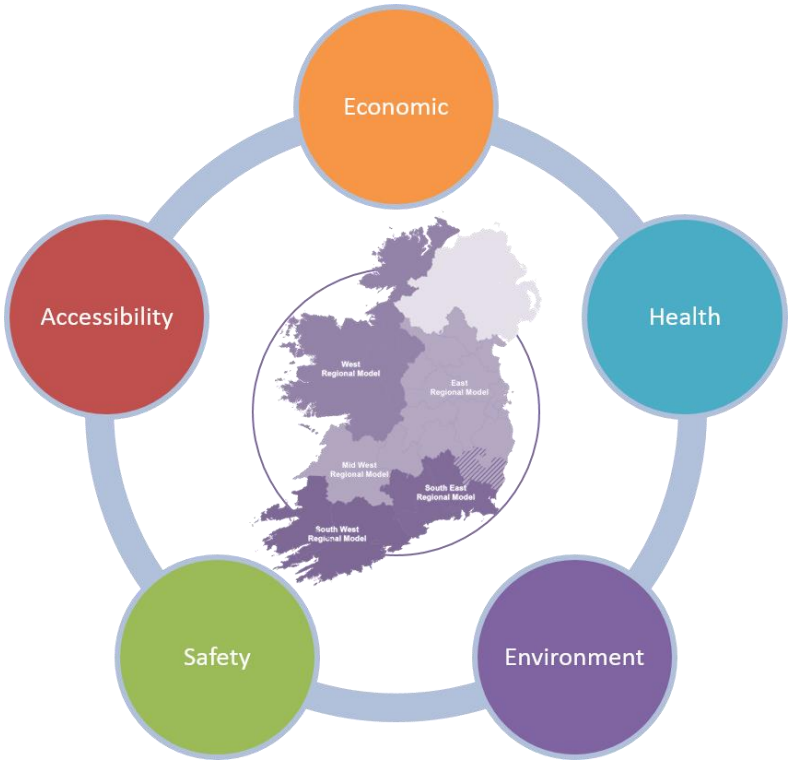
Údarás
Náisiúnta Iompair
National **Transport** Authority



Environment Module

User Guide

March 2021 (v3.3.1)

National Transport Authority,
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DOCUMENT IDENTIFICATION TABLE	
Client/Project owner	National Transport Authority
Title of Document	Environment Module User guide
Task Order	P4
Deliverable Code	P4.02
Version	3
Document Status	FINAL

DOCUMENT STATUS TABLES

Version 3.1 – V2

	Name	Position	Date
Originated by			September 2018

Version 3.1.2 – V3

	Name	Position	Date
Originated by	Josh Noon		March 2021
Checked by	Chris Bushell	Associate Director	March 2021
Approved by	Chris Bushell	Associate Director	March 2021

Version 3.3.1 – V3

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Originated by	Josh Noon		March 2021
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Figures and Tables

Foreword

This document is designed to guide both new and experienced users through the main processes of Environment Module of the NTA's Appraisal Toolkit. Note this tool and User Guide have been designed and developed for the V3 RMS models. It includes a troubleshooting section to help guide the user through any known issues that may arise through its use. For more detailed information on the module please see the Environment Module Development Report and Version Control Log.

It is assumed the user has prior CUBE and environmental assessment experience.

1 What is the tool being used for?

The Environment Module is **NOT** an air quality tool. Results are pure emissions and do not account for dispersion.

There are three general categories of use for the Environment Module. Under each use there are different steps to be taken as follows;

1) **Emissions Assessment using standard inputs and no predefined fishnet –**
   - Uses the full tool to do a test with the standard inputs provided with ENEVAL. Outputs will be CSVs and shapefiles.
   - Sections to follow for instructions;
     - Section 6.1 (CUBE Process)
2) **Emissions Assessment using standard inputs and predefined fishnet –**
   - Uses the full tool to do a test with the standard inputs provided with ENEVAL. Outputs will be CSVs and shapefiles.
   - Sections to follow for instructions;
     - Section 6.3 (CUBE Process)
   - For help creating a custom fishnet;
     - Section 7.2
3) **Running the Environment Module with SATURN only inputs –**
   - Uses the tool to carry out an ENEVAL run using only SATURN input files, suitable for Cordons.
   - Sections to follow for instructions;
     - Section 6.5 (CUBE Process)
   - For help creating a custom fishnet;
     - Section 7.2 (CUBE Process)
4) **Creating additional GIS outputs from a pre-existing run –**
   - Uses the ArcGIS process to produce a new set of outputs using a pre-existing run.
   - Sections to follow for instructions;
     - Section 6.8 (CUBE Process)
   - For help creating a custom fishnet;
     - Section 7.2 (CUBE Process)

For t**roubleshooting** please refer to Section 7.

A fishnet is a grid in GIS, in the case of the Environment Module the fishnet contains the sum of a proportional level of emissions of the links that cross it. For further information see Section 7.2.

2 Overview of Process

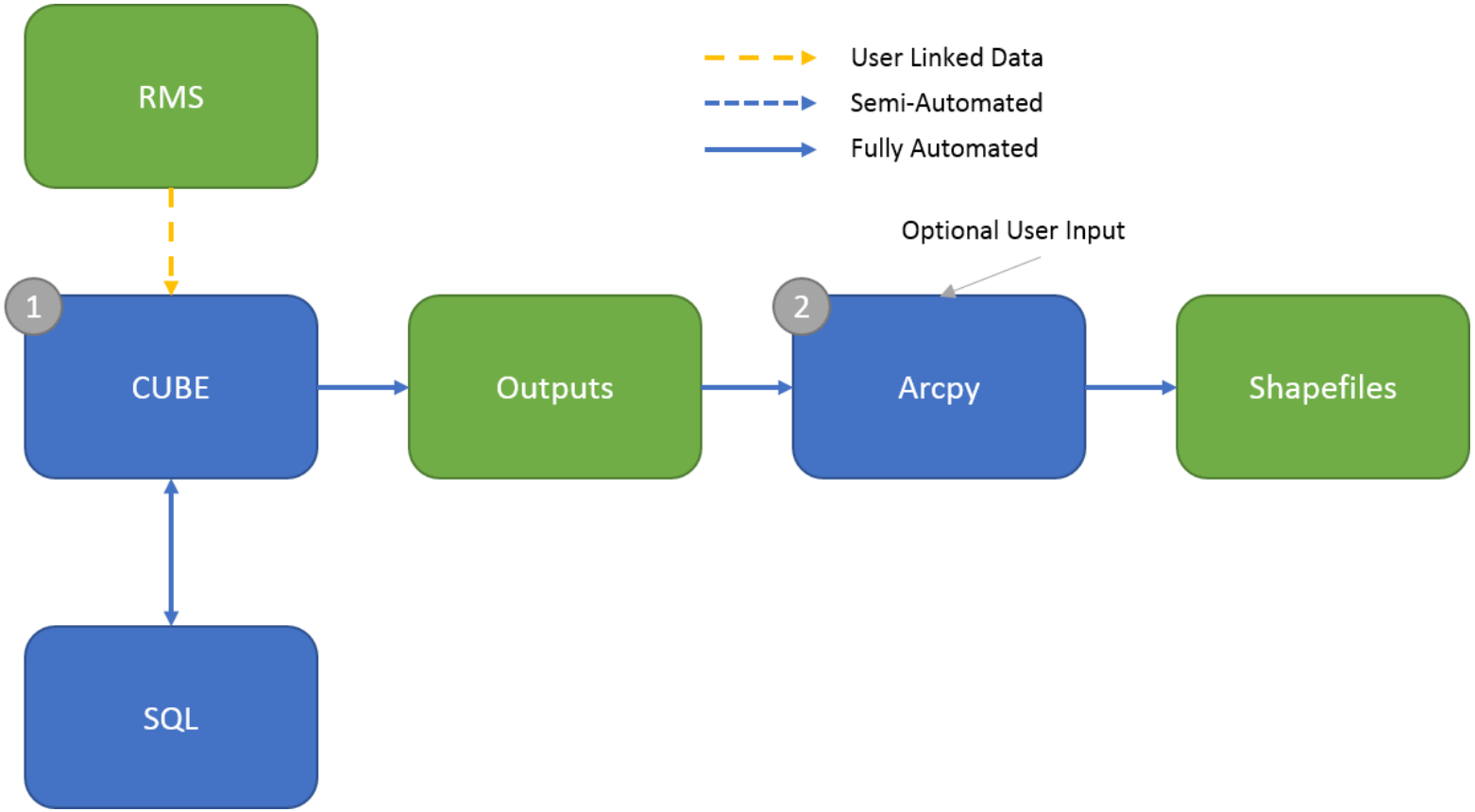


Figure 2.1 Overview of Environment Module Process

3 Before you Start

The latest version of the Environment Module is stored here;

NDFM:\04_Data\Appraisal Tools\Apprasial_Modules_Version_3\Environment

To run the Environment Module the following programs must be installed on the local machine;

CUBE Voyager V6.4 or above

SATURN 11.2.05 or 11.4.07H

ArcGIS 10.4 or earlier with ArcPy installed for CUBE 6.4.2

ArcGIS 10.6 or earlier with ArcPy installed for CUBE 6.4.4

Any version of ArcGIS with ArcPy installed for CUBE 6.4.5

In addition to this the network location \\nta-mod-slq-01\DataStore needs to be mapped to the Y: drive. In most cases this should be already set up but following machine rebuilds or patching the drive may become unmapped.

If editing an existing database with new parameters this will need to be done in SQL Server 11.0.0 or earlier to ensure compatibility with NTA-MOD-SQL-01.

SQL Server 11.0.0 or earlier

4 Parameters

The Environment Module v3 and onwards has the capability to read in user defined parameters for the following;

- Annualisation Factors
  - {Region}_Annualisation_Factors.csv
- Fleet Profile
  - Road_Type_Profiles.csv
  - ID_RoadType.csv – Reference Only
  - Fleet_Profile.csv – For advanced users
  - Fleet_ID_to_Veh_ID.csv – For advanced users
  - Fleet_ID – Reference Only
- Link Types
  - SFC_Ref_Table.csv
  - SFC_to_Link.csv
- User Classes
  - ID_User_Classes.csv
  - UC_to_Vehicle.csv

All default parameters can be found in the Master_Parameter_Sheet.xlsx included with the model. The sources of parameters are listed in this sheet.

4.1 Annualisation Factors

Annualisation factors included in the model are the default for each region, however these can be, and it is recommended, that these are updated with user defined values relevant to the scheme being tested.

4.2 Fleet Profile

Road_Type_Profiles.csv

The fleet profile input is a split of vehicle types by road type. The vehicle types and Fleet Split are defined in the table below;

ID	Vehicle Name
1	Electric Car
2	Petrol Car
3	Diesel Car
4	Electric LGV
5	Petrol LGV
6	Diesel LGV
7	Rigid HGV
8	Articulated HGV
9	PSV
10	Motorcycle
11	Taxi
12	LPG Car
13	LPG LGV
14	Urban Bus

15	Non-Urban Bus
16	Dublin Bus

ID	Fleet Split Name	Description (Current)
1	All (ROI)	Default Irish Fleet, includes UK Bus Fleet Split
2	ERM	Default Irish Fleet with Dublin Bus Fleet and Non-Urban Buses
3	Other Regions	Default Irish Fleet with Urban and Non-Urban bus fleet.
4	Motorway (ROI)	Default Irish Fleet
5	Rural (ROI)	Default Irish Fleet
6	Dublin City Centre (ROI)	Default Irish Fleet
7	Cork City Centre (ROI)	Default Irish Fleet
8	Galway City Centre (ROI)	Default Irish Fleet
9	Limerick City Centre (ROI)	Default Irish Fleet
10	Waterford City Centre (ROI)	Default Irish Fleet
11	User Spec	Default Irish Fleet

By default, only Fleet Split 1 is used in the Environment Module, however this can be changed by the user using 1 of two approaches;

- Changing the SFC_to_Link.csv table, mentioned in the next section, to define a Fleet Split for each speed flow curve/capacity index. This is most applicable to setting a fleet split for motorways.
- Using the Geo_ID in the input zone shape file, this is mentioned in a later section and can be used to define Fleet Split by geographic area.
- Both of the above, see section on Geo_ID.

Read Next Section if using Fleet Split 2 or 3

Fleet split 2 and 3 have been created to provide a base bus split using available data. These splits are divided into two to represent the significant difference in buses fleets in Dublin versus the other regional cities.

In order to use these fleet splits the Bus user classes must be assigned to the correct Vehicle type in the parameters folder. The instructions below explain this.

1. Open the file \Parameters\User_Classes\UC_to_Vehicle.csv
2. For User Class 11, assign the Vehicle Type as either Urban Bus (14) or Dublin Bus (16) depending on choice of Fleet. This is done by placing a 1 in the column “Lookup”.
3. For User Class 12, assign the Vehicle Type to Non-Urban Bus (15) using the same method as above.
4. Save the file and close. When the Environment Module runs it will now update the relevant stored tables to assign flows to the vehicle class chosen above.

Fleet_Profile.csv

This file contains the full 1213 Sub Vehicle fleet splits and determines the mix of fuel variants, euro standard and engine/weight sizes for each vehicle class. It is not advised this file be edited, however it is included as the split of Bus Fleet can only be adjusted within this file.

If you are unsure if you need to edit this file consider the following;

- As part of your project are you developing an alternative future fleet?
  - If **No** then you do not need to edit this file
- As part of your project do you have future fleet data at Euro Class and Weight Level?
  - If **No** then you do not need to edit this file
- Are you looking to adjust the mix of Petrol, Diesel and Other?
  - If **Yes** then do not edit this file, instead you will need to edit Road_Type_Profiles.csv
- Do you need to change the future bus fleet?
  - If **Yes** then you will need to edit this file for the relevant Vehicle Type.

DO NOT add extra lines to the Fleet_Profile.csv. If you need to define a new set of data contact the relevant email provided in this document.

4.3 Link Types

The inputs for Link Types are used to assign SFC/CI from the model to a road type. SFC_Ref_Table.csv contains the names of each SFC used in the Regional Models. The current SFC table runs from 1-1099, however 1000-1099 are reserved for the Geo_ID function.

SFC_to_Link.csv is used to set road type by SFC, with links with no SFC being defined as SFC = 0. By default, all inputs links are assigned to Road Type 1.

4.4 User Classes

The User Classes parameters files are used to define the User Classes and PCU factors for use in the Environment Module, as well as matching User Classes to Vehicle Type. The default values for these are set to work with the 10 UC regional models with two additional user classes for Urban Bus and Non-Urban Bus.

5 Geo_ID - Setting Fleet Split by Geographic Area

From version 3.2.2 of the Environment Module you can set the Fleet Split by Geographic location using a zone system. To do this the Geo_ID column of the ENEVAL RMS zone shapefile can be edited.

The Environment Module is set up to allow for 9 different geographic definitions and are, by default, directly linked to the 9 Fleet Splits (Road Types).

These Geo_IDs are applied by updating the SFC/CI of links in the ENEVAL input to match a range of assigned Link Types, 1000-1099, shown in the table below.

Geo_ID	Link ID	Description
0	1000-1009	Reserved for Links that could not be matched to a zone.
x	1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090	Not used
1	1011-1019	All (ROI) – Where the final digit denotes number of lanes.
2	1021-1029	Motorway (ROI) – Where the final digit denotes number of lanes.
3	1031-1039	Dublin City Centre (ROI) – Where the final digit denotes number of lanes.
4	1041-1049	Cork City Centre (ROI) – Where the final digit denotes number of lanes.
5	1051-1059	Galway City Centre (ROI) – Where the final digit denotes number of lanes.
6	1061-1069	Limerick City Centre (ROI) – Where the final digit denotes number of lanes.
7	1071-1079	Waterford City Centre (ROI) – Where the final digit denotes number of lanes.
8	1081-1089	Rural (ROI) – Where the final digit denotes number of lanes.
9	1091-1099	User Spec 1– Where the final digit denotes number of lanes.

6 CUBE Process (Process 1)

Figure 6.1 shows the main Cube view seen by the user when opening Cube with annotation describing the main sections.

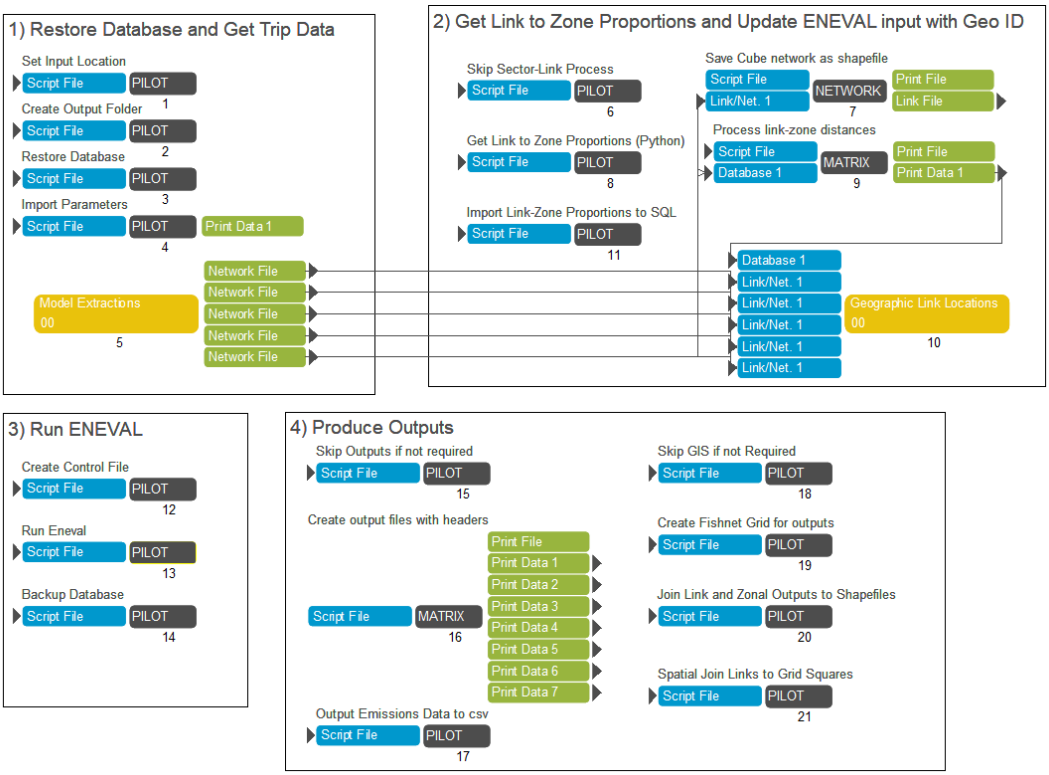


Figure 6.1 Cube process as seen by the user

PURPOSE 1

6.1 Process (Full Run with default ENEVAL values and no custom fishnet)

This step assumes you have checked that \\nta-mod-sql-01\DataStore is correctly mapped.

This process tree covers a full run of the Cube Process.

1) Copy down the latest version of the Environment Module from the network to the local C Drive.

2) Open Cube and allow it to update all file paths. (Figure 6.2)

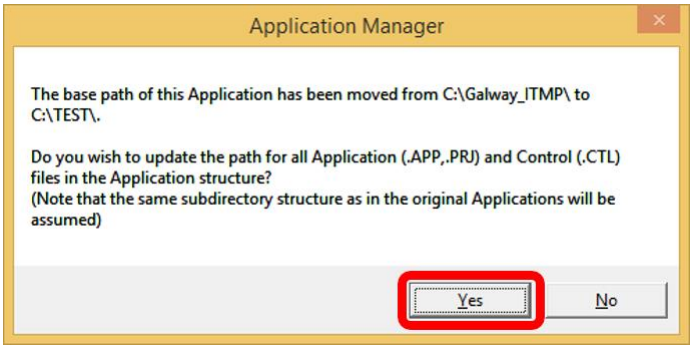


Figure 6.2 Cube prompt to update links

3) Create a new "child" under the correct regional model. This will create a new scenario with the regional model defaults included.
4) Open the new scenario key entry and complete the keys as shown below. Alternatively see Figure 5.5 to Figure 5.7 for a view of the key entries.

Key	Value to be Entered (Purpose 1)
Keys Page 1 (Figure 5.5**)**	
Region	ERM, WRM, SWRM, SERM, MWRM
Zones	1953 (ERM), 836 (WRM), 834 (SWRM), 654 (SERM), 650 (MWRM)
Run ID	Run ID
Model Year	Model Run Year (YY format)
Growth	Demand Scenario for Model Run
Input Version	Run ID version number – default is 0001
Run from Remote Location?	True if model run is stored in another folder location, including network locations.
Run Folder Location	Model Run Catalog Directory\Runs
Saturn Only Extraction?	No – This option lets the user run extractions using just a SATURN network
File Path for Zone Conversion File	Use 0 as blank value – this key is only required if Saturn only extraction is selected
SATURN Directory	Location of the SATURN XEXES folder
Python Executable Folder	Location of ArcGIS Python executable folder
Keys Page 2 (Figure 5.6**)**	
Number of Time Periods	Number based off list below; 1. AM 2. AM+LT 3. AM+LT+SR 4. AM+LT+SR+PM 5. AM+LT+SR+PM+OP
Database Version Template	V11_ROI_v9
File Chunk Size	ERM, SWRM, WRM – 10000 SERM, MWRM – 5000 If this value is larger than the total turn and link counts, then ENEVAL won't run
Link Types to Include	'0-1099'

Include Tyre and Break Emissions?	Will add emissions from tyre and break abrasion to results. Important if looking at Electric Vehicles.
Output emissions at the Fleet ID level	Outputs database by fleet ID, not recommended.
Options for Providing Link to Zone Proportion File	Calculate from Network
Zonal Shapefile	ENEVAL_National_Zone_System_v1_3_Dissolved
Zone Column Name	Column name for Zones. For default shape file; ERM – ERM_SeqZ WRM – WRM_SeqZ SERM – SERM_SeqZ SWRM – SWRM_SeqZ MWRM – MWRM_SeqZ
Link to Zone Proportion File	Dummy File: C:\ERM_link_proportions.csv
ProjectionFile	Cube_Network_Links_20150918
CIs to Exclude from Geo_ID	Any Capacity Indices entered here will retain their Cap Index for the purpose of matching fleet profiles. All other CIs will be matched to the Geo_ID defined in the Zonal Shape File. Can be entered in list format.
SQL Server Name	Nta-mod-sql-01
SQL Username	sa
SQL Password	nta
Keys Page 3 (Figure 5.7**)**	
Options for Outputs	GIS Shapefiles – CSV outputs and grid shape file
Use Existing Fishnet	No
Custom Fishnet Location	Dummy Value
Custom Fishnet Name	Dummy Value
Fishnet Grid Size	Set size for Fishnet, not recommended to go below 25.
Create National Fishnet	Creates a 1km grid for whole country

6.2 Checking (Purpose 1)

The following are checks that must be undertaken before moving onto the next section;

- Are you using the latest version of the tool taken from the network?
- Is \\nta-mod-sql-01\datastore mapped to Y:
- Does the zone number entered in the key match the number of zones in the model?
- Have you entered the correct name for the database?
- Have you unticked use existing Fishnet?
- Have you entered the correct version of ArcGIS?

Once these checks are complete press “Run” on the keys page. Output files will be found in the outputs folder under Appraisal Tools\Environment. For detail on outputs got to Section 5.

PURPOSE 2

6.3 Process (Full Run with default ENEVAL values and a custom fishnet)

This step assumes you have checked that \\nta-mod-sql-01\DataStore is correctly mapped.

This process tree covers a full run of the Cube Process and assumes that you have a custom fishnet ready to use. If you do not see section 6.1 on creating custom fishnets.

1) Copy down the latest version of the Environment Module from the network to the local C Drive.
2) Open Cube and allow it to update all file paths. (Figure 6.3)

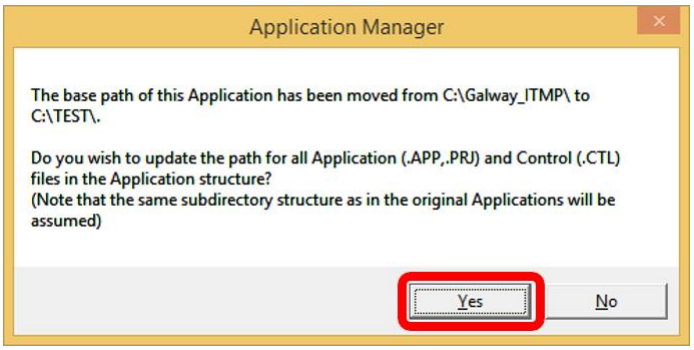


Figure 6.3 Cube prompt to update links

3) Create a new "child" under the correct regional model. This will create a new scenario with the regional model defaults included.
4) Open the new scenario key entry and complete the keys as shown below. Alternatively see Figure 5.5 to Figure 5.7 for a view of the key entries.

Key	Value to be Entered (Purpose 2)
Keys Page 1 (Figure 5.5**)**	
Region	ERM, WRM, SWRM, SERM, MWRM
Zones	1953 (ERM), 836 (WRM), 834 (SWRM), 654 (SERM), 650 (MWRM)
Run ID	Run ID
Model Year	Model Run Year (YY format)
Growth	Demand Scenario for Model Run
Input Version	Run ID version number – default is 0001
Run from Remote Location?	True if model run is stored in another folder location, including network locations.
Run Folder Location	Model Run Catalog Directory\Runs
SATURN Directory	Location of the SATURN XEXES folder
Python Executable Folder	Location of ArcGIS Python executable folder

Keys Page 2 (Figure 5.6)	
Number of Time Periods	Number based off list below; 1. AM 2. AM+LT 3. AM+LT+SR 4. AM+LT+SR+PM 5. AM+LT+SR+PM+OP
Database Version Template	V11_ROI_v9
File Chunk Size	ERM, SWRM, WRM – 10000 SERM, MWRM – 5000 If this value is larger than the total turn and link counts, then ENEVAL won't run
Link Types to Include	'0-1099'
Include Tyre and Break Emissions?	Will add emissions from tyre and break abrasion to results. Important if looking at Electric Vehicles.
Output emissions at the Fleet ID level	Outputs database by fleet ID, not recommended.
Options for Providing Link to Zone Proportion File	Calculate from Network
Zonal Shapefile	ENEVAL_National_Zone_System_v1_3_Dissolved
Zone Column Name	Column name for Zones. For default shape file; ERM – ERM_SeqZ WRM – WRM_SeqZ SERM – SERM_SeqZ SWRM – SWRM_SeqZ MWRM – MWRM_SeqZ
Link to Zone Proportion File	Dummy File: C:\ERM_link_proportions.csv
ProjectionFile	Cube_Network_Links_20150918
SQL Server Name	Nta-mod-sql-01
SQL Username	sa
SQL Password	nta
Keys Page 3 (Figure 5.7)	
Options for Outputs	GIS Shapefiles – CSV outputs and grid shape file
Use Existing Fishnet	Yes

Custom Fishnet Location	File path for custom grid system
Custom Fishnet Name	Custom grid system filename
Fishnet Grid Size	Dummy value – will no be used
Create National Fishnet	Creates a 1km grid for whole country

6.4 Checking (Purpose 2)

The following are checks that must be undertaken before moving onto the next section;

- Are you using the latest version of the tool taken from the network?
- Is \\nta-mod-sql-01\datastore mapped to Y:
- Does the zone number entered in the key match the number of zones in the model?
- Have you entered the correct name for the database?
- Have you ticked use existing Fishnet and entered the correct file path and name for the shape file?
- Have you entered the correct version of ArcGIS? – See Appendix A if using a non-compatible version of ArcGIS.

Once these checks are complete press "Run" on the keys page. Output files will be found in the outputs folder under Appraisal Tools\Environment. For detail on outputs got to Section 5.

PURPOSE 3

6.5 Process (Run with SATURN only network)

This step assumes you have checked that \\nta-mod-sql-01\DataStore is correctly mapped.

This process tree covers a full run of the Cube Process and assumes that you do not have a full RMS model, for example if using the DLAM or a Road Cordon of the RMS.

5) Copy down the latest version of the Environment Module from the network to the local C Drive.
6) Open Cube and allow it to update all file paths. (Figure 6.3)

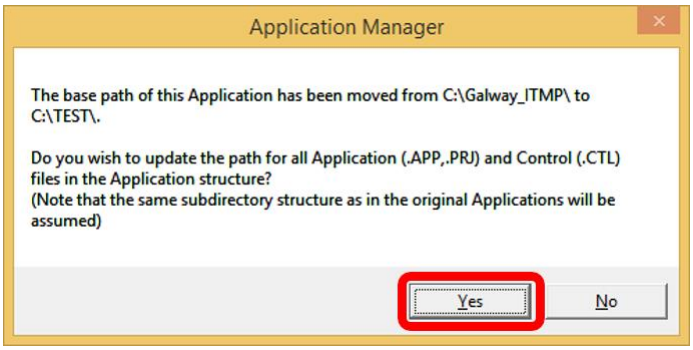


Figure 6.4 Cube prompt to update links

7) Create a new "child" under the correct regional model. This will create a new scenario with the regional model defaults included.
8) Open the new scenario key entry and complete the keys as shown below. Alternatively see Figure 5.5 to Figure 5.7 for a view of the key entries.

Key	Value to be Entered (Purpose 3)
Keys Page 1 (Figure 5.5**)**	
Region	DLAM or SATURN_Only
Zones	Number of Zones
Run ID	Run ID
Model Year	Model Run Year (YY format)
Growth	Demand Scenario for Model Run, needed to mimic RMS setup
Input Version	Run ID version number – default is 0001
Run from Remote Location?	False
Run Folder Location	Blank Value
Saturn Only Extraction?	Yes

File Path for Zone Conversion File	File path and file name of conversion file for Saturn zones to GIS zones.
SATURN Directory	Location of the SATURN XEXES folder
Python Executable Folder	Location of ArcGIS Python executable folder
Keys Page 2 (Figure 5.6**)**	
Number of Time Periods	Number based off list below; 6. AM 7. AM+LT 8. AM+LT+SR 9. AM+LT+SR+PM 10. AM+LT+SR+PM+OP
Database Version Template	V11_ROI_v9
File Chunk Size	1000
Link Types to Include	'0-1099'
Include Tyre and Break Emissions?	Will add emissions from tyre and break abrasion to results. Important if looking at Electric Vehicles.
Output emissions at the Fleet ID level	Outputs database by fleet ID, not recommended.
Options for Providing Link to Zone Proportion File	Calculate from Network
Zonal Shapefile	Provide a zone shape file from Cordon Model
Zone Column Name	Column name for Zones.
Link to Zone Proportion File	Dummy File: C:\ERM_link_proportions.csv
ProjectionFile	Cube_Network_Links_20150918
CIs to Exclude from Geo_ID	Any Capacity Indices entered here will retain their Cap Index for the purpose of matching fleet profiles. All other CIs will be matched to the Geo_ID defined in the Zonal Shape File. Can be entered in list format.
SQL Server Name	Nta-mod-sql-01
SQL Username	sa
SQL Password	nta
Keys Page 3 (Figure 5.7**)**	

Options for Outputs	GIS Shapefiles – CSV outputs and grid shape file
Use Existing Fishnet	Yes
Custom Fishnet Location	File path for custom grid system
Custom Fishnet Name	Custom grid system filename
Fishnet Grid Size	Dummy value – will no be used
Create National Fishnet	Creates a 1km grid for whole country

6.6 Checking (Purpose 3)

The following are checks that must be undertaken before moving onto the next section;

- Are you using the latest version of the tool taken from the network?
- Is \\nta-mod-sql-01\datastore mapped to Y:
- Does the zone number entered in the key match the number of zones in the model?
- Have you entered the correct name for the database?
- Have you ticked use SATURN_Only run?
- Have you entered the correct version of ArcGIS?

DO NOT press Run after completing checks.

6.7 Running the correct processes (Purpose 3)

1) Run Step 2 of the CUBE application – Create Output Folder
2) Copy the SATURN UFS files into the correct sub folders and rename them to match the RMS; *{TP}_{Run ID}{Growth}{Model Year}.ufs*
3) Run the Environment Module

Output files will be found in the outputs folder under Appraisal Tools\Environment. For detail on outputs got to Section 5.

PURPOSE 4

6.8 Process (Rerunning GIS outputs with pre-existing outputs)

This step assumes you have checked that \\nta-mod-sql-01\DataStore is correctly mapped and that would have an ENEVAL compatible database with outputs.

This process tree covers a partial run of the Cube Process and assumes that if you plan to use a custom fishnet it is already created ready to use. If you do not see section 6.1 on creating custom fishnets.

1) Copy the database you wish to retract data from to Y:\ENEVAL_v3.1.2\ModelFiles\DbfTemplates
2) Rename your database to be 'ENEVAL_{Your database name}'
3) Copy down the latest version of the Environment Module from the network to the local C Drive.
4) Open Cube and allow it to update all file paths. (Figure 6.5)

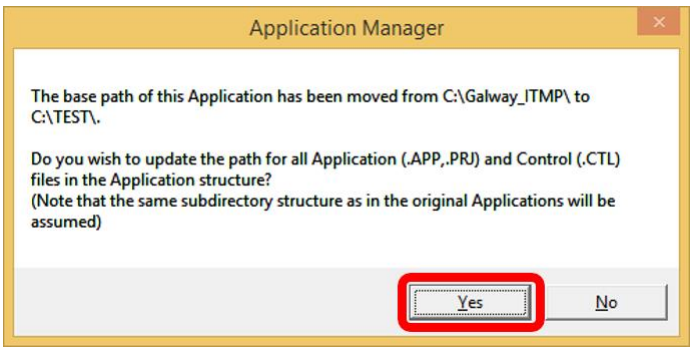


Figure 6.5 Cube prompt to update links

5) Create a new "child" under the correct regional model. This will create a new scenario with the regional model defaults included.
6) Open the new scenario key entry and complete the keys as shown below. Alternatively see Figure 5.5 to Figure 5.7 for a view of the key entries.

Key	Value to be Entered (Purpose 4)
Keys Page 1 (Figure 5.5**)**	
Region	ERM, WRM, SWRM, SERM, MWRM
Zones	1953 (ERM), 836 (WRM), 834 (SWRM), 654 (SERM), 650 (MWRM)
Run ID	Run ID
Model Year	Model Run Year (YY format)
Growth	Demand Scenario for Model Run
Input Version	Input version of RMS Model
Run from Remote Location?	True if model run is stored in another folder location, including network locations.

Run Folder Location	Model Run Catalog Directory\Runs
SATURN Directory	Location of the SATURN XEXES folder
Python Executable Folder	Location of ArcGIS Python executable folder
Keys Page 2 (Figure 5.6**)**	
Number of Time Periods	Number based off list below; 1. AM 2. AM+LT 3. AM+LT+SR 4. AM+LT+SR+PM 5. AM+LT+SR+PM+OP
Database Version Template	{Your database name}
File Chunk Size	ERM, SWRM, WRM – 10000 SERM, MWRM – 5000 If this value is larger than the total turn and link counts, then ENEVAL won't run
Link Types to Include	'0-1099'
Include Tyre and Break Emissions?	Will add emissions from tyre and break abrasion to results. Important if looking at Electric Vehicles.
Output emissions at the Fleet ID level	Outputs database by fleet ID, not recommended.
Options for Providing Link to Zone Proportion File	Calculate from Network
Zonal Shapefile	ENEVAL_National_Zone_System_v1_3_Dissolved
Zone Column Name	Column name for Zones. For default shape file; ERM – ERM_SeqZ WRM – WRM_SeqZ SERM – SERM_SeqZ SWRM – SWRM_SeqZ MWRM – MWRM_SeqZ
Link to Zone Proportion File	Dummy File: C:\ERM_link_proportions.csv
ProjectionFile	Cube_Network_Links_20150918
SQL Server Name	Nta-mod-sql-01
SQL Username	sa
SQL Password	nta

Keys Page 3 (Figure 5.7)	
Options for Outputs	GIS Shapefiles – CSV outputs and grid shape file
Use Existing Fishnet	Yes/No
Custom Fishnet Location	If yes for last step then put file path of custom grid system here
Custom Fishnet Name	Filename of custom grid system
Fishnet Grid Size	Set size for Fishnet, not recommended to go below 25.
Create National Fishnet	Creates a 1km grid for whole country

6.9 Checking (Purpose 3)

The following are checks that must be undertaken before moving onto the next section;

- Are you using the latest version of the tool taken from the network?
- Is \\nta-mod-sql-01\datastore mapped to Y:
- Does the zone number entered in the key match the number of zones in the model?
- Is your database in the DBFTemplates folder on nta-mod-sql-01?
- Have you entered the correct name for your database?
- Have you ticked use existing Fishnet and entered the correct file path and name for the shape fle?
- Have you entered the correct version of ArcGIS?

DO NOT press Run after completing checks.

6.10 Running the correct processes (Purpose 4)

7) Run Step 2 of the CUBE application – Create Output Folder
8) Run Step 3 of the CUBE application - Restore Database
9) Run Steps 15 – 20 of the CUBE Application – Produce Outputs

If you run Step 12 this will create a blank database with the project name. Outputs from this will be blank.

Output files will be found in the outputs folder under Appraisal Tools\Environment. For detail on outputs got to Section 5.

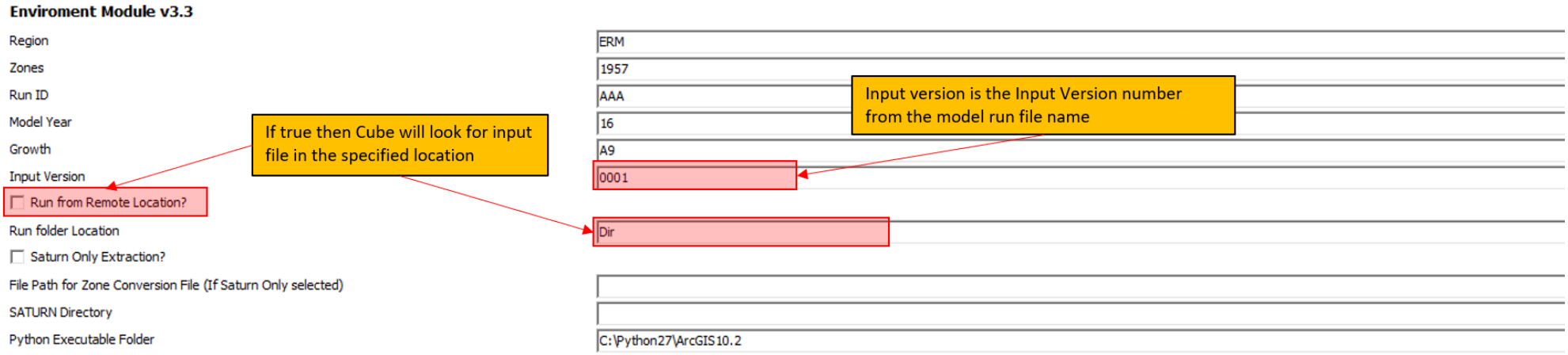
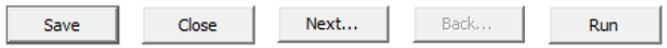


Figure 6.6 Cube Keys Page 1



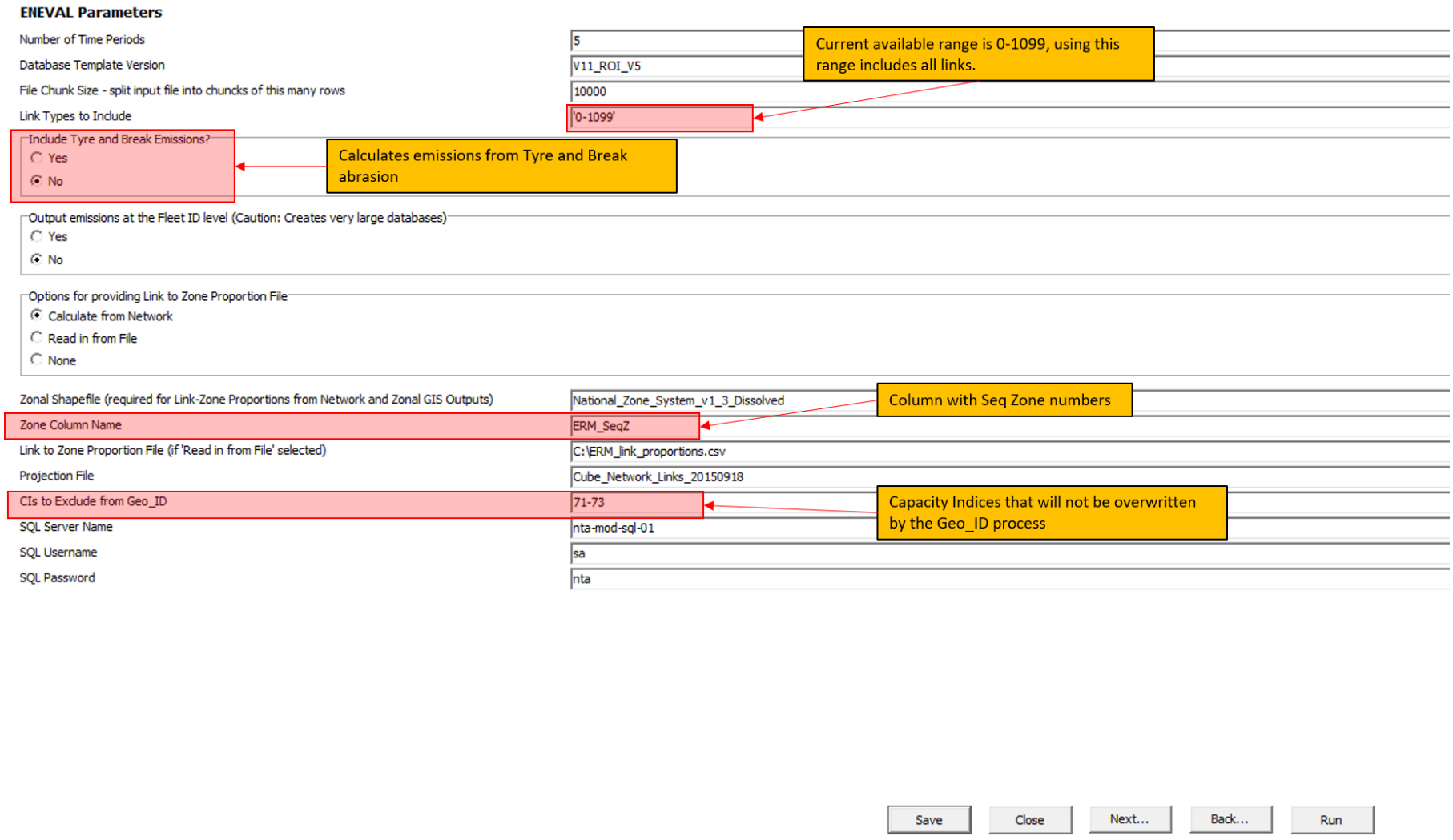


Figure 6.7 Cube Keys Page 2

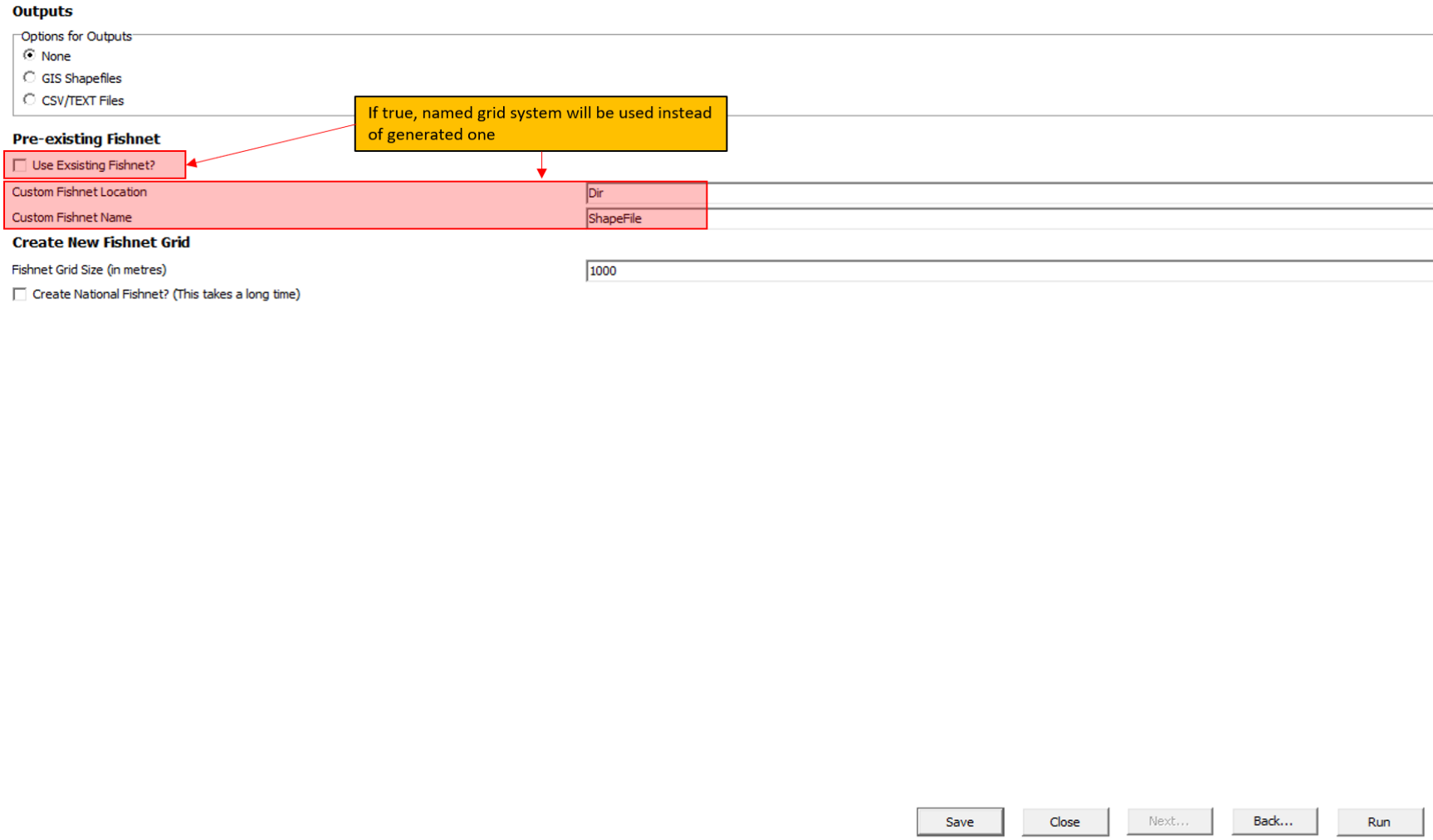


Figure 6.8 Cube Keys Page 3

7 Outputs

7.1 Output Text Files

This step will run automatically if GIS or TXT outputs are requested.

This section is intended to offer a guide to the variety of outputs produced by the ENEVAL tool. This section does not cover GIS outputs, they are covered in Section 5.2. ENEVAL will produce seven csv output files as shown in table 5.1 below;

Table 7.1 Text Outputs from ENEVAL

File Name	Annualised	Notes
{RMS}_{RunID}{Growth}{Year}_EmissionsSummary	No	Summary of emissions by Time Period and User Class
{RMS}_{RunID}{Growth}{Year}_OutputsByJtn	Yes	Outputs by B node aggregated for all User Classes and Time Periods
{RMS}_{RunID}{Growth}{Year}_OutputsByLink	Yes	Outputs by A-B node aggregated for all User Classes and Time Periods
{RMS}_{RunID}{Growth}{Year}_OutputsByLink_VehClass.csv	Yes	Outputs by A-B node aggregated by Vehicle Class.
{RMS}_{RunID}{Growth}{Year}_ OutputsByLinkType	Yes	Outputs by Link Type aggregated across all Time Periods and User Classes
{RMS}_{RunID}{Growth}{Year}_OutputsByZone	Yes	Outputs by Zone aggregated for all User Classes and Time Periods
{RMS}_{RunID}{Growth}{Year}_VehKmsSummary	No	Summary of vehicle kms by Time Period and User Class

Each CSV will contain emissions outputs for ten different emissions, these are listed in Table 7.2 below;

Table 7.2 Emissions included in output tables

Number	SQL Label	Chemical Name	Long Name	Area of Impact
1	NOX	NO_x	Oxides of Nitrogen	Regional
2	NO2	NO_2	Nitrogen Dioxide	Regional
3	PM10	PM_{10}	Particulate Matter	Local
4	PM25	$PM_{2.5}$	Fine Particulate Matter	Local
5	HC	HC	Hydro-Carbons	Local
6	CO	CO	Carbon Monoxide	Local
7	CO2	CO_2	Carbon Dioxide	Global
8	Benz	C_6H_6	Benzene	Regional
9	Meth	CH_4	Methane	Global
10	Butad	C_4H_6	1,3-Butadiene	Local

All emissions outputs are in grams.

Table 7.2 above categorises the emissions by their area of impact, these areas of impact are as follows;

- Local – These emissions are the most damaging to health and directly affect those in close proximity to the emissions source. The impact of these emissions are usually felt more strongly in built up urban areas where they take longer to dissipate.
- Regional – These emissions have the greatest impact on the meteorological region they are produced in as they react with, and are dispersed by weather systems. These emissions are producers of smog and acid rain.
- Global – These emissions have a global impact in the form of global warming. It generally is less important as to where these emissions are generated as they will disperse evenly across the globe.

7.2 Output GIS Files

This step will run automatically if GIS outputs are requested.

This section is intended to offer a guide to the variety of outputs produced by the ENEVAL tool. This section covers GIS outputs. ENEVAL will produce 4 sets of shape file output files as shown in Table 7.3 below;

Table 7.3 GIS Outputs from GIS Process

File Name	Notes
{RMS}_{RunID}_Outputs_{FishnetSize}Grid	Outputs for generated fishnet if selected by user.
{RMS}_{RunID}_Outputs_CustomGrid	Outputs for user defined fishnet if specified by user.
{RMS}_{RunID}_Outputs_NatGrid	Outputs for National 1km^2 grid if specified by user.
{RMS}_{RunID}_Outputs_Links	Outputs joined to link.

8 Additional Information

8.1 Fishnets/Grid Systems

Fishnets are another word for grids that are used in the GIS process. Using fishnets allows emissions to be mapped in equal size grids across an area. Figure 8.1 shows an example of the fishnet process.

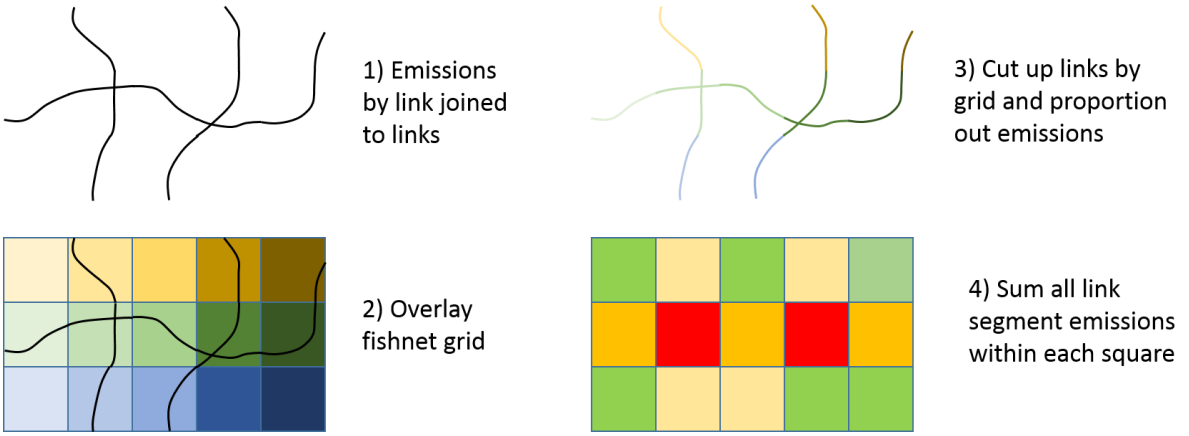


Figure 8.1 Example of Fishnet Process

The advantage of using fishnets over mapping only link emissions levels is that it provides an emission density map, per X m^2 or X km^2. An emission density map is more useful for the analysis of emissions production that link emissions as emissions by nature are not constrained to a single link.

8.2 Custom Fishnet Grids

A custom fishnet grid for use in the Economic Module can be created following the steps outlined below;

1) Open ArcGIS
2) Identify the study area using OpenStreetMap
3) Create a layer that covers your study area. Alternatively, if you have a fishnet for a larger area you can select the grids that represent the area you wish to cover with the new fishnet. The advantage of this is that the new fish net, if made to the correct size, will align with the larger fishnet.
4) Open the tool 'Create Fishnet' from the ArcGIS toolbox and fill in as per Figure 8.2 below.

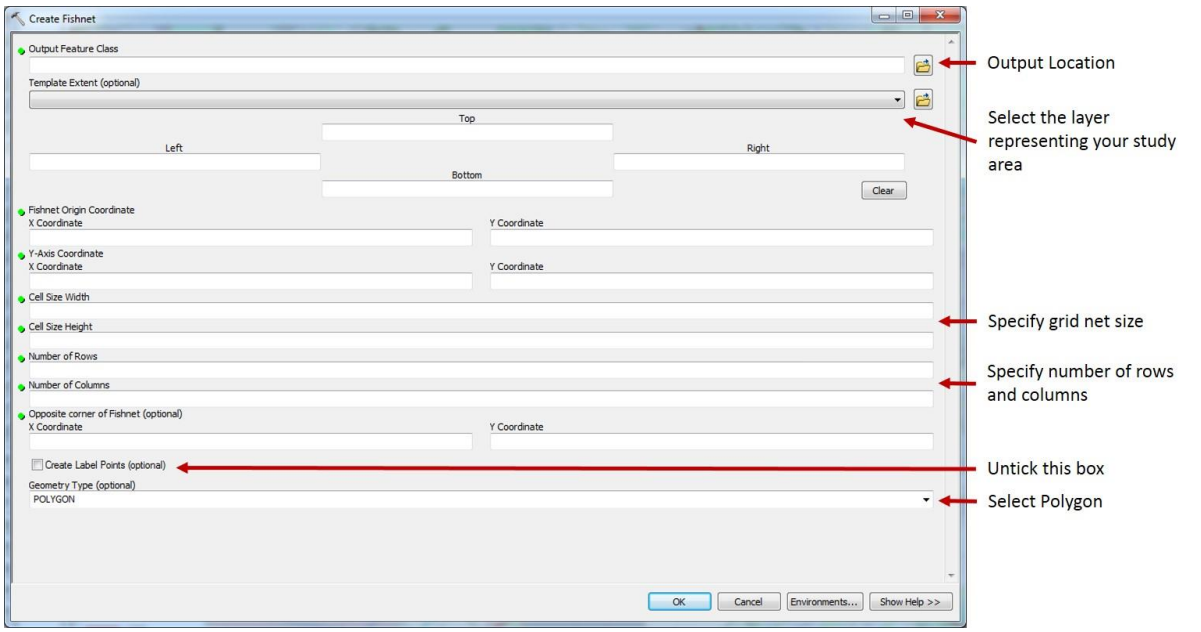


Figure 8.2 Create Fishnet tool in ArcGIS

5) Close ArcGIS
6) Return to Section 4.3 (Running the Cube Process with a custom fishnet) or 4.4 (Reproducing outputs with an existing database).

8.3 Full Keys Table with Descriptions

Key	Value to be Entered
Keys Page 1 (Figure 5.5**)**	
Region	ERM, WRM, SWRM, SERM, MWRM
Zones	1953 (ERM), 836 (WRM), 834 (SWRM), 654 (SERM), 650 (MWRM)
Run ID	Run ID
Model Year	Model Run Year (YY format)
Growth	Demand Scenario for Model Run
Input Version	Input version of RMS Model
Run from Remote Location?	True if model run is stored in another folder location, including network locations.
Run Folder Location	Model Run Catalog Directory\Runs
SATURN Directory	Location of the SATURN XEXES folder
Python Executable Folder	Location of ArcGIS Python executable folder
Keys Page 2 (Figure 5.6**)**	

Number of Time Periods	Number based off list below; 1. AM 2. AM+LT 3. AM+LT+SR 4. AM+LT+SR+PM 5. AM+LT+SR+PM+OP
Database Version Template	Version of the database to be used in the ENEVAL assessment.
File Chunk Size	ERM, SWRM, WRM – 10000 SERM, MWRM – 5000 If this value is larger than the total turn and link counts, then ENEVAL won't run.
Link Types to Include	Any link types not included in this list will be excluded from the assessment. This can be used to exclude some geographic areas by using the CI 1000-1099.
Include Turns?	Option to calculate Emissions by Turn as well as by link. GIS and Zonal results are always by link. Recommended this is set to 'No'.
Include Tyre and Break Emissions?	Will add emissions from tyre and break abrasion to results. Important if looking at Electric Vehicles.
Output emissions at the Fleet ID level	Outputs database by fleet ID, not recommended.
Options for Providing Link to Zone Proportion File	Calculate from Network – Will use PT .net file to get input network. Read in from File – Will read Link to Zone proportions from CSV None – No Zonal results created
Zonal Shapefile	Shape file containing the relevant zone system, must have a zone column and a column called Geo_ID.
Zone Column Name	Column name for Zones. For default shape file; ERM – ERM_SeqZ WRM – WRM_SeqZ SERM – SERM_SeqZ SWRM – SWRM_SeqZ MWRM – MWRM_SeqZ
Link to Zone Proportion File	File path and file name of Link to Zone proportion file if required.

ProjectionFile	Spatial Reference File - Cube_Network_Links_20150918
SQL Server Name	Name of Server. For NTA server is *Nta-mod-sql-01*
SQL Username	Username for SQL server. For NTA username is *sa*
SQL Password	Password for specified account. For NTA password is *nta*
Options for Providing Link to Zone Proportion File	Calculate from Network
Keys Page 3 (Figure 5.7**)**	
Options for Outputs	None – ENEVAL will run but no outputs will be generated GIS Shapefiles – CSV outputs and grid shape file CSV/Text Files – CSV outputs only (Quicker)
Use Existing Fishnet	Allows user to identify a pre-existing grid system for GIS outputs.
Custom Fishnet Location	Filepath for user specified grid system
Custom Fishnet Name	File name of custom grid system
Fishnet Grid Size	If not custom fishnet Environment Module will generate a fishnet to the size specified here. Recommended not to go below 25
Create National Fishnet	Creates a 1km grid for whole country

8.4 Running with an incompatible version of ArcGIS

If you do not have the correct version of ArcGIS installed, you will need to produce a link to zone proportion file in order to get results by zone. You will also need to provide shapefile of the network in order to produce GIS outputs.

This zone proportion can be calculated from ArcGIS or QGIS using an approach similar to the description of fishnets/grids above with Zones instead of grids.

The file for input into the Environment Module must be in the format;

A Node	B Node	Zone	Proportion

In order to run the GIS outputs a copy of the links shapefile needs to be placed in;

{CATALOG_DIR}\Runs\{Region}\{Model Year}\{Run ID}\4_Outputs_{Region}_{Model Year}_{Growth}_{Run ID}_Input_v{Input Version}\Appraisal_Tools\ENEVAL\

And all relevant files renamed to: {Region}_Network

8.5 Running for a year after 2050

ENEVAL only has data for future fleets to 2050, if a model run needs to be tested for post-2050 then the user must manually adjust the control file to force ENEVAL to use 2050 fleet splits. As data does not exist for a future fleet at present it should be assumed that the 2050 fleet remains static moving beyond 2050.

The following steps should be followed to manually override the year in ENEVAL.

1. Disable step 13 – Run ENEVAL
2. Choose the option to produce no outputs
3. Run the module
4. Once complete open the control file in a text editor, the control file is stored here;
5. Edit line 24 of the Control file to year 2050. Save and Close.
   {CATALOG_DIR}\Runs\{Region}\{Model Year}\{Run ID}\4_Outputs_{Region}_{Model Year}_{Growth}_{Run ID}_Input_v{Input Version}\Appraisal_Tools\ENEVAL\ENEVAL.ctl
6. Run step 13 – Run ENEVAL
7. Run any outputs steps required.

9 Troubleshooting

The machine capable of running the environment module are shown below. If you are encountering a problem please ensure you are using one of the machines that supports the Environment Module.

NTA-Mod-01	NTA-Mod-02	NTA-Mod-03	NTA-Mod-04	NTA-Mod-05	NTA-Mod-06	NTA-Mod-07	NTA-Mod-08	NTA-Mod-09	NTA-Mod-10	UAT1	UAT2	AWS
×	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×

In all cases the print files, .prn for CUBE and .prn in the ENEVAL output folder for ENEVAL, will provide the best clues as to why the run has not worked.

PROBLEM SOFTWARE	PROBLEM	SOLUTION
CUBE	ENEVAL completes within a few minutes	Database did not restore. Either \\nta-mod-sql-01\datastore has not been mapped to Y: or the database name is incorrect.
CUBE	Step 9 crashes with missing files	Check version of ArcGIS entered in keys is correct.
CUBE	No Summary Outputs table	Ensure that the database version being used is V3 or later
Outputs	Summary output table does not match sum of zonal or links emissions	Summary outputs are not annualised while zonal and link emissions are.
Outputs	No Zonal Emissions	Ensure 'Options for Providing Link to Zone Proportion File' is set to 'Calculate from Network'

If the problem cannot be resolved from the print files or troubleshooting table please email ntamodel@nationaltransport.ie to get technical support.

If you have any feedback on the NTA Toolkit operation or documentation please also contact the above.