Scenario Inputs\General tables in the Data Section window, can be consulted

    b) MODE_N=1, because it is a road terminal

11) In order to change the number of zones for the entire network, right-click on the Network layer in the TOC and select "Properties". Change the Highest Zone No. to the number of the just added terminal and click "OK", see Figure 86

Figure 86 How to change the number of zones for the entire network

12) Select the Network_Link Layer in the "Layers" drop down menu. To the question whether
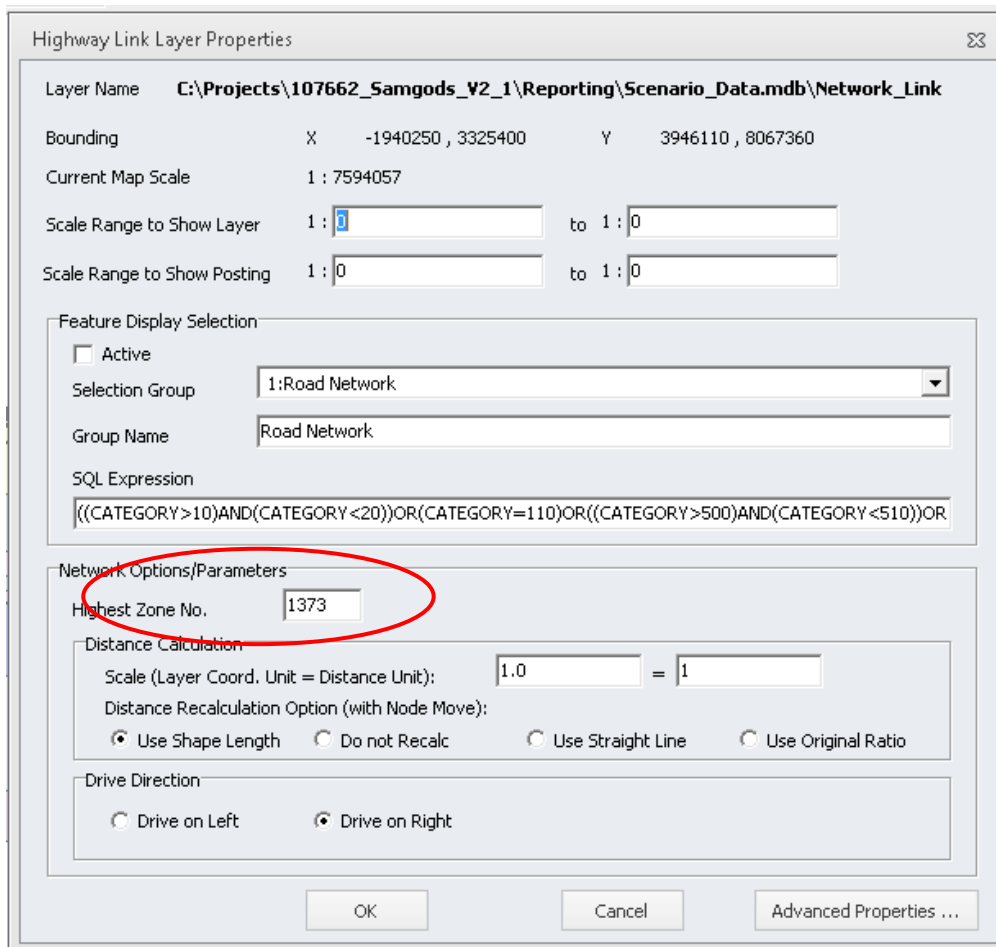
the changes should be saved, answer "Yes". Using the new node as a starting node, draw a link connector from the node to the road network, as described in the New roads section above. Then type in the following information in the Feature Explorer window. In order to assign the same values to both directions (A to B and B to A), make sure that both ways are selected in the Feature Explorer window:

    a) ALL_M=1 (always equal to 1, which means that it is an open link)

    b) LORRY_40T=1 (1 if open for vehicle types 102, 103 and 104, 0 otherwise)

    c) LORRY_60T=1 (1 if open for vehicle type 105, 0 otherwise)

    d) LORRY_74T=0 (1 if open for vehicle type 106, 0 otherwise)

    e) CAR=1 (1 if open for vehicle type 101, 0 otherwise)

f) Leave all the other modes as zero

g) CATEGORY=110 or 201[14] (see available numbers and descriptions in the Data Section window, under Scenario Inputs\General tables\Link Categories); See Representation of the Swedish transport and logistics system in Samgods 1.2.2 (Bernhardsson, 2024) for details about different link categories used in the model.

h) NLANES=1

i) FUNCTION=61

j) SPEED_1=50

k) SPEED_2=0

l) DIST_KM: update using the SHAPE_LENGTH value using Link -> Compute tool as displayed in Figure 87

m) MODE_L=1 because it is a road link
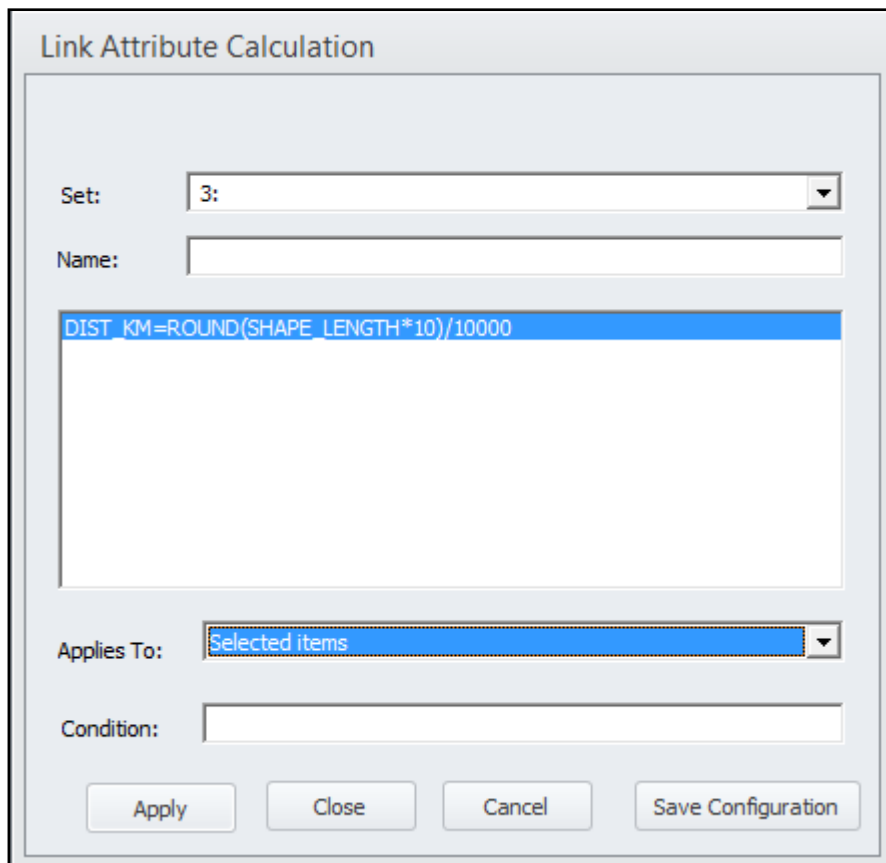
Figure 87 The Link Attribute Calculation window

Please note: it is recommended to round the distance values to avoid excessive number of digits after the comma

---

Nodes_commodities layer:

1) In the "Layers" drop down menu, select the Nodes_commodities layer. Answer "Yes" to the question whether to save the changes to the selected feature

---

[14] Only valid link categories for domestic road terminals in Sweden

2) Tick and select the Nodes_commodities layer in the TOC

3) Add a new node by clicking in the map and give it exactly the same node number as the terminal (it doesn't matter if it is located in another position; it is only the node number that is important). The node number is specified by assigning it to the attribute "N"

4) Type in the TRANSF_TYPE value – for a terminal with transfer road to road, TRANSF_TYPE=1 (a list of the transfer types is located in the Data section window in Scenario Input\General tables\Transfer type of terminal). See Representation of the Swedish transport and logistics system in Samgods 1.2.2 (Bernhardsson, 2024) for details about different transfer types used in the model.

5) For each commodity, disable (0) or enable (1) transfer at the terminal

6) If there is another transfer type (e.g., transfer road-train – for road mode, possible values for transfer type is 1 to 6) to edit, add the same node again in the same way as for the previous transfer type, by setting the same node number and change all the other values for the specific case

Nodes layer:

1) In the "Layers" drop down menu, select the Nodes layer. On request, answer "Yes" to save the changes made

2) Tick and select the Nodes layer in the TOC

3) Add a new node with exactly the same node number as the terminal, in the same manner as in the Nodes_commodities layer

4) Define the following attributes:

- If a zone has direct access to the terminal, ZONET=the number of zone. If no zone has direct access, define ZONET=0

- If a zone belongs to an aggregation group for consolidation set CONAGGR= the zone number in which the zone in included

- DOMESTIC=1 if the terminal is Swedish, 0 otherwise;

- Set technology factors C_TECH_FAC and T_TECH_FAC=1

5) On the Editor toolbar, select Editor -> Stop Editing. Answer "Yes" to the question(s) whether to save the changes made

All the three node layers will now have the new terminal. Figure 88 below shows the Feature Explorer window for the three layers, displaying some of the attributes of the terminal.

Nodes_commodities layer

Network node layer
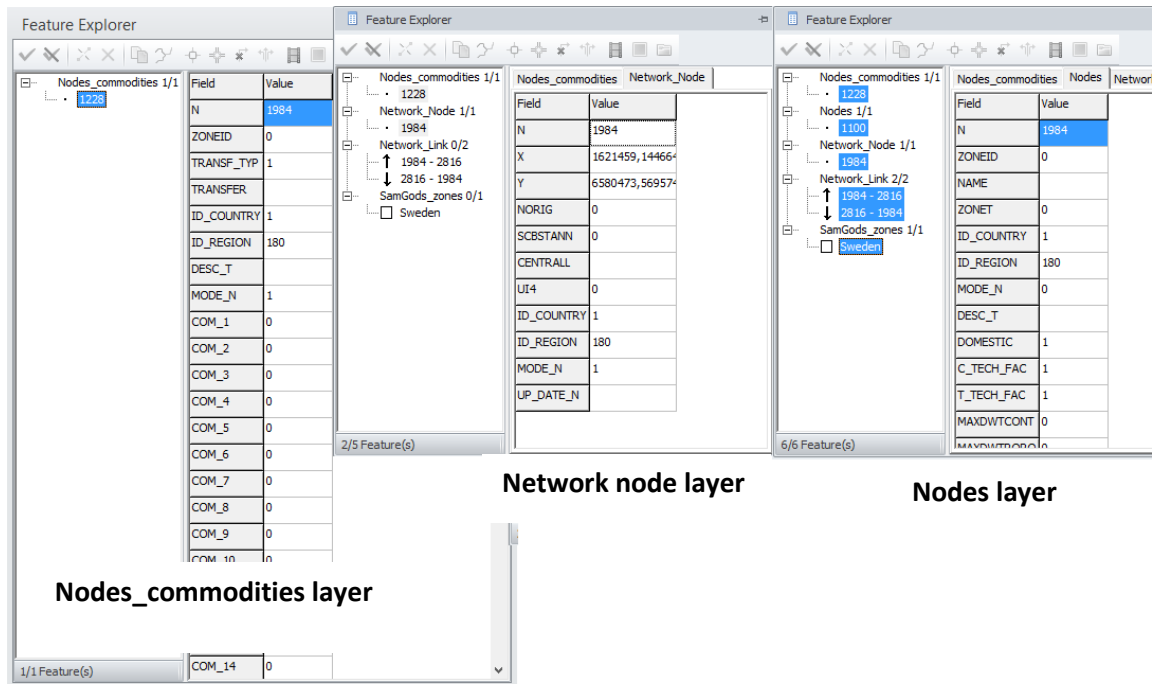
Nodes layer

Figure 88 Feature Explorer windows for the Nodes_commodities layer, the Network_Node layer and the Nodes layer, all displaying the attributes of the new terminal

Rail terminal

The required actions for adding a rail terminal are similar to the ones for a road terminal. Of course the attributes specific to the mode should be set for rail and railway vehicles instead of roads. The attributes that differ from the case with the road terminal are:

- MODE_N = 2
- Possible values for TRANSF_TYPE .See Representation of the Swedish transport and logistics system in Samgods 1.2.2 (Bernhardsson, 2024) for details about different transfer types used in the model.
- CATEGORY=211 for the rail link connection. See Representation of the Swedish transport and logistics system in Samgods 1.2.2 (Bernhardsson, 2024) for details about link categories used in the model.

The terminal must have a rail link to connect it to the rail network and a road link to connect it to the road network, see Figure 89 (if there is direct access from a zone to the terminal, the road connector is not mandatory). Please refer to the instructions for a new road terminal and for how to add a new railroad.
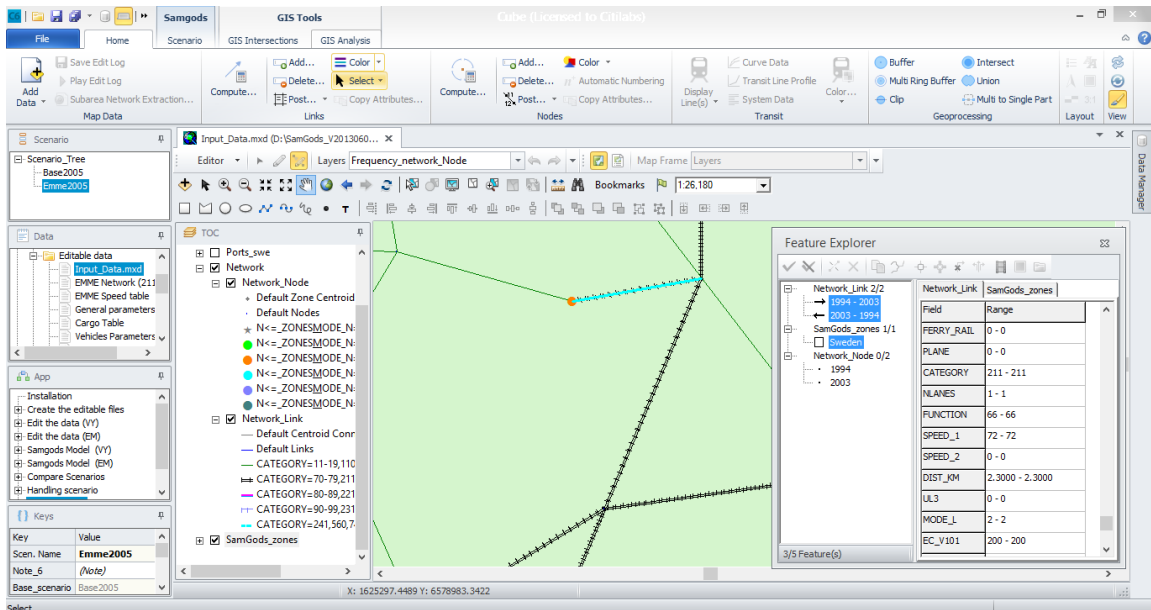
Figure 89 Nodes layer illustration for rail terminal, connected to the rail network by a rail link and to the road network by a road link

Sea terminal

A new sea terminal is added in the same way as a rail terminal (except for the mode specific attributes), except that the Ports_swe layer also must be edited, by adding the new terminal to it in a similar way as in the Nodes_commodities layer. The attributes necessary to edit in the Ports_swe layer are:

- N = the same number as in the other three layers
- MODE_N = 3
- The pilot fees for each one of the vehicle types

Ferry terminal

A new ferry terminal is added in the same way as a rail terminal (except for the mode specific attributes).

Air terminal

A new air terminal is added in the same way as a rail terminal (except for the mode specific attributes).

9.11. Change speed on different links

1) Click "Edit" on the "ArcMap GIS Project File" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\Input_Data.mxd from the Data section window for the specific scenario

2) Select the Network Link Layer in the TOC

3) Start an edit session (Editor -> Start editing)

4) Select the Network Link layer in the "Layers" drop down menu on the Editor toolbar

5) Make a selection (one or several links) and change the speed values in the Feature Explorer window based on the selection made. For each mode, the speed is managed in a different way, see below

9.11.1. Road Mode

1) Activate the filter for Road Mode (please refer to Section 8.15 for instructions)
2) If SPEED_1 and SPEED_2 for a link/links inside Sweden are equal to 0, the default values in the general tables will be applied. The default values for the base speed are in the delay tables in the Data Section window, Scenario Inputs\General tables\V101/V102 speed flow curves (V101 – applied to class 101, V102 – applied to classes 102-106)
3) The SPEED_1 field is defined as km per hour for vehicle class 101
4) SPEED_2 defines the speed for all other road vehicle classes (102-106)
5) Select a single link using the Select Features tool or select a group of links using Datasets -> Select by attributes… or Select by location… (see Section 8.15 for instructions). Edit the values directly in the Feature Explorer window or using Link -> Compute
6) When all edits have been made, select Editor -> Stop Editing on the Editor toolbar
7) On the request "Do you want to save your edits?", click "Yes"
8) Close the GIS window by clicking on the "X" icon at the top right corner, without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary)

9.11.2. Rail Mode

1) Activate the filter for Rail Mode (please refer to Section 8.15 for instructions);
2) Select a single link using the Select Features tool or select a group of links using Datasets -> Select by attributes… or Select by location… (see Section 8.15 for instructions). Edit the speed value in the SPEED_1 attribute (in km/h) directly in the Feature Explorer window or using Link -> Compute (the SPEED_2 attribute is only used for road mode and should be set to 0 for all other modes)
3) On the Editor toolbar, select Editor -> Stop Editing
4) On the request "Do you want to save your edits?", click "Yes"
5) Close the GIS window by clicking on the "X" icon at the top right corner without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary).

9.11.3. Sea Mode – enclosed waterways

1) Activate the filter for Sea Mode (please refer to Section 8.15 for instructions)
2) Select a link or set of links with CATEGORY=80 or 540, using the Select Features tool or Datasets -> Select by attributes… or Select by location… (see Section 8.15 for instructions). Edit the speed value in the SPEED_1 attribute (in km/h) directly in the Feature Explorer window or using Link -> Compute (the SPEED_2 attribute is only used for road mode and should be set to 0 for all other modes). For the other sea categories, the default values in the Vehicles Parameters table are applied (see the next section)
3) On the Editor toolbar, select Editor -> Stop Editing

4) On the request "Do you want to save your edits?", click "Yes"

5) Close the GIS window by clicking on the "X" icon at the top right corner without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary)

9.11.4. Sea Mode – All the other categories

1) Open the Vehicles Parameters table by clicking "Edit…" for the "General parameters of Vehicle Classes [Table]" catalog key using the *Edit the data* application or open Scenario Inputs\Editable data\Vehicles Parameters from the Data Section window for the specific scenario

2) Edit the speed values in the SPEED attribute for the vehicle types 301-317

3) Close the table by clicking on the "X" icon at the top right corner

4) On request, click "Yes" to save the edits

9.11.5. Ferry Mode

1) Activate the filter for Ferry Mode (please refer to Section 8.15 for instructions)

2) Select a single link using the Select Features tool or select a group of links using Datasets -> Select by attributes… or Select by location… (see Section 8.15 for instructions). Edit the speed value in the SPEED_1 attribute (in km/h) directly in the Feature Explorer window or using Link -> Compute (the SPEED_2 attribute is only used for road mode and should be set to 0 for all other modes)

3) On the Editor toolbar, select Editor -> Stop Editing

4) On the request "Do you want to save your edits?", click "Yes"

5) Close the GIS window by clicking on the "X" icon at the top right corner without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary)

9.11.6. Air Mode

1) Activate the filter for Air Mode (please refer to Section 8.15 for instructions)

2) Select a single link using the Select Features tool or select a group of links using Datasets -> Select by attributes… or Select by location… (see Section 8.15 for instructions). Edit the speed value in the SPEED_1 attribute (in km/h) directly in the Feature Explorer window or using Link -> Compute (the SPEED_2 attribute is only used for road mode and should be set to 0 for all other modes)

3) On the Editor toolbar, select Editor -> Stop Editing

4) On the request "Do you want to save your edits?", click "Yes"

5) Close the GIS window by clicking on the "X" icon without saving the ArcGIS Map Document (*.mxd) (if any edits to the legends and/or the layout have been made, the map could be saved, otherwise this is not necessary)

9.12. Speed limits on road network by user class

A feature controlling the speed limit for road vehicle classes is available in the model, allowing the user to define a maximum allowed speed by road vehicle type.

To set speed limits:

1) Select General Vehicles Parameters (by vh class only) under Data Panel;

2) Under Max_Speed input the maximum allowed speed (km/h) for each road vehicle class (from 101 to 106);

3) Close the table saving the changes (at pop-up window click yes);

4) Run Edit the data application.

Please note: this feature is implemented only for road mode. Any value entered in the other modes (rail, sea and air) will not affect the current speeds coded within the network.

9.13.   Edit the capacities for rail links

The Rail Capacity Management process requires input in terms of the number of trains per day allowed on each domestic link (a link flow capacity). This information is provided via the capacity link table. This section describes the steps to update this table:

1) Click "Edit" on the "Table with rail capacity [Table]" catalog key using the *Edit the data* application, or open Scenario Inputs\Editable data\RailCapacity table from the Data section window for the specific scenario

2) Sort the table on the attribute ID_LINK clicking on the attribute name

3) Browse to the end of the table

4) Add a new empty record clicking on the button ✚

5) Edit the A and B numbers for the new link in Voyager format

6) Edit the ID_LINK value as the first available from the list (e.g. if the last record has 388, use 389); Note, there can't be any gap in the ID_LINK list, stricly follow the next index.

7) Edit the ORIGCAP as number of trains per day bidirectional (e.g. total number of trains in both the direction)

8) Add the orther direction (B-A) by add another new empty record clicking on the button ✚

9) Edit the A and B numbers where A is the B value introduced in the previous record and B is the A value introduced in the previous record (basically each time two records must be introduced, one with A->B and one with B->A)

10) Edit the ID_LINK using the same value as previous record (e.g. 389). Note that it is required to have the same LINK_ID in both directions since the capacity restriction is given as the bidirectional flow.

11) Edit the ORIGCAP value using the same value as previous record

12) Close the table by clicking the "X" icon in the top right corner;

13) On request, click "Yes" to save the edits.

Important note!

The links present in capacity table MUST be consistent with the links present in the network. This consistency is related to:

- a rail link in the capacity table must be present in the network

- a domestic rail link in the network must have a capacity value in the rail capacity table, else the capcity in the network will be assigned 0 for that specific link (exceptions are made for centroid and terminal connectors).

- the links must be always bidirectional, therefore two records must always be present

- the ID_LINK must be sequential and no gaps are allowed

- two links with same node numbers (A to B and B to A) must have the same ID_LINK

The user has all these checks already available in the "Edit the data" application. During the run report #8 will be produced under Report_ED_{SCENARIO_SHORTNAME}.txt. It is strongly recommended to check this file prior the run of Samgods model.

9.14.   Lorry HGV 74 ton setup

The current model setup includes 40 vehicle types in the definition of chain types used in the logistic process. The scenario MainSc2045 and sensitivity tests already include the larger train (tehicle types 210-212) and the barge inland water way (vehicle type 322), while HGV74 lorry (vehicle type 106) is still not active. To active this specific vehicle type there are two options:

1. When editing the network in Network window, update the attribute " LORRY_74T" with 1.
2. When providing the network as Emme file, update MODESTR value adding **B** (for instance "
    a 711400 171695   0.26 xabcB   110 1.0 81   50   0.26   0").

On the chain list submodes "c" and "X" are included. They represent specific submodes for vehicle type 106.

10. Advanced user options

The advanced user rights have been specified for users demanding a more complex setup in terms of functionalities. In this chapter, each functionality is described.

10.1. Consolidation factors

The consolidation factors can be specified using two different levels:

- First level: using catalog keys 21 and 22 in Table 6:
- Lower bound for consolidation factor (new) (applied to all commodities)
- Upper bound for consolidation factor (new) (applied to all commodities)
- Second level: CONSOL<Mode> table under Input_data.mdb which contains the lower and upper bound for consolidation factor by sub-mode and per specific commodity groups, using catalog key 7 in Table 15.

The value provided at the first level will be overridden by the values present at the second level.

In the current model some extra consolidation factor are provided for commodity groups 2, 8 and 9.

The table has the following values seen in Figure 90.

ID	MODE_C	CONSOL_L	CONSOL_U	Mode	ID_MODE	CONSOL_L0:	CONSOL_U0:	CONSOL_L0:	CONSOL_U0:	CONSOL_L0:	CONSOL_U0:	CONSOL_L0:	CONSOL_U0:	CONSOL_L0:
1	A	0.2	0.5	Road	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
2	B	0.2	0.5	Road	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
3	c	0.2	0.5	Road	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
4	C	0.2	0.5	Road	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
5	S	0.3	0.7	Road	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
6	X	0.3	0.7	Road	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
7	d	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
8	D	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
9	E	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
10	F	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
11	f	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
12	G	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
13	h	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
14	H	0.8	0.95	Rail	2	-1	-1	0.8	0.98	-1	-1	-1	-1	-1
15	i	0.8	0.98	Rail	2	-1	-1	0.8	-1	-1	-1	-1	-1	-1
16	I	0.8	0.98	Rail	2	-1	-1	0.8	-1	-1	-1	-1	-1	-1
17	T	0.8	1	Rail	2	-1	-1	0.8	-1	-1	-1	-1	-1	-1
18	U	0.8	1	Rail	2	-1	-1	0.8	-1	-1	-1	-1	-1	-1
19	J	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
20	K	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
21	L	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
22	M	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
23	N	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
24	O	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
25	P	0.15	0.9	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
26	Q	0.15	0.9	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
27	V	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
28	W	0.05	0.6	Sea	3	-1	-1	-1	-1	-1	-1	-1	-1	-1
29	R	0.15	0.8	Air	4	-1	-1	-1	-1	-1	-1	-1	-1	-1
(Ny)														

Figure 90 Default CONSOL_L and CONSOL_U values and by commodity group.

The steps to perform if the Advanced user wishes to modify these values using a different set are:

1) Open Data Manager from Cube Interface by clicking on the icon in the red rectangle;
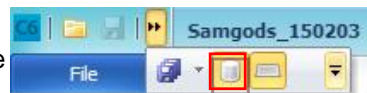
2) Open Input_data.mdb in data manager, see Figure 91.**Fel! Hittar inte referenskälla.**

3) Select BuildChain_CONSOL in data manager window, see Figure 92

4) Right click and select "Copy"

5) Select Input_Data,mdb in Data Manager window, right click and select "Paste"

6) Refresh Data Manager window clicking on

7) Browse to BuildChain_CONSOL_1 (this is the copied table from BuildChain_CONSOL) and double click on it. Made desired changes and close the window clicking on "X". Default values can be modified, as per by commodity group. Entry =-1 means derive the value from defaul. For instance CONSOL_L01 for Chain A is -1, the applied value is CONSOL_L for Chain A 0.4

8) Select Samgods application and scenario under scenario window

9) Double click on scenario name to open the scenario window

10) Click next until reach the catalog key Consolidation factors table

11) Click on "Browse" , select in the left window Input_Data.mdb and in the right window BuildChain_CONSOL_1

12) Click on OK

13) Click "Save"
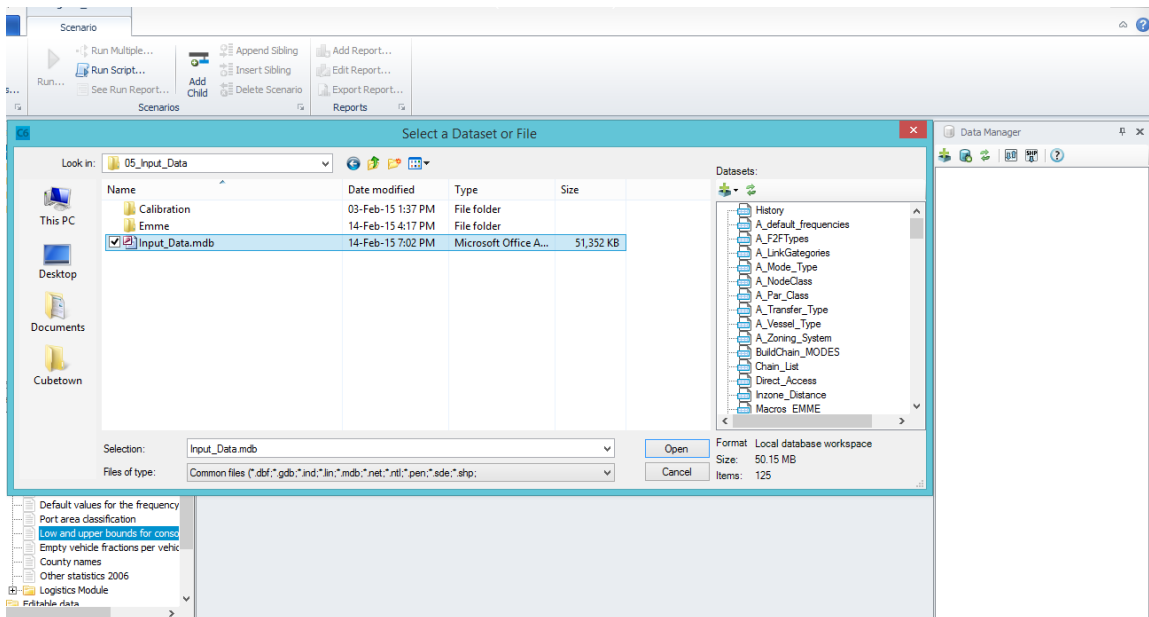
Figure 91 Input data

With the above changes the Samgods application is ready for the run.

For an exhaustive description on how those parameters work in the logistic module see [2].
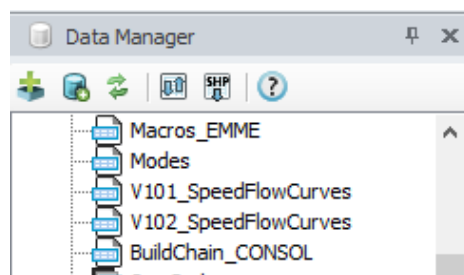
Figure 92 Data Manager

10.2.   Wait time for prompt messages

In some applications, some prompt windows will pop up during the execution. The prompt windows always require an action from the user since the process will be in pause until a choice

will be made within a determined time (10 minutes). The prompt windows give information on the run, normally warnings and failure messages.

The advanced user has the option to modify these settings and cutting down the wait time to a few seconds when he/she wishes to run several scenarios in sequence.

To change the waiting time perform the following steps:

1) Select "Create the editable files" application and "Scenario_Tree" scenario under scenario window

2) Double click on scenario name to open the scenario window

3) Under " Wait time for prompt messages during execution (default 10 minutes=600 seconds):" catalog key type 1 (1 will be 1 second)

4) Click "Save"

5) Click "Close"

10.3. Locking solutions option for Rail Capacity Management

A feature is available in the model, allowing locking the transport chain solutions for a set of large flows for system trains (locking is not possible for any other submode than system trains). Locking is done by listing the specific relations in a table within the calibration databases (Input_Data_Calibration_Base2019.mdb or Input_Data_Calibration_MainsSc2045.mdb located in folder 05_Input_Data\Calibration\). An example of its structure is shown in Figure 93.

Locked_2045

ID	Commodity	FromNode	ToNode	SubCell	Freq	Mode	NNodes	Node1	Node2	Node3
1	1	960700	960100	0	-1	I	3	960711	930511	960111
2	3	952300	958000	0	-1	U	2	952311	958012	
3	3	958400	952300	0	-1	U	2	958411	952311	
4	3	958400	958500	0	-1	U	2	958411	958412	
5	3	958400	958500	8	-1	U	2	958411	958412	
6	3	958500	960700	0	-1	U	2	958412	960711	
7	4	960100	960700	0	-1	I	3	960111	930511	960711
8	4	960100	960700	9	-1	I	3	960111	930511	960711
9	8	958000	958400	0	-1	T	2	958012	958411	

Figure 93 LockedSTDLogMod.txt file example.

The values provided are:

- Commodity: commodity group, in the example first row commodity number 1
- FromNode: origin zone (828300)
- ToNode: destination zone (948200)
- SubCell: subcell in PWC matrix (0)
- Freq: frequency (-1)
- Mode used (I): the locked solution is only avaliable for system trains, possible submodes at I,T,U and i
- NNodes: number of nodes used in the locked solution (3)
- List of intermediate terminals along the path (correct order is reqired): 828300 – 828311 – 828011 – 806011 – 786211 – 758111 – 902111 – 948211 – 948200
- The table is pointed out in the GUI of the Samgods Model application, it is possible for the user to create another table with locked solutions in the calibration database and change the path in the Samgods Model application (as long as the table format remains the same).

| Table with list of locked solutions | 2019 |

Figure 94 Edit box and input

The transport chain list must be checked using Input_Data.mdb\BuildChain_MODES table and not Input_Data.mdb\Modes table. The former is used in the logistic modules, while the latter is used in the network coding. Letters I and i have the opposite meaning of vehicle type numbers:I = 204 and i=211 in BuildChain_Modes, while i=204 and I=211 in network coding.

The transport chains listed in this file will be excluded in the evaluation of the new alternatives during Standard Logmod and Rail Capacity Management process. Their impact on the rail capacity consumption is of course still accounted for in the LP-model.

10.4. Empty vehicle fractions

The Extract procedure reads the output files from LogMod and RCM and produces the OD matrices for tonnes and number of loaded and empty vehicles respectively. It comprises a stepwise linear function for deriving the number of empties as fraction of the loaded vehicles. The applied curve is shown in Figure 95 Curve of empty vehicle fractions.
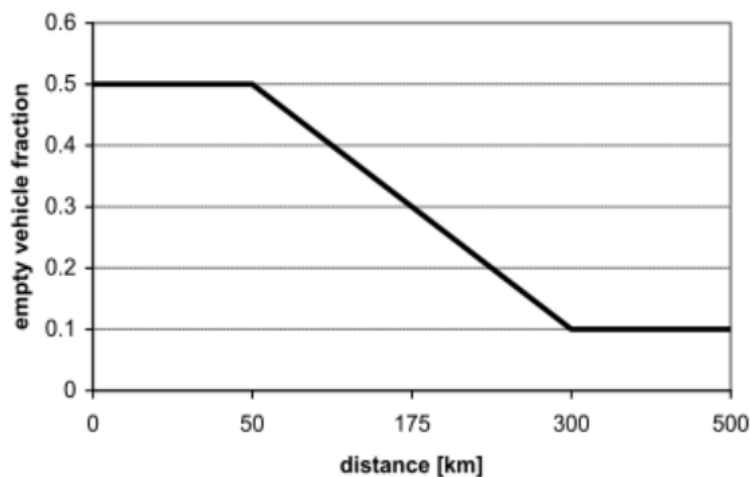
Figure 95 Curve of empty vehicle fractions.

From version 1.0 of the logistics model the curve could be specified via the interface updating the table " Empty vehicle fractions per vehicle type and distance" under data panel (Scenario Inputs\General tables\). The structure of the table is as shown in Figure 96.

OBJECTID	ID	VEH_NR	DIST1	EMPFAC1	DIST2	EMPFAC2	ASYM
1	1	101	50	0.5	300	0.1	50
2	2	102	50	0.5	300	0.1	50
3	3	103	50	0.5	300	0.1	50
4	4	104	50	0.5	300	0.1	50
5	5	105	50	0.5	300	0.1	50
6	6	106	50	0.5	300	0.1	50
7	7	201	0	0.2	0	0	99999
8	8	202	0	0.79	0	0	99999
9	9	204	0	0.56	0	0	99999
10	10	205	0	0.56	0	0	99999
11	11	206	0	1	0	0	99999
12	12	207	0	0.45	0	0	99999
13	13	208	0	0.45	0	0	99999
14	14	209	0	0.45	0	0	99999
15	15	210	0	0.2	0	0	99999
16	16	211	0	0.56	0	0	99999
17	17	212	0	0.45	0	0	99999
18	18	301	50	0.5	300	0.1	50
19	19	302	50	0.5	300	0.1	50
20	20	303	50	0.5	300	0.1	50
21	21	304	50	0.5	300	0.1	50

Figure 96 Input table for empty vehicle fractions.

The attributes in the table represent the points of the curve the user wants to apply:

- ○ DIST1: first distance (km) where will be applied the EMPFAC1 value (with a flat distribution)
- ○ DIST2: second distance (km) where will be applied the EMPFAC2 value (with a linear function between EMPFAC1 and EMPFAC2 for distances between DIST1 and DIST2)
- ○ If DIST1 and DIST2 are zero, a constant level curve with the value EMPFAC1 will be applied.

The above attributes in other words shape the function used in the extract procedure. The attribute ASYM provides a threshold distance above which asymmetric flows will generate empty vehicles. The asymmetric part is determined as the absolute value of the difference in the loaded flows in pairwise, opposite OD-relations. To illustrate the calculation consider an OD-relation (the asymmetric part is $abs(120 - 100) = 20$):

- ○ Distance = 70 km
- ○ OD-flow ij= 120 vhcls
- ○ DO-flow ji = 100 vhcls
- ○ Empty vehicle fraction at 70 km = 0.1

If ASYM=50 the distance (70) is above the threshold value so asymmetric flows will generate empty vehicles (according to empties := symmetric term + asymmetric term):

- ○ OD-flow empties ji = 0.1*100
- ○ DO-flow empties ij = 0.1*120 + 20

10.5. Restart from failure

In the event of a crash during a Samgods run different actions could be performed by the user depending on the crashed application.

The model failure can occur under different circumstances:

- hard disk space insufficient to save output
- locked mdb that prevents move data in Input_data.mdb (if the geodatabase has been open in GIS interface or is MS Access the .ldb file could reside in the system and protect the mdb in read mode)
- failure in running in the LP solution with CLP64.exe
- wrong settings of catalog keys

If the failure happens in Standard LogMod or Rail Capacity Manamegemnt or in some of their sub steps (LOS, Logistic Module, Assignment, Report, RCM,Assignment RCM, Report RCM) it is possible to rerun the process until the next sub step and after that run each remaining sub step selecting " Run only one step, or run all steps" with the appropriate value.

For instance, if the process crashes in "Logistics module\Save Reports" group it is required to run this and next sub group "Assignment\Conversion From Logmod to VY". The instructions below must be performed for those two groups with the same execution order shown in the interface (first "Save Reports", second "Conversion From Logmod to VY"). After this the Assignment, Report, Rail Capacity Management steps will be run separately.

To rerun a specific subgroup the following actions must be undertaken from the Cube interface:

1) Select the scenario that failed
2) Open the application that failed by double click on the actual application in the "Application window"
3) Click on "Run", located in the top left corner of the Cube interface (see icon in red rectangle in)
4) In pop-up menu "Run Application", select "Run Application now from Task Monitor' and tick "Run Current Group Only", see settings in Figure 97
5) Click on "OK"
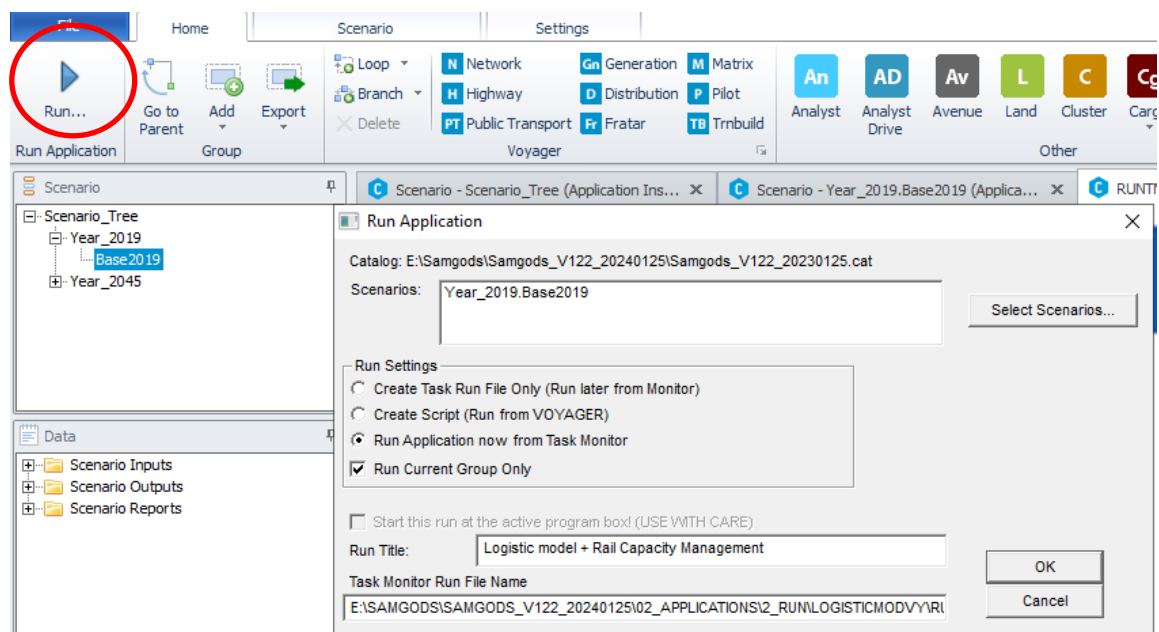
Figure 97 Restart from failure

The single subgroup will be run.

10.6.   Scaling factor for outpus

The "Scaling factor for outputs" define how the results will be presented in the report tables. The original values from the model will be divided by

- "Thousands" (/1,000)
- "Millions" (/1,000,000) or
- "Billions" (/1,000,000,000).

In the current implementation the unique and default value is "Thousands" and the normal/advance user has not access to the catalog key to modify the default. Only the developer mode let modify the value.

The steps to modify the value are as follow:

1) Select "Scaling factor for outputs" catalog key from scenario window:

Scaling factor for outputs	Thousands	▾

2) Type in the box "Millions" or "Billions"

Scaling factor for outputs	Millions	▾

3) Click on enter and "Save"

Note: The only allowed values are "Thousands", "Millions" and "Billions". Any other value is NOT accepted and it will cause the failure of the run. Also be careful in NOT mispelling the name of the scaling factor since also this will lead to a failure.

11. Log reports

In this chapter, log reports from running some of the applications are presented. The reports include messages that help the user to analyze and understand the results.

11.1. Edit the data application

The *Edit the data* log report is created when the application *Edit the data* is run. Possible messages inside the log report file Report_ED_{SCENARIO_CODE}.txt under the scenario specific folder, or accessible from the Data section window under Scenario outputs\Edit the data Report, are listed and explained inTable 40.

Table 40 Reports for *Edit the data* application

Number of message inside the log report	Purpose	Example of messages	Message explanation
#1	Inform whether the scenario is editable or not	Report #1 – the scenario is still editable.	The scenario is in editable mode.
		Report #1 – the scenario is locked.	Changed the scenario into read only mode. It is not possible to change it back from the interface.
#2	Verify the Port_swe table	Report #2: the terminal *N(6.0) TERMINAL N(6.0)* is not a sea terminal!! Please check the" Ports Sweden" layer.	The terminal number that is not a sea terminal is printed out. In the Ports_swe table there should be only sea terminals. If the terminal is not a port, it will not be saved in the table.
	Verify if a domestic port has the PortArea number specified	Report #2: the terminal *N(6.0) is missing the Port Area attribute. Please associate a port area number. See table "A_Port_areas" for the attribute names*	Each domestic port must be given to a port area since some calibration parameters are associated to this attribute. It is also used for reporting procedures. Correct the PortArea number with proper number.
#3	Information on the number of zones\terminals	Report #3: the number of zones is *MAX NETWORK(5.0)*	Maximum number of zones\terminals in the highway network
#3	Verify the coherence between network and nodes	Report #3: the number of zones is not the same in the network and the node table. In the network there are MAX *NETWORK(5.0)* and in the nodes table *MAX NODES(5.0)*. Please check the Scenario network.	In this step, the application updates the variable ZONES_M inside the general tables and gives the report. MAX NETWORK(5.0) is the variable used to count the maximum number of zones in the network MAX NODES(5.0) is the variable used to count the maximum number of zones in the node s table. During the run, they will be substitute by the zone node numbers.
#4	Verify the coherence between tables	Report #4: Please add the node *ZONE(6.0)* to the node table.	The zone is in the network but not in the nodes table.
		Report #4: Please add the node *ZONE(6.0)* to the network.	The zone is in the nodes table but not in the network.
		Report #4: Please add the sea terminal *ZONE(6.0)* to the network.	The sea terminal is in the Node_Terminals but not in the network.

Number of message inside the log report	Purpose	Example of messages	Message explanation
		Report #4: Please add the commodity node *ZONE(6.0)* to the network.	The node is in the Nodes_commodities table but not in the network.
		Report #4: Please add the frequency node *ZONE(6.0)* to the network.	The node is in the Frequency_Data_Node table but not in the network.
		Report #4: Please add the frequency node *ZONE(6.0)* to the network.	The node is in the Frequency_Data_Link table but not in the network.
#5	Verify the numbering system	Report #5 – numbering system. Node / Code_error / Description	Header of the message
		N / 1 / Missed the mode! – must be correct!	Missed the mode for node N – must be correct in the node table
		N / 2 / Missed the ID COUNTRY or the ID REGION code – must be correct!	Missed the ID_COUNTRY or the ID_REGION code in the node table for node N
#6	View the errors during the creation of NORIG numbers for the zones	List of errors during the creation of SCBSTANN for the zones	Header of the message NORIG is the Emme node number and its specification comes from a set of rules when edits are made in GIS interface. From Emme network it is the value already present.
		The node is without MODE_N. Please check the data.	The mode for the zone is missing
		The node has no values available. Please check the data.	There are no node numbers available for the zone
#7	View the errors during the creation of NORIG numbers for the nodes	List of errors during the creation of NORIG for the nodes	Header of the message
		No more node numbers are available. Please check the data	There are no node numbers available for the node
#8	Check the consistency of rail capacity table with Rail Network	Report#8: There are mistakes in the rail capacity table. Please check the rail capacity table. The link A B ID_LINK is not a rail link	The link listed is not a rail link. Check the node numbers A and B in the rail network and identify the proper node number. (NOTE: the links must be only Swedish links).
		The link A B ID_LINK is not present in the network.	The link listed is not present in the rail network. Two actions are: 1) amend the A and B nodes because the link is in the network; 2) add the link in the network because the link is missing.
		The link A B is in the rail capacity table but has not any capacity	The links listed in the rail capacity table MUST have a capacity value greater than zero. The capacity is number of BIDIRECTIONAL trains per day.

Number of message inside the log report	Purpose	Example of messages	Message explanation
		The ID_LINK sequence is wrong. for the following links: A B A B ...	Links with opposite direction but same node number MUST have same ID_LINK. Example: 2001-2000 and 2000-2001
		The ID_LINK sequence is wrong.	The ID_LINK must start from 1 to the highest number. No gaps could be present.
#9	To identify nodes unconnected to any link – this precludes the correct structure of spanning tree data later produced by Samgods application. This must be considered as sever mistake and always fixed.	Report#9: There are mistakes in the network. The following nodes must be removed since not used in any link Node number= 12345	The nodes listed must be deleted from the network. Open GIS interface, start an edit session, select them and delete from feature explorer window. Save and close.

In addition to the controls of the data loaded into the model, there are also controls and concictency checks with the calibration databases (Input_Data_Calibration_Base2019.mdb and Input_Data_Calibration_MainSc2045.mdb) compared to the Input_Data.mdb. Reports are also listed in Report_ED_{SCENARIO_CODE}.txt and are explained in Table 41. Note that in order to apply calibration factors for a specific parameter, the parameter must be in place within the main database (explains why tolls = 0 SEK are represented in main database) else the program will crash because of inconsistencies within the data.

Table 41 Calibration related reports for *Edit the data* application

Number of messages inside the log report	Purpose	Example of messages	Message explanation
#C1	Consistency checks of table Nodes, comparing Input_Data.mdb and relevant calibration database for actual scenario	Report #C1. Consistency between Nodes in scenario and calibration parameters. There are 0 errors in the Nodes table.	No inconsistencies appears between listed input data and calibration parameters for nodes
#C2	Consistency checks of table Tax_Country, comparing Input_Data.mdb and relevant calibration database for actual scenario	Report #C2. Consistency between Tax_Country in scenario and calibration parameters. There are 0 errors in the Tax_Country table.	No inconsistencies appears between listed input data and calibration parameters for tax country
#C3	Consistency checks of table Tax_Link, comparing Input_Data.mdb and relevant calibration database for actual scenario	Report #C3. Consistency between Tax_Link in scenario and calibration parameters. There are 0 errors in the Tax_Link table.	No inconsistencies appears between listed input data and calibration parameters for tax link
#C4	Consistency checks of table Toll_Link, comparing Input_Data.mdb and relevant calibration database for actual scenario	Report #C4. Consistency between Toll_Link in scenario and calibration parameters. There are 0 errors in the Toll_Link table.	No inconsistencies appears between listed input data and calibration parameters for toll link
#C5	Consistency checks of table Rail_Capacity, comparing Input_Data.mdb and relevant calibration database for actual scenario	Report #C5. Consistency between Rail_Capacity table in scenario and calibration parameters. There are 0 errors in the Rail_Capacity table.	No inconsistencies appears between listed input data and calibration parameters for rail capacity
#C6	Consistency checks of Network related data, comparing	Report #C6. Consistency between Network and calibration	No inconsistencies appears between listed

Number of messages inside the log report	Purpose	Example of messages	Message explanation
	Input_Data.mdb and relevant calibration database for actual scenario	parameters. There are 0 errors in the Network.	input data and calibration parameters for network

11.2. Samgods Model application

The Existing Outputs log report is created when the *Samgods Model* application is run. The messages inside the log report file Report_SG_{SCENARIO_CODE}.txt under the scenario specific folder, or accessible from the Data Section window in Scenario outputs\Samgods Report\Existing Outputs, are listed and explained in Table 42.

Table 42 Reports for the *Samgods Model* application

Number of message inside the log report	Purpose	Example of messages	Message explanation
#1	Analyse inconsistencies between input data in different runs	The output for the commodity *ID_COM(2.0)* was created with a different Input data. Please check the scenario data. The previous run has *DATE_E* and the current run has *DATE_L*.	Warning that the input data has been modified between the last run and the current run.
	List of output files	The results have been computed by Voyager. The output under path is available.	List of all available output files and their locations.

11.3. Handling scenario application

The Report for the import phase is created when the Import function in the *Handling Scenario* application is run. The messages inside the log report file Report_HL_{SCENARIO_CODE}.txt under the scenario specific folder, or accessible from the Data Section window under Scenario Outputs\Import function Report\Report for the import phase, are listed in Table 43.

Table 43 Reports for the *Handling scenario* application

Messages	Required actions
All the catalog keys have the correct value. No actions are requested.	Nothing
List of catalog keys that have to be changed and how.	Change the listed catalogue keys for the imported scenario under "Scenario Parameters" in the *Handling Scenario* application and run the application again. Check the report again.

11.4.   Check-list when errors occur

- Do you have the required administrative rights to install and run the Samgods GUI?

- Is the model user role correct? Model Standard user is typically used when running scenarios etc., while Model developer typically is used during installation and setting up the system. Model Advanced user is used when some main parameters in the model setup should be changed for sensitivity tests

- What is the ReturnCode no? ReturnCode 2 is a fatal error – view the error report

- Is the name of the scenario correct? Geodatabase format does not allow:
    - Begin the name with numbers (i.e., 01_scenario is not allowed, but scenario_01 is OK)
    - Special characters (like space " " or -,+, **n f t** in the beginning of the name)
    - Blankspace is not allowed, use underscore ("_") instead. Note that the path of the Samgods catalog cannot contain blankspace either.
    - Too long names (maximum 12 characters)

- Some errors (regarding delimiter problems with "." and ","), it is recommended to use delimiter ".".

- If the mode stops because the task monitor disappears, close Cube and check the combability of Cube.exe, it should be set to be combability with Windows 8 (see Figure 1)

- If the logistics module stops operating, the reason could be that the execution is split up into too many processors. RAM per processor should be at least 1.5 GB. The number of processors to use is set in the interface, via a catalog key in the *Samgods model* application, see Section 7.5.
  Warning messages as in Figure 98: will interrupt the model run (with Return Code =3). They refer to the LP setup (made by a set of batch files called in sequence). In this case a failure is occurred in MPS.jar program or CLP64.exe program. To debug the problem refers to documents listed in [7] and [3]. Along the process in each fundamental stage, similar prompts will appear. In all cases the failure is one of the external programs (BuildChain, ChainChoi, ConsolidRateMode, extract, mergerep, RCM, LP2CC, SelectDirect). The proper folder that contains information on failure is LogMod\LOG folder that will contain the log file (per commodity or vehicle class) and err file (listing the probable reason of failure).

- JVM (Java Virtual Machine) is not working and therefore RCM does not produce any result: check java pattern first, and if correct check if the correct java pattern is defined in PATH system variable. Guidance for setting the environmental variable is present under: https://www.java.com/en/download/help/path.xml

  The value under PATH environment variable should point to the folder containing the java.exe.
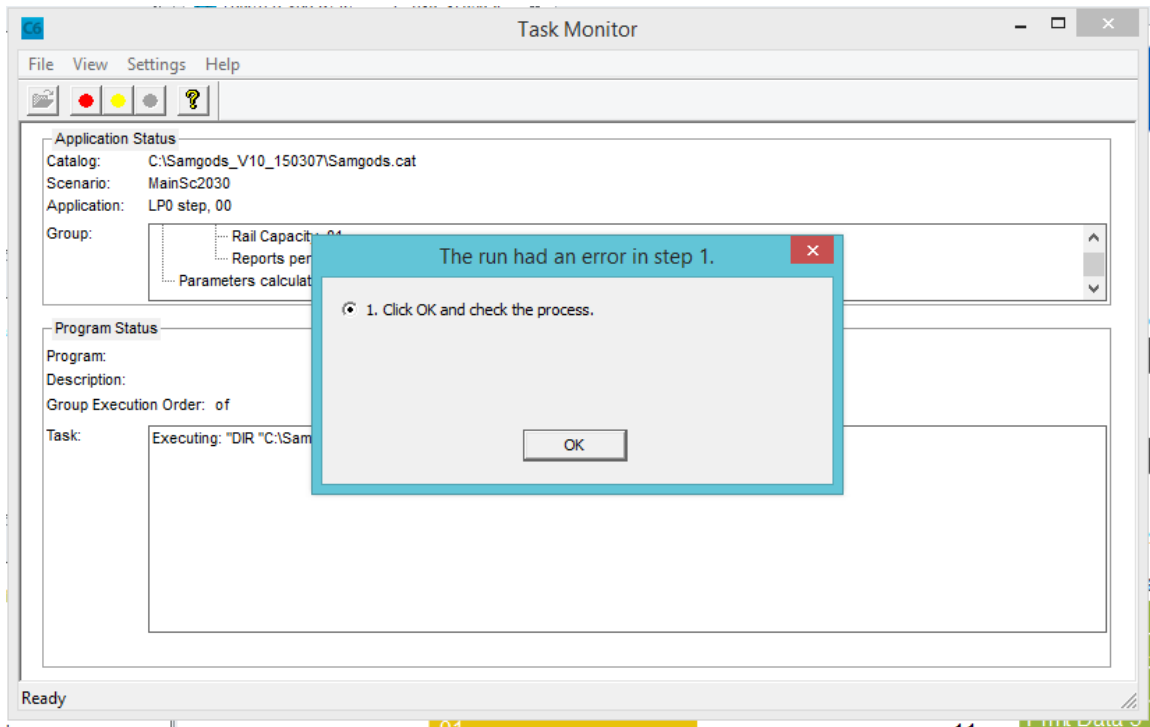
Figure 98 Run error

12. Maps on outputs

The model produces outputs that can be classified into two main groups:

- tabular reports
- geodatabase networks

The first group can be visualized via Cube interface, Access or ArcMap. The second group can be visualized via Cube interface or ArcMap. In this chapter we will provide the procedure to create maps for the second group. A standard set of maps that could be exchange with people without Cube license is also described in this chapter.

12.1.   List of networks

The available networks are presented in Table 44.

Table 44 Geodatabase networks in output

ID	Data panel	Name	Notes
1	Scenario Outputs\Samgods Report\Assignment	Road Assigned Network	
		Rail Assigned Network	
		Sea Assigned Network	
		Air Assigned Network	
2	Scenario Outputs\Samgods Report\Reports	Assigned Network	
3		Bidirectional tons per mode STD	
4	Scenario Outputs\RCM Report\Assignment	Road Assignment Network (RCM)	
		Rail Assignment Network (RCM)	
		Sea Assignment Network (RCM)	
		Air Assignment Network (RCM)	
5	Scenario Outputs\RCM Report\Reports	Assigned Network	
6		Report #15b Rail Capacity Network	Only for RCM
7		Bidirectional tons per mode RCM	

12.2.   Create a map

To create a map in GUI interface:

1) Select the scenario from which you want to create a map

2) Select from data panel the geodatabase network you want to visualize (in the example Report #15b Rail Capacity Network) and double click on it

3) The GIS window will be open having in TOC only the network (named Rail_BiDir)

4) Clicking on "Add data>Geodatabase Data", see Figure 99, add {CATALOG_KEY}\Input_Data.mdb\Samgod$_S$_zones background layer. This is used only for cosmetic purposes
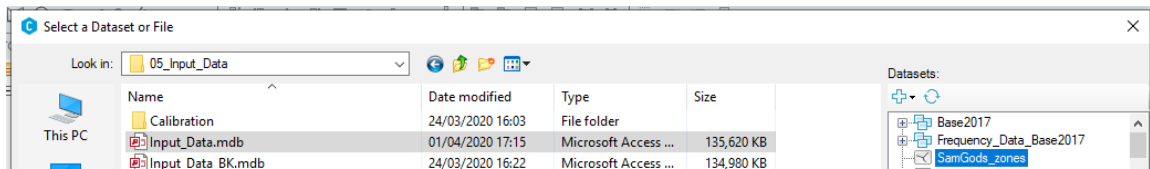
Figure 99 Samgods_zones layer in Input_data.mdb

5) Clicking on "Add data>Shapefile" add background shapefiles located under {CATALOG_KEY}\03_Gis_Data. This is used only for cosmetic purposes

6) In the TOC drag and drop Rail_BDir on the top of all the layers

7) Untick the network node layer (Rail_BDir_node)
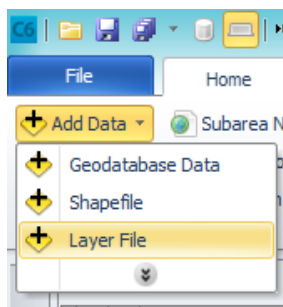
Figure 100 Add data

At this point the map will looks like Figure 101.
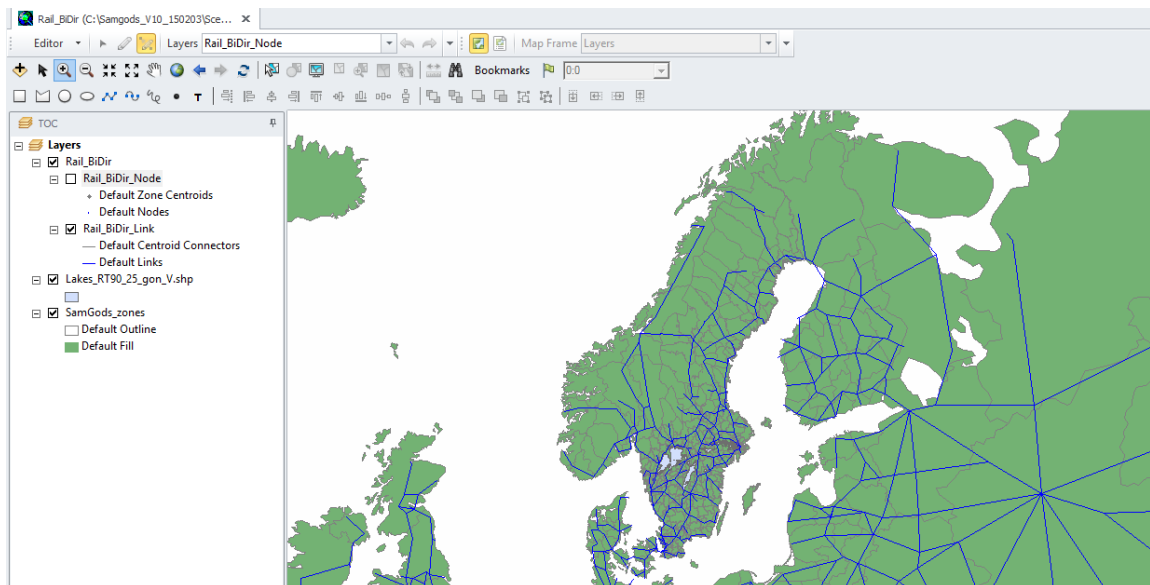
Figure 101 Map with geodatabase network and general layers

8) Click on the tab "GIS Analysis" in the interface and click on "Multi-Bandwidth tool", see Figure 102.

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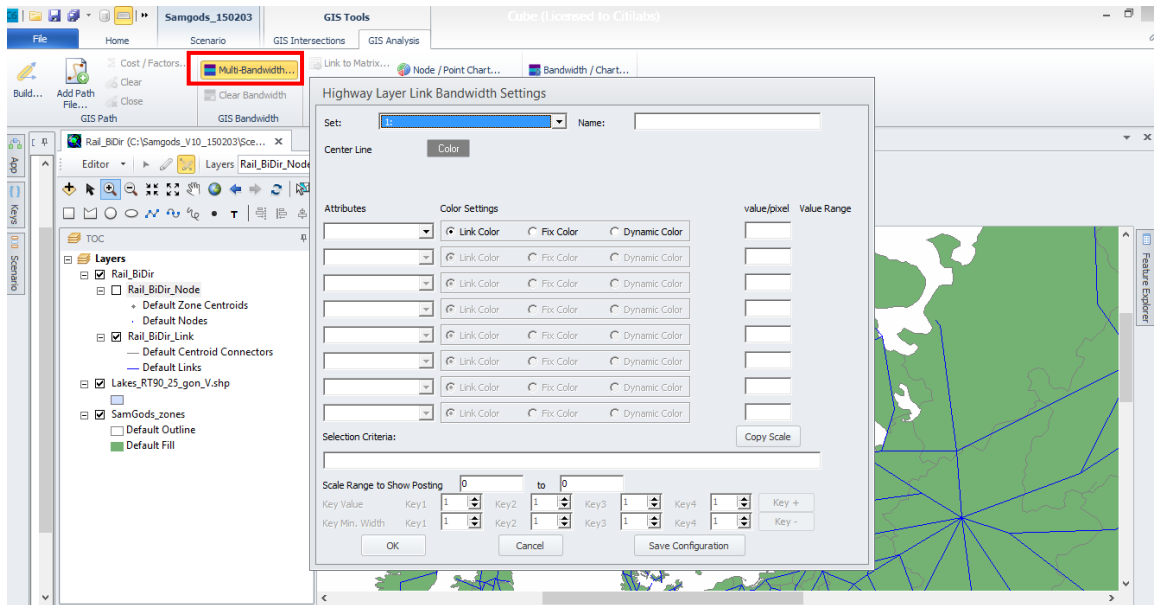
Figure 102 Multi-Bandwidth tool

9) The Highway Layer Link Bandwidth Setting window will pop up. Select the attribute to visualize in the map (TOT_EMPT) and Dynamic Color in the dialog screen. This option allows specification of different colors for different value ranges for the selected attribute

10) Enter in the Name input frame, the name of the map (in the example Empty trains bidirectional per day), in Figure 103.
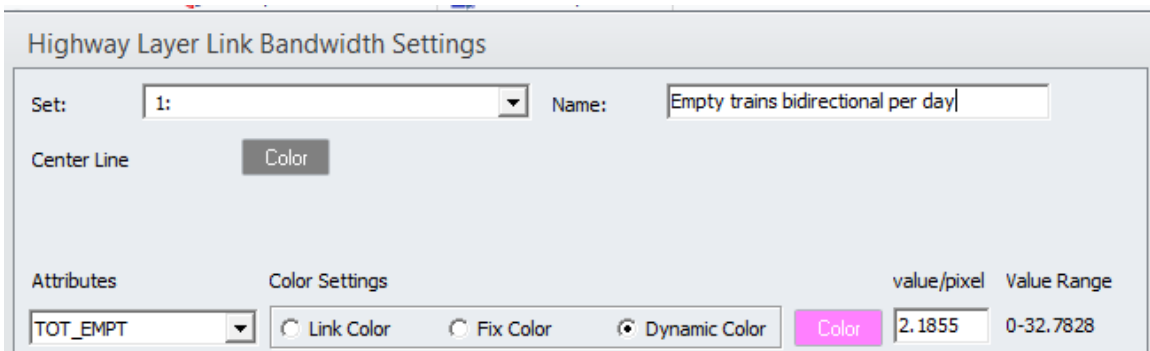
Figure 103 Name input frame

11) Click on "Color" and specified in the following window: Number of groups (6), the Color Range clicking on colored icon (green and red). Click on Apply Color Range and Apply Value Range. Accommodate the High Value in the range of values per desired class. Click on OK.
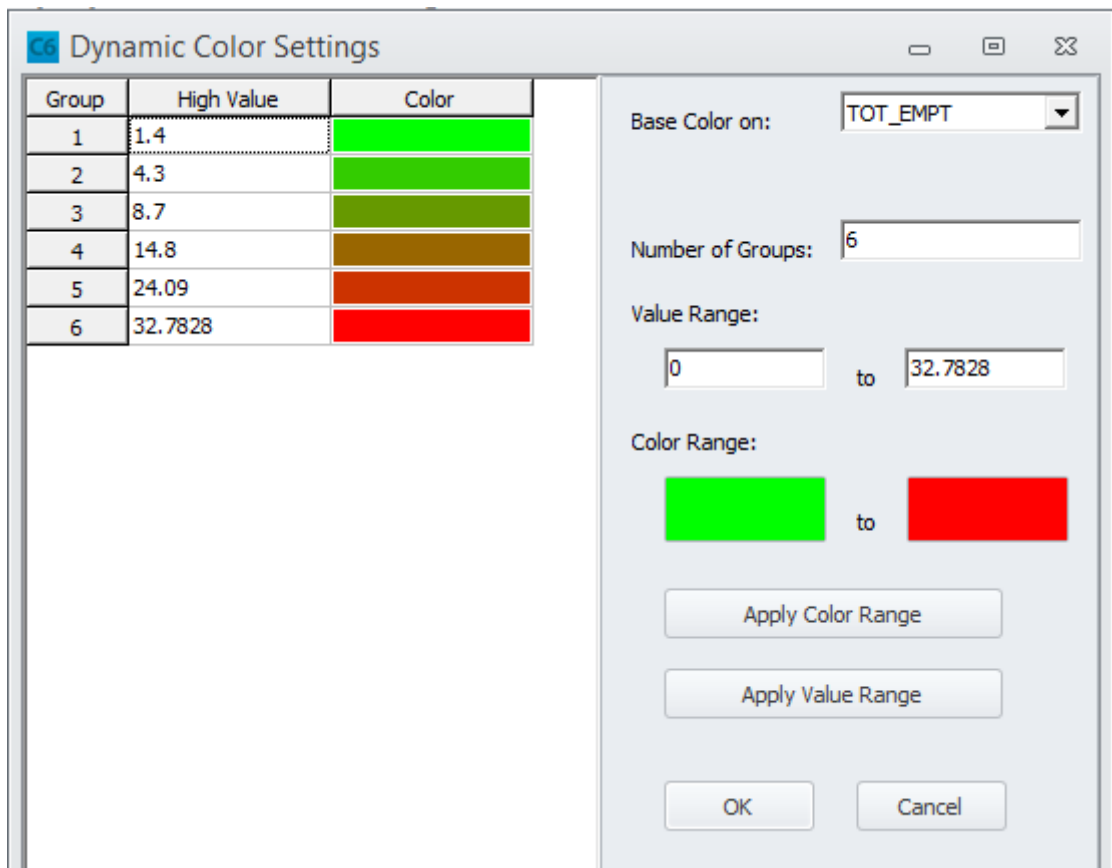
Figure 104 Colour settings

12) Click on OK in the following two menues

The resulting map will be as shown in Figure 105.
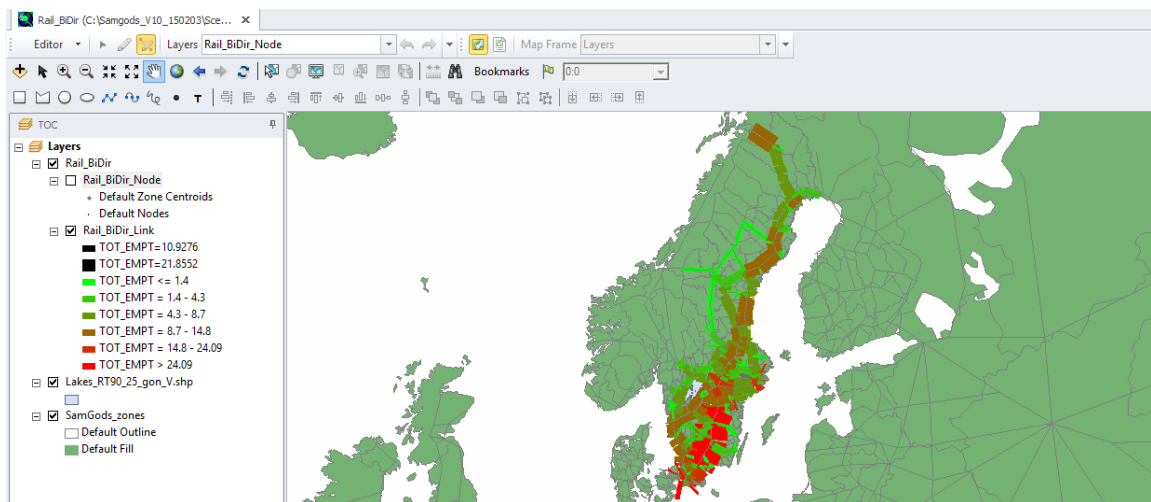
Figure 105 Present map

13) Click on "X" to close the map, the system will prompt if it is necessary save the map giving a location and a name. Select the scenario folder and give the name "RCM.mxd", see Figure 106.
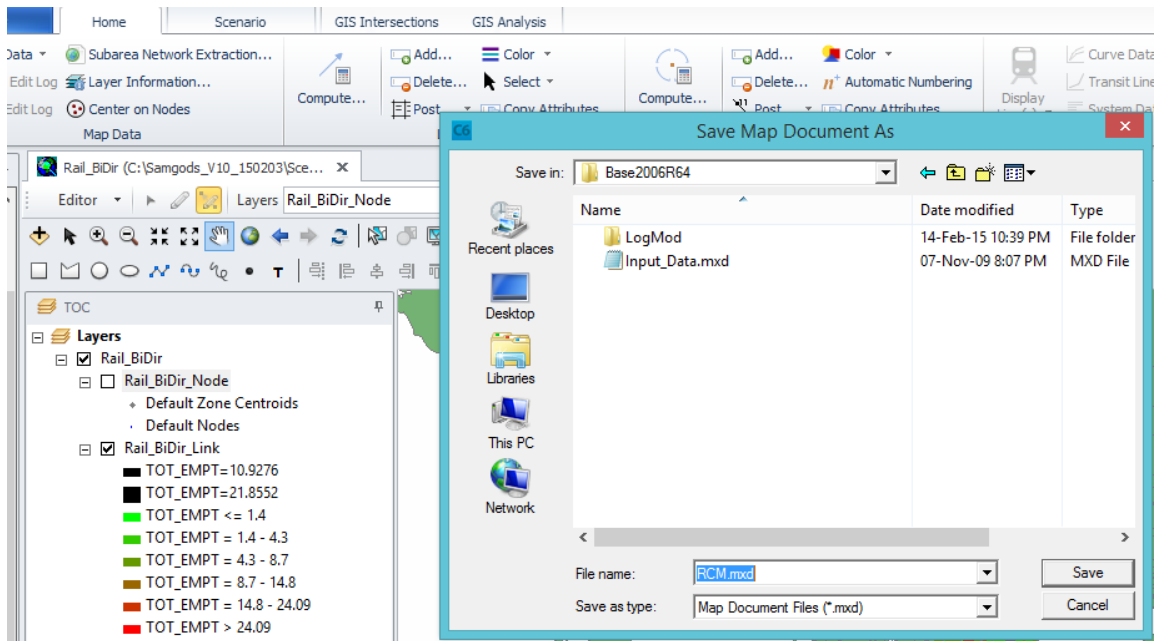
Figure 106 Save the map if necessary

12.3.   Copy existing maps in new scenarios

The practice to start from scratch is not recommended and will be extremely time consuming. A useful option is to inherit/copy all the settings specified with Multi-Bandwidth (or any tool in the graphical interface) from one scenario to another scenario by copying those settings from the vpr file.

The vprfile, normally created and saved alongside the output.mdb, takes the name of the geodatabase which it refers to. In Samgods model its name is output{Commodity}_{SCENARIO_SHORTNAME}.vpr and it is placed under the scenario folder. If it is not present, it means that no maps are yet specified for the scenario.

The vpr file saves all the settings specified in the mxd document which refer to elements loaded according to the TOC.

To import in a new scenario the legends, Multi-Bandwidths, labels specified in another scenario proceed in the following manner:

1)   Right click on RailBdir_Link layer
2)   On the window select "Copy Layer Settings From Another Layer", see Figure 107.
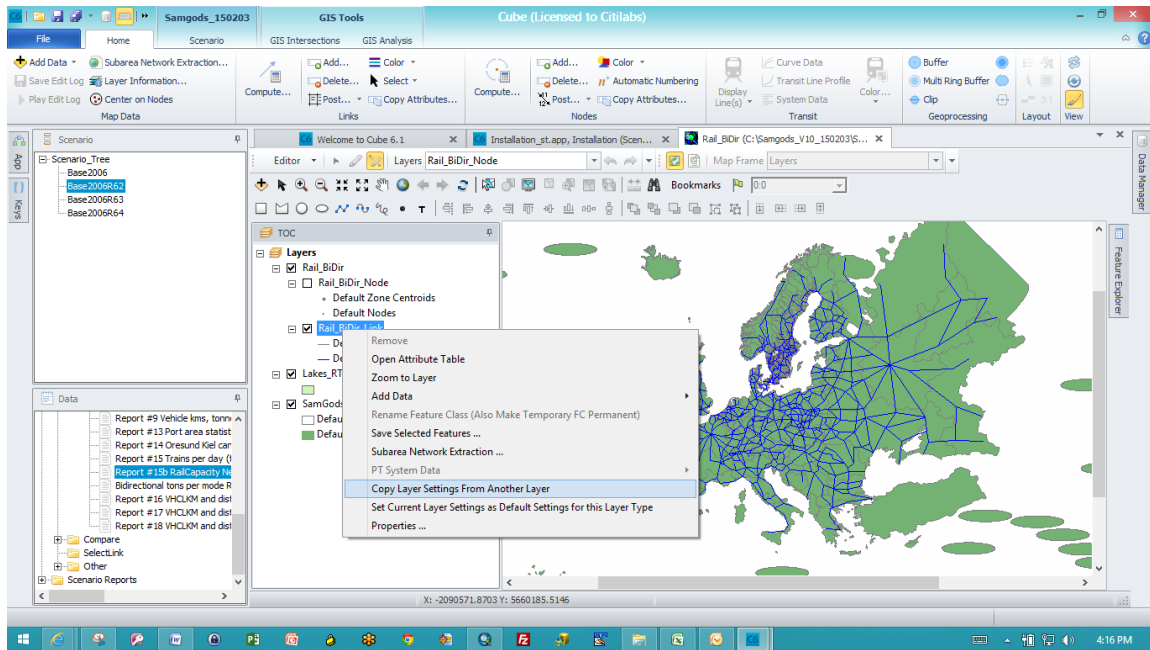
Figure 107 Copy layer settings from another layer

3) Select the Vpr file from scenario having the map you want to use (in the example Base2006R64 folder and Output0_Base2006R64.vpr file), see Figure 108.
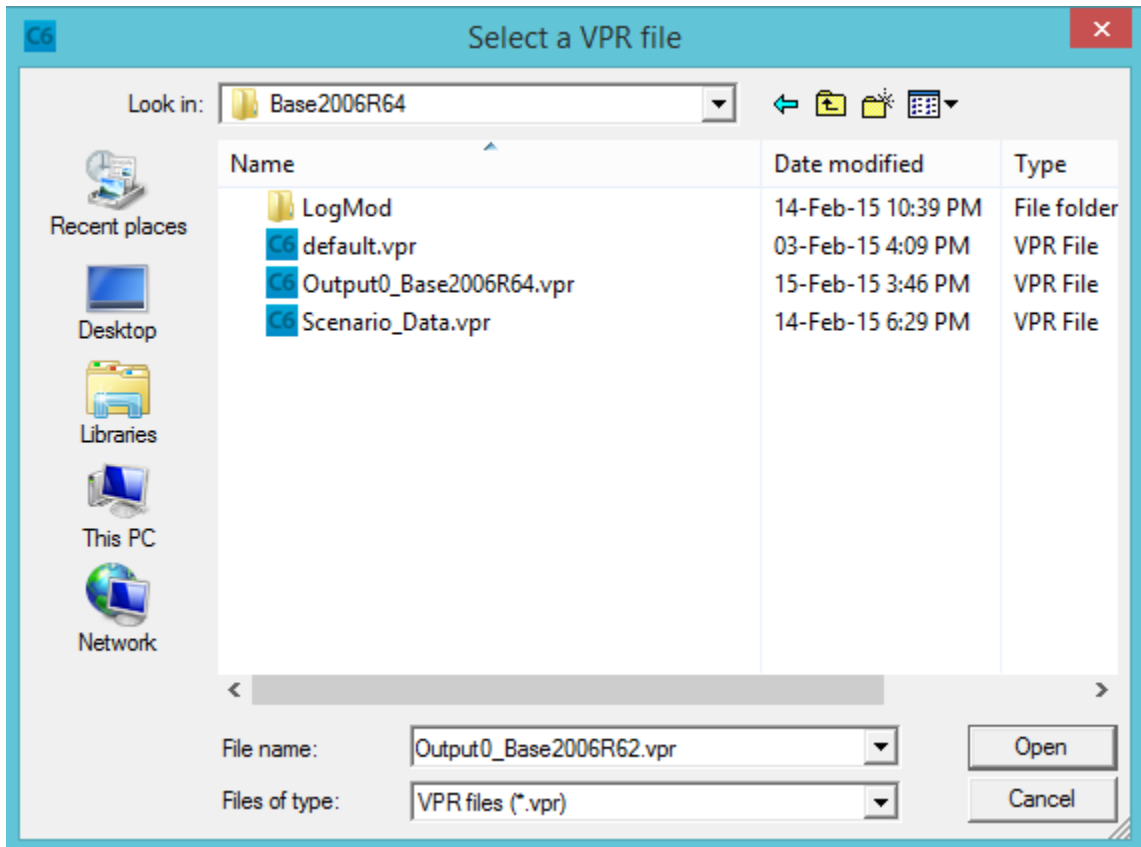
Figure 108 Select vpr file

4) Select the layer having the same name of the current network (e.g. Rail_BDir), see Figure 109.
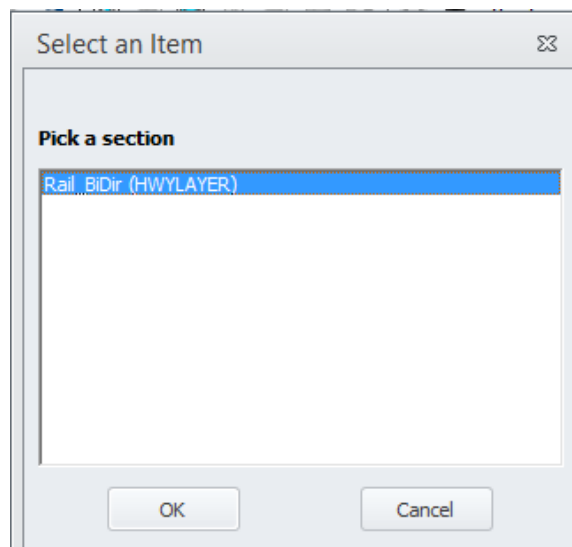
Figure 109 Select layer

5) Click on GIS Analysis tab in the interface and click on Multi-Bandwidth tool. The legend specified in the other network will be prompted automatically.

6) Click on OK

7) Click on X to close the map, the system will prompt if it is necessary save the map giving a location and a name. Select the scenario folder and give the name "RCM_64.mdx".

12.4. Attributes names for maps

The available attributes that can be visualized in a map for networks 1,2,4,5 in Table 52 are listed under 14.4.2. Here the attributes in networks 3,6 and 7 in Table 45 are listed.

Table 45 Attributes in geodatabase networks

Attribute	Meaning	Network
TOT_ROAD_TM_BD	Bidirectional tonne flows on road in millions	Loaded_Bid_STD (Bidirectional tonnes per mode STD) Loaded_Bid_RCM (Bidirectional tonnes per mode RCM)
TOT_RAIL_TM_BD	Bidirectional tonne flows on rail in millions	
TOT_SEA_TM_BD	Bidirectional tonne flows on sea in millions	
TOT_EMPT	Bidirectional empty train flows per day	Rail_Bdir (Report #15b Rail Capacity Network)
TOT_ASS	bidirectional per day total train flows (empty + loaded	
TOT_LOAD	Bidirectional number of loaded trains per day	
CAP	Bidirectional capacity (#trains/day)	
FLAG_OVCAP	1 if overcapacity load of 1 train/day, otherwise 0	
FLAG_PER	1 if overcapacity load of 1%, otherwise 0	
FLAG_TOT	1 if FLAG_PER=1 or FLAG_OVCAP=1	
DIFF_VC	Differences in number of trains over capacity	

12.5. Standard Output maps

For three specific outputs, there are available standard output maps respectively under:

1) Data Panel\Scenario Outputs\RCM Report\GIS maps – for total Ktons and vehicles per commodity group, see Figure 110 and Figure 111
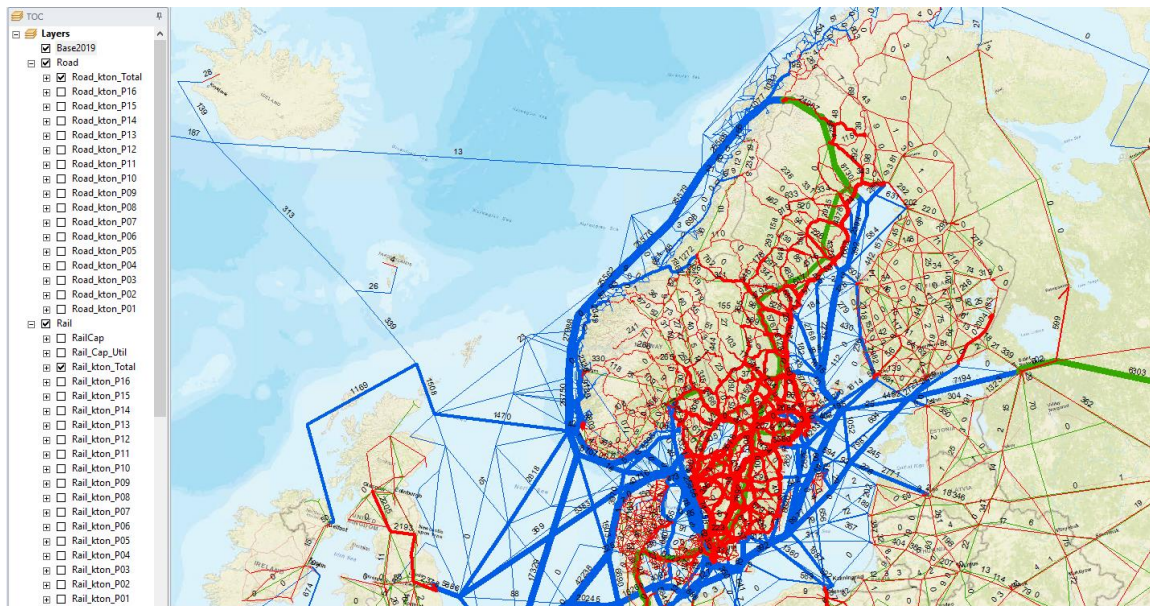
Figure 110 Standard map on ktons by total and commodity groups. (map name: Output_COM_RCM_GIS_TON.mxd)
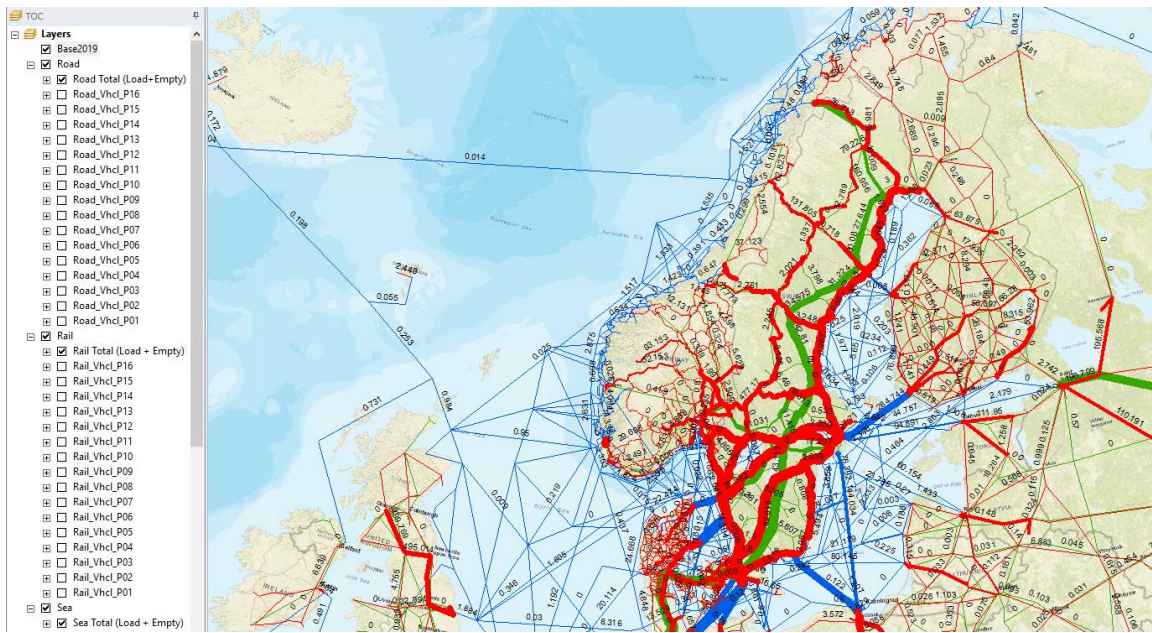
Figure 111 Standard map on Loaded vehicles by total and commodity groups. (map name: Output_COM_RCM_GIS_VHCL.mxd)

2) Data Panel\Scenario Outputs\Samgods Report\GIS maps – for total Ktons and vehicles per commodity group, see Figure 112 and Figure 113.
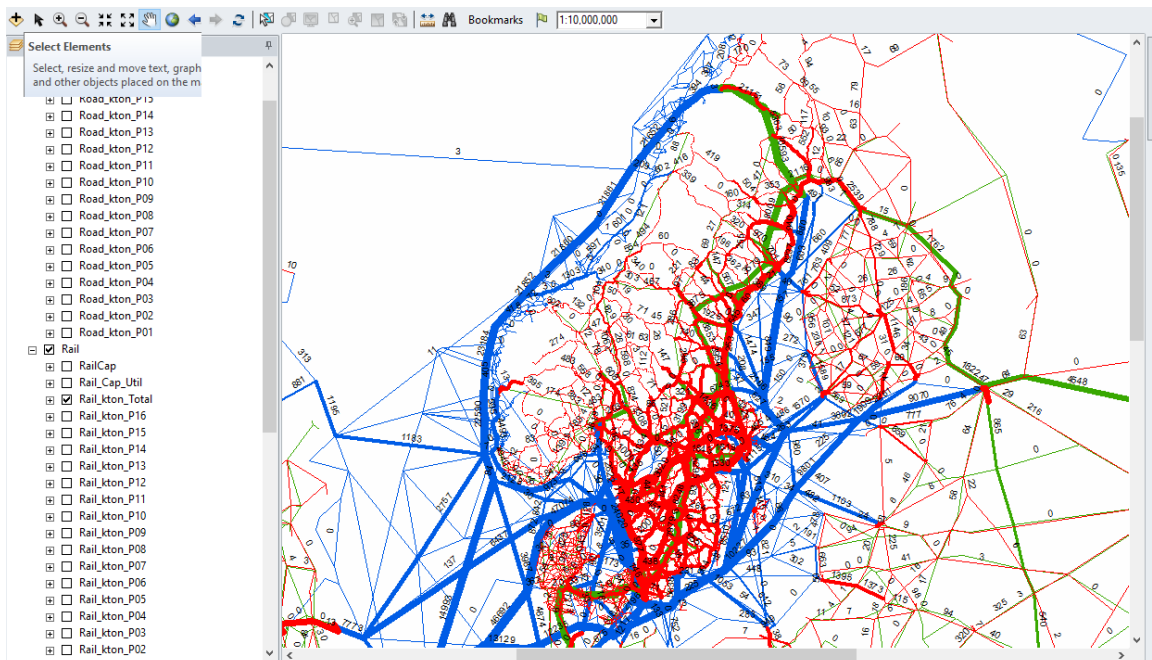
Figure 112 Standard map on ktons by total and commodity groups. (map name: Output_COM_STD_GIS_TON.mxd)
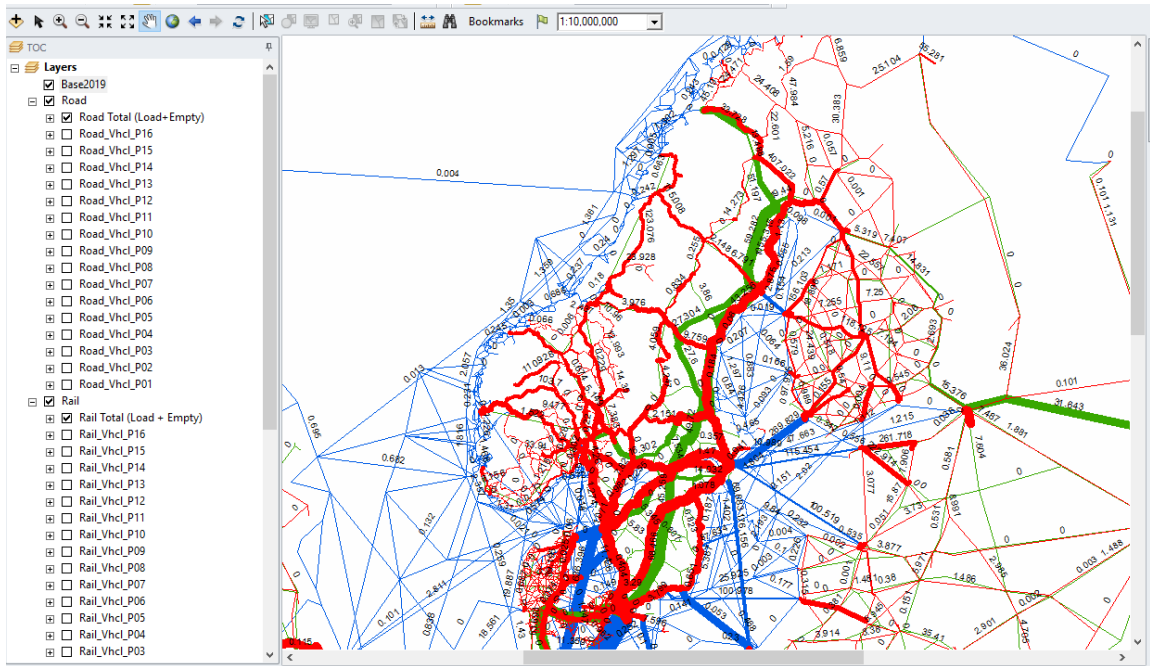
Figure 113 Standard map on Loaded vehicles by total and commodity groups. (map name: Output_COM_STD_GIS_VHCL.mxd)

3) Data Panel\Scenario Outputs\Compare\GIS maps – for differences on total Ktons by commodity group, see Figure 114.
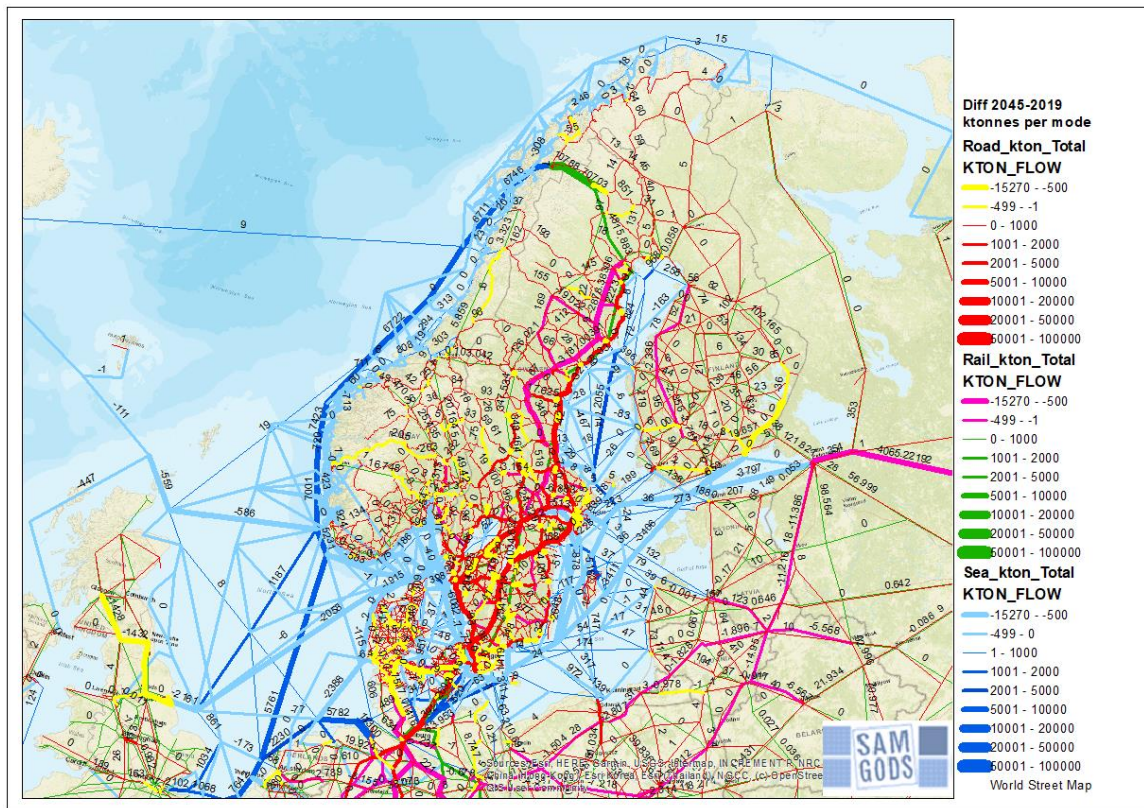
Figure 114 Standard map on ktons for total and commodity groups

4) Data Panel\Scenario Outputs\SelectLink\STD\GIS Maps and Data Panel\Scenario Outputs\SelectLink\RCM\GIS

The former is produced when running Samgods application, the later when running Compare application.

Their setup allows the following actions:

1) To open them from GUI interface clicking under Data Panel
2) To open them in GIS Desktop via mxd-file
3) To redistribute the maps and related layers to non-Cube users (with a valid ArcGIS software)

The maps and the data sources are saved under:

- ○ {Scenario_Dir}\ABS_GIS{SCENARIO_SHORTNAME} for absolute values on current scenario
- ○ {Scenario_Dir}\DIFF_GIS2045_2019 for differences between current scenario and base scenario
- ○ {Scenario_Dir}\SelectLink\{FolderSL}\SEL_GIS

To share the results it will be sufficient to zip the specific folder and send it over, all the required data will be present in there.

13. References

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[4] G. Sala, "Samgods 1.2.2 - Technical Documentation," Trafikverket, 2024.

[5] V. Bernhardsson, "Representation of the Swedish transport and logistics system in Samgods 1.2.2," Trafikverket, 2024.

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[9] TASM, "Transport Analysis Guidance UNIT M2.1 - Variable Demand Modelling," Transport Appraisal and Strategic Modelling (TASM) - Department for Transport, London, 2020 (https://assets.publishing.service.gov.uk/media/5fbfbcf2d3bf7f573a808291/tag-m2-1-variable-demand-modelling.pdf).

14. Appendices

14.1. Dimensions in the model

The commodity types represented in the model is listed in Table 46, vehicle types and submodes used in the model is listed in Table 47 and allowed transport chains is represented in Table 48.

Table 46 Overview of commodity types in Samgods 1.2.2

Commodity	Description
1	Products from agriculture, forestry and fishing
2	Coal, crude oil and natural gas
3	Ore, other products of extraction
4	Food, beverages and tobacco
5	Textiles, clothing, leather and leather goods
6	Wood and articles of wood and cork (excl. Furniture), pulp, paper and paper products, printed matter
7	Coal and refined petroleum products
8	Chemicals, chemical products, synthetic fibres, rubber and plastic products and nuclear fuel
9	Other non-metallic mineral products
10	Metal products excluding machinery and equipment
11	Machinery and instruments
12	Transport equipment
13	Other manufacturing ex furniture
14	Household waste, other waste and return raw material
15	Round timber
16	Air transport goods

Table 47 Overview of vehicle type numbers, and aggregate modes for container transport and non-container transport

Aggregate mode		ModeNr	VhclNr	Vehicle type
Containers	Heavy lorry	A	104	Lorry HGV 40 ton
			105	Lorry HGV 60 ton
	Extra heavy lorry	X	106	Lorry HGV 74 ton
	Kombi train	D	201	Kombi train
	Long kombi train	d	210	Long kombi train
	Feeder train	E	202	Feeder/shunt train
	Wagonload train	F	207	Short wagon load train
			208	Medium wagonload train
			209	Long wagonload train
	Long Wagonload train	f	212	Long wagonload train
	Direct Sea	J	301	Container vessel 5 300 dwt[1]
			302	Container vessel 16 000 dwt[1]
			303	Container vessel 27 200 dwt[1]
			304	Container vessel 100 000 dwt[1]
			305	Other vessel 1 000 dwt
			306	Other vessel 2 500 dwt
			307	Other vessel 3 500 dwt
			308	Other vessel 5 000 dwt
			309	Other vessel 10 000 dwt
			310	Other vessel 20 000 dwt
			311	Other vessel 40 000 dwt
			312	Other vessel 80 000 dwt
			313	Other vessel 100 000 dwt
			314	Other vessel 250 000 dwt
			315	Ro/ro vessel 3 600 dwt
			316	Ro/ro vessel 6 300 dwt
			317	Ro/ro vessel 10 000 dwt
	Feeder vessel	K	301	Container vessel 5 300 dwt
			315	Ro/ro vessel 3 600 dwt
			316	Ro/ro vessel 6 300 dwt
	Long-Haul vessel	L	303	Container vessel 27 200 dwt
			304	Container vessel 100 000 dwt
			317	Ro/ro vessel 10 000 dwt
	IWW	V	322	IWW-vessel
Non-Containers	Light Lorry	B	101	Lorry light LGV, ≤ 3,5 ton
			102	Lorry medium 16 ton
			103	Lorry medium 24 ton
	Heavy lorry	C / S[15]	104	Lorry HGV 40 ton
			105	Lorry HGV 60 ton
	Extra heavy lorry	c	106	Lorry HGV 74 ton
	Feeder train	G	202	Feeder/shunt train
	Wagonload train	H	207	Short wagonload train
			208	Medium wagonload train

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[15] Consolidated heavy lorry is coded as mode S in the chains file. Consolidation in heavy lorries is only available on an intermediate leg in a chain with at least three legs.

Aggregate mode		ModeNr	VhclNr	Vehicle type
Non-Containers	Long wagonload train	h	212	Long wagonload train
	System train	I	204	System train STAX 22,5
		T	205	System train STAX 25
		U	206	System train STAX 30
		i	211	Long system train
	Direct Sea	M	305	Other vessel 1 000 dwt
			306	Other vessel 2 500 dwt
			307	Other vessel 3 500 dwt
			308	Other vessel 5 000 dwt
			309	Other vessel 10 000 dwt
			310	Other vessel 20 000 dwt
			311	Other vessel 40 000 dwt
			312	Other vessel 80 000 dwt
			313	Other vessel 100 000 dwt
			314	Other vessel 250 000 dwt
			315	Ro/ro vessel 3 600 dwt
			316	Ro/ro vessel 6 300 dwt
			317	Ro/ro vessel 10 000 dwt
	Feeder vessel	N	315	Ro/ro vessel 3 600 dwt
			316	Ro/ro vessel 6 300 dwt
	Long-Haul vessel	O	317	Ro/ro vessel 10 000 dwt
	IWW	W	322	IWW-vessel
	Road Ferry	P	318	Road ferry 2 500 dwt
			319	Road ferry 5 000 dwt
			320	Road ferry 7 500 dwt
	Rail Ferry	Q	321	Rail ferry 5 000 dwt
	Plane	R	401	Freight airplane

Table 48 Transport chains used for Sweden

Number	Potential chain	Explanation	Included in model year 2019	2045
1	A	Direct transport by Heavy lorry	Yes	Yes
2	ADA	Heavy lorry-Kombi train-Heavy lorry	Yes	Yes
3	ADJA	Heavy lorry-Kombi train-Direct sea-Heavy lorry	Yes	Yes
4	ADJDA	Heavy lorry-Kombi train-Direct sea-Kombi train-Heavy lorry	Yes	Yes
5	ADJDX	Heavy lorry-Kombi train-Direct sea-Kombi train-Extra heavy lorry	No	Yes
6	ADJX	Heavy lorry-Kombi train-Direct sea-Extra heavy lorry	No	Yes
7	ADKL	Heavy lorry-Kombi train-Feeder vessel-Long-haul vessel	Yes	Yes
8	ADX	Heavy lorry-Kombi train-Extra heavy lorry	No	Yes
9	AJ	Heavy lorry-Direct sea	Yes	Yes
10	AJA	Heavy lorry-Direct sea-Heavy lorry	Yes	Yes
11	AJDA	Heavy lorry-Direct sea-Kombi train-Heavy lorry	Yes	Yes
12	AJDX	Heavy lorry-Direct sea-Kombi train-Extra heavy lorry	No	Yes
13	AJX	Heavy lorry-Direct sea-Extra heavy lorry	No	Yes
14	AJdA	Heavy lorry-Direct sea-Long kombi train-Heavy lorry	No	Yes
15	AJdX	Heavy lorry-Direct sea-Long kombi train-Extra heavy lorry	No	Yes
16	AKL	Heavy lorry-Feeder vessel-Long-haul vessel	Yes	Yes
17	APA	Heavy lorry-Road ferry-Heavy lorry	Yes	Yes
18	APX	Heavy lorry-Road ferry-Extra heavy lorry	No	Yes
19	AV	Heavy lorry-INW	Yes	Yes
20	AVA	Heavy lorry-INW-Heavy lorry	Yes	Yes
21	AVX	Heavy lorry-INW-Extra heavy lorry	No	Yes
22	AX	Heavy lorry-Extra heavy lorry	No	Yes
23	AdA	Heavy lorry-Long kombi train-Heavy lorry	No	Yes
24	AdJA	Heavy lorry-Long kombi train-Direct sea-Heavy lorry	No	Yes
25	AdJX	Heavy lorry-Long kombi train-Direct sea-Extra heavy lorry	No	Yes
26	AdJdA	Heavy lorry-Long kombi train-Direct sea-Long kombi train-Heavy lorry	No	Yes
27	AdJdX	Heavy lorry-Long kombi train-Direct sea-Long kombi train-Extra heavy lorry	No	Yes
28	AdKL	Heavy lorry-Long kombi train-Feeder vessel-Long-haul vessel	No	Yes
29	AdX	Heavy lorry-Long kombi train-Extra heavy lorry	No	Yes
30	B	Direct transport by Light Lorry	Yes	Yes
31	BR	Light Lorry-Plane	Yes	Yes
32	BRB	Light Lorry-Plane-Light Lorry	Yes	Yes
33	BS	Light Lorry-Heavy lorry	Yes	Yes
34	BSB	Light Lorry-Heavy lorry-Light Lorry	Yes	Yes
35	Bc	Light Lorry-Extra heavy lorry	Yes	Yes
36	C	Direct transport by Heavy lorry	Yes	Yes
37	CGH	Heavy lorry-Feeder train-Wagonload train	Yes	Yes
38	CGHC	Heavy lorry-Feeder train-Wagonload train-Heavy lorry	Yes	Yes
39	CGHM	Heavy lorry-Feeder train-Wagonload train-Direct sea	Yes	Yes
40	CGHc	Heavy lorry-Feeder train-Wagonload train-Extra heavy lorry	Yes	Yes
41	CGh	Heavy lorry-Feeder train-Long wagonload train	No	Yes
42	CGhC	Heavy lorry-Feeder train-Long wagonload train-Heavy lorry	No	Yes
43	CGhM	Heavy lorry-Feeder train-Long wagonload train-Direct sea	No	Yes

Number	Potential chain	Explanation	Included in model year	
			2019	2045
44	CGhc	Heavy lorry-Feeder train-Long wagonload train-Extra heavy lorry	No	Yes
45	CH	Heavy lorry-Wagonload train	Yes	Yes
46	CHG	Heavy lorry-Wagonload train-Feeder train	Yes	Yes
47	CHGC	Heavy lorry-Wagonload train-Feeder train-Heavy lorry	Yes	Yes
48	CHGc	Heavy lorry-Wagonload train-Feeder train-Extra heavy lorry	Yes	Yes
49	CHM	Heavy lorry-Wagonload train-Direct sea	Yes	Yes
50	CM	Heavy lorry-Direct sea	Yes	Yes
51	CMC	Heavy lorry-Direct sea-Heavy lorry	Yes	Yes
52	CMH	Heavy lorry-Direct sea-Wagonload train	Yes	Yes
53	CMI	Heavy lorry-Direct sea-System train STAX 22,5	Yes	Yes
54	CMM	Heavy lorry-Direct sea-Direct sea	Yes	Yes
55	CMMC	Heavy lorry-Direct sea-Direct sea-Heavy lorry	Yes	Yes
56	CMT	Heavy lorry-Direct sea-System train STAX 25	Yes	Yes
57	CMU	Heavy lorry-Direct sea-System train STAX 30	Yes	Yes
58	CMc	Heavy lorry-Direct sea-Extra heavy lorry	Yes	Yes
59	CMi	Heavy lorry-Direct sea-Long system train	No	Yes
60	CPC	Heavy lorry-Road ferry-Heavy lorry	Yes	Yes
61	CUM	Heavy lorry-System train STAX 30-Direct sea	Yes	Yes
62	CWC	Heavy lorry-Inland water way-Heavy lorry	Yes	Yes
63	CWc	Heavy lorry-Inland water way-Extra heavy lorry	Yes	Yes
64	Ch	Heavy lorry-Long wagonload train	No	Yes
65	ChG	Heavy lorry-Long wagonload train-Feeder train	No	Yes
66	ChGC	Heavy lorry-Long wagonload train-Feeder train-Heavy lorry	No	Yes
67	ChGc	Heavy lorry-Long wagonload train-Feeder train-Extra heavy lorry	No	Yes
68	ChM	Heavy lorry-Long wagonload train-Direct sea	No	Yes
69	GH	Feeder train-Wagonload train	Yes	Yes
70	GHC	Feeder train-Wagonload train-Heavy lorry	Yes	Yes
71	GHG	Feeder train-Wagonload train-Feeder train	Yes	Yes
72	GHM	Feeder train-Wagonload train-Direct sea	Yes	Yes
73	GHMI	Feeder train-Wagonload train-Direct sea-System train STAX 22,5	Yes	Yes
74	GHMT	Feeder train-Wagonload train-Direct sea-System train STAX 25	Yes	Yes
75	GHMU	Feeder train-Wagonload train-Direct sea-System train STAX 30	Yes	Yes
76	GHMi	Feeder train-Wagonload train-Direct sea-Long system train	No	Yes
77	GHQH	Feeder train-Wagonload train-Rail ferry-Wagonload train	Yes	Yes
78	GHc	Feeder train-Wagonload train-Extra heavy lorry	Yes	Yes
79	Gh	Feeder train-Long wagonload train	No	Yes
80	GhC	Feeder train-Long wagonload train-Heavy lorry	No	Yes
81	GhG	Feeder train-Long wagonload train-Feeder train	No	Yes
82	GhM	Feeder train-Long wagonload train-Direct sea	No	Yes
83	GhMI	Feeder train-Long wagonload train-Direct sea-System train STAX 22,5	No	Yes
84	GhMT	Feeder train-Long wagonload train-Direct sea-System train STAX 25	No	Yes
85	GhMU	Feeder train-Long wagonload train-Direct sea-System train STAX 30	No	Yes
86	GhQh	Feeder train-Long wagonload train-Rail ferry-Long wagonload train	No	Yes
87	Ghc	Feeder train-Long wagonload train-Extra heavy lorry	No	Yes

Number	Potential chain	Explanation	Included in model year 2019	2045
88	HC	Wagonload train-Heavy lorry	Yes	Yes
89	HG	Wagonload train-Feeder train	Yes	Yes
90	HGC	Wagonload train-Feeder train-Heavy lorry	Yes	Yes
91	HGc	Wagonload train-Feeder train-Extra heavy lorry	Yes	Yes
92	HM	Wagonload train-Direct sea	Yes	Yes
93	HMC	Wagonload train-Direct sea-Heavy lorry	Yes	Yes
94	HQH	Wagonload train-Rail ferry-Wagonload train	Yes	Yes
95	Hc	Wagonload train-Extra heavy lorry	Yes	Yes
96	I	Direct transport by System train STAX 22,5	Yes	Yes
97	IM	System train STAX 22,5-Direct sea	Yes	Yes
98	IMC	System train STAX 22,5-Direct sea-Heavy lorry	Yes	Yes
99	IMHG	System train STAX 22,5-Direct sea-Wagonload train-Feeder train	Yes	Yes
100	IMc	System train STAX 22,5-Direct sea-Extra heavy lorry	Yes	Yes
101	IMhG	System train STAX 22,5-Direct sea-Long wagonload train-Feeder train	No	Yes
102	J	Direct transport by Direct sea	Yes	Yes
103	JA	Direct sea-Heavy lorry	Yes	Yes
104	JX	Direct sea-Extra heavy lorry	No	Yes
105	KL	Feeder vessel-Long-haul vessel	Yes	Yes
106	LK	Long-haul vessel-Feeder vessel	Yes	Yes
107	LKA	Long-haul vessel-Feeder vessel-Heavy lorry	Yes	Yes
108	LKDA	Long-haul vessel-Feeder vessel-Kombi train-Heavy lorry	Yes	Yes
109	LKDX	Long-haul vessel-Feeder vessel-Kombi train-Extra heavy lorry	No	Yes
110	LKX	Long-haul vessel-Feeder vessel-Extra heavy lorry	No	Yes
111	LKdA	Long-haul vessel-Feeder vessel-Long kombi train-Heavy lorry	No	Yes
112	LKdX	Long-haul vessel-Feeder vessel-Long kombi train-Extra heavy lorry	No	Yes
113	M	Direct transport by Direct sea	Yes	Yes
114	MC	Direct sea-Heavy lorry	Yes	Yes
115	MH	Direct sea-Wagonload train	Yes	Yes
116	MHG	Direct sea-Wagonload train-Feeder train	Yes	Yes
117	MHGC	Direct sea-Wagonload train-Feeder train-Heavy lorry	Yes	Yes
118	MHGc	Direct sea-Wagonload train-Feeder train-Extra heavy lorry	Yes	Yes
119	MI	Direct sea-System train STAX 22,5	Yes	Yes
120	MMC	Direct sea-Direct sea-Heavy lorry	Yes	Yes
121	MT	Direct sea-System train STAX 25	Yes	Yes
122	MU	Direct sea-System train STAX 30	Yes	Yes
123	Mc	Direct sea-Extra heavy lorry	Yes	Yes
124	Mh	Direct sea-Long wagonload train	No	Yes
125	MhG	Direct sea-Long wagonload train-Feeder train	No	Yes
126	MhGC	Direct sea-Long wagonload train-Feeder train-Heavy lorry	No	Yes
127	MhGc	Direct sea-Long wagonload train-Feeder train-Extra heavy lorry	No	Yes
128	Mi	Direct sea-Long system train	No	Yes
129	RB	Plane-Light Lorry	Yes	Yes
130	SB	Heavy lorry-Light Lorry	Yes	Yes
131	T	Direct transport by System train STAX 25	Yes	Yes
132	TM	System train STAX 25-Direct sea	Yes	Yes
133	TMC	System train STAX 25-Direct sea-Heavy lorry	Yes	Yes

Number	Potential chain	Explanation	Included in model year 2019	2045
134	TMGH	System train STAX 25-Direct sea-Feeder train-Wagonload train	Yes	Yes
135	TMc	System train STAX 25-Direct sea-Extra heavy lorry	Yes	Yes
136	U	Direct transport by System train STAX 30	Yes	Yes
137	UM	System train STAX 30-Direct sea	Yes	Yes
138	UMC	System train STAX 30-Direct sea-Heavy lorry	Yes	Yes
139	UMGH	System train STAX 30-Direct sea-Feeder train-Wagonload train	Yes	Yes
140	UMGh	System train STAX 30-Direct sea-Feeder train-Long wagonload train	No	Yes
141	UMc	System train STAX 30-Direct sea-Extra heavy lorry	Yes	Yes
142	VA	INW-Heavy lorry	Yes	Yes
143	VX	INW-Extra heavy lorry	No	Yes
144	WB	Inland water way-Light Lorry	Yes	Yes
145	X	Direct transport by Extra heavy lorry	No	Yes
146	XA	Extra heavy lorry-Heavy lorry	No	Yes
147	XDA	Extra heavy lorry-Kombi train-Heavy lorry	No	Yes
148	XDJA	Extra heavy lorry-Kombi train-Direct sea-Heavy lorry	No	Yes
149	XDJDA	Extra heavy lorry-Kombi train-Direct sea-Kombi train-Heavy lorry	No	Yes
150	XDJDX	Extra heavy lorry-Kombi train-Direct sea-Kombi train-Extra heavy lorry	No	Yes
151	XDJX	Extra heavy lorry-Kombi train-Direct sea-Extra heavy lorry	No	Yes
152	XDKL	Extra heavy lorry-Kombi train-Feeder vessel-Long-haul vessel	No	Yes
153	XDX	Extra heavy lorry-Kombi train-Extra heavy lorry	No	Yes
154	XJ	Extra heavy lorry-Direct sea	No	Yes
155	XJA	Extra heavy lorry-Direct sea-Heavy lorry	No	Yes
156	XJDA	Extra heavy lorry-Direct sea-Kombi train-Heavy lorry	No	Yes
157	XJDX	Extra heavy lorry-Direct sea-Kombi train-Extra heavy lorry	No	Yes
158	XJX	Extra heavy lorry-Direct sea-Extra heavy lorry	No	Yes
159	XJdA	Extra heavy lorry-Direct sea-Long kombi train-Heavy lorry	No	Yes
160	XJdX	Extra heavy lorry-Direct sea-Long kombi train-Extra heavy lorry	No	Yes
161	XKL	Extra heavy lorry-Feeder vessel-Long-haul vessel	No	Yes
162	XPA	Extra heavy lorry-Road ferry-Heavy lorry	No	Yes
163	XPX	Extra heavy lorry-Road ferry-Extra heavy lorry	No	Yes
164	XV	Extra heavy lorry-INW	No	Yes
165	XVA	Extra heavy lorry-INW-Heavy lorry	No	Yes
166	XVX	Extra heavy lorry-INW-Extra heavy lorry	No	Yes
167	XdA	Extra heavy lorry-Long kombi train-Heavy lorry	No	Yes
168	XdJA	Extra heavy lorry-Long kombi train-Direct sea-Heavy lorry	No	Yes
169	XdJX	Extra heavy lorry-Long kombi train-Direct sea-Extra heavy lorry	No	Yes
170	XdJdA	Extra heavy lorry-Long kombi train-Direct sea-Long kombi train-Heavy lorry	No	Yes
171	XdJdX	Extra heavy lorry-Long kombi train-Direct sea-Long kombi train-Extra heavy lorry	No	Yes
172	XdKL	Extra heavy lorry-Long kombi train-Feeder vessel-Long-haul vessel	No	Yes
173	XdX	Extra heavy lorry-Long kombi train-Extra heavy lorry	No	Yes
174	c	Direct transport by Extra heavy lorry	Yes	Yes
175	cB	Extra heavy lorry-Light Lorry	Yes	Yes
176	cC	Extra heavy lorry-Heavy lorry	Yes	Yes

Number	Potential chain	Explanation	Included in model year 2019	2045
177	cGH	Extra heavy lorry-Feeder train-Wagonload train	Yes	Yes
178	cGHC	Extra heavy lorry-Feeder train-Wagonload train-Heavy lorry	Yes	Yes
179	cGHM	Extra heavy lorry-Feeder train-Wagonload train-Direct sea	Yes	Yes
180	cGHc	Extra heavy lorry-Feeder train-Wagonload train-Extra heavy lorry	Yes	Yes
181	cGh	Extra heavy lorry-Feeder train-Long wagonload train	No	Yes
182	cGhC	Extra heavy lorry-Feeder train-Long wagonload train-Heavy lorry	No	Yes
183	cGhM	Extra heavy lorry-Feeder train-Long wagonload train-Direct sea	No	Yes
184	cGhc	Extra heavy lorry-Feeder train-Long wagonload train-Extra heavy lorry	No	Yes
185	cH	Extra heavy lorry-Wagonload train	Yes	Yes
186	cHG	Extra heavy lorry-Wagonload train-Feeder train	Yes	Yes
187	cHGC	Extra heavy lorry-Wagonload train-Feeder train-Heavy lorry	Yes	Yes
188	cHGc	Extra heavy lorry-Wagonload train-Feeder train-Extra heavy lorry	Yes	Yes
189	cHM	Extra heavy lorry-Wagonload train-Direct sea	Yes	Yes
190	cM	Extra heavy lorry-Direct sea	Yes	Yes
191	cMC	Extra heavy lorry-Direct sea-Heavy lorry	Yes	Yes
192	cMI	Extra heavy lorry-Direct sea-System train STAX 22,5	Yes	Yes
193	cMT	Extra heavy lorry-Direct sea-System train STAX 25	Yes	Yes
194	cMU	Extra heavy lorry-Direct sea-System train STAX 30	Yes	Yes
195	cMc	Extra heavy lorry-Direct sea-Extra heavy lorry	Yes	Yes
196	cMi	Extra heavy lorry-Direct sea-Long system train	No	Yes
197	cPc	Extra heavy lorry-Road ferry-Extra heavy lorry	Yes	Yes
198	cS	Extra heavy lorry-Heavy lorry	Yes	Yes
199	cUM	Extra heavy lorry-System train STAX 30-Direct sea	Yes	Yes
200	cWC	Extra heavy lorry-Inland water way-Heavy lorry	Yes	Yes
201	cWc	Extra heavy lorry-Inland water way-Extra heavy lorry	Yes	Yes
202	ch	Extra heavy lorry-Long wagonload train	No	Yes
203	chG	Extra heavy lorry-Long wagonload train-Feeder train	No	Yes
204	chGC	Extra heavy lorry-Long wagonload train-Feeder train-Heavy lorry	No	Yes
205	chGc	Extra heavy lorry-Long wagonload train-Feeder train-Extra heavy lorry	No	Yes
206	chM	Extra heavy lorry-Long wagonload train-Direct sea	No	Yes
207	hC	Long wagonload train-Heavy lorry	No	Yes
208	hG	Long wagonload train-Feeder train	No	Yes
209	hGC	Long wagonload train-Feeder train-Heavy lorry	No	Yes
210	hGc	Long wagonload train-Feeder train-Extra heavy lorry	No	Yes
211	hM	Long wagonload train-Direct sea	No	Yes
212	hQh	Long wagonload train-Rail ferry-Long wagonload train	No	Yes
213	hc	Long wagonload train-Extra heavy lorry	No	Yes
214	i	Direct transport by Long system train	No	Yes
215	iM	Long system train-Direct sea	No	Yes
216	iMC	Long system train-Direct sea-Heavy lorry	No	Yes
217	iMHG	Long system train-Direct sea-Wagonload train-Feeder train	No	Yes
218	iMc	Long system train-Direct sea-Extra heavy lorry	No	Yes
219	A2J	Heavy lorry-(different loading point compared to AJ)-Direct sea	Yes	Yes

Number	Potential chain	Explanation	Included in model year 2019	2045
220	A2JA	Heavy lorry-(different loading point compared to AJA)-Direct sea-Heavy lorry	Yes	Yes
221	AJ2A	Heavy lorry-Direct sea-(different loading point compared to AJA)-Heavy lorry	Yes	Yes
222	C2M	Heavy lorry-(different loading point compared to CM)-Direct sea	Yes	Yes
223	C2MC	Heavy lorry-(different loading point compared to CMC)-Direct sea-Heavy lorry	Yes	Yes
224	CM2C	Heavy lorry-Direct sea-(different loading point compared to CMC)-Heavy lorry	Yes	Yes
225	J2A	Direct sea-(different loading point compared to JA)-Heavy lorry	Yes	Yes
226	M2C	Direct sea-(different loading point compared to MC)-Heavy lorry	Yes	Yes

14.2.   Empty vehicles description

The computation of the empty vehicles matrices in the current version of the model is based on a non-linear, non-separable model. Therefore the output in terms of empty vehicle flows in general will depend on the set of commodities included in the logistics model simulations. The flows of empty vehicles will be correctly estimated only if the model is run for all commodities. An exception to this observation is the set of user defined empty vehicle modelling functions, in which empty train flows are modeled as strictly proportional to the number of loaded trains. With this setting the rail empty flows are strictly proportional to the loaded flows, and the results can be aggregated to total volumes from any disaggregated level.

To obtain comparable results between scenarios it is therefore recommended that the model is run for all commodities. There are two cases:

- EMPTY_OK: the catalogue key for selecting the commodity group is set to 0, which means that all commodities are selected for the logistics model simulation; This 0 is also added to the vehicle OD-matrix names as for example OD_Tonnes201_0.314, which during the railway capacity management procedure are renamed to OD_Tonnes201_STD.314, where STD stands for STanDard logistics model.
- EMPTY_ERROR: all other cases, i.e. the model is run for one commodity or all commodity groups. In this case the empty vehicle flows will in general be according to non-separable relationships.

The program originally gives three kinds of output matrices: The number of empty vehicles, the total number of (loaded and empty) vehicles and the number of tonnes transported. In the EMPTY_ERROR case, the total number of vehicles will be incorrect as well. This issue is dealt with in two ways, presented below.

1: Compute the number of loaded vehicles.

Instead of producing the total number of vehicles (empty + loaded), the program now produces the number of loaded vehicles. This is done by default, by computing

number of loaded vehicles = total number of vehicles – number of empty vehicles

in an intermediate step in Cube, after the logistics model. This operation will always give the correct result, since the estimated number of empty vehicles (with any errors) is subtracted from the total number of vehicles in all OD relations (containing the same errors). The output in the current version is thus made up by the three types of matrices:

- Number of loaded vehicles (always correct values);
- Number of empty vehicles (comparable and correct only in case EMPTY_OK);
- Tonnes (correct values).

Furthermore, the total number of vehicles will be computed (by adding the empty and loaded vehicles outputs) in the case EMPTY_OK. For the other case – EMPTY_ERROR – the total number of vehicles will be replaced by zeros in order to reduce the risk of using incorrect values. This gives the extra output

- Total number of vehicles (correct in case EMPTY_OK, set to zero otherwise).

The output in terms of total number of vehicles appears in some of the tables, but not in any of the networks. Generally, in the outputs, the number of vehicles always refers to the number of loaded vehicles, if nothing else is expressed.

2: Skip estimation of the empty vehicles

The user is given the option to not produce the empty vehicle matrices at all. The choice is made by setting the attribute

EMPTY_V = 1   to produce empty vehicle matrices, or

EMPTY_V = 0   to not produce empty vehicle matrices.

The attribute is set for each vehicle class separately, in the table "Vehicle Parameters" (see Section 9.4). If EMPTY_V=0, the empty vehicle matrices will be filled with zeroes. Summarizing all the possibilities, we have the following cases and the result in each case in Table 49.

Table 49 All different cases for the empty and total vehicles calculation

	EMPTY_V=0	EMPTY_V=1
EMPTY_OK	Empty vehicles = 0 Total vehicles = loaded vehicles	Empty vehicles ≠ 0 Total vehicles = empty + loaded
EMPTY_ERROR	Empty vehicles = 0 Total vehicles = 0	Empty vehicles ≠ 0 Total vehicles = 0

The empty vehicles calculation was designed for lorries, but is used for all vehicles as described above.

14.3.   Frequency network

The frequency networks are saved and can be displayed as GIS maps in the Samgods model and could be edited as any other GIS layers, using the Compute function or the Feature Explorer window. However, editing these layers in the GIS window is rather difficult and slow. New terminals are given default frequencies, so that the user does not have to edit the frequency networks unless any specific frequencies should be changed. The reason for saving the frequency data as GIS layers instead of a matrix is that it saves hard disk space. The user just has to think of the node layer as the diagonal elements of the imagined frequency matrix (giving the frequencies within zones) and the link layer as the non-diagonal elements, giving the

frequencies between zones. By default, the frequency network layers are initially filtered to show only the links and nodes connected to Stockholm.

14.4. Variable names and their meaning

Below, some of the variable names in different tables in the interface are listed and explained. Table 55 in Section 14.7 also gives information to help to understand the contents of the tables.

14.4.1. Variables in the output tables

In the output tables, different variable names appear. Table 51 gives the variables, their meaning and in which data set (in the Data Section window) they appear. These data sets are found in Scenario Outputs\Samgods Report\Logistics Module\OD Covered and Scenario Outputs\Samgods Report\Reports. Generally, the abbreviations listed in Table 50 are used, separated by an underscore.

Table 50 Abbreviations used for variable names

NV	Number of vehicles
KM	Kilometre
TON	Tonne
TKM	Tonne Kilometre
VHCLKM	Vehicle Kilometre
DOM	Domestic
DTOT	Total domestic (domestic + domestic part of international)
INT	International
TOT	Total (in the sense total domestic + international)
L	Loaded (vehicle)
E	Empty (unloaded vehicle)
A	All (in the sense loaded + empty vehicles)

Table 51 Variable names used in the output files in the folders Scenario Outputs\Samgods Report\Logistics Module\OD Covered and Scenario Outputs\Samgods Report\Reports in the Data Section window

Data set	Variable	Meaning
Output by vehicle type	NV_DTOT	Number of vehicles, total domestic
Output by vehicle type	NV_INT	Number of vehicles, international
Output by vehicle type	NV_TOT	Number of vehicles, total
Output by vehicle type, Output by chain	KM_DTOT	Number of kilometres, total domestic
Output by vehicle type, Output by chain	KM_INT	Number of kilometres, international
Output by vehicle type, Output by chain	KM_TOT	Number of kilometres, total
Output by vehicle type, Output by chain	TON_DTOT	Number of tonnes, total domestic
Output by vehicle type, Output by chain	TON_INT	Number of tonnes, international
Output by vehicle type, Output by chain	TON_TOT	Number of tonnes, total
Output by vehicle type, Output by chain	TKM_DTOT	Number of tonne kilometres, total domestic
Output by vehicle type, Output by chain	TKM_INT	Number of tonne kilometres, international
Output by vehicle type, Output by chain	TKM_TOT	Number of tonne kilometres, total
Output by vehicle type	ALF_DOM	Average loading factor, domestic
Output by vehicle type	ALF_INT	Average loading factor, international

Data set	Variable	Meaning
Output by vehicle type	ALF_TOT	Average loading factor, total
Output by vehicle type	AVDIST_DOM	Average distance, domestic
Output by vehicle type	AVDIST_INT	Average distance, international
Output by vehicle type	AVDIST_TOT	Average distance, total
Output by chain	COST_DOM	Logistic cost, domestic
Output by chain	COST_DTOT	Logistic cost, total domestic
Output by chain	COST_INT	Logistic cost, international
Output by chain	COST_TOT	Logistic cost, total
Output by chain	AC_TKM_DOM	Average cost per tonne kilometre, domestic
Output by chain	AC_TKM_INT	Average cost per tonne kilometre, international
Output by chain	AC_TKM_TOT	Average cost per tonne kilometre, total
Report #1	NV_A_TOT	Number of vehicles, loaded + empty, total domestic + international
Report #1	NV_A_DTOT	Number of vehicles, loaded + empty, total domestic
Report #1	VHCLKM_A_TOT	Number of vehicle kilometres, loaded + empty, total domestic + international
Report #1	VHCLKM_A_DTOT	Number of vehicle kilometres, loaded + empty, total domestic
Report #1	NV_L_TOT	Number of loaded vehicles, total domestic + international
Report #1	NV_E_TOT	Number of empty vehicles, domestic + international
Report #1	VHCLKM_L_TOT	Number of loaded vehicle kilometres, domestic + international
Report #1	VHCLKM_E_TOT	Number of unloaded vehicle kilometres, domestic + international
Report #1	NV_L_DTOT	Number of loaded vehicles, total domestic
Report #1	NV_E_DTOT	Number of empty vehicles, total domestic
Report #1	VHCLKM_L_DTOT	Number of loaded vehicle kilometres, total domestic
Report #1	VHCLKM_E_DTOT	Number of empty vehicle kilometres, total domestic
Report #4	TON_DTOT	Number of tones, total domestic
Report #4	TON_INT	Number of tones, international
Report #4	TON_TOT	Number of tones, dom. + int.
Report #4	TKM_DTOT	Number of tonne kilometres, total domestic
Report #4	TKM_INT	Number of tonne kilometres, international
Report #4	TKM_TOT	Number of tonne kilometres, total domestic + international
Report #9	VHCLKM_L_ROAD	Number of loaded vehicle kilometres, road mode
Report #9	VHCLKM_E_ROAD	Number of empty vehicle kilometres, road mode
Report #9	VHCLKM_A_ROAD	Number of vehicle kilometres, empty + loaded vehicles on road
Report #9	TKM_ROAD	Number of tonne kilometres on road
Report #9	VHCLKM_L_RAIL	Number of loaded vehicle kilometres, rail mode
Report #9	VHCLKM_E_RAIL	Number of empty vehicle kilometres, rail mode
Report #9	VHCLKM_A_RAIL	Number of vehicle kilometres, empty + loaded vehicles on rail
Report #9	TKM_RAIL	Number of tonne kilometres on rail

14.4.2. Variables in the assigned networks

Below, some of the variables found in the attribute tables of the assigned networks are listed and explained. The outputs in terms of assigned networks are found in the folders Scenario Outputs\ Samgods Report\Assignment (assigned networks per mode), Scenario Outputs\Samgods Report\Reports (assigned network with all modes) and Scenario Outputs\Compare\Assignment (differences between the current scenario and the base scenario in loaded vehicle flows for all modes). In the assigned networks (except the compared vehicle flows, see below), the rule for the variable names is the following:

Each vehicle type has a label (the labels are found in the table Scenario Inputs\Editable data\Vehicles Parameters in the data Section window). For example, vehicle class 101 has the label LGV3. For each vehicle class there are three attributes in the network, which for the example for LGV3 are LGV3 (only the label), LGV3T (label + T) and LGV3E (label + E). LGV3 then gives the number of loaded LGV3 vehicles per year on the link, LGV3T gives the number of tonnes transported by LGV3 vehicles per year and LGV3E gives the number of empty (unloaded) LGV3 vehicles per year. There is one exception from this rule and that is the attribute FS_TRAIN, which cannot be found in the Vehicles Parameters table. FS_TRAIN is the sum of the attributes FEEDV and FEEDW which are two separated assignments for vehicle class 202 (Feeder/shunt train).

Except the attributes for each vehicle class, there are also aggregated numbers in the networks (for air mode there are no aggregated numbers, since there is only one vehicle type for air mode (label FLYG)), see Table 52.

Table 52 Variable names in the assigned networks and their meanings.

Variable	Meaning
TOT_ROAD	Total number of loaded road vehicles
TOT_RAIL	Total number of loaded rail vehicles
TOT_SEA	Total number of loaded sea vehicles
TOT_ROAD_T	Total numbers of tonnes transported by road vehicles
TOT_RAIL_T	Total numbers of tonnes transported by trains
TOT_SEA_T	Total numbers of tonnes transported by sea vehicles
TOT_ROAD_E	Total number of empty road vehicles
TOT_RAIL_E	Total number of empty rail vehicles
TOT_SEA_E	Total number of empty sea vehicles
VOLTO	Total number of loaded vehicles
TONTO	Total number of tonnes transported
EMPTO	Total number of empty vehicles

For the compared assigned network, only the loaded vehicle flows are included and they are represented by the vehicle class label, with the prefix DIF. For the example used above, the variable DIF_LGV3 gives the difference in number of loaded LGV3 vehicles, between the current scenario and the base scenario. Also there are differences in aggregated loaded vehicle flows, represented by e.g. DIF_ROAD and DIF_VOLTO (the latter gives the compared flows summed for all vehicle types).

14.5. Intra zonal flows treatment

The intrazonal flows are present in some reports and not present on others. The different cases are related to the procedure or program in charge of produce the report itself. As simple principle, all the reports derived from the external programs will contain the intrazonal tons values, meanwhile all the reports from Voyager assignment will exclude those values. The following scheme represents the cases presented in Table 53.

Table 53 Reports including or excluding intrazonal tonnes values

Report name	Intrazonal Values included
Report_1 Tot VHCKM by VHC Type	No
Report_2_Logistics Module	Yes
Report_2_LM_CHAINS	Yes
Report_2_LM_DEMAND	Yes
Report_3_TonKm_Per_Mode_With_2006Statistics	Yes
Report_4_Total tonne kms by VHC Type	No
Report_5_Total logistic cost at zone-level	Yes
Report_6_Goods flow through terminals (number of tonnes in and out per year)	Yes
Report_6_b_Goods flow through terminals (total number of tonnes per year without land based transfers)	Yes
Report_7_Domestic tonne kms with container per mode (road, rail, sea, air) and vehicle cl	Yes
Report_8_Domestic vehicle kms with container per mode (road, rail, sea, air) and vehicle cl	Yes
Report_9_Vehicle kms and Tonne kms per geographic region	No
Report_10_Transport work (tonne kms) per mode and vehicle cl, total and split per commodity, domestic, tdomestic and international	Yes
Report_11_ Transported goods volume per mode and vehicle cl, total and split per commodity, domestic, tdomestic and international	Yes
Report_12_node and link costs per vehicle and product group	Yes
Report_13_Tons_per_PortArea_and_Commodity_Group	No
Report_14_Oresund Bridge_Kiel Canal and Jylland	No
Report_15_Trains per day (tot, empty, loaded)	No
Report_16_VHCLKM and distribution by county - totals	No
Report_17_VHCLKM and distribution by county - E10 roads	No
Report_18_VHCLKM and distribution by country - Other roads	No
Report_19_Loaded_Unloaded_Tons_Rail	Yes
Report_20 Inventory and order cost per commodity group	
Report_21_Domestic Total and International Tonkm and VhclKm per commodity group RCM - Rail	No

14.6. Error hadling within model structure

Table 54 List of batch files calling external program, location and scripts which manage potential failure

ID	Name and location during the run	Purpose	Script creating the batch file	Script having error handling
1	{SCENARIO_DIR}\LogMod_{OverallLoopMax}\RCM\1_RUN_SelectDirect.bat	Select link analysis for STD and RCM	{CATALOG_DIR}\02_APPLICATIONS\10_SELECTLINK\CFMAT01M.S	{CATALOG_DIR}\02_APPLICATIONS\10_SELECTLINK\PNPIL00A.S
2	{SCENARIO_DIR}\LogMod_{OverallLoopMax}\RCM\2_RUN_SelectDirect_CBA.bat	Select link analysis for CBA	{CATALOG_DIR}\02_APPLICATIONS\10_SELECTLINK\CFMAT01M.S	{CATALOG_DIR}\02_APPLICATIONS\10_SELECTLINK\PNPIL00A.S
3	{SCENARIO_DIR}\LogMod\RCM\CB_RUN_LOS.BAT	create LOS matrices without rescaling factors	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LOMAT01B.S	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LOPIL01A.S
4	{SCENARIO_DIR}\LOGMOD\RUNALL_CBA.BAT	run LP2CC for CBA	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLMAT01A.S	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLPIL01B.S
5	{SCENARIO_DIR}\LOGMOD\COMMODITY_CBA.BAT	sub bat file for ID 4	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLMAT01B.S	
6	{SCENARIO_DIR}\LOGMOD\CALL_JAR_CBA.BAT	parallel process for ID 4	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLMAT01E.S	
7	{SCENARIO_DIR}\LOGMOD\MERGEREP\MERGEREPALLCBA.BAT	Mergerep program	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLMAT01D.S	
8	{SCENARIO_DIR}\LogMod\RCM\COMMODITY_CBA.BAT	Produce Commodity_CBA.dat and VehicleTrpEmpInv_Input_CBA.dat	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLMAT01F.S	{CATALOG_DIR}\02_APPLICATIONS\11_CBA\LP2CC\RLPIL01A.S
9	{SCENARIO_DIR}\LOGMOD\RUNALL.BAT	Run STD log mod Build Chain, Chainchoi and ConsolidRateMode	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\LOGISTICMODVY\RLMAT01A.S	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\LOGISTICMODVY\RLPIL01B.S
10	{SCENARIO_DIR}\LOGMOD\COMMODITY.BAT	sub bat file for ID 9	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\LOGISTICMODVY\RLMAT01B.S	
11	{SCENARIO_DIR}\LOGMOD\EXTRACT\EXTRACTALL.BAT	Extract vehicle and ton matrices	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\LOGISTICMODVY\RLMAT01C.S	
12	{SCENARIO_DIR}\LOGMOD\CALL_JAR.BAT	Parallel process for ID 9	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\LOGISTICMODVY\RLMAT01E.S	
13	{SCENARIO_DIR}\LOGMOD\MERGEREP\MERGEREPALL.BAT	Mergerep program	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\LOGISTICMODVY\RLMAT01D.S	
14	{SCENARIO_DIR}\LOGMOD\RCM\COMMODITY_STD.BAT	Produce COMMODITY_STD.dat file (tons and vehicle figures by commodity group) which is translated into Loaded_Bid_STD_Link	{CATALOG_DIR}\02_APPLICATIONS\2_RUN\RESULTS\BDMAT01B.S	{SCENARIO_DIR}\02_APPLICATIONS\2_RUN\RESULTS\BDPIL01C.S
15	{SCENARIO_DIR}\LogMod\RCM\0_Compact.bat	Compact spanning tree data	{CATALOG_DIR}\02_Applications\9_RCM1\DATAPREP_LP\DPMAT01B.S	{CATALOG_DIR}\02_Applications\9_RCM1\DATAPREP_LP\DPPIL01A.S
16	{SCENARIO_DIR}\LogMod\RCM\1_RUN_MPS_LP0_step1.BAT	LP step W	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP0\LPMAT00B.S	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP0\LPPIL00B.S

ID	Name and location during the run	Purpose	Script creating the batch file	Script having error handling
17	{SCENARIO_DIR}\LogMod\RCM\2_run LP.bat	LP Solve	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP0 \LPMAT00C.S	No
18	{SCENARIO_DIR}\LogMod\RCM\3_RU N_MPS_LP0_step2.BAT	LP step LXR	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP0 \LPMAT00D.S	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP0\LPP IL00G.S
19	{SCENARIO_DIR}\LOGMOD\RUNALL_ RCM.BAT	Run RCM Build Chain and Chainchoi	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1 \RLMAT01A.S	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1\RLP IL01E.S
20	{SCENARIO_DIR}\LOGMOD\COMMOD ITY_RCM.BAT	sub bat file for ID 19	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1 \RLMAT01B.S	
21	{SCENARIO_DIR}\LOGMOD\CALL_JA R.BAT	parallel process for ID 19	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1 \RLMAT01E.S	
22	{SCENARIO_DIR}\LogMod\RCM\1_RU N_MPS_LP@RCM_Loop@_step1.BAT	LP 1+ step w	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1 \FPMAT00B.S	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1\FPP IL00E.S
23	{SCENARIO_DIR}\LogMod\RCM\2_run @RCM_Loop@.bat	LP Solve	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1 \FPMAT00C.S	No
24	{SCENARIO_DIR}\LogMod\RCM\3_RU N_MPS_LP@RCM_Loop@_step2.BAT	LP 1+ step LXR	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1 \FPMAT00D.S	{CATALOG_DIR}\02_Applications\9_RCM1\LP\LP1\FPP IL00F.S
25	{SCENARIO_DIR}\LOGMOD\RUNALL_ FIN.BAT	Run LP2CC for FINAL	{CATALOG_DIR}\02_Applications\9_RCM1\FINAL\ RLMAT01A.S	{CATALOG_DIR}\02_Applications\9_RCM1\FINAL\RLPI L01B.S
26	{SCENARIO_DIR}\LOGMOD\COMMOD ITY_FIN.BAT	sub bat file for ID 25	{CATALOG_DIR}\02_Applications\9_RCM1\FINAL\ RLMAT01B.S	
27	{SCENARIO_DIR}\LOGMOD\EXTRACT \EXTRACTALL_FIN.BAT	Extract vehicle and ton matrices	{CATALOG_DIR}\02_Applications\9_RCM1\FINAL\ RLMAT01F.S	
28	{SCENARIO_DIR}\LOGMOD\CALL_JA R.BAT	Parallel process for ID 25	{CATALOG_DIR}\02_Applications\9_RCM1\FINAL\ RLMAT01G.S	
29	{SCENARIO_DIR}\LOGMOD\MERGER EP\MERGEREPALLFIN.BAT	Mergerep program	{CATALOG_DIR}\02_Applications\9_RCM1\FINAL\ RLMAT01D.S	
30	{SCENARIO_DIR}\LOGMOD\RCM\CO MMODITY_XTD.BAT	Produce COMMODITY_XTD.dat and VehicleTrpEmpInv_Input_XTD.dat	{CATALOG_DIR}\02_Applications\9_RCM1\RESUL TS\BDMAT01B.S	{CATALOG_DIR}\02_Applications\9_RCM1\RESULTS\B DPIL01C.S
31	{SCENARIO_DIR}\LOGMOD\RUNALL. BAT	Run STD log mod	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTI CITY\1_RUN\3_LOGISTICMOD\RLMAT01A.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\ 1_RUN\3_LOGISTICMOD\RLPIL01B.S
32	{SCENARIO_DIR}\LOGMOD\COMMOD ITY.BAT	sub bat file for ID 9	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTI CITY\1_RUN\3_LOGISTICMOD\RLMAT01B.S	
33	{SCENARIO_DIR}\LOGMOD\EXTRACT \EXTRACTALL.BAT	Extract vehicle and ton matrices	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTI CITY\1_RUN\3_LOGISTICMOD\RLMAT01C.S	
34	{SCENARIO_DIR}\LOGMOD\CALL_JA R.BAT	Parallel process for ID 9	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTI CITY\1_RUN\3_LOGISTICMOD\RLMAT01E.S	
35	{SCENARIO_DIR}\LOGMOD\MERGER EP\MERGEREPALL.BAT	Mergerep program	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTI CITY\1_RUN\3_LOGISTICMOD\RLMAT01D.S	
36	{SCENARIO_DIR}\LogMod\RCM\0_Co mpact.bat	Compact spanning tree data	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTI CITY\2_RCM\1_DATAPREP_LP\DPMAT01B.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\ 2_RCM\1_DATAPREP_LP\DPPIL01A.S

ID	Name and location during the run	Purpose	Script creating the batch file	Script having error handling
37	{SCENARIO_DIR}\LogMod\RCM\1_RUN_MPS_LP0_step1.BAT	LP step W	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\LPMAT00B.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\LPPIL00B.S
38	{SCENARIO_DIR}\LogMod\RCM\2_run LP.bat	LP Solve	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\LPMAT00C.S	No
39	{SCENARIO_DIR}\LogMod\RCM\3_RUN_MPS_LP0_step2.BAT	LP step LXR	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\LPMAT00D.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\LPPIL00G.S
40	{SCENARIO_DIR}\LOGMOD\RUNALL_RCM.BAT	Run RCM Build Chain and Chainchoi	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\RLMAT01A.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\RLPIL01E.S
41	{SCENARIO_DIR}\LOGMOD\COMMODITY_RCM.BAT	sub bat file for ID 19	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\RLMAT01B.S	
42	{SCENARIO_DIR}\LOGMOD\CALL_JAR.BAT	parallel process for ID 19	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\RLMAT01E.S	
43	{SCENARIO_DIR}\LogMod\RCM\1_RUN_MPS_LP@RCM_Loop@_step1.BAT	LP 1+ step w	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\FPMAT00B.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\FPPIL00E.S
44	{SCENARIO_DIR}\LogMod\RCM\2_run @RCM_Loop@.bat	LP Solve	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\FPMAT00C.S	No
45	{SCENARIO_DIR}\LogMod\RCM\3_RUN_MPS_LP@RCM_Loop@_step2.BAT	LP 1+ step LXR	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\FPMAT00D.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\2_LP_STEPS\FPPIL00F.S
46	{SCENARIO_DIR}\LOGMOD\RUNALL_FIN.BAT	Run LP2CC for FINAL	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\3_FINAL\RLMAT01A.S	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\3_FINAL\RLPIL01B.S
47	{SCENARIO_DIR}\LOGMOD\COMMODITY_FIN.BAT	sub bat file for ID 27	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\3_FINAL\RLMAT01B.S	
48	{SCENARIO_DIR}\LOGMOD\EXTRACT\EXTRACTALL_FIN.BAT	Extract vehicle and ton matrices	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\3_FINAL\RLMAT01F.S	
49	{SCENARIO_DIR}\LOGMOD\CALL_JAR.BAT	Parallel process for ID 27	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\3_FINAL\RLMAT01G.S	
50	{SCENARIO_DIR}\LOGMOD\MERGEREP\MERGEREPALLFIN.BAT	Mergerep program	{CATALOG_DIR}\02_APPLICATIONS\12_ELASTICITY\2_RCM\3_FINAL\RLMAT01D.S	

14.7. Structure of Data Section window

Table 55 List of inputs and outputs accessible from the Data Section window

Folder	Name	Description	Used by application
Scenario Inputs	List of scenarios	This folder contains all the inputs for the scenarios Given a base scenario with standard costs, the process applies variation of costs expressed as variation in %	All *Elasticity Module*
	Logit parameters by commodity and f2f type	Table with logit parameter for Chain Choice by commodity group and flow-to-flow type	*Samgods Model/Elasticity Module*
	Number of missing calibration parameters	Report providing information on consistency checks between calibration parameters and input data – produced after full run of Edit the data	*Edit the data*
	KielParameter	Kiel scaling factor	*Samgods Model/Elasticity Module*
Scenario Inputs\Model Operating instructions	Model Operating Instructions	Rtf file with a brief description on how to run the Samgods GUI	All
Scenario Inputs\General tables	Link Categories	Lookup table for the categories in the network	All
	NodeClass description	Lookup table for the numbering system (no longer required for the VY part)	All
	Transfer Type at terminals	Lookup table for the transfer type coded in the Nodes_Commodities data	*Samgods Model/Elasticity Module*
	List and codes for modes (only visible in developer mode)	Alphanumerical codes for modes	All
	Zoning System	Lookup table for the ID_Region and ID_Country codes	All
	Modes	Lookup table for codes used for modes	All
	V101 Speed Flow Curves	Speed flow table with parameter values for defining the delay functions for vehicle class 101 (light lorry)	*Samgods Model/Elasticity Module*
	V102 Speed Flow Curves	Same as previous but for vehicle classes 102-105	*Samgods Model/Elasticity Module*
	Ranges for node classes (only visible in developer mode)	For node classes from 12 to 19 the range of allowed values for node numbers	*Edit the data*
	Default values for the frequency matrices (only visible in developer mode)	Default frequencies for different vehicle classes based on the terminal type	*Edit the data*
	Port area classification	Port areas classification for Swedish ports	*Edit the data*

Folder	Name	Description	Used by application
	Empty vehicle fractions per vehicle type and distance	Function applied in extract procedure per vehicle type. The empty vehicles are calculated as fraction of loaded ones based on function depending on distance.	*Samgods Model/Elasticity Module*
	County names	List of Sweden counties (in Swedish: län) and related identification code	*Samgods Model/Elasticity Module*
	Other statistics 2019	Statistics on Kiel Canal, Öresund bridge and Jylland in year 2019 used in the calibration procedure	*Samgods Model/Elasticity Module*
	Trakbandel definition	Trakbandel codes with their description of section and corridor	*Samgods Model/Elasticity Module*
	NEW- LBD_Ratio	The Lower Bound Ratio used in the new rule implementation for consolidation	*Samgods Module\Logistics Module*
	NEW-Max Capacity and Consolidation exceptions	The Max Capacity and Consolidation exceptions used in the new rule implementation for consolidation	*Samgods Module\Logistics Module*
Scenario Inputs\General tables\Logistics module (only visible in developer mode and advanced user)	Main vehicle class for BuildChain	The main vehicle type used in the BuildChain process by submode id (i.e. vehicle submode A-U) and commodity (P1-P16).	*Samgods Model/Elasticity Module*
	Vehicle types by chain and submode (ChainChoi)	List of vehicle types (VHCL_NR) by submode id and commodity for ChainChoi	*Samgods Model/Elasticity Module*
	Direct Access	Whether direct access is active by commodity (P1-P16) and type of firm-to-firm flow (0-9, see table Type of Flow MATRIX below)	*Samgods Model/Elasticity Module*
	Type of Flow MATRIX	Lookup table with codes for type of flow matrices	*Samgods Model/Elasticity Module*
	Vessel Type (vessel/ship)	Lookup table with codes for container and non-container vessels	*Samgods Model/Elasticity Module*
	Consolidation factors by chain (i. e. General and by product groups)	Individual consolidation bounds for all sub modes [LB, UB] Default values and values by commodity group (-1 value means keep default values)	*Samgods Model/Elasticity Module*
	List of Chains 2019	List of Chain types	*Samgods Model/Elasticity Module*
	List of Chains 2045	List of Chain types	*Samgods Model/Elasticity Module*
Scenario Inputs\Editable data	Input_Data.mxd	General map to visualize all georeferenced data	*Edit the data*

Folder	Name	Description	Used by application
	EMME Network (211 format)	The Emme transport network with all link and node attributes	*Edit the data*
	EMME Speed table	Emme speed table	*Edit the data*
	General parameters (only visible in developer mode)	Table with the scenario parameters catalog key settings	*Edit the data*
	Logistics model parameters (only visible in developer mode)	Table with logistics module parameters	*Edit the data*
	Cargo Table	General values per commodity	*Edit the data*
	General Vehicles Parameters (by vhcl class only)	Costs and capacity values by vehicle type. The attribute "EMPTY_V" (1 or 0) concerns whether the number of empty vehicles will be calculated (1) or not (0)	*Edit the data*
	Specific Vehicles Parameters (by vhcl class and commodity group)	Cost values by vehicle type and commodity group	*Edit the data*
	Scenario Network	Network (links and nodes) for all modes (GIS map)	*Edit the data*
	Nodes Commodities	GIS map with all terminals and specifications on allowed transfer types and commodities per terminal	*Edit the data*
	Nodes	GIS map of zones and terminals with values for the logistics module and port area classification	*Edit the data*
	Ports Sweden	GIS map of Swedish ports with the pilot fees by vehicle type (sea mode only)	*Edit the data*
	Frequency network	GIS map with service frequencies (transports per week) per mode/combination of modes and origin-destination connection. For more information on the frequency network, see the appendix	*Edit the data*
	Tax by country Table	Tax by country and vehicle type	*Edit the data*
	Tax by Linkclass Table	Tax by link type and vehicle type	*Edit the data*
	Tax by link Table	Tax for specific links by vehicle type	*Edit the data*
	Toll bridges Table	Bridge tolls per vehicle type	*Edit the data*
	Rail capacity table	Daily bidirectional capacity for domestic rail links	*Edit the data*
Scenario Inputs\Emme tables	Default values for the EMME macros (only visible in developer mode)	Table containing matrix names for LOS matrices in Emme format	*Edit the data*
Scenario Inputs\Others	In-zone distances – default values (only visible in developer mode)	Default values for distances within each zone (diagonal values in the distance matrices). Applied when origin and destination are in the same zone	*Samgods Model*

Folder	Name	Description	Used by application
	Geodatabase file for exported matrices	Location of the geodatabase file	*Change matrix format*
	Rail capacity table with EMME node numbers	As Rail capacity table with added information of EMME nodes	*Samgods Model*
	Folder of Scenario JA (CBA)	Folder location of scenario JA used in CBA (Example: {CATALOG_DIR}\Scenario_Tree\Year_2019\Base2019\)	*Cost Benefit Analysis - ASEK Values*
Scenario Inputs\PWC_Matrices	PWC matrix by commodity	Displays the PWC matrix in Voyager format for a specific commodity, see Section 7.8 for instructions	*PWC_Matrices*
Scenario Inputs\Calibration factors	Port area differences (RCM) - output (only visible in developer mode)	Differences between modelled and surveyed tonnes per port area and commodity group	*Samgods Model/Elasticity Module*
	Parameters for Port Area Calculation (only visible in developer mode)	Step length, minimum value, cut off value and default minimum value for calibration of port area throughputs	*Samgods Model/Elasticity Module*
	Parameters for Kiel Canal Calculation (only visible in developer mode)	Step length, minimum value, cut off value and default minimum value for calibration of Kiel Canal flows	*Samgods Model/Elasticity Module*
	Port Area Scaling factors (only visible in developer mode)	Resulting scaling factors applied by commodity group and port area to TIME skims	*Samgods Model/Elasticity Module*
	Kiel Canal Scaling factor (only visible in developer mode)	Resulting scaling factor for the Kiel canal applied to TOLL value	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for Vehicle class parameters Part B	Calibration parameters for vehicle costs by commodity group Part B	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for Vehicle class parameters Part A	Calibration parameters for vehicle costs by commodity group Part A	*Samgods Model/Elasticity Module*
	Lock Solution by year	Lock Solution by year	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for technological factors under nodes	Calibration parameters for the technological factors in nodes table	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for rail capacities	Calibration parameters to rescale rail capacities	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for tax countries	Calibration parameters for taxes by country	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for tax links	Calibration parameters for taxes on link level	*Samgods Model/Elasticity Module*
	Parameters (Factors and Terms) for toll links	Calibration parameters for tolls on links	*Samgods Model/Elasticity Module*

Folder	Name	Description	Used by application
	Parameters (Factors and Terms) for speeds and sea constraints in the network	Calibration parameters for sped and capacity constraints on sea mode	*Samgods Model/Elasticity Module*
Scenario Outputs	Existing Outputs (Log report)	List of available outputs in the Samgods Report	*Samgods Model*
	Number of inconsistencies in calibration factors	Lists the number of inconsistencies observed between input data and calibration factors	*Edit the data/ Samgods Model*
	Record File 1	Not relevant for the user	
	Record File 2	Not relevant for the user	
Scenario Outputs\Scenario_Import_function_Report	Report for the import phase (Log report)	Report with any warnings or messages from the Scenario import function (in the *Handling scenario* application) (see Section 7.7)	*Handling scenario*
Scenario Outputs\Edit the data Report	Report for the edit phase (Log report)	Report with any warnings or error messages from the *Edit the data* application (see Section 7.4)	*Edit the data*
Scenario Outputs\Scenario Tables_costs taxes tolls	Network with costs for checking	Binary network with Toll, Taxes and Fees integrated	*Samgods Model/Elasticity Module*
	Tax_Country Scenario Table	Taxes by Country ID applied in current scenario	*Samgods Model/Elasticity Module*
	Tax_Category Scenario Table	Taxes by Category applied in current scenario	*Samgods Model/Elasticity Module*
	Tax_by_Link Scenario Table	Specific taxes on links applied in current scenario	*Samgods Model/Elasticity Module*
	Toll_by_link Scenario Table	Tolls present in current scenario	*Samgods Model/Elasticity Module*
	Vehicle_parameters Scenario Table	Vehicle costs applied by vehicle type and commodity group in current scenario	*Samgods Model/Elasticity Module*
Scenario Outputs\Samgods Report\LOS matrices generation	LOS Road Mode	LOS matrices between zones (both terminals and actual zones) per vehicle type for:	*Samgods Model*
	LOS Rail Mode	time – T [hours],	
	LOS Sea Mode	distance – D [km],	
	LOS Air Mode	extra costs – X [SEK],	
		domestic distances – DD [km]	
Scenario Outputs\Samgods Report\Logistics Module\OD Vehicles MAT	Road – Vehicle Flows	OD matrices of loaded vehicle flows by vehicle type. The sheet name indicates the vehicle type and the scenario name	*Samgods Model*
	Rail – Vehicle Flows		
	Sea – Vehicle Flows		
	Air – Vehicle Flows		

Folder	Name	Description	Used by application
Scenario Outputs\Samgods Report\Logistics Module\OD Tonnes MAT	Road – Goods Flows	OD matrices in tonnes by vehicle type. The sheet name indicates the vehicle type and the scenario name	*Samgods Model*
	Rail – Goods Flows		
	Sea – Goods Flows		
	Air – Goods Flows		
Scenario Outputs\Samgods Report\Logistics Module\OD Empty Vehicles MAT	Road – Empty vehicle Flows	OD matrices of empty vehicle flows by vehicle type. The sheet name indicates the vehicle type and the scenario name.	*Samgods Model*
	Rail – Empty vehicle Flows		
	Sea – Empty vehicle Flows		
	Air – Empty vehicle Flows		
Scenario Outputs\Samgods Report\Logistics Module\OD Covered	Output by vehicle class (spreadsheet for summary report no. 2: Logistics module)	Summary table with information by vehicle type (number of shipments, number of loaded vehicles, transport distances, tonnes, tonne kms, average loading factors, average distances), split up on domestic, international and total	*Samgods Model*
	Output by chain (spreadsheet for summary report no. 2: LM chains)	Summary table with information by chain type (total numbers of shipments, transport distances, tonnes, tonne kms, logistic costs, average costs per tonne km), split up on domestic, international and total	*Samgods Model*
	Loaded Demand (spreadsheet for summary report no. 2: LM Demand) (new)	Summary table of the tonnes transported and the tonnes in the PWC-matrices together with allocation success rates	*Samgods Model*
	Report #5 Logistics costs at zone level (spreadsheet for summary report no. 5)	Logistics costs per zone by commodity group (P01-P16) and from/to flows to a zone	*Samgods Model*
	Report #6 Goods flow through terminals (spreadsheet for summary report no. 6)	Goods flow (tonnes) through terminals per commodity (P01-P16) and divided by direct access to (DAIMPORN), and from (DAEXPORN) or regular (REGULARN). Regular refers to flows not having direct access	*Samgods Model*
	Report #6b Goods flow through terminals (excluding land-based transfers) (spreadsheet for summary report no. 6b) STD	Total goods flow (tonnes) through terminals per commodity (P01-P16) excluding land-based transfers	*Samgods Model*
	Report #7 Domestic tonne kms with container per mode (road, rail, sea, air) (spreadsheet for summary report no. 7)	Transport work (tonne kms) in Sweden for containers per commodity and vehicle type	*Samgods Model*

Folder	Name	Description	Used by application
	Report #8 Domestic vehicle kms with container per mode (road, rail, sea, air) (spreadsheet for summary report no. 8)	Traffic work (vehicle kms) in Sweden for container transports per commodity and vehicle type	*Samgods Model*
	Report #10 Tonnes km per mode, commodity, domestic, total domestic and international (spreadsheet for summary report no. 10)	Transport work (tonne kms) per commodity, mode. Split into three categories: domestic, total domestic and international respectively	*Samgods Model*
	Report #11 Tonnes per mode, commodity, domestic, tdomestic and international (spreadsheet for summary report no. 11)	Transported tonnes per commodity. Split into three categories: domestic, total domestic and international respectively	*Samgods Model*
	Report#12 node and link costs per vehicle and product group (spreadsheet for summary report no. 12)	Link and node costs per vehicle type, per commodity and split into total domestic and international respectively	*Samgods Model*
	Report #19 Loaded and unloaded tons on rail terminals (spreadsheet for summary report no. 19)	Loaded and unloaded tons on Rail terminals per product group	*Samgods Model*
Scenario Outputs\Samgods Report\Assignment	Road Assigned Network	GIS network with the assignment of the freight flows to the transport network per vehicle type, in tonnes and in number of vehicles (loaded and empty).	*Samgods Model*
	Rail Assigned Network		
	Sea Assigned Network		
	Air Assigned Network		
Scenario Outputs\Samgods Report\Reports	Assigned Network	GIS network with the assignment of the freight flows to the transport network with all vehicle types in the same network, in tonnes and in number of vehicles (loaded and empty).	*Samgods Model*
	Report #1 VHCLKM (spreadsheet for summary report no. 1)	Summary table of number of vehicle kms per vehicle type and mode (split up into 2 regional categories domestic and total domestic and 3 aggregation levels loaded/empty/all vehicles).	*Samgods Model*
	Report #3 Tonkm per Mode with statistics STD (spreadsheet for summary report no. 3)	Tonne-kms in millions on domestic movements per main mode (Road, Rail, Sea) and international (Air) in standard logistics module	*Samgods Model*
	Report #4 TONNESKM (spreadsheet for summary report no. 4)	Summary table of tonne kms (domestic, international and total) per vehicle type and mode road, rail, sea and air.	*Samgods Model*
	Report #9 Vehicle kms, tonne kms, empty vehicle kms and total vehicle kms per geographic region per mode (road, rail)	Summary table of vehicle kms (split up into loaded, empty and all vehicles) and tonne kms per geographic region and mode (road and rail).	*Samgods Model*

Folder	Name	Description	Used by application
	(spreadsheet for summary report no. 9)		
	Report #13 Port area statistics STD (spreadsheet for summary repost no. 13)	Tonnes per port area and commodity group and comparison with statistics (results from standard logistics module)	*Samgods Model*
	Report #14 Oresund Kiel canal STD (spreadsheet for summary report no. 14)	Results on Öresund bridge, Kiel canal and Jylland and comparison with statistics (results from standard logistics module)	*Samgods Model*
	Bidirectional tonnes per mode STD	Network with bidirectional tonnes/100.000 per mode road, rail and sea (results from standard logistics module)	*Samgods Model*
	Report #16 VHCLKM and distribution per road vehicle type and county – totals (spreadsheet for summary report no. 16)	Vehicle kms per county and vehicle type and their distribution on all the roads (results from standard logistics module)	*Samgods Model*
	Report #17 VHCLKM and distribution per road vehicle type and county – Category 11 (spreadsheet for summary report no. 17)	Vehicle kms per county and vehicle type and their distribution on E10 (European roads = category 11) (results from standard logistics module)	*Samgods Model*
	Report #18 VHCLKM and distribution per road vehicle type and county – Other roads (spreadsheet for summary report no. 18)	Vehicle kms per county and vehicle type and their distribution on all types roads except E10 (results from standard logistics module)	*Samgods Model*
Scenario Outputs\Samgos Report\GIS Maps	GIS map with Ktons by commodity group	Standard GIS map with layers per Mode and commodity group - Ktons	*Samgods Model*
	GIS map with vhcl by commodity group	Standard GIS map with layers per Mode and commodity group Loaded Vhcl	*Samgods Model*
Scenario Outputs\RCM Report	Rail Capacity table for current scenario	Definition of rail bidirectional capacities per day for the current scenario	*Samgods Model*
	Kiel Oresund Jylland RMSE calculation	Comparison by mode of ml tonkm modelled vs observed and related RMSE	*Samgods Model*
	Number of links over capacity	Number of links where flows over capacity ratio is greater than one. In the event the number is zero, RCM process is skep since not required.	*Samgods Model*
Scenario Outputs\RCM Report\Logistic Module\OD Vehicles MAT	Road – Vehicle Flows	OD matrices of loaded vehicle flows by vehicle type (results from Rail Capacity Management module). The sheet name indicates the vehicle type and the scenario name.	*Samgods Model*
	Rail – Vehicle Flows		
	Air – Vehicle Flows		
	Sea – Vehicle Flows		
Scenario Outputs\RCM Report\Logistic Module\OD Tonnes MAT	Road – Goods Flows	OD matrices in tones by vehicle type (results from Rail Capacity Management module). The sheet name indicates the vehicle type and the scenario name	*Samgods Model*
	Rail – Goods Flows		
	Air – Goods Flows		
	Sea – Goods Flows		

Folder	Name	Description	Used by application
Scenario Outputs\RCM Report\Logistic Module\OD Empties MAT	Road – Empty vehicle Flows	OD matrices of empty vehicle flows by vehicle type.	*Samgods Model*
	Rail – Empty vehicle Flows		
	Air – Empty vehicle Flows		
	Sea – Empty vehicle Flows		
Scenario Outputs\RCM Report\Logistic Module\OD Covered	Output by vehicle class (RCM)	Summary table with information by vehicle type (number of shipments, number of loaded vehicles, transport distances, tonnes, tonne kms, average loading factors, average distances) and regional diff DTI.	*Samgods Model*
	Output by chain (RCM)	Summary table with information by chain type (total numbers of shipments, transport distance, tonnes, tonne kms, logistic cost, average cost per tonne km) and regional diff DTI.	*Samgods Model*
	Loaded Demand (RCM)	Summary table of the tonnes transported and the tonnes in the PWC-matrices together with allocation success rates	*Samgods Model*
	Report #5 Logistic costs at zone level (RCM) (spreadsheet for summary report no. 5)	Logistics costs per zone per commodity (P01-P16) and from/to flows to a zone	*Samgods Model*
	Report #6 Goods flow through terminals (spreadsheet for summary report no. 6)	Goods flow (tonnes) through terminals per commodity (P01-P16) and divided by direct access to (DAIMPORN), and from (DAEXPORN) or regular (REGULARN). Regular refers to flows not having direct access	*Samgods Model*
	Report #6b Goods flow through terminals (excluding land-based transfers) (spreadsheet for summary report no. 6b)	Total goods flow (tonnes) through terminals per commodity (P01-P16) excluding land-based transfers	Samgods Model
	Report #7 Domestic tonne kms with container per mode (road, rail, sea, air) (RCM) (spreadsheet for summary report no. 7)	Transport work (tonne kms) in Sweden for container transports per commodity and vehicle type	*Samgods Model*
	Report #8 Domestic vehicle kms container per mode (road, rail, sea, air) (RC) (spreadsheet for summary report no. 8)	Traffic work (vehicle kms) in Sweden for container transports per commodity and vehicle type	*Samgods Model*
	Report #10 Tonnes km per mode, commodity, domestic, tdomestic and international (RCM) (spreadsheet for summary report no. 10)	Transport work (tonne kms) per commodity, vehicle type and regional diff DTI	*Samgods Model*

Folder	Name	Description	Used by application
		domestic/total domestic/international	
	Report #11 Tonnes per mode, commodity, domestic, tdomestic and international (spreadsheet for summary report no. 11)	Tonnes per commodity, vehicle type and regional diff DTI	*Samgods Model*
	Report #12 node and link costs per vehicle and product group (RCM) (spreadsheet for summary report no. 12)	Link and node costs per vehicle type, per commodity and regional diff DTI	*Samgods Model*
	Report #19 Loaded and unloaded tons on rail terminals (spreadsheet for summary report no. 19) (new)	Loaded and unloaded tons on Rail terminals per product group	Samgods Model
Scenario Outputs\RCM Report\Assignment	Road Assignment Network (RCM)	GIS network with the assignment of the freight flows to the transport network per vehicle type, in tonnes and in number of loaded and empty vehicles respectively	*Samgods Model*
	Rail Assignment Network (RCM)		
	Sea Assignment Network (RCM)		
	Air Assignment Network (RCM)		
Scenario Outputs\RCM Report\Reports	Assigned Network	GIS network with the assignment of the freight flows to the transport network with all vehicle types in the same network, in tonnes and in number of loaded and empty vehicles respectively	*Samgods Model*
	Report #1 VHCLKM (RCM) (spreadsheet for summary report no. 1)	Summary table of number of vehicle kms per vehicle type and mode (split up into regional diff DT and into loaded/empty total number of vehicles).	*Samgods Model*
	Report #3 Tonkm per mode with statistics RCM (spreadsheet for summary report no. 3)	Tonne-km in millions on domestic movements per main mode (Road, Rail, Sea) and international (Air)	*Samgods Model*
	Report #4 TONNESKM (RCM) (spreadsheet for summary report no. 4)	Summary table of tonne kms by regional DTI per vehicle type and mode	*Samgods Model*
	Report #9 Vehicle kms, tonne kms, empty vehicle kms and total vehicle kms per geographic region per mode (road, rail) (RCM) (spreadsheet for summary report no. 9)	Summary table of vehicle kms (split up into #LEA-vehicles) and tonne kms per geographic region and mode (road and rail)	*Samgods Model*
	Report #13 Port area statistics (RCM) (spreadsheet for summary report no. 13)	Tons per port area and commodity group and comparison with statistics	*Samgods Model*
	Report #14 Oresund Kiel canal (RCM) (spreadsheet for summary report no. 14)	Results on Öresund bridge, Kiel canal and Jylland and comparison with statistics	*Samgods Model*

Folder	Name	Description	Used by application
	Report #15 Trains per day (tot, empty, loaded) from RCM procedure (spreadsheet for summary report no. 15)	Number of loaded and empty trains per day bidirectional and differences between totals and capacities and associated marginal costs	*Samgods Model*
	Report #15b Rail Capacity Network	Network with capacities and #LEA-trains per day (same statistics as in Report #15 but shown in the network)	*Samgods Model*
	Bidirectional tonnes per mode RCM	Network with bidirectional tonnes/100.000	*Samgods Model*
	Report #16 VHCLKM and distribution per road vehicles and county – totals (RCM) (spreadsheet for summary report no. 16)	Vehicle kms per county and vehicle type and their distribution on all the roads	*Samgods Model*
	Report #17 VHCLKM and distribution per road vehicles and county – Category 11 (RCM) (spreadsheet for summary report no. 17)	Vehicle kms per county and vehicle type and their distribution on E10 (European roads = category 11)	*Samgods Model*
	Report #18 VHCLKM and distribution per road vehicles and county – Other roads (RCM) (spreadsheet for summary report no. 18)	Vehicle kms per county and vehicle type and their distribution on other road types than E10	*Samgods Model*
	Comparison MI Tons RCM vs Standard per mode	Absolute and percentage differences per mode road, rail and sea (in millions of tonnes) between RCM and STD	*Samgods Model*
	Report Tons by commodity groups and total (Ktons) (related map under GIS maps\ GIS map with Ktons by commodity group)	GIS network with total Ktons and divided by commodity group, and rail utilization as well (as percentage of capacity)	*Samgods Model*
	Report #21 Domestic Total and International Tonkm and VhclKm by commodity group RCM - RAIL	Table with tonkm, loaded and unloaded vhclkm per total domestic and international (tons are per year, vehicles per day) on rail.	*Samgods Model*
Scenario Outputs\RCM Report\GIS Maps	GIS map with Ktons by commodity group	Standard GIS map with layers per Mode and commodity group - Ktons	*Samgods Model*
	GIS map with vhcl by commodity group	Standard GIS map with layers per Mode and commodity group Loaded Vhcl	*Samgods Model*
Scenario Outputs\CBA Report > Main Reports	Logistic Cost Changes used for CBA	Table with results produced using methodology for CBA	*Cost Benefit Analysis - ASEK Values*
	Vehicles, loaded and empty, within Swedish territory	Report of vhcl-km for loaded and empties for emission model (ferries are expressed as ferry vehicles)	*Cost Benefit Analysis - ASEK Values*

Folder	Name	Description	Used by application
Scenario Outputs\CBA Report\OD Covered	Output by vehicle class (CBA)	Summary table with information by vehicle type (number of shipments, number of loaded vehicles, transport distances, tonnes, tonne kms, average loading factors, average distances) and regional diff DTI.	*Cost Benefit Analysis - ASEK Values*
	Report B Costs_D_I_X_T by vehicle type	Summary table with information by vehicle type and vehicle on ferry of transport/ inventory and empty costs both in RCM and CBA	*Cost Benefit Analysis - ASEK Values*
	Output by chain (CBA)	Summary table with information by chain type (total numbers of shipments, transport distance, tonnes, tonne kms, logistic cost, average cost per tonne km) and regional diff DTI.	*Cost Benefit Analysis - ASEK Values*
	Loaded Demand (CBA)	Summary table of the tonnes transported and the tonnes in the PWC-matrices together with allocation success rates	*Cost Benefit Analysis - ASEK Values*
	Report #5 Logistic costs at zone level (CBA) (spreadsheet for summary report no. 5)	Logistics costs per zone per commodity (P01-P16) and from/to flows to a zone. Cost based on ASEK values.	*Cost Benefit Analysis - ASEK Values*
	Report #6 Goods flow through terminals (CBA) (spreadsheet for summary report no. 6)	Goods flow (tonnes) through terminals per commodity (P01-P16) and divided by direct access to (DAIMPORN), and from (DAEXPORN) or regular (REGULARN). Regular refers to flows not having direct access	*Cost Benefit Analysis - ASEK Values*
	Report #6b Goods flow through terminals (excluding land-based transfers) (CBA) (spreadsheet for summary report no. 6b)	Total goods flow (tonnes) through terminals per commodity (P01-P16) excluding land-based transfers	*Cost Benefit Analysis - ASEK Values*
	Report #7 Domestic tonne kms with container per mode (road, rail, sea, air) (CBA) (spreadsheet for summary report no. 7)	Transport work (tonne kms) in Sweden for container transports per commodity and vehicle type	*Cost Benefit Analysis - ASEK Values*
	Report #8 Domestic vehicle kms container per mode (road, rail, sea, air) (CBA) (spreadsheet for summary report no. 8)	Traffic work (vehicle kms) in Sweden for container transports per commodity and vehicle type	*Cost Benefit Analysis - ASEK Values*
	Report #10 Tonnes km per mode, commodity, domestic, tdomestic and international (CBA) (spreadsheet for summary report no. 10)	Transport work (tonne kms) per commodity, vehicle type and regional diff DTI	*Cost Benefit Analysis - ASEK Values*

Folder	Name	Description	Used by application
	Report #11 Tonnes per mode, commodity, domestic, tdomestic and international (CBA) (spreadsheet for summary report no. 11)	Tonnes per commodity, vehicle type and regional diff DTI	*Cost Benefit Analysis - ASEK Values*
	Report #12 node and link costs per vehicle and product group (CBA) (spreadsheet for summary report no. 12)	Link and node costs per vehicle type, per commodity and regional diff DTI	*Cost Benefit Analysis - ASEK Values*
	Report #19 Loaded and unloaded tons on rail terminals (spreadsheet for summary report no. 19) (CBA)	Loaded and unloaded tons on Rail terminals per product group	*Cost Benefit Analysis - ASEK Values*
	Report #20 Order and inventory costs for TDOM and INT (CBA)	Order and inventory cost per product group and total domestic/international using ASEK values	*Cost Benefit Analysis - ASEK Values*
Scenario Outputs\Compare\LOS matrices generation	LOS Road Dif	Absolute cost differences between the current scenario and the scenario used for comparison for the LOS matrices	*Compare Scenarios*
	LOS Rail Dif		
	LOS Sea Dif		
	LOS Air Dif		
Scenario Outputs\Compare\Logistics Module\OD vehicles MAT	Road OD Dif	Absolute differences in loaded vehicles between the current scenario and the scenario used for comparison for the OD matrices	*Compare Scenarios*
	Rail OD Dif		
	Sea OD Dif		
	Air OD Dif		
Scenario Outputs\Compare\Logistics Module\OD Tonnes MAT	Road TON Dif	Absolute differences in tonnes between the current scenario and the scenario used for comparison for the OD matrices	*Compare Scenarios*
	Rail TON Dif		
	Sea TON Dif		
	Air TON Dif		
Scenario Outputs\Compare\Logistics Module\OD empty MAT	Road EMP Dif	Absolute differences in empty vehicles between the current scenario and the scenario used for comparison for the OD matrices.	*Compare Scenarios*
	Rail EMP Dif		
	Sea EMP Dif		
	Air EMP Dif		
Scenario Outputs\Compare\Logistics Module\Tot Gen Att	TRIPEND Road Dif	Total generation (sum of each row) and attraction (sum of each column) for the vehicle OD matrices and absolute differences to the scenario used for comparison	*Compare Scenarios*
	TRIPEND Rail Dif		
	TRIPEND Sea Dif		
	TRIPEND Air Dif		
Scenario Outputs\Compare\Assignment	Compared Load Net STD	GIS network with absolute differences between the current scenario and the scenario used for comparison of loaded vehicles flows for all vehicle types and modes from Standard logmod	*Compare Scenarios*
	Compared Load Net RCM	GIS network with absolute differences between the current scenario and the scenario used for	

Folder	Name	Description	Used by application
		comparison of loaded vehicles flows for all vehicle types and modes after RCM	
Scenario Outputs\Compare\GIS maps	GIS map with differences (Ktons)	GIS map with absolute differences between the current scenario and the scenario used for comparison of total tonnes and by commodity group	*Compare Scenarios*
Scenario Outputs\SelectLink\STD	Flows and Tonnes Network STD	GIS network loaded vehicles flows and tons for all vehicle types and modes using the set of links, nodes and commodities provided for the analysis	*Select Link Analysis*
Scenario Outputs\SelectLink\STD \OD Vehicles MAT	Road - vehicle flows	Select link matrices by mode for loaded vehicles	*Select Link Analysis*
	Rail – vehicle flows		
	Sea – vehicle flows		
	Air – vehicle flows		
Scenario Outputs\SelectLink\STD \OD Tonnes MAT	Road - good flows	Select link matrices by mode for tonnes	*Select Link Analysis*
	Rail – good flows		
	Sea – good flows		
	Air – good flows		
Scenario Outputs\SelectLink\STD \OD Empty Vehicles MAT	Road -Empty vehicle flows	Select link matrices by mode for unloaded vehicles	*Select Link Analysis*
	Rail – Empty vehicle flows		
	Sea – Empty vehicle flows		
	Air – Empty vehicle flows		
Scenario Outputs\SelectLink\STD \GIS Maps	GIS map with Ktons by commodity group	Standard GIS map with layers per Mode and commodity group Ktons	Select Link Analysis
	GIS map with vhcl by commodity group	Standard GIS map with layers per Mode and commodity group Loaded Vhcl	Select Link Analysis
Scenario Outputs\SelectLink\RC M	Flows and Tonnes Network RCM	GIS network loaded vehicles flows and tons for all vehicle types and modes using the set of links, nodes and commodities provided for the analysis	*Select Link Analysis*
Scenario Outputs\SelectLink\RC M \OD Vehicles MAT	Road - vehicle flows	Select link matrices by mode for loaded vehicles	*Select Link Analysis*
	Rail – vehicle flows		
	Sea – vehicle flows		
	Air – vehicle flows		
Scenario Outputs\SelectLink\RC M \OD Tonnes MAT	Road - good flows	Select link matrices by mode for tonnes	*Select Link Analysis*
	Rail – good flows		
	Sea – good flows		
	Air – good flows		
Scenario Outputs\SelectLink\RC	Road -Empty vehicle flows	Select link matrices by mode for unloaded vehicles	*Select Link Analysis*

Folder	Name	Description	Used by application
M \OD Empty Vehicles MAT	Rail – Empty vehicle flows		
	Sea – Empty vehicle flows		
	Air – Empty vehicle flows		
Scenario Outputs\SelectLink\RCM\GIS Maps	GIS map with Ktons by commodity group	Standard GIS map with layers per Mode and commodity group Ktons	Select Link Analysis
	GIS map with vhcl by commodity group	Standard GIS map with layers per Mode and commodity group Loaded Vhcl	Select Link Analysis
Scenario Outputs\SelectLink\TraversalMat\STD	Folder location for Road Traversal Matrices (STD)	Traversal matrices in Emme format (314) on road mode	Select Link Analysis
Scenario Outputs\SelectLink\TraversalMat\RCM	Folder location for Road Traversal Matrices (RCM)	Traversal matrices in Emme format (314) on road mode	Select Link Analysis
Scenario Reports\Logistic Module (contains the summary reports for standard logistic module)	Report_1_Tot VHCKM by VHC Type	Number of vehicle kms per vehicle type (#LEA). And regional diff DT.	*Samgods Model*
	Report_2_Logistics Module	Summary table of no. of shipments, no. of loaded vehicles, transport distances, tonnes, tonne kms, average load factors and average distance by vehicle type by regional diff DTI	*Samgods Model*
	Report_2_LM_CHAINS	Summary table of no. of shipments, costs, vehicle kms, tonnes, tonne kms and average logistic costs per tonne km, by transport chain type	*Samgods Model*
	Report_2_LM_DEMAND	Summary table of the tonnes transported and the tonnes in the PWC-matrices together with allocation success rate	*Samgods Model*
	Report_3_TonKm_by_Mode_with_2016StatisticsSTD	Tonne-kms in millions on domestic movements per main mode (Road, Rail, Sea) and international (Air)	*Samgods Model*
	Report_4_Total tkms by VHC type	Summary table of tonne-kms (regional diff DTI) per vehicle type	*Samgods Model*
	Report_5_Total logistic cost at zone-level	Total logistics costs per commodity type (P01-P16) split by import and export at geographical zone level	*Samgods Model*
Scenario Reports\Logistic Module (contains the summary reports for standard logistic module)	Report_6_Goods flow through terminals (number of tonnes in and out per year)	No. of tonnes through terminals (described as zones) per commodity (P01-P16), split into from/to flows for direct access and flow for other terminals (without direct access)	*Samgods Model*
	Report_6_b_Goods flow through terminals (total number of tonnes per year without land-based transfers)	No. of tonnes through terminals (described as zones) per commodity (P01-P16), (without land-based transfers)	*Samgods Model*
	Report_7_Domestic tonne kms with container per mode	Domestic tonne kms with container transports per mode and vehicle type, split by commodity.	*Samgods Model*

Folder	Name	Description	Used by application
	(road, rail, sea, air) and vehicle cl		
	Report_8_Domestic vehicle kms with container per mode (road, rail, sea, air) and vehicle cl	Domestic vehicle kms with container transports per mode and vehicle type, split by commodity Total volume is also reported	*Samgods Model*
	Report_9_Vehicle kms and Tonnes kms per geographic region	Vehicle kms (for #LEA-vehicles) and tonne kms per geographical region (road and rail mode).	*Samgods Model*
	Report_10_Transport work (tonne kms) per mode and vehicle cl, total and split per commodity, domestic, tdomestic and international	Transport work (tonne kms) per mode and vehicle type and commodity. Regional diff DTI	*Samgods Model*
	Report_11_ Transported goods volume per mode vehicle cl, total and split per commodity, domestic, tdomestic and international	Transported goods (in tonnes) per mode and vehicle type and commodity, as well as regional diff DTI	*Samgods Model*
	Report_12_node and link costs per vehicle and product group	Node and link costs per vehicle type and product group, divided in total domestic and international	*Samgods Model*
	Report_13_Tons_per_PortArea_and_commodity_Group	Tonnes per port area and commodity group and comparison with statistics	*Samgods Model*
	Report_14_Oresund Bridge_Kiel Canal and Jylland	Results on Öresund bridge, Kiel canal and Jylland and comparison with statistics	*Samgods Model*
	Report_16_VHCLKM and distribution by county - totals STD	Vehicle kms per county and vehicle type and their distribution on all the roads	*Samgods Model*
	Report_17_VHCLKM and distribution by county - E10 roads STD	Vehicle kms per county and vehicle type and their distribution on E10 (category 11)	*Samgods Model*
	Report_18_VHCLKM and distribution by county Other roads STD	Vehicle kms per county and vehicle type and their distribution on all the roads except E10	*Samgods Model*
	Report_19_Loaded_Unloaded_Tons_Rail	Loaded and unloaded tons on rail terminals per product group	*Samgods Model*
Scenario Reports\Rail Capacity Management (contains the summary reports for rail capacity management)	Report_1_Tot VHCKM by VHC Type (RCM)	Number of vehicle kms (#LEA) Regional diff DT	*Samgods Model*
	Report_2_Logistics Module (RCM)	Summary table of no. of shipments, no. of loaded vehicles, transport distances, tonnes, tonne kms, average load factors and average distances by vehicle type, split up into regional diff DTI	*Samgods Model*

Folder	Name	Description	Used by application
	Report_2_LM_CHAINS (RCM)	Summary table of no. of shipments, costs, vehicle kms, tonnes, tonne kms and average logistic costs per tonne km, by transport chain type	*Samgods Model*
	Report_2_LM_DEMAND (RCM)	Summary table of the tonnes transported and the tonnes in the PWC-matrices together with allocation success rate	*Samgods Model*
	Report_3_TonKm_per_Mode_with_2016Statistics (RCM)	Tonne-kms in millions on domestic movements per main mode (Road, Rail, Sea) and international (Air)	*Samgods Model*
	Report_4_Total tkms by VHC type (RCM)	Summary table of tonnes and tonne-kms (regional diff DTI) per vehicle type	*Samgods Model*
	Report_5_Total logistic cost at zone-level (RCM)	Total logistics costs per commodity (P01-P16) split by from/to flow at geographical zone level	*Samgods Model*
	Report_6_Goods flow through terminals (number of tonnes in and out per year) (RCM)	No. of tonnes through terminals per P01-P16.	*Samgods Model*
	Report_6_b_Goods flow through terminals (total number of tonnes per year without land-based transfers) (RCM)	No. of tonnes through terminals (described as zones) per commodity (P01-P16), (without land-based transfers)	*Samgods Model*
	Report_7_Domestic tonne kms with container per mode (road, rail, sea, air) and vehicle cl (RCM)	Domestic tonne kms with container transports per mode and vehicle type, split by commodity Total volume is also reported	*Samgods Model*
	Report_8_Domestic vehicle kms with container per mode (road, rail, sea, air) and vehicle cl (RCM)	Domestic vehicle kms with container transports per mode and vehicle type, split by commodity Total volume is also reported	*Samgods Model*
	Report_9_Vehicle kms and Tonnes kms per geographic region (RCM)	Vehicle kms (#LEA) and tonne kms per geographical region (road and rail mode).	*Samgods Model*
	Report_10_Transport work (tonne kms) per mode and vehicle cl, total and split per commodity, domestic, tdomestic and international (RCM)	Transport work (tonne kms) per mode, vehicle type and commodity, and regional diff DTI	*Samgods Model*
	Report_11_ Transported goods volume per mode vehicle cl, total and split per commodity, domestic, tdomestic and international (RCM)	Transported goods (in tonnes) per mode and vehicle type, commodity, and regional diff DTI	*Samgods Model*
	Report_12_node and link costs per vehicle and product group (RCM)	Node and link costs per vehicle type and product group, divided into regional diff DTI	*Samgods Model*

Folder	Name	Description	Used by application
	Report_13_Tons_per_PortArea_and_Commodity_Group (RCM)	Tons per port area and commodity group and comparison with statistics	*Samgods Model*
	Report_14_Oresund Bridge_Kiel Canal_Jylland (RCM)	Results on Öresund bridge, Kiel canal and Jylland and comparison with statistics	*Samgods Model*
	Report_15_Trains per day (tot, empty, loaded) (RCM)	Number of loaded and empty trains per day bidirectional and differences between totals and capacities	*Samgods Model*
	Report_16_VHCLKM and distribution by county - totals (RCM)	Vehicle kms per county and vehicle type and their distribution on all the roads	*Samgods Model*
	Report_17_VHCLKM and distribution by county - E10 roads (RCM)	Vehicle kms per county and vehicle type and their distribution on E10 (category 11)	*Samgods Model*
	Report_18_VHCLKM and distribution by country - Other roads (RCM)	Vehicle kms per county and vehicle type and their distribution on all the roads except E10	*Samgods Model*
	Report_19_Loaded_Unloaded_Tons_Rail (RCM)	Loaded and unloaded tons on rail terminals per product group	*Samgods Model*
	Report_21_Domestic Total and International Tonkm and VhclKm per commodity group RCM - Rail	Vehicle kms and tonne-kms for total domestic and international by commodity group	*Samgods Model*
Scenario Reports\CBA	Report_2_Logistics Module	Summary table of no. of shipments, no. of loaded vehicles, transport distances, tonnes, tonne kms, average load factors and average distance by vehicle type by regional diff DTI	*Cost Benefit Analysis - ASEK Values*
	Report_2_LM_CHAINS (CBA)	Summary table of no. of shipments, costs, vehicle kms, tonnes, tonne kms and average logistic costs per tonne km, by transport chain type	*Cost Benefit Analysis - ASEK Values*
	Report_2_LM_DEMAND (CBA)	Summary table of the tonnes transported and the tonnes in the PWC-matrices together with allocation success rate	*Cost Benefit Analysis - ASEK Values*
	Report_5_Total logistic cost at zone-level	Total logistics costs per commodity type (P01-P16) split by import and export at geographical zone level	*Cost Benefit Analysis - ASEK Values*
	Report_6_Goods flow through terminals (number of tonnes in and out per year)	No. of tonnes through terminals (described as zones) per commodity (P01-P16), split into from/to flows for direct access and flow for other terminals (without direct access)	*Cost Benefit Analysis - ASEK Values*
	Report_6_b_Goods flow through terminals (total number of tonnes per year without land-based transfers)	No. of tonnes through terminals (described as zones) per commodity (P01-P16), (without land-based transfers)	*Cost Benefit Analysis - ASEK Values*

Folder	Name	Description	Used by application
	Report_7_Domestic tonne kms with container per mode (road, rail, sea, air) and vehicle cl	Domestic tonne kms with container transports per mode and vehicle type, split by commodity.	*Cost Benefit Analysis - ASEK Values*
	Report_8_Domestic vehicle kms with container per mode (road, rail, sea, air) and vehicle cl	Domestic vehicle kms with container transports per mode and vehicle type, split by commodity Total volume is also reported	*Cost Benefit Analysis - ASEK Values*
	Report_10_Transport work (tonne kms) per mode and vehicle cl, total and split per commodity, domestic, tdomestic and international	Transport work (tonne kms) per mode and vehicle type and commodity. Regional diff DTI	*Cost Benefit Analysis - ASEK Values*
	Report_11_ Transported goods volume per mode vehicle cl, total and split per commodity, domestic, tdomestic and international	Transported goods (in tonnes) per mode and vehicle type and commodity, as well as regional diff DTI	*Cost Benefit Analysis - ASEK Values*
	Report_12_node and link costs per vehicle and product group	Node and link costs per vehicle type and product group, divided in total domestic and international	*Cost Benefit Analysis - ASEK Values*
	Report_19_Loaded_Unl oaded_Tons_Rail	Loaded and unloaded tons on rail terminals per product group	*Cost Benefit Analysis - ASEK Values*
	Report_20_Inventory and order cost per commodity group	Order and inventory cost per product group and total domestic/international using ASEK values	*Cost Benefit Analysis - ASEK Values*

TRAFIKVERKET