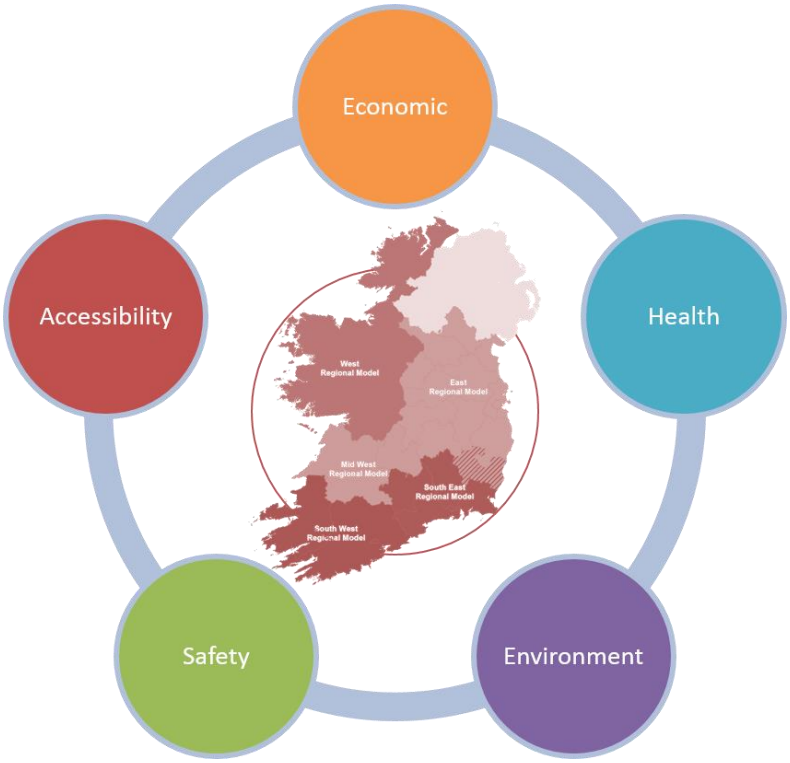
Údarás Náisiúnta Iompair
National Transport Authority



Health Module

User Guide

March 2021 (v3.1.2)

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Foreword

This document is designed to guide both new and experienced users through the main processes of the Health Module as part 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 Health Module Development Report and Version Control Log.

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

1 Introduction

1.1 Background

The Health Appraisal Module forms part of the NTA's Appraisal Toolkit, which has been built for efficient manipulation of regional model outputs that will support strategy development, assessment and scheme appraisal.

This document is designed to guide both new and experienced users through the Health Module of the NTA's Appraisal Toolkit. This document is split into sections that each describe an element of the process. The process is described below and where relevant the user is directed to the relevant section of the user guide. Note this tool and User Guide have been designed and developed for the V3 RMS models.

For more detailed information on the module please see the Health Module Development Report and Version Control Log.

1.2 Overview of the Module

An increase in levels of physical activity can reduce the risk of premature death from illness. Furthermore, absenteeism due to illness has been found empirically to decline when more people walk or cycle. This reduction in the number of sick days provides a benefit to the economy. The monetisation of this is based on increased output resulting from a reduction in absenteeism.

The Health Module outlined in this note provides the basis for calculating the health benefits of changes in the demand for active modes (walking and cycling). The tool concentrates on monetising the impact of physical activity on premature death and absenteeism, resulting from changes in the levels of walking and/or cycling. The tools that it employs are Cube Voyager and Microsoft Excel.

The Cube Voyager element aggregates transport model outputs to 24 hours and calculates the average walking and cycling times and distances which are then used in the Excel spreadsheet. Currently end to end active mode trips are included in this process with walk leg of public transport mode trips included.

The Excel spreadsheet monetises these impacts based on the relative number of lives saved as suggested in the HEAT Tool developed by the World Health Organisation (WHO) and reduction in absenteeism as suggested in the Active Travel 'toolkit' developed by the Department for Transport (DfT) (UK).

1.3 Components of the Process

Figure 1.1 shows the process and the interactions between each element. Orange boxes represent Regional Modelling System (RMS) outputs required, the processes (Cube and Excel) are shown in the blue boxes, whilst the outputs from these shown in the green boxes.

RMS Outputs

To run the Health Module a complete RMS model run is required. The modelling inputs required to run the Health Module are trip matrices and time / distance skims for active modes and walk leg of PT trips. These are listed in detail in Appendix A.

Cube Process

The Cube element of the tool aggregates the active mode model and the walking portion of PT trips and outputs them into 24-hour demand and then calculates the average walking and cycling times and distances, with the user required to enter parameters in the Catalog Keys, which informs the model parameters when running the Cube application.

An overview of the Cube process and its components are described in **Sections 2.1**, whilst the Cube application process can be found in **Section 2.2**.

Outputs from Cube

The outputs created from the Cube process are the 24-hour demand matrix and a weighted average time / distance print file, which are required as inputs to the Excel process. These are listed in detail in Appendix B.

Excel Process

The Excel element of the tool is automated to run within the Cube application, which monetises the impacts, and is described in Section 3.

1.4 Before you Start

The latest version of the Health Module is stored here:

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

The 0_Version_Control subfolder contains the Version Control Log.

The 1_ Program subfolder contains the Module files for the latest version.

To run the Health Module the following programs must be installed on your local machine:

Microsoft Excel – macros need to be enabled

CUBE Voyager V6 or above

The folder structure and required files to run this tool are shown in Appendix A.

1.5 Troubleshooting

A troubleshooting guide has been included listing common issues when running the Health Tool. This list will be kept up to date with new issues, and is found in Section 4.

1.6 Contents

This document is structured by the different elements in the process, as shown in figure 1.1. These are broken down as follows:

Section 1 – Location of Health module, required programmes and macro settings

Section 2 - CUBE Process

Section 3 - Excel Process

Section 4 - Troubleshooting

Appendix A – Input from RMS

Appendix B – Inputs to Excel Process

Appendix C – Module Parameters

Appendix D – Model machine matrix

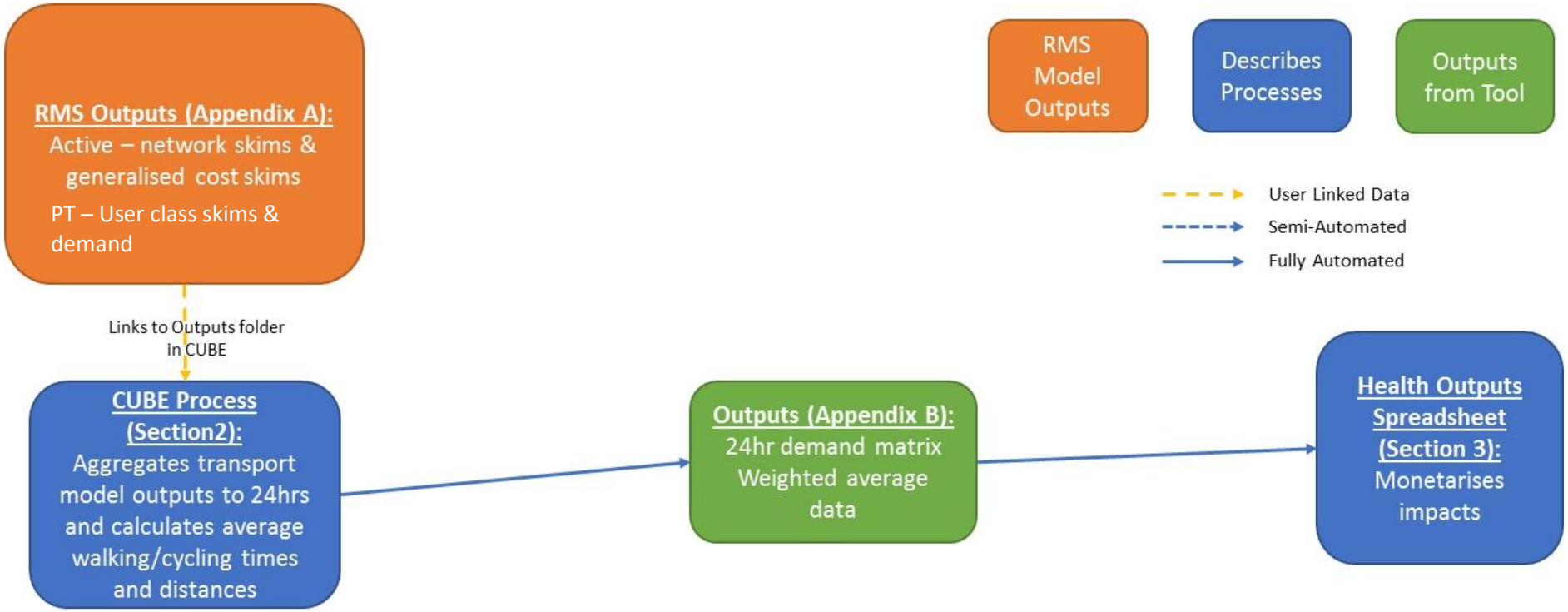


Figure 1.1: Overview of Health Process

2 CUBE Process

2.1 Overview

User Input

The required user input to the Cube process are the catalog key values that determine the model run scenarios for the Base/Do Minimum and Do Something. After selecting the appropriate catalogue key values, the user then runs the overall Cube application. The components of this Cube application are described below (Section 2.1).

This is followed by a step by step process of how to run the Cube Voyager element of the Health Module (see Section 2.2). These steps include opening the Cube catalog, creating a new scenario, the Cube catalog keys and running the Cube application.

There is an input file that is used to aggregate demand into 24hr demand. This demand is in the form of a matrix, with an entry per time period. This should be adjusted by the user if necessary. This file is described further in appendix C.

Cube Application Components

There are eighteen sub-application components (see Figure 2.2) that run as part of the Cube application process:

- **Create Output Folder:** The first sub-application is a PILOT box that creates the directories for storing the outputs.
- **Running Model Remotely:** The 2nd sub-application checks if the 'Run Model from Network' catalog key is checked and changes the catalog directory as per the user input in the catalog keys
- **Demand Aggregation to 24hr:** The 3rd sub-application reads in the generalised cost skims and aggregates to 24 hours for the Base/Do Minimum scenario.
- **PT UC Aggregation:** The 4th/5th/6th sub-applications are used to bypass the CUBE limit of 25 input files, and aggregate all the skims into 5 matrices per UC.
- **PT UC Aggregation:** The 7th sub-application reads in the demand and skims for the PT UCs and outputs the appropriate demand and time/distance averages for the PT trips.
- **Demand Aggregation to 24hr:** The 8rd sub-application reads in the generalised cost skims and aggregates to 24 hours for the Base/Do Minimum scenario.
- **User Classes Time and Distance Averages:** The 9th sub-application reads in the network skims and calculates the weighted average walking and cycling times and distances by user class for the Base/Do Minimum scenario.
- **PT UC Aggregation:** The 10th sub-application takes the Active and PT demand and averages and combines them into one output file.
- **PT UC Aggregation:** The 11th/12th/13th sub-applications are used to bypass the CUBE limit of 25 input files and aggregate all the skims into 5 matrices per UC.
- **PT UC Aggregation:** The 14th sub-application reads in the demand and skims for the PT UCs and outputs the appropriate demand and time/distance averages for the PT trips.
- **Demand Aggregation to 24hr:** The 15th sub-application reads in the generalised cost skims and aggregates to 24 hours for the Do Something scenario.
- **User Classes Time and Distance Averages:** The 16th sub-application reads in the network skims and calculates the weighted average walking and cycling times and distances by user class for the Do Something scenario.

- **PT UC Aggregation:** The 17th sub-application takes the Active and PT demand and averages and combines them into one output file.
- **Health Outputs:** The 18th sub-application launches the Health Appraisal Tool and reads the outputs created from the Cube process according to whether an Active/PT/Combined run was chosen.

2.2 Running the Cube Application (Step by Step instructions)

This section describes how the user runs the Cube application elements of the Health Tool.

1) Open up the Cube Voyager catalog – Health_Tool.Cat

2) Allow it to update all file paths if required (Figure 2.1)

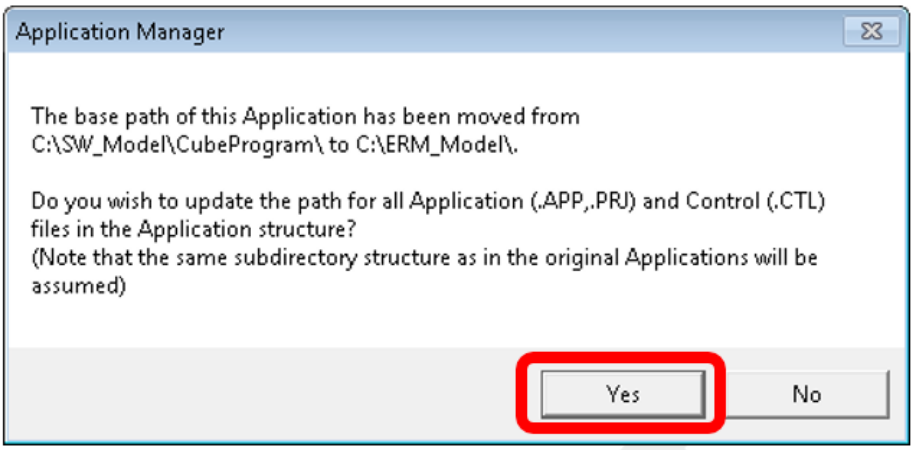


Figure 2.1: Cube prompt to update links

The main Cube interface, which is seen by the user is presented in Figure 2.2.

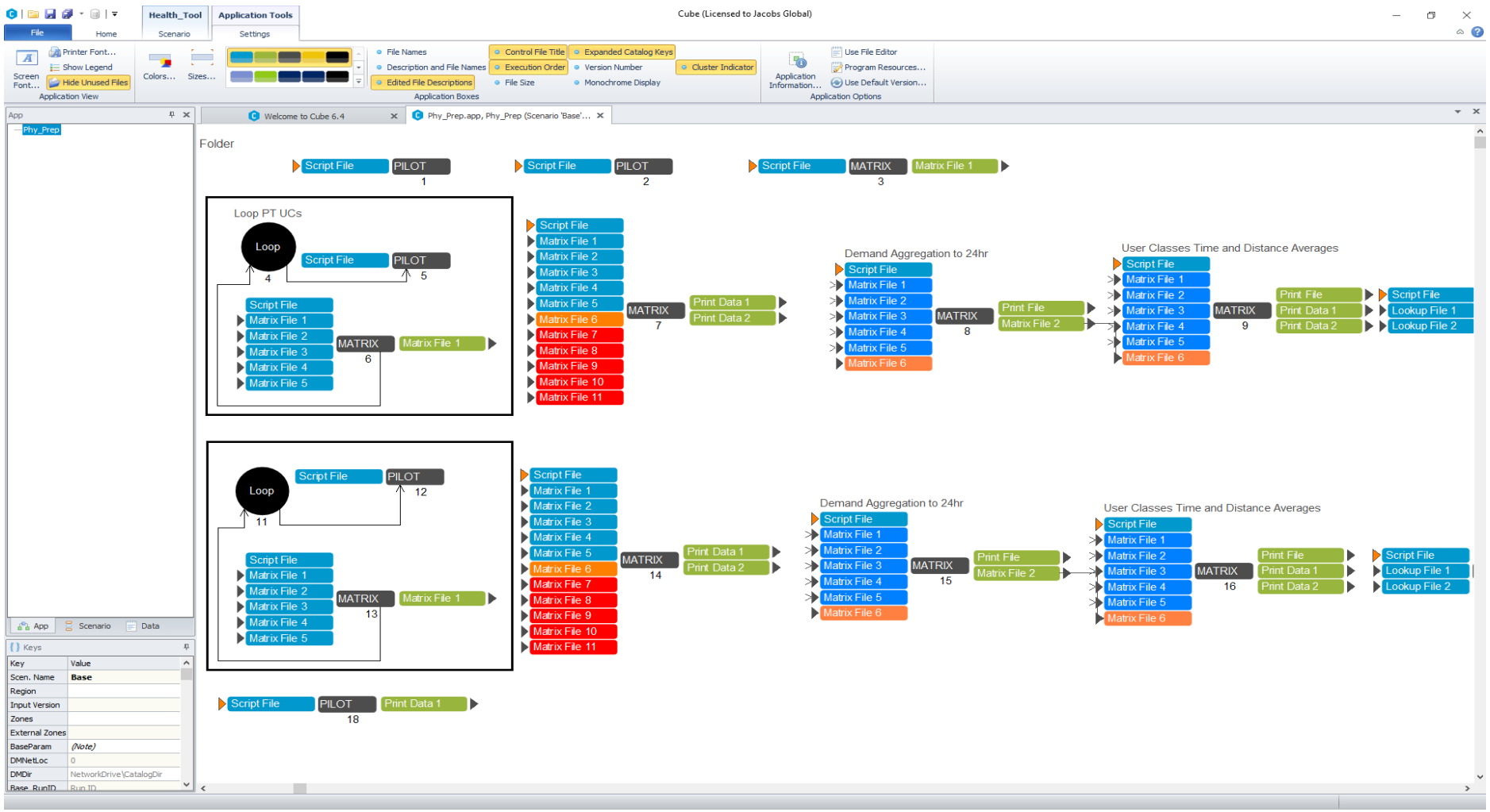


Figure 2.2: Cube process

For each model scenario that requires analysis, a "child" needs to be created, which is then run through the Cube process.

3) On the main user interface (as shown in Figure 2.2), within the columns on the left-hand side, in the Scenario section, right click on the appropriate regional model, and click "Add Child" (Figure 2.3)

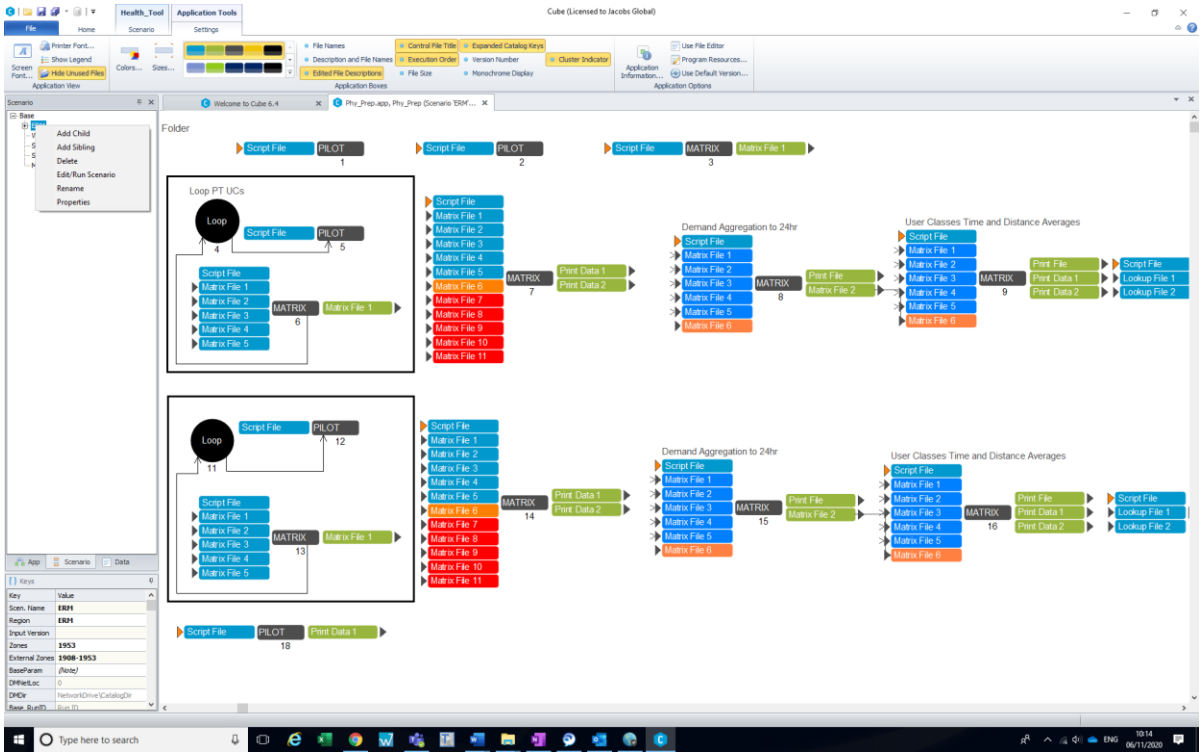


Figure 2.3: Add Child

4) Enter the model name of the scenario and any other key information to identify the scenario (such as forecast year or growth) (Figure 2.4).

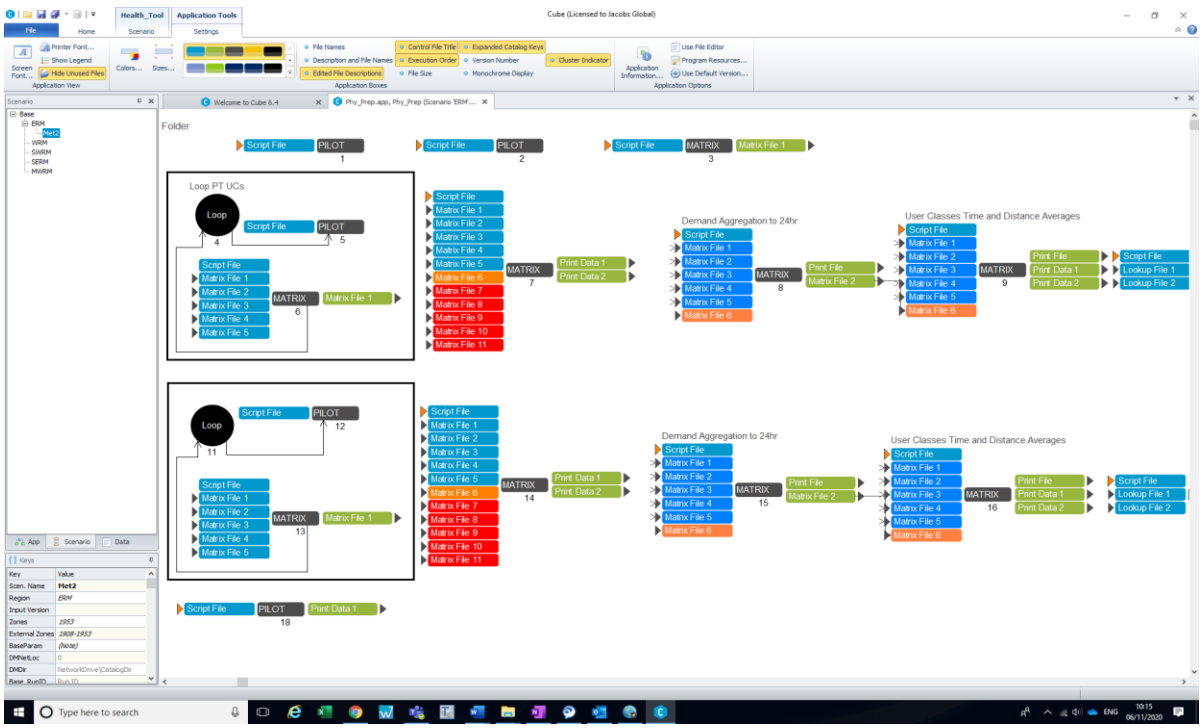


Figure 2.4: Re-naming Child

5) Enter any further properties to identify the scenario (Figure 2.5). Press OK, and this will open up the Cube catalog keys.

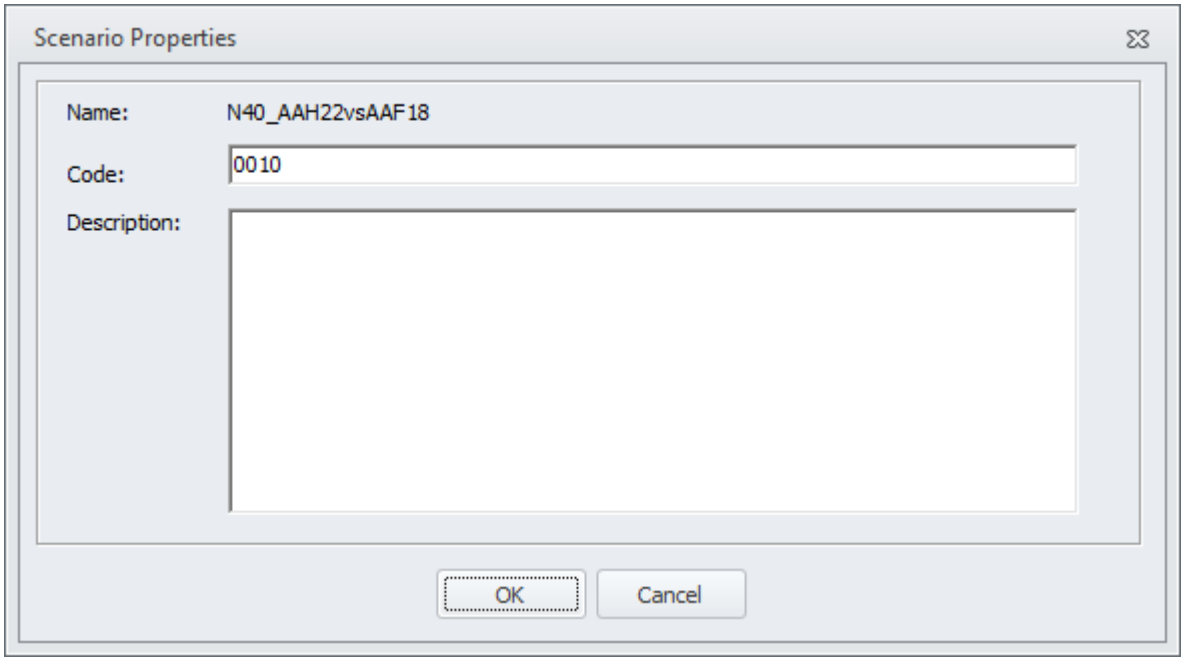


Figure 2.5: Scenario Properties

6) Open the new scenario key entry and complete the single page of catalog keys, which are shown as viewed by the user in Figure 2.6.

Catalog Keys Page 1 (Figure 2.6)		
Catalog Key	**Value to be Entered**	**Description**
Zones	1953 (ERM), 836 (WRM), 834 (SWRM), 654 (SERM), 650 (MWRM)	Total number of zones in each regional model
External Zones	1908-1953 (ERM), 802-836 (WRM), 823-834 (SWRM), 626-654 (SERM), 616-650 (MWRM)	Range of numbers of external zones in each regional model. These need to be entered as a range, eg for ERM "1908-1953", where the first number is the first external zone and the second number is the last external zone.
Run Type	Active/PT/Both	This option lets the user pick if they want the calculation and results undertaken for only the Active travel, only the walk-leg of PT travel, or the combination of both.
Base\Do Minimum Parameters		
Run DoMin from Network?	✓	✓ if RMS outputs are not in the same directory as the Health Module Catalog
Network Location	Model Run Catalog Directory	Location of RMS outputs on the network if previous key is✓
Base\Do Min Run ID	Base/Do Minimum Model Run ID	The Run ID for the Base/Do Minimum Year transport model
Base\Do Min Year	YY	Base/Do Minimum Year in YY format
Base\Do Min Growth	Base/Do Minimum Demand Scenario ID	The Base/Do Minimum travel demand scenario ID
Do Something Parameters		
Run DoSomething from Remote Location?	✓	✓ if RMS outputs are not in the same directory as the Health Module Catalog
Network Location	Model Run Catalog Directory	Location of RMS outputs on the network if previous key is✓
Model Year	YY	Do Something Year in YY format
Run ID	Do Something Model Run ID	The Run ID for the Do Something transport model

Catalog Keys Page 1 (Figure 2.6)		
Catalog Key	**Value to be Entered**	**Description**
Growth	Do Something Demand Scenario ID	The Do Something travel demand scenario ID

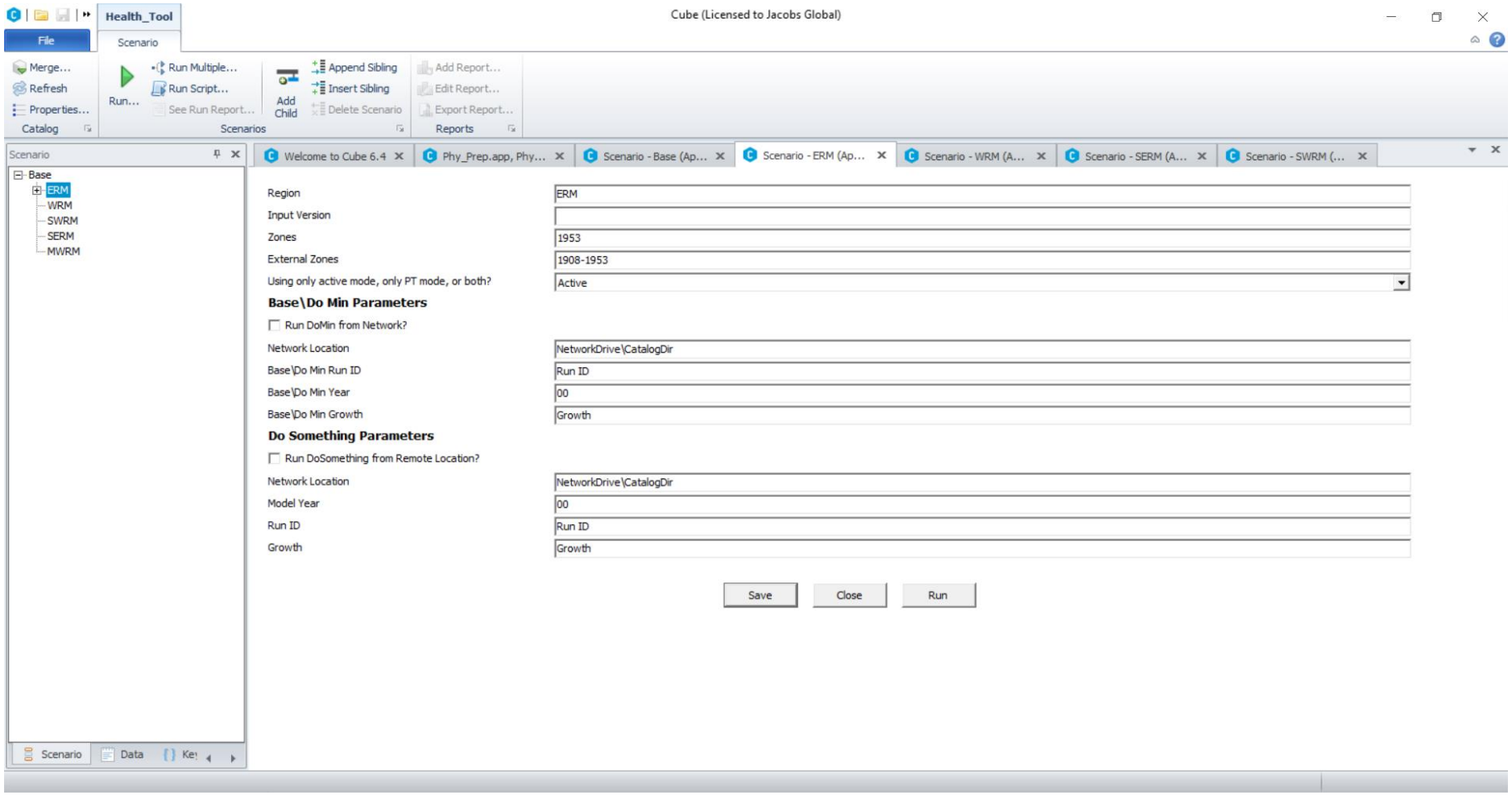


Figure 2.6: Catalog Keys Page

The following are checks that are recommended before undertaken the Health Cube process:

- Are you using the latest version of the tool taken from the network?
- Do the zone numbers entered in the key match the number of zones in the model?
- Did you pick the correct type of run you want (Active/PT/Both)?

7) Once these checks are complete, either press "Run" on the keys page or F2 on the main Cube view. The following prompt is displayed, ensure that Run Current Group Only box is ticked, and click OK (Figure 2.7).

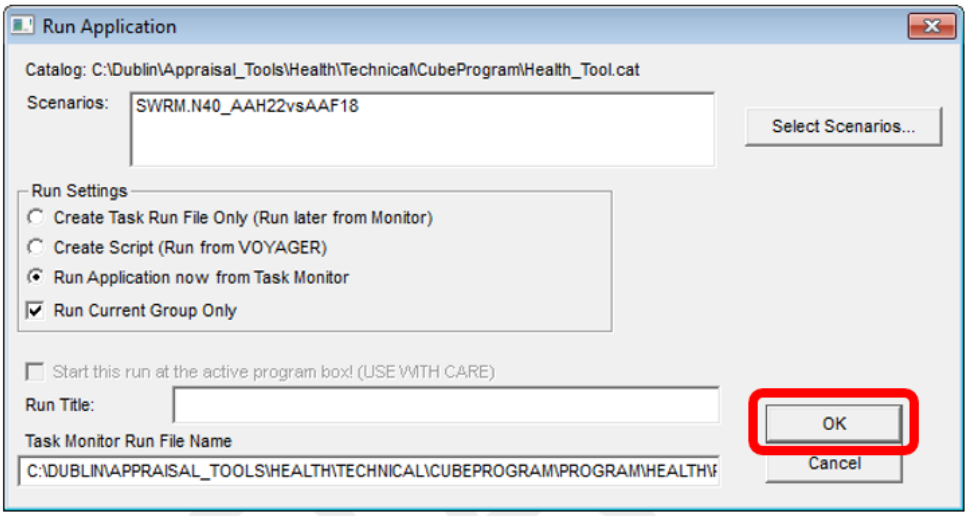


Figure 2.7: Running Cube Application (1)

The following prompt is then displayed, click on OK to start the module (Figure 2.8).

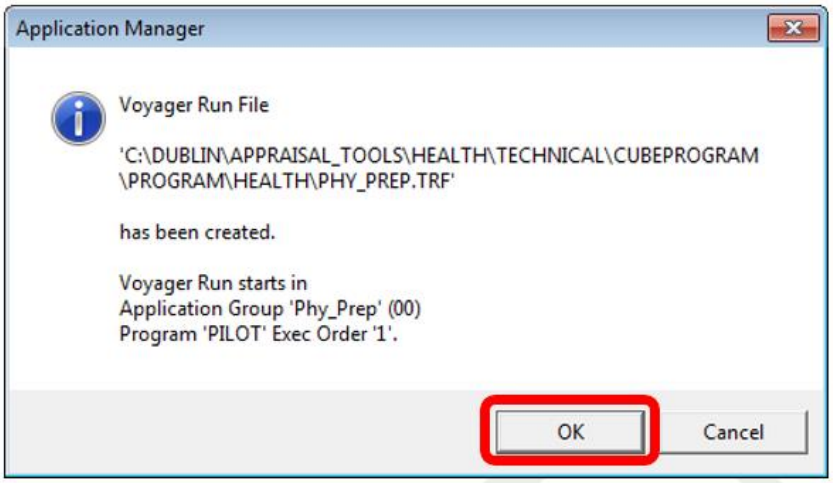


Figure 2.8: Running Cube Application (2)

Once the model has run successfully, the following message will be displayed in Cube Voyager (Figure 2.9).

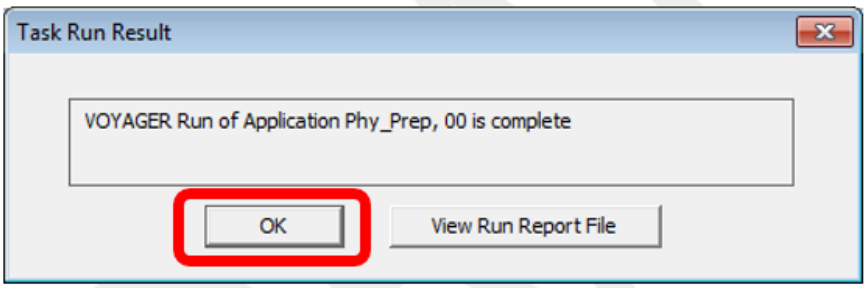


Figure 2.9: Finished Cube Application

The outputs created following the Cube Voyager application are described in Appendix B, and are used to inform the Excel process.

3 Excel Process

3.1 Overview

The Excel element of the Health Module monetarises the impacts produced within the Cube Process (Section 2).

The Excel spreadsheet is a fully automated process, and is based on the relative number of lives saved as suggested in the HEAT Tool by the World Health Organisation (WHO) and reduction in absenteeism as suggested in the Active Travel 'toolkit' developed by the Department for Transport (DfT) (UK).

The output of this appraisal tool is the monetisation as determined by:

- Physical Activity -– the value of life saved through an increase in physical activity; and
- Absenteeism – change in output arising from a reduction in absenteeism in terms of days saved due to illness.

The rest of this section describes the components of the Excel process, followed by a section on understanding the health tool outputs.

3.2 Components

The Excel process is fully automated within the Cube catalog and reads in the number of cycling / walking journeys per day as a result of the scheme being tested in the Do Something scenario, along with the length of these trips (km) and the duration of these trips (mins).

The Health Appraisal Tool Excel spreadsheet is saved with the Module files.

A set of parameters are also built into the Excel process relating to physical activity and absenteeism monetisation calculations, where default values have already been populated but should be modified by the user to reflect current values. These are explained in more detail in the Health Module Development Report and listed in Appendix C.

3.3 Understanding the Health Tool Outputs

The outputs from the process are stored in Health_Outputs.xls. This workbook has four worksheets, which are described below.

Input

This worksheet is where the outputs from the Cube process are automatically exported for both the Base/Do Minimum and Do Something scenarios.

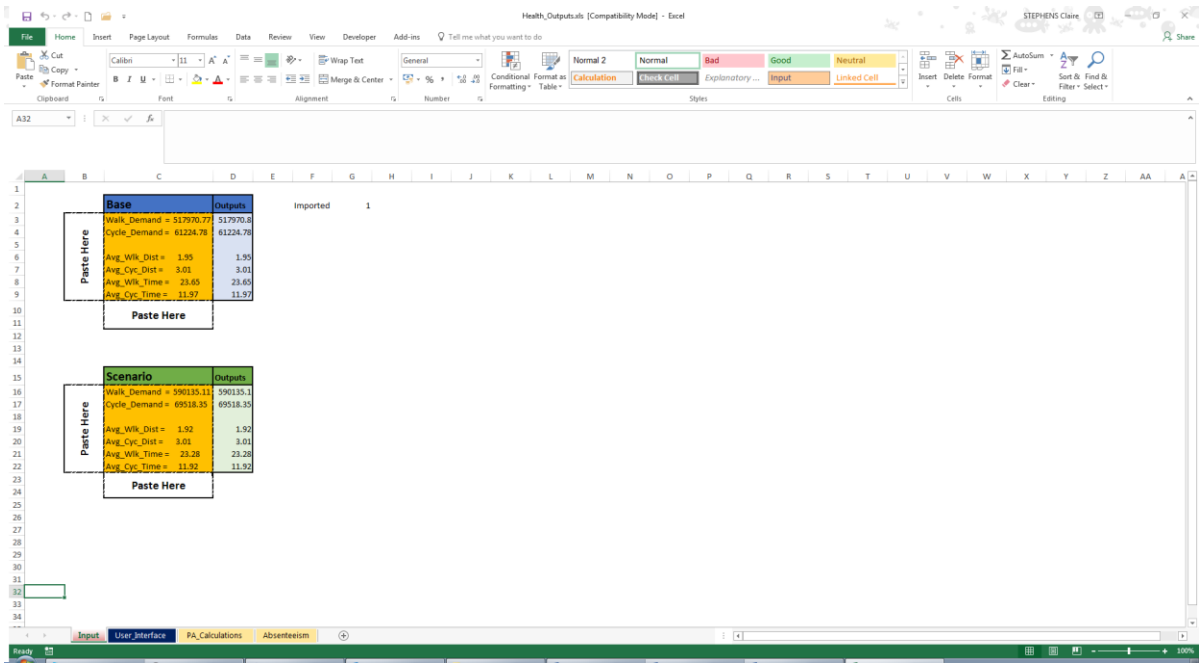


Figure 3.1: Input tab

User Interface

This worksheet is where the user can change the Model Base Year and Forecast Year. All other inputs either read directly from the Input worksheet or are calculation parameters as described above.

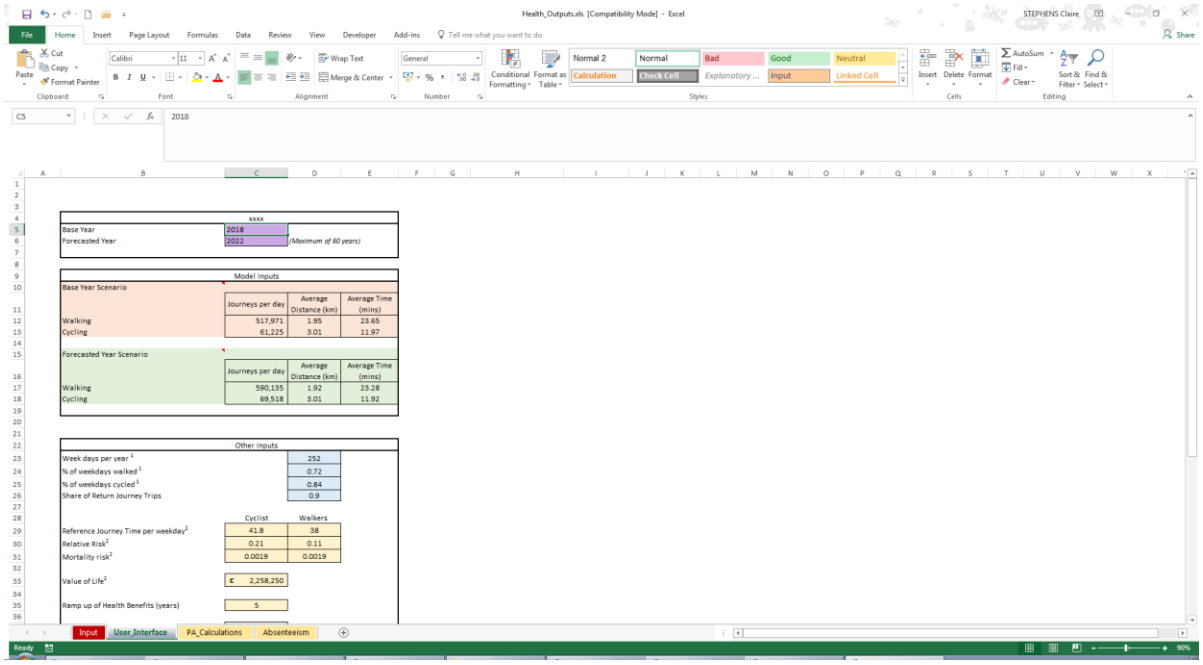


Figure 3.2: User Interface tab

PA Calculation

This worksheet includes calculated cells and displays the net impact in monetary terms of cycling trips and walking trips per annum (PA). This is further split up into new users and existing users.

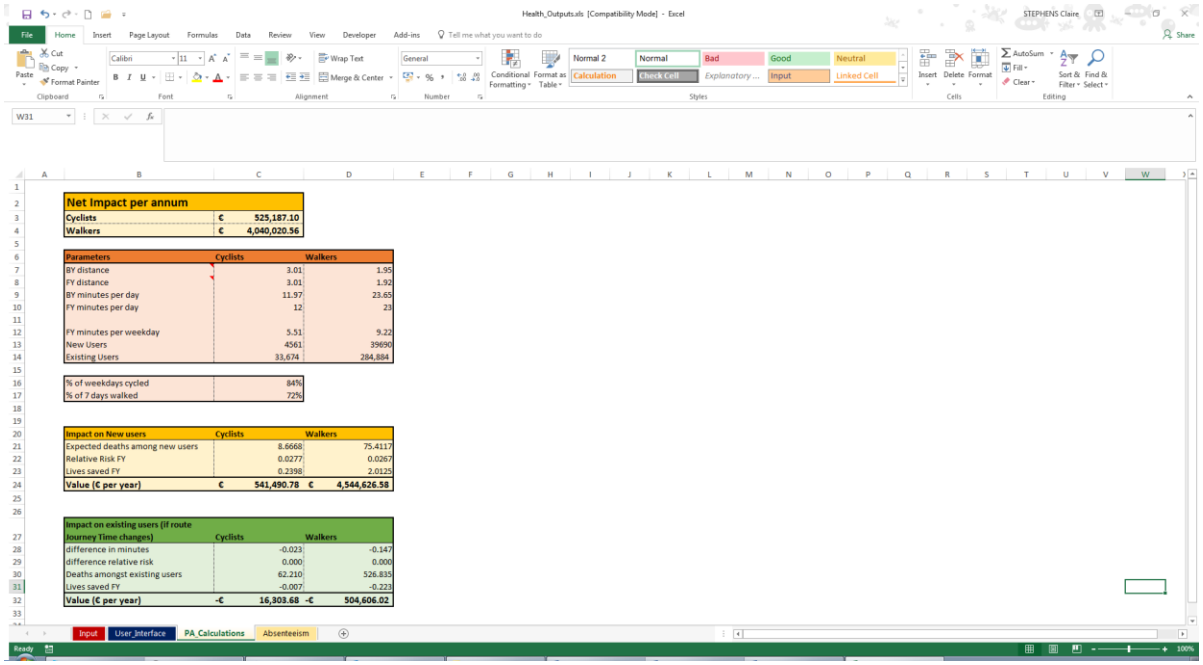


Figure 3.3: PA Calculation tab

Absenteeism

This worksheet includes calculated cells and displays the change in absenteeism (days), and the monetary output lost from day leave and the increased output from the reduction in absenteeism per year.

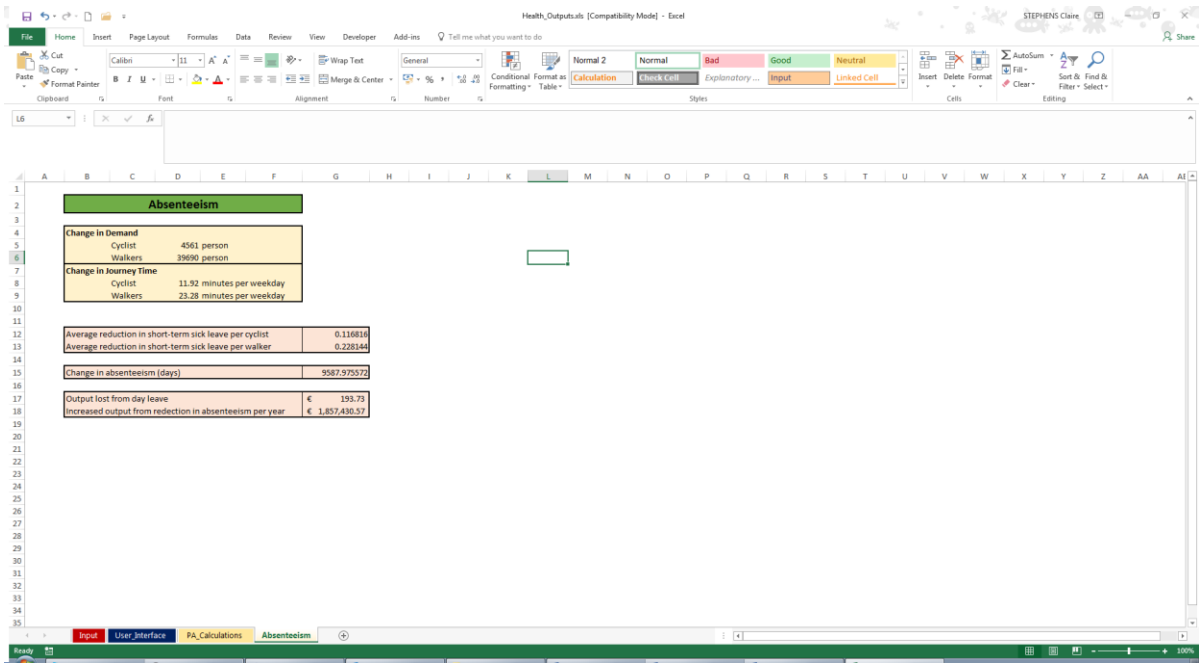


Figure 3.4: Absenteeism tab

4 Troubleshooting

In the CUBE Voyager cases the print files (.prn), which provides the best clues as to why the run has not worked.

PROBLEM SOFTWARE	PROBLEM	SOLUTION
CUBE	Tool crashes as files missing	Check all files are named and stored correctly
Excel	Not able to run macro	Check macros are enabled

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

5 Appendix A - Inputs from RMS

5.1 Folder structure

The latest RMS output folder structure is: {CATALOG_DIR}\Runs\(Region)\(Year)\(Scenario)\4_Outputs_(Region)_(Year)_(Growth Scenario)_(Scenario)_Input_(Version number)

Within the RMS output folder, the toolkit is set to create two additional folders on two different levels; the 'Appraisal_Tools' folder (upper level) and the 'Health' folder (lower level) where the toolkit's outputs are saved. An example of the final folder structure is shown below:

Where: {CATALOG_DIR}[1] = C:\NTA\AppraisalTools\Health

{Region} = ERM (variable)

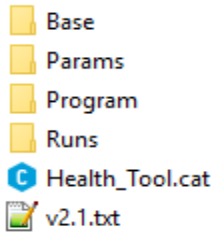
{Model Year} = 20 (variable)

{Run ID} = Metro1 (variable)

{Growth Scenario} = D1 (variable)

{Version number} = v0001 (variable)

The final module structure (i.e. file structure within the {CATALOG_DIR}), is shown below:



5.2 Input files

The output RMS active mode demand and skim matrices for each time period are used as inputs to the Health toolkit. The complete list of input files required to run the toolkit are presented below:

Active Mode

Do Minimum demand matrices

- Active_AM_(DM_RunID)(DM_Growth)(DM_Model Year).AAM
- Active_LT_(DM_RunID)(DM_Growth)(DM_Model Year).AAM
- Active_SR_(DM_RunID)(DM_Growth)(DM_Model Year).AAM
- Active_PM_(DM_RunID)(DM_Growth)(DM_Model Year).AAM
- Active_OP_(DM_RunID)(DM_Growth)(DM_Model Year).AAM

Do Minimum skim matrices

- AAM_AM_(DM_RunID)(DM_Growth)(DM_Model Year)_Skims.MAT
- AAM_LT_(DM_RunID)(DM_Growth)(DM_Model Year)_Skims.MAT
- AAM_SR_(DM_RunID)(DM_Growth)(DM_Model Year)_Skims.MAT
- AAM_PM_(DM_RunID)(DM_Growth)(DM_Model Year)_Skims.MAT
- AAM_OP_(DM_RunID)(DM_Growth)(DM_Model Year)_Skims.MAT

[1] The {CATALOG_DIR} is user specific (usually saved on C: Drive).

Do Something demand matrices

- Active_AM_(DS_Run ID)(DS_Growth)(DS_Model Year).AAM
- Active_LT_(DS_Run ID)(DS_Growth)(DS_Model Year).AAM
- Active_SR_(DS_Run ID)(DS_Growth)(DS_Model Year).AAM
- Active_PM_(DS_Run ID)(DS_Growth)(DS_Model Year).AAM
- Active_OP_(DS_Run ID)(DS_Growth)(DS_Model Year).AAM

Do Something skim matrices

- AAM_AM_(DS_Run ID)(DS_Growth)(DS_Model Year)_Skims.MAT
- AAM_LT_(DS_Run ID)(DS_Growth)(DS_Model Year)_Skims.MAT
- AAM_SR_(DS_Run ID)(DS_Growth)(DS_Model Year)_Skims.MAT
- AAM_PM_(DS_Run ID)(DS_Growth)(DS_Model Year)_Skims.MAT
- AAM_OP_(DS_Run ID)(DS_Growth)(DS_Model Year)_Skims.MAT

PT Mode

Demand matrices

- PT_AM_(Run ID)(Growth)(Model Year).PTM
- PT_LT_(Run ID)(Growth)(Model Year).PTM
- PT_SR_(Run ID)(Growth)(Model Year).PTM
- PT_PM_(Run ID)(Growth)(Model Year).PTM
- PT_OP_(Run ID)(Growth)(Model Year).PTM

Skim matrices

- AM_PT_EMP.MAT for each (Run ID),(Growth) and (Model Year)
- AM_PT_COM.MAT for each (Run ID),(Growth) and (Model Year)
- AM_PT_OTH.MAT for each (Run ID),(Growth) and (Model Year)
- AM_PT_EDU.MAT for each (Run ID),(Growth) and (Model Year)
- AM_PT_RET.MAT for each (Run ID),(Growth) and (Model Year)
- LT_PT_EMP.MAT for each (Run ID),(Growth) and (Model Year)
- LT_PT_COM.MAT for each (Run ID),(Growth) and (Model Year)
- LT_PT_OTH.MAT for each (Run ID),(Growth) and (Model Year)
- LT_PT_EDU.MAT for each (Run ID),(Growth) and (Model Year)
- LT_PT_RET.MAT for each (Run ID),(Growth) and (Model Year)
- SR_PT_EMP.MAT for each (Run ID),(Growth) and (Model Year)
- SR_PT_COM.MAT for each (Run ID),(Growth) and (Model Year)
- SR_PT_OTH.MAT for each (Run ID),(Growth) and (Model Year)
- SR_PT_EDU.MAT for each (Run ID),(Growth) and (Model Year)
- SR_PT_RET.MAT for each (Run ID),(Growth) and (Model Year)
- PM_PT_EMP.MAT for each (Run ID),(Growth) and (Model Year)
- PM_PT_COM.MAT for each (Run ID),(Growth) and (Model Year)
- PM_PT_OTH.MAT for each (Run ID),(Growth) and (Model Year)
- PM_PT_EDU.MAT for each (Run ID),(Growth) and (Model Year)
- PM_PT_RET.MAT for each (Run ID),(Growth) and (Model Year)
- OP_PT_EMP.MAT for each (Run ID),(Growth) and (Model Year)
- OP_PT_COM.MAT for each (Run ID),(Growth) and (Model Year)
- OP_PT_OTH.MAT for each (Run ID),(Growth) and (Model Year)
- OP_PT_EDU.MAT for each (Run ID),(Growth) and (Model Year)
- OP_PT_RET.MAT for each (Run ID),(Growth) and (Model Year)

6 Appendix B - Inputs to Excel Process

There are three separate files that are produced as part of the CUBE run that are then read by Excel. The file that is read is determined by which option of the run was selected (PT/Active/Both), however all the files are produced every run. These files are produced once for the DM scenario, and once for the DS scenario. The three files for both scenarios have the same name, but sit in a different folder depending on the scenario (DM/DS). These three files are:

- Weighted_Ave_Data_PT.PRN – For use in PT only runs.
- Weighted_Ave_Data.PRN - For use in Active only runs
- Weighted_Ave_Data_Comb.PRN – For use in a “both” run incorporating both active and PT.

7 Appendix C - Module Parameters

The file as described above used to aggregate demand into 24hr demand is called PeriodToHour_(Region).MAT, and is found in {CATALOG_DIR}\Params\Health. It contains different matrices, one for each time period and travel mode. Each matrix entry has the same value, so that all the entries in a certain time period are adjusted in the same way. This file is split by travel mode (walk/cycle/PT), with each factor applied to its corresponding demand (E.g. the walk factor to the walk demand). The factors per regional model are as follows (Correct as of 09/12/20):

Time_UC\RMS	ERM	WRM	SWRM	SERM	MWRM
PuT_AM	0.46	0.578	0.5173	0.61651	0.37
PuT_LT	0.35	0.572	0.4467	0.50783	0.35
PuT_SR	0.37	0.568	0.4712	0.53424	0.33
PuT_PM	0.4	0.512	0.437	0.49061	0.37
PuT_OP	0.19	0.58	0.4004	0.51875	0.19
Wlk_AM	0.39	0.54	0.498	0.539	0.39
Wlk_LT	0.33	0.33333	0.33333	0.33333	0.33
Wlk_SR	0.33	0.33333	0.33333	0.33333	0.33
Wlk_PM	0.41	0.4	0.368	0.34	0.41
Wlk_OP	0.08	0.08333	0.08333	0.08333	0.08
Cyc_AM	0.39	0.52	0.499	0.515	0.39
Cyc_LT	0.33	0.33333	0.33333	0.33333	0.33
Cyc_SR	0.33	0.33333	0.33333	0.33333	0.33
Cyc_PM	0.41	0.42	0.442	0.42	0.41
Cyc_OP	0.08	0.08333	0.08333	0.08333	0.08

The hourly demand for each time period is divided by the respective factors above and hence the hourly demand is expanded using factors that are less than 1.

The other set of parameters that are used are found in the spreadsheet itself, in the “User_Interface” tab. These parameters can be changed by the user, to reflect different values and uses if necessary. These parameters are subdivided into two categories. The first category, of physical activity includes information like reference journey time per weekday, relative risk, mortality risk, value of time etc. The second subcategory is absenteeism, and these parameters are short-term sickness reduction, average length of daily exercise, average hours worked in a weekday and Ireland’s short-term sick leave average.

8 Appendix D – Machine model matrix

Model Machine	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
Cube Version	6.4.2	6.4.2	6.4.2	6.4.2	6.4.2	6.4.2	6.4.2	6.4.2	6.4.2	6.4.2
Health Module	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The table above shows which NTA model machines can currently run the Health module.