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CIPFA The Chartered Institute of Public Finance & Accountancy

ADEPT Association of Directors of Environment, Economy Planning and Transport

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HAMFIG Highway Asset Management Financial Information Group
Document Control

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Liz Kirkham                    Gloucestershire County Council
Dr Vicky Vassou                Atkins
Margot Mear                    Atkins
Kat Spitieri                   Atkins
Lila Tachtsi                   Atkins

Project Team

Dr Vicky Vassou                Atkins
Margot Mear                    Atkins
Kat Spitieri                   Atkins
Lila Tachtsi                   Atkins
John Paterson                  Atkins
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1. **Introduction**

1.1 **General**

1.1.1 This document is the user guide to the computerised proof-of-concept model for the *Structures Asset Management Planning Toolkit* (SAMPt).

1.1.2 Two versions of the proof-of-concept model have been developed:

- The full version of the model, allowing for a maximum of 2,500 individual – or groups of – structures and 30,000 elements on those structures (*SAMPr_Model_v01-03_BLANK.xlsm*)
- The small version of the model, having the same functionality as the full version but allowing for a maximum of 250 individual – or groups of – structures and 3,750 elements on those structures (*SAMPr_Model_v01-03_small_BLANK.xlsm*)

1.1.3 Unless clearly stated otherwise, the guidance in this document applies to both versions of the proof-of-concept model.

1.1.4 This user guide should be read in conjunction with the following:

- Part A: Methodology
- Part B: Functional Specification
- Part C: Supporting Information

1.2 **Background Information**

1.2.1 The *Structures Asset Management Planning Toolkit* supports bridge engineers and managers in their management and other related activities, for example, financial planning, prioritisation of needs, lifecycle planning and asset valuation.

1.2.2 This version of the toolkit (Version 1.03, June 2014) primarily focuses on long-term asset management and financial planning and asset valuation/depreciation for highway structures.

1.3 **Layout of the User Guide**

1.3.1 The layout of this user guide is summarised in Table 1.

<table>
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<tr>
<th>Section</th>
<th>Description</th>
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<tr>
<td>2. Overview of the Model</td>
<td>Presents an overview of the SAMPt model, including general guidance that should be considered before and while using the model.</td>
</tr>
<tr>
<td>3. Essential Input Data</td>
<td>Describes what data are required to run the model and how to enter the data.</td>
</tr>
<tr>
<td>4. Outputs of the Model</td>
<td>Provides details of the model outputs.</td>
</tr>
<tr>
<td>5. References</td>
<td>Lists relevant documents that may need to be read in conjunction with this user guide to fully understand the model.</td>
</tr>
<tr>
<td>Appendix A: Interpretation of Output</td>
<td>Describes how the output charts may be interpreted.</td>
</tr>
<tr>
<td>Appendix B: Default Information</td>
<td>Explains the default information in the model.</td>
</tr>
</tbody>
</table>
## 1.4 Important Notes for the User

| 1.4.1 | Important notes that require the user’s particular attention are highlighted with the use of a box around the text. |
2. Overview of the Model

2.1 General

2.1.1 This section presents an overview of the SAMPt model, including general guidance that should be considered before and while using the model.

2.2 Creating a New Copy of the Blank Model

2.2.1 It is recommended that a copy of the blank model is retained and that a separate copy of the blank model is created for analysis.

i. In Windows Explorer, right-click on the file name.

ii. Select Copy on the menu that appears (shown in the red box in Figure 01).

iii. Choose the appropriate folder to which the copy of the model should be saved.

iv. Right-click in Windows Explorer.

v. Select Paste on the menu that appears (shown in the red box in Figure 02).
vi. Rename the copy of the blank model by right-clicking on its filename and selecting **Rename** from the menu that appears (shown in the red box in Figure 03). Replace the previous file name with an appropriate new file name.

---

**2.3 Considerations before and while Using the Model**

**2.3.1** The user should bear the following in mind before and while operating the SAMPt model:

- The computerised proof-of-concept model has been developed in Microsoft Excel 2007.
The model must NOT be opened in earlier versions of Excel, e.g. Microsoft Excel 2003. Also, users may experience reduced performance when using Excel 2013.

- It may take the full version of the model two minutes or more to open, depending on the specification of the computer hardware.

To keep run-times to a minimum, close all other computer programs before using the model.

- Microsoft Excel's Cut and Paste functionality must NOT be used in the model, as this could – obviously or subtly – corrupt the model. Instead, the Copy and Paste Special -- Values functionality may be used.

- Table 2 describes the colour coding used in the model.

### Table 2: Colour Coding in the Model

<table>
<thead>
<tr>
<th>Colour of Cell Background and Format of Text</th>
<th>Data Type</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>XXXXXXXXXXXXXXX</td>
<td>Hints and Tips</td>
<td>Cells containing table headings with hints and tips for the user, e.g. exceptions where 'Essential Input Data' are not required or suggested assumptions that can be made in the absence of better information.</td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXX</td>
<td>Essential Input Data</td>
<td>Cells where it is essential that, where appropriate (see data type 'Hints and Tips' above), input data be entered by the user. ‘Essential’ means that data entry is required for the model to run correctly. In the absence of better information, essential input data may be based on engineering judgement and expert opinion.</td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXX</td>
<td>Amendable Default Information OR Desirable Information</td>
<td>Cells containing default data that can be changed by the user OR Cells where it is desirable that input data be entered.</td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXX</td>
<td>Non-Amendable Default Information OR Model Output</td>
<td>Cells containing default data that cannot be changed by the user OR Cells evaluated by the model.</td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXX</td>
<td>Warnings or Error Messages</td>
<td>Cells containing warnings or error messages, as evaluated by the model, for the user to address, as appropriate.</td>
</tr>
</tbody>
</table>

- It may take the full version of the SAMPt model a significant amount of time to analyse a new scenario, depending on the volume of essential data entered, the type of analysis to be run (i.e. with or without evaluation of Depreciated Replacement Cost (DRC) over the 30-year analysis period) and the specification of the computer hardware. A message showing progress will be displayed in the status bar at the foot of the spreadsheet (see the red boxes in Figure 04 for two examples).
It may take the small version of the SAMPt model between several minutes and several hours to analyse a new scenario, depending on the volume of essential data entered, the type of analysis to be run (i.e. with or without evaluation of DRC over the 30-year analysis period) and the specification of the computer hardware. Again, a message showing progress will be displayed in the status bar at the foot of the spreadsheet (see Figure 04).

A stock of structures must be analysed in a single model.

For example, four or more copies of the small version of the SAMPt model (SAMPt_Model_v01-03_small_BLANK.xlsm) should not be used to analyse a stock of 1,000 structures. This is to ensure that the in-built prioritisation of maintenance requirements is unbiased.

The model – and particularly the full version of the SAMPt model – should be saved regularly to avoid data loss. This can be achieved by clicking on the Office button on the menu bar in the top left corner of the model (Figure 05).
2.4 Opening the SAMPt Model

2.4.1 Macros must be enabled to allow the model to run.

i. Open the SAMPt model.

ii. Click Options… near the security warning, as shown in the red box in Figure 06.

iii. Click Enable this content on the pop-up that appears, as shown in the blue box in Figure 06.

2.4.2 Click OK. The Main Menu of the SAMPt model (Figure 07) appears.
2.4.3 Between four and five buttons are available to the user. These buttons and the model functionality accessed through them are described in Sections 2.5 to 2.9.

2.4.4 The Main Menu can be accessed at any time. On the ‘Main Page’ worksheet (see the red box in Figure 08), click **Show Main Menu** (shown in the blue box in Figure 08).
Figure 08: Accessing the Main Menu
2.5 Clear the Model

2.5.1 Input data that have been entered in the SAMPt model can be deleted in bulk by clicking **Clear the Model** on the Main Menu (Figure 07). The following pop-up appears.

![Figure 09: Selecting Which Parts of the Model should be Cleared](image)

2.5.2 Select the parts of the model that should be cleared and click **OK**.

- **Inventory Data**: If this checkbox is ticked, then all inventory data in the 'Structure Database' (Section 3.2) and 'Element Database' (Section 3.3) worksheets will be deleted.

- **Programme of Upgrades, Improvements and Lifecycle Plans**: If this checkbox is ticked, then all input data in the 'Upgrades, Improvements & LCPs' worksheet (Section 3.4) will be deleted.

- **Programme of Routine Maintenance, Inspections and Assessments**: If this checkbox is ticked, then all input data in the 'Rtn Mntnce, Inspctns & Assmnts' worksheet (Section 3.5) will be deleted.

2.5.3 If no data need to be cleared, then click **Close**.
2.6 View/Enter Essential Data

2.6.1 View/Enter Essential Data on the Main Menu (Figure 07) enables the user to view and enter essential inventory data on individual structures or groups of structures and their elements.

2.6.2 A complete set of essential input data must be entered in the model before a scenario is analysed.

2.6.3 When View/Enter Essential Data is clicked on the Main Menu, the pop-up shown in Figure 10 appears.

![Figure 10: Viewing and Entering Essential Input Data](image)

2.6.4 Click Close.

2.6.5 Enter the essential input data in the appropriate worksheets (Section 3).

2.6.6 When entering data one cell at a time, ensure that the calculation mode is set to automatic. This ensures that the drop-down lists that are available to the user, the results from interim calculations and any warnings are up-to-date and appropriate.

2.6.7 On the menu bar, select Formulas -- Calculation Options -- Automatic, so that a ✔ appears next to Automatic (Figure 11).

![Figure 11: Enabling Automatic Calculations](image)

2.6.8 When entering data in bulk (e.g. by copying data from another spreadsheet and pasting values in the model), the calculation mode can temporarily be set to manual. This can speed up the transfer of data. Once the data transfer is complete, the calculation mode should be reset to automatic (Section 2.6.7). This is necessary to validate the input data and update any warnings, as appropriate.

2.6.9 To set the calculation mode to manual, select Formulas -- Calculation Options -- Manual on the menu bar, so that a ✔ appears next to Manual.
2.7 View Results from Last Analysis

2.7.1 View Results from Last Analysis on the Main Menu (Figure 07) becomes available for the user to select only after the first scenario has been analysed (Figure 12).

2.7.2 When View Results from Last Analysis is clicked, the results from the last analysis appear in the pop-up shown in Figure 12. These results may not be relevant to the data, rules and assumptions currently in the model.
Figure 13: Viewing the Results from the Last Analysis

2.7.3 Click **Produce Report** to view all charts and supporting data tables in the spreadsheet.

2.7.4 Appendix A outlines how the model’s results can be interpreted.
2.8 Analyse New Scenario

2.8.1 After entering a complete set of essential input data and ensuring that the calculation mode is set to automatic, click Analyse New Scenario on the Main Menu (Figure 07). The pop-up shown in Figure 14 appears.

![Analysis of New Scenario](image)

Figure 14: Selecting the Type of Analysis to be Performed

2.8.2 Particular requirements have been imposed for the calculation of DRC for 2013/2014. In the proof-of-concept model, two types of analysis may be performed:

- calculation of DRC for 2013/2014, including aspects of asset management planning; or
- asset management planning with or without a calculation of DRC that is not valid for 2013/2014.
Calculating DRC Valid for 2013/2014

2.8.3 Click **Calculate DRC for 2013/2014**. The pop-up shown in Figure 15 appears.

![Figure 15: Calculating DRC Valid for 2013/2014](image)

2.8.4 For the purposes of Whole of Government Accounts (WGA) returns for 2013/2014, the model automatically:

- uses one specific intervention strategy - 'Unplanned Reactive' - for all elements
- ignores the uncertainty in the times to failure for all elements
- assumes that the annual budget is unlimited (therefore, maintenance is not postponed or carried forward to later years)

2.8.5 The user is NOT required to change the intervention strategy to 'Unplanned Reactive' for all elements.

2.8.6 The user is NOT required to start again from a blank copy of the model, if uncertainty in the times to failure has already been allowed for (Section 2.8.17).

2.8.7 For the purpose of calculating DRC for 2013/2014, the user MUST run the model with default reference data. This includes using the default service lives and deterioration rates, thereby assuming that an appropriate routine maintenance regime is in place.

2.8.8 For the purpose of calculating DRC for 2013/2014, the user MUST run the model without any upgrades, improvements or lifecycle plans in the 'Upgrades, Improvements & LCPs' worksheet.

2.8.9 Click **Analyse Scenario**.

2.8.10 Once the scenario has been analysed, the pop-up shown in Figure 16 appears.
2.8.11 It is assumed that, for this scenario, the charts of Gross Replacement Cost (GRC), DRC and Accumulated Depreciation are of primary interest. For this reason, only these charts are provided in the pop-up. To view all charts and supporting data tables in the spreadsheet, click **Produce Report**.

2.8.12 As shown in Figure 17, AH5 and AI5 in the ‘Results Summary’ worksheet (viewable when **Produce Report** is clicked on the pop-up shown in Figure 16) indicate if the DRC and Accumulated Depreciation, respectively, calculated in the last analysis are valid for 2013/2014.
2.8.13 The pop-up shown in Figure 16 can be recalled at a later time by following the steps described in Section 2.7, provided that no other scenario is analysed in the model in the meantime.

2.8.14 Appendix A outlines how the model's results can be interpreted.

2.8.15 Once the scenario has been analysed, the model automatically restores for all elements the intervention strategy previously specified by the user and the uncertainty in the times to failure.
Developing Asset Management Plans (and Calculating DRC Not Valid for 2013/2014)

2.8.16 To develop asset management plans (with or without calculating a value for DRC that cannot be submitted as part of the WGA returns in 2013/2014), click Develop Asset Management Plans. The pop-up shown in Figure 18 appears.

![Structures Asset Management Planning Toolkit: Model](image)

Figure 18: Developing Asset Management Plans and Calculating DRC Not Valid for 2013/2014

2.8.17 Experience indicates that diverse deterioration rates and service lives occur across a network due to the wide range of exposure environments and construction qualities present. **Allow for Uncertainty in Times to Failure** should therefore be clicked at least once after all the structure and element information has been entered in the model. This allows for uncertainty in the model’s deterioration service lives and deterioration rates (Section 2.13 of *Structures Asset Management Planning Toolkit, Part A: Methodology*).

It is recommended that **Allow for Uncertainty in Times to Failure** is NOT clicked between analyses of the same structure and element information. Effects from changes in the budget or changes in strategies will then be more recognisable.

2.8.18 The following details need to be provided on the pop-up:

- **Type of Authority:** Select the appropriate authority. Two options are provided in the drop-down list – Local Authority or Overseeing (Trunk Road) Authority. This is required to select the appropriate weighting coefficients for the evaluation of structure stock condition.

- **Budget:** Enter a budget for each year in the 30-year analysis period. If the same budget is to be entered for all (or most) years, enter the budget in the textbox for Year 1 and click **Copy Budget for Year 1 to All Years**. The model will automatically populate the textboxes for all 30 years with the budget specified for Year 1. The user can then overwrite the automatically populated values, as required.

Do NOT leave any of the textboxes for the budget blank. If you wish to enter a zero-budget, please enter ‘0’.

The budget should - as a minimum - cover the costs identified in the ‘Upgrades, Improvements & LCPs’ and ‘Rtn Mntnce, Inspectns & Assmnts’ worksheets. The model spends the budget on these items first, before allocating the remaining funding to condition-triggered maintenance.
Any available funding not used in a given year is not carried forward to later years in the SAMPt model.

2.8.19 Click **Analyze Scenario**.

2.8.20 Once the scenario has been analysed, the pop-up shown in Figure 19 appears.

![Figure 19: Viewing Results for Asset Management Plans](image)

2.8.21 To view all charts and supporting data tables in the spreadsheet, click **Produce Report**.

2.8.22 As shown in Figure 20, cells AH5 and AI5 in the ‘Results Summary’ worksheet (viewable when **Produce Report** is clicked on the pop-up shown in Figure 19) indicate if the DRC and Accumulated Depreciation were calculated in the last analysis.

![Figure 20: Checking Validity of DRC for 2013/2014](image)

2.8.23 The pop-up shown in Figure 19 can be recalled at a later time by following the steps described in Section 2.7, provided that no other scenario is analysed in the model in the meantime.

2.8.24 Appendix A outlines how the model’s results can be interpreted.

2.9 **Show/Hide Worksheets with Reference Data**

2.9.1 The model uses the default assumptions and data provided in *Structures Asset Management Planning Toolkit, Part C: Supporting Information*[^3].

2.9.2 The model can be operated without reviewing the default information.
2.9.3 To show or hide the default information that can be modified in the model to suit a user’s particular needs, click **Show/Hide Worksheets with Reference Data** on the Main Menu (Figure 07).

2.9.4 The default information that can be modified in the model is contained in cells highlighted in blue (Section 2.3) in worksheets where the name starts with ‘Reference_’ (e.g. ‘Reference_03&04_i’, ‘Reference_03&04_ii’, ‘Reference_05&07’, etc.). The number after ‘Reference_’ in the name of the worksheet is the number of the relevant section in *Structures Asset Management Planning Toolkit, Part C: Supporting Information*[^3]. For example, information presented in the ‘Reference_03&04_i’ worksheet is based on Sections 3 and 4 of *Structures Asset Management Planning Toolkit, Part C: Supporting Information*[^3]. Table 3 outlines the content of each worksheet with default information.

**Table 3: Content of Worksheets with Reference Data**

<table>
<thead>
<tr>
<th>Worksheet</th>
<th>Corresponding Sections and Tables in <em>Structures Asset Management Planning Toolkit, Part C: Supporting Information</em>[^3]</th>
</tr>
</thead>
</table>
| Reference_03&04_i | Section 3: Default Deterioration Profiles for Components  
Table C.3.A: Deterioration Profile for Components  
Section 4a: Default Deterioration Profiles for Materials  
Table C.4.A: Deterioration Profiles for Materials  
Section 4b: Default Deterioration Profiles for Groups/Structures  
Table C.4.B: Deterioration Profiles for Groups/Structures |
| Reference_03&04_ii | Section 3: Default Deterioration Profiles for Components  
Table C.3.A: Deterioration Profile for Components  
Section 4a: Default Deterioration Profiles for Materials  
Table C.4.A: Deterioration Profiles for Materials  
Section 4b: Default Deterioration Profiles for Groups/Structures  
Table C.4.B: Deterioration Profiles for Groups/Structures |
| Reference_05&07 | Section 5: Maintenance Options  
Table C.5.A: Maintenance Options  
Section 7: Base Unit Rates  
Table C.7.A: Base Unit Rates (2Q 2010 indexed to 2Q 2012 using Road Project Index for 2013/2014 prices) |
| Reference_06 | Section 6a: Default Intervention Levels and Effects for Materials and Components  
Table C.6.A: Intervention Levels and Effects for Materials and Components  
Section 6b: Default Intervention Levels and Effects for Groups/Structures  
Table C.6.B: Intervention Levels and Effects for Groups/Structures |
| Reference_08 | Section 8: Element or Structure Size Formulae  
Table C.8.A: Size Formulae for Bridge Elements  
Table C.8.B: Size Formulae for Retaining Wall Elements  
Table C.8.C: Size Formulae for Sign/Signal Gantry Elements  
Table C.8.D: Size Formulae for Groups/Structures |
<table>
<thead>
<tr>
<th>Worksheet</th>
<th>Corresponding Sections and Tables in <em>Structures Asset Management Planning Toolkit, Part C: Supporting Information</em>[^3]</th>
</tr>
</thead>
</table>
| Reference_09 | Section 9: Add-ons  
Table C.9.A: Preliminaries  
Table C.9.B: Other Costs  
Table C.9.D: Design Costs  
Table C.9.C: Traffic Management Costs  
Table C.9.E: Bridge - Works Location and TM Arrangements  
Table C.9.F: Retaining Wall - Works Location and TM Arrangements  
Table C.9.G: Sign/Signal Gantry - Works Location and TM Arrangements  
Table C.9.H: Groups/Structures - Works Location and TM Arrangements |
| Reference_10 | Section 10: Penalties  
Table C.10.A: Traffic Restrictions  
Table C.10.B: Traffic Delay Costs |
| Reference_11i | Section 11: Prioritisation  
Table C.11.A: Priority Weighting Coefficients  
Table C.11.B: Factor based on Traffic  
Table C.11.C: Factor based on Obstacle Crossed OR For Retaining Walls / Structural Earthworks, Route Adjacent to the Foot of the Wall/Earthworks  
Table C.11.D: Factor based on Route Supported by or Adjacent to a Structure OR For Retaining Walls / Structural Earthworks, Route Adjacent to the Top of the Wall/Earthworks OR For Spanning Sign/Signal Gantries, Route Crossed  
Table C.11.E: Factor based on Structure Type |
| Reference_12 | Section 12: Gross Replacement Cost  
Table C.12.A: Replacement Unit Rates  
Table C.12.B: Adjustment Factors |
| Reference_14 | Section 14: Element Codes  
Definition of Element Codes |

2.9.5 Appendix B describes the worksheets with default information in more detail.

2.9.6 When modifying the default information, ensure that the calculation mode is set to automatic (Section 2.6.7). This is necessary to validate the data and update any warnings, as appropriate.
3. Essential Input Data

3.1 General

3.1.1 This section describes what data are required to run the model and how to enter the data.

3.1.2 Essential input data need to be entered in the following four worksheets:

- ‘Structure Database’ worksheet (Section 3.2)
- ‘Element Database’ worksheet (Section 3.3)
- ‘Upgrades, Improvements & LCPs’ worksheet (Section 3.4)
- ‘Rtn Mntnc, Inspctns & Assmnts’ worksheet (Section 3.5)

3.2 Data on (Groups of) Structures: ‘Structure Database’ Worksheet

3.2.1 A summary of the essential input data to be entered in the ‘Structure Database’ worksheet is provided in Section 15 of Structures Asset Management Planning Toolkit, Part C: Supporting Information[3].

3.2.2 The first entry in the ‘Structure Database’ worksheet should be made in row 5. There must be NO blank rows between entries.

3.2.3 If a cell is populated then, as a minimum, all relevant Essential Input Data (Table 2) must be provided for the row of that cell.

3.2.4 Care should be taken when defining groups of structures. For groups with a large number of structures, the expenditure profile over the analysis period may include some extreme values. The model will maintain/replace an element on either all or none of the structures belonging to the group in a year.

For example, suppose that a group of 50 bridges is defined with waterproofing in condition 3E at the start of the analysis period and under a Planned Targeted maintenance strategy. The waterproofing on all 50 bridges has exceeded its intervention threshold condition. In the model, either all or none of the waterproofing on these 50 bridges will be replaced in one year, depending on the funding available. In reality, the waterproofing would be replaced over a number of years. This can be modelled by splitting the group of 50 bridges into several groups with fewer bridges. Alternatively, the user could leave the group of 50 bridges as it is and keep in mind the fact that all or none of the waterproofing will be replaced in one year when defining the budget and interpreting the model’s outputs.

3.2.5 Data may be copied and pasted in cells with a tan or blue background in the ‘Structure Database’ worksheet, using Microsoft Excel’s Copy and Paste Special – Values functionality. The model does not allow data to be copied and pasted in other cells, including cells that are hidden.

For example, all data in row 5 cannot be copied and pasted simultaneously to another row in the ‘Structure Database’ worksheet because columns Q to X are hidden (Figure 21).
3.2.6 Columns AD to AI (Figure 22) in the ‘Structure Database’ worksheet are currently not used. They are available for use if the list of adjustment factors for the GRC is extended beyond the list in Structures Asset Management Planning Toolkit, Part C: Supporting Information. The list of adjustment factors for the GRC can be modified in the ‘Reference_12’ worksheet (Section 2.9).

3.3 Data on Elements: ‘Element Database’ Worksheet

3.3.1 A summary of the essential input data to be entered in the ‘Element Database’ worksheet is provided in Section 15 of Structures Asset Management Planning Toolkit, Part C: Supporting Information.
3.3.2 Data on elements must NOT be entered in the ‘Element Database’ worksheet until after all required data on the associated structure or group of structures have been entered in the ‘Structure Database’ worksheet.

This ensures that the drop-down lists that are available to the user, the results from interim calculations and any warnings are up-to-date and appropriate.

3.3.3 The first entry in the ‘Element Database’ worksheet should be made in row 2. There must be NO blank rows between entries.

3.3.4 If a cell is populated then, as a minimum, all relevant Essential Input Data (Table 2) must be provided for the row of that cell.

3.3.5 Cells in columns B to D must be populated from left to right (i.e. data must be entered in column B, then in column C and finally in column D).

Following this sequence ensures that the drop-down lists that are available to the user, the results from interim calculations and any warnings are up-to-date and appropriate.

The items that appear in the drop-down lists for ‘Identifier of Structure or Group of Structures’ in column B of the ‘Element Database’ worksheet are based on the entries in column B of the ‘Structure Database’ worksheet.

The drop-down lists for ‘Full Name of Element’ in column C are based on the CSS Structure Inspection Elements\(^4\). As such, ‘Br09. Abutments (incl. Arch Springing)’ means CSS Bridge Inspection Element \(09\), which is ‘Abutments (incl. Arch Springing)’. It does NOT refer to the abutments on the ninth bridge entered in the ‘Structure Database’ worksheet. Column B in the ‘Element Database’ worksheet identifies the structure or group of structures to which the element belongs.

3.3.6 Data may be copied and pasted in cells with a tan background in the ‘Element Database’ worksheet, using Microsoft Excel’s Copy and Paste Special – Values functionality. The model does not allow data to be copied and pasted in other cells, including cells that are hidden.

3.3.7 ‘Condition at the End of Year 0’ in column E of the ‘Element Database’ worksheet refers to the condition recorded for the element when it was last inspected.

3.3.8 If the error message ‘The structure or group of structures is not recognised.’ appears in column H of the ‘Element Database’ worksheet, then the data entered in column B are invalid. Select an appropriate item from the drop-down list in column B.

3.3.9 If the error message ‘The element is not recognised.’ appears in column I of the ‘Element Database’ worksheet, then the data entered in column C are invalid. Select an appropriate item from the drop-down list in column C.

3.3.10 If the error message ‘The component/material type is not recognised.’ appears in column J of the ‘Element Database’ worksheet, then the data entered in column D are invalid. Select an appropriate item from the drop-down list in column D.

3.3.11 If the error message ‘The element condition is not recognised.’ appears in column W of the ‘Element Database’ worksheet, then the data entered in column E are invalid. Select an appropriate item from the drop-down list in column E.

3.4 Data on Programmes of Work: ‘Upgrades, Improvements & LCPs’ Worksheet

3.4.1 A summary of the essential input data to be entered in the ‘Upgrades, Improvements & LCPs’ worksheet is provided in Section 15 of Structures Asset Management Planning Toolkit, Part C: Supporting Information\(^3\).
3.4.2 Data on programmes of work must NOT be entered in the ‘Upgrades, Improvements & LCPs’ worksheet until after all required data on the associated structure or group of structures and its elements have been entered in the ‘Structure Database’ and ‘Element Database’ worksheets.

This ensures that the drop-down lists that are available to the user, the results from interim calculations and any warnings are up-to-date and appropriate.

3.4.3 Programmes of work (Section 2.7 of Structures Asset Management Planning Toolkit, Part A: Methodology\(^1\)) should only be entered in the ‘Upgrades, Improvements & LCPs’ worksheet if (i) schemes are scheduled to take place in the future, (ii) schemes are Capital, and (iii) funding is secured (i.e. the schemes are certain to be commissioned).

This is because the model deteriorates the condition of elements but does not schedule any condition-triggered maintenance or renewal works until after the last scheme for the element defined in the ‘Upgrades, Improvements & LCPs’ worksheet has been completed. Furthermore, the model spends the budget on items in the ‘Upgrades, Improvements & LCPs’ worksheet before allocating funding to condition-triggered maintenance (Section 2.8.18). Therefore, if schemes are not certain to be commissioned, no data should be entered in the ‘Upgrades, Improvements & LCPs’ worksheet. This enables the model to predict and prioritise maintenance and funding needs appropriately.

3.4.4 The first entry in the ‘Upgrades, Improvements & LCPs’ worksheet should be made in row 2. There must be NO blank rows between entries.

3.4.5 If a cell is populated then, as a minimum, all relevant Essential Input Data (Table 2) must be provided for the row of that cell.

3.4.6 ‘Element ID’ in column A of the ‘Upgrades, Improvements & LCPs’ worksheet refers to the ‘Element ID’ in column A of the ‘Element Database’ worksheet for the relevant element.

3.4.7 The items that appear in the drop-down list for ‘Maintenance Action’ in column G of the ‘Upgrades, Improvements & LCPs’ worksheet are based on the list of maintenance activities in Section 7 of the Structures Asset Management Planning Toolkit, Part C: Supporting Information\(^3\). The list of maintenance activities in the model can be modified in the ‘Reference_05&07’ worksheet (Section 2.9).

3.4.8 Data may be copied and pasted in cells with a tan or blue background in the ‘Upgrades, Improvements & LCPs’ worksheet, using Microsoft Excel’s Copy and Paste Special – Values functionality. The model does not allow data to be copied and pasted in other cells, including cells that are hidden.

3.5 Data on Regular Maintenance: ‘Rtn Mntnce, Inspctns & Assmnts’ Worksheet

3.5.1 A summary of the essential input data to be entered in the ‘Rtn Mntnce, Inspctns & Assmnts’ worksheet is provided in Section 15 of Structures Asset Management Planning Toolkit, Part C: Supporting Information\(^3\).

3.5.2 This worksheet is used to record data on the planned future expenditure on regular or Revenue maintenance of the entire structure stock over the analysis period. The default deterioration profiles provided in the model are based on the assumption that routine maintenance is carried out.

3.5.3 To analyse a scenario in which limited or no routine maintenance is carried out, the mean times to failure should be adjusted.

This can be achieved either by applying a global reduction factor to the mean times to failure for all component/material types, or by applying reduction factors selectively in column V in the ‘Reference_03&04_ii’ worksheet.
3.5.4 To apply a global reduction factor to the mean times to failure for all component/material types, click **Apply a Global Reduction Factor to Mean Times to Failure**. The pop-up shown in Figure 23 appears.

![Figure 23: Applying a Global Reduction Factor to the Mean Times to Failure](image)

3.5.5 The reduction factor of 0.25 that automatically appears in the text box when the pop-up in Figure 23 is activated is a suggested value only. It is not necessarily the value last entered in the model or the current value in column V in the 'Reference_03&04_ii' worksheet.

3.5.6 Enter the global reduction factor to be applied to the mean times to failure for all component/material types.

3.5.7 Click **Apply to All**.

3.5.8 Other than the effect on the deterioration profiles of component/material types, regular or Revenue maintenance does not impact DRC, Accumulated Depreciation or the overall condition of the structure stock in the model – provided that the budget covers the costs identified in the 'Rtn Mntnce, Inspctns & Assmnts' worksheet.

The model spends the budget on items in the 'Rtn Mntnce, Inspctns & Assmnts' worksheet before allocating funding to condition-triggered maintenance (Section 2.8.18).

3.5.9 Data may be copied and pasted in cells with a tan background in the 'Rtn Mntnce, Inspctns & Assmnts' worksheet, using Microsoft Excel's **Copy** and **Paste Special – Values** functionality.

3.5.10 Data may be copied and pasted in cells with a blue background in the 'Reference_03&04_ii' worksheet, using Microsoft Excel's **Copy** and **Paste Special – Values** functionality. The model does not allow data to be copied and pasted in other cells, including cells that are hidden.
4. Outputs of the Model

4.1 General

4.1.1 This section describes the outputs of the model.

4.1.2 Appendix A outlines how the model's results can be interpreted.

4.2 Output Charts and Data Tables

4.2.1 The model outputs up to 10 charts (Section 2.7 and Section 2.8) and supporting data tables in the spreadsheet. Table 4 describes each chart.

Table 4: Output Charts of the SAMPt Model

<table>
<thead>
<tr>
<th>Chart</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart01 - Work,Shortfall&amp;Cond</td>
<td>Profiles of budget, expenditure, shortfall, and the average and critical Structure Stock Condition Indicators (SSClav and SSClicrit, respectively) over the analysis period</td>
</tr>
</tbody>
</table>
| Chart02 - SSClav by Type | Profiles of average condition over the analysis period, broken down by structure type:  
  - Bridges  
  - Retaining walls  
  - Culverts  
  - Sign/signal gantries  
  - High mast lighting  
  - Tunnel and vehicular underpasses |
| Chart03 - SSClicrit by Type | Profiles of critical condition over the analysis period, broken down by structure type:  
  - Bridges  
  - Retaining walls  
  - Culverts  
  - Sign/signal gantries  
  - High mast lighting  
  - Tunnel and vehicular underpasses |
| Chart04 - Expenditure by Type | Profiles of expenditure over the analysis period, broken down into:  
  - Regular maintenance (Revenue)  
  - Upgrades, improvements and lifecycle plans (Capital)  
  - Condition-triggered maintenance (Capital) |
<table>
<thead>
<tr>
<th>Chart</th>
<th>Description</th>
</tr>
</thead>
</table>
| Chart05 - Expenditure by Life | Profiles of expenditure over the analysis period, broken down into:  
  - Cost of condition-triggered maintenance for elements with a finite life  
  - Cost of upgrades, improvements and lifecycle plans for elements with a finite life  
  - Cost of condition-triggered maintenance for elements with an indefinite life  
  - Cost of upgrades, improvements and lifecycle plans for elements with an indefinite life |
| Chart06 – Shortfall | Profile of shortfall for condition-triggered maintenance over the analysis period                                                             |
| Chart07 - Risk & Traffic Delay | Number of structures with Safety or Performance at Risk, and the associated traffic delay cost over the analysis period |
| Chart08 - GRC & DRC | Profiles of GRC and DRC over the analysis period                                                                                           |
| Chart09 - Acc Depreciation | Profile of Accumulated Depreciation over the analysis period                                                                                   |
| Chart10 - Condition Bands | Number of structures in different condition bands (i.e. Very Good, Good, Fair, Poor and Very Poor) over the analysis period               |

4.2.2 The ‘Results Summary’ worksheet contains the data tables for the 10 charts described in Table 4.

4.2.3 The ‘ECS Profile’ worksheet shows how the Element Condition Score (ECS) of each element changes over the analysis period.

4.2.4 The ‘Total Capital Work Profile’ shows the cost profile of Capital works (from defined upgrades, improvements and lifecycle plans and from condition-triggered maintenance) for each element over the analysis period.

4.2.5 Data in the ‘Results Summary’, ‘ECS Profile’ and ‘Total Capital Work Profile’ worksheets may be copied and pasted in another spreadsheet, using Microsoft Excel's **Copy** and **Paste Special – Values** functionality.

This allows for further analysis of the output data outside the SAMPt model.
5. References

Appendix A: Interpretation of Output Charts
A.1 General

A.1.1 This appendix outlines how the model’s results can be interpreted. The charts used for this purpose are outputs from an analysis of dummy data.

A.2 Chart01 - Work, Shortfall & Cond

A.2.1 An example of this chart is shown in Figure 24.

Figure 24: Example of Output Chart 01

A.2.2 In Figure 24, the predicted expenditure exceeds the specified budget in a number of years. Two possible reasons for this are:

- The specified budget does not cover the costs identified in the ‘Upgrades, Improvements & LCPs’ and ‘Rtn Mntnce, Inspectns & Assmnts’ worksheets. The model assumes that these costs will be incurred regardless of the specified budget because the works are certain to be commissioned.

- A number of elements reach condition 5B in the same year.

When at least one element on a structure or group of structures reaches condition 5B, that element is treated – regardless of the specified budget. That is, the safety or performance of the structure or group of structures is assumed to be at a risk so critical that some form of intervention (which may be closure of the structure or group of structures rather than works to restore the structure’s condition or functionality) is mandatory.

This trend suggests that the specified budget is insufficient for the maintenance needs of the structure stock.

Section A.5 helps to clarify which of the two possible explanations above applies.

A.2.3 The large differences between minimum and maximum annual expenditure and between minimum and maximum shortfall seen over the analysis period suggest that a number of elements reach or exceeded the intervention threshold.
exceed their intervention threshold condition in the same year. This may be because groups with a large number of structures have been defined (Section 3.2.4). For example, the large expenditure in Year 5 is mostly on the replacement of waterproofing on two groups of structures, with 45 and 44 structures each. Therefore, in reality the expenditure would be spread over a number of years and would not all be incurred in Year 5. The model may reflect this better if the two groups are broken down into more groups with fewer structures.

A.2.4 There is significant variation in the average Structure Stock Condition Indicator over the analysis period, with a notably low value in Year 4. This suggests that the specified budget is insufficient for the maintenance needs of the structure stock under the current maintenance strategies.

A.2.5 There is a significant shortfall over the analysis period. This implies that the funding is not sufficient to carry out works on a number of elements that have reached or exceeded their intervention threshold. This suggests that the funding should be increased or the maintenance strategies for the elements should be revised.

A.3 Chart02 - SSCIav by Type

A.3.1 An example of this chart is shown in Figure 25.

![Average Condition by Structure Type](chart.png)

**Figure 25: Example of Output Chart 02**
A.3.2 Figure 25 shows that no sign/signal gantries, no high mast lighting and no tunnels or vehicular underpasses have been defined as being part of the structure stock.

A.3.3 There is significant variation in the average condition of bridges, retaining walls and culverts over the analysis period. In Year 28, the average condition of retaining walls is notably low – in the Very Poor condition band. This supports the conclusion that the specified budget is insufficient for the maintenance needs of the structure stock under the current maintenance strategies.

A.4 Chart03 - SSCIcrit by Type

A.4.1 An example of this chart is shown in Figure 26.

![Critical Condition by Structure Type](image_url)

**Figure 26: Example of Output Chart 03**
A.4.2 Figure 26 shows that no sign/signal gantries, no high mast lighting and no tunnels or vehicular underpasses have been defined as being part of the structure stock.

A.4.3 The critical condition of bridges, retaining walls and culverts is better and varies less than the average condition of these structures over the analysis period. This suggests that the low values and the variation in average condition of the structures are mainly due to elements that are not critical to structural integrity.

A.5 Chart04 - Expenditure by Type
A.5.1 An example of this chart is shown in Figure 27.

![Expenditure by Type Chart]

Figure 27: Example of Output Chart 04
A.5.2 The total expenditure profile in Figure 27 is the same as that in Figure 24.

A.5.3 Figure 27 shows that most of the expenditure is on condition-triggered works. Combined with Figure 24, Figure 27 suggests that a number of elements reach condition 5B in the same year and the specified budget is insufficient for the maintenance needs of the structure stock.

A.6 Chart05 - Expenditure by Life

A.6.1 An example of this chart is shown in Figure 28.

![Expenditure by Type of Element Life](image)

**Figure 28: Example of Output Chart 05**
A.6.2 Figure 28 shows that more money is spent on maintaining indefinite life elements than on maintaining/replacing finite life elements. This may be surprising at first. The reason for this trend may be that the maintenance strategies specified for the indefinite life elements are not appropriate, leading to an unnecessarily high frequency of works. Furthermore, the under-funding in works may be creating a severe exposure environment for a number of indefinite life elements, thereby increasing the frequency of necessary maintenance. For example, if the waterproofing on a bridge fails (i.e. reaches or exceeds condition 4B) and is not replaced, then the exposure environment of the bridge’s deck elements and abutments will be severe and the condition of these elements will deteriorate faster.

A.7 Chart06 – Shortfall

A.7.1 An example of this chart is shown in Figure 29.

![Shortfall of Condition-Triggered Maintenance (Capital)](image)

Figure 29: Example of Output Chart 06
A.7.2 Figure 29 repeats the shortfall profile in Figure 24.

A.7.3 Shortfall is carried forward from one year to the next until the required work can be undertaken. The shortfall associated with a particular element may increase over time if the element continues to deteriorate and the value of work required to restore it to “as-new” condition increases as a result.

A.7.4 The large difference between minimum and maximum shortfall seen over the analysis period suggests that a number of elements reach or exceed their intervention threshold condition in the same year. This may be because groups with a large number of structures have been defined (Section 3.2.4).

A.7.5 There is a significant shortfall over the analysis period. This implies that the funding is not sufficient to carry out works on a number of elements that have reached or exceeded their intervention threshold. This suggests that the funding should be increased or the maintenance strategies for the elements should be revised.

A.8 Chart07 - Risk & Traffic Delay

A.8.1 An example of this chart is shown in Figure 30.

Figure 30: Example of Output Chart 07
A.8.2 Figure 30 shows the number of structures with safety or performance at risk, and the associated traffic delay cost over the analysis period.

A.8.3 A structure’s safety or performance is considered to be at risk if at least one element with a Very High importance rating has reached or exceeded condition 4B.

A.8.4 Where the number of structures with safety or performance at risk remains the same but the associated traffic delay cost increases (e.g. Years 10 and 11 and Years 28 and 29), this may because elements with a Very High importance rating have deteriorated from a condition with a Severity of 4 to a condition with a Severity of 5. Alternatively, the set of structures for which safety or performance are at risk in Years 10 and 28 may be different to the set of structures in Years 11 and 29. The traffic delay cost would be higher in Years 11 and 29 if the set of affected structures in these years have a greater length or carry more traffic (leading to more onerous traffic restrictions) than the affected structures in Years 10 and 28.

A.9 Chart08 - GRC & DRC

A.9.1 An example of this chart is shown in Figure 31.

![Gross Replacement Cost and Depreciated Replacement Cost Chart](image)

Figure 31: Example of Output Chart 08
A.9.2 The GRC of the structure stock is constant over the analysis period. The proof-of-concept model assumes that no structures are added to or removed from the structure stock over the analysis period. Furthermore, the proof-of-concept model assumes that no changes are made to the functionality of existing structures (i.e. currently substandard structures are not strengthened to conform to current standards in the analysis period).

A.9.3 The DRC is always less than or equal to the GRC.

A.9.4 When works are carried out to improve the condition of the structure stock, the DRC increases. However, the DRC profile does not exactly follow the condition profile of the structure stock. This is because the decrease in DRC as a result of the deterioration of the structure stock’s condition is smoothed. Furthermore, the impact of an element’s condition on the overall condition of the structure stock may not be directly proportional to the contribution of the maintenance/renewal cost of an element to the value of the structure stock.

A.10 Chart09 - Acc Depreciation

A.10.1 An example of this chart is shown in Figure 32.

Figure 32: Example of Output Chart 09
A.10.2 The Accumulated Depreciation is the difference between the GRC and the DRC.

A.10.3 The Accumulated Depreciation suggests how the amount of money saved in the bank should build up or decrease to fund the required maintenance/replacement works on the structure stock.

A.11 Chart10 - Condition Bands

A.11.1 An example of this chart is shown in Figure 33.

Figure 33: Example of Output Chart 10

- A.11.2 The Accumulated Depreciation is the difference between the GRC and the DRC.

- A.11.3 Figure 33 shows that most of the structures are in Very Good or Good condition over the analysis period. Structures in Very Poor condition over the analysis period imply that the funding should be increased or the maintenance strategies for the elements should be revised.
Appendix B : Default Information
B.1 General

B.1.1 This appendix explains the default information in the model.

5.1.1 Data may be copied and pasted in cells with a blue background in the worksheets described in this appendix, using Microsoft Excel’s Copy and Paste Special – Values functionality. The model does not allow data to be copied and pasted in other cells, including cells that are hidden.

B.2 ‘Reference_03&04_i’ Worksheet

B.2.1 This worksheet lists the possible component/material types for each element.

B.2.2 Common component/material types are listed in column B of the ‘Reference_03&04_i’ worksheet.

B.2.3 New component/material types may be defined in cells B100 to B105 (Figure 34).

B.2.4 To indicate if a component/material type applies to an element, complete cells C3 to BN105. For example, ‘Blockwork, i.e. Masonry or Stone’ is appropriate for ‘Br01. Primary Deck Element’. To indicate this, the ‘Component/Material Type ID’ in cell A6 for ‘Blockwork, i.e. Masonry or Stone’ should be given in cell C6 for ‘Br01. Primary Deck Element’ (see the red box in Figure 35). On the other hand, ‘Asphaltic Plug Joint’ is not appropriate for ‘Br01. Primary Deck Element’. Therefore, cell C5 does not contain the ‘Component/Material Type ID’ from cell A5 and is left blank instead (see the yellow box in Figure 35).

Figure 34: Adding Additional Component/Material Types

Figure 35: Indicating Which Component/Material Types are Appropriate for Elements
B.2.5 ‘Functioning Finishes Protect Component/Material Type from Deterioration?’ in column BO of the ‘Reference_03&04_i’ worksheet indicates if a functioning finish freezes the deterioration of the component/material type. For example, deterioration of ‘Cast Iron or Wrought Iron’ is assumed to be frozen if it has a functioning finish. Therefore, ‘100’ is entered in cell BO13 (see the red box in Figure 36). On the other hand, deterioration of ‘Clay Pipe’ is assumed not to be frozen if the component has a functioning finish. Therefore, ‘0’ is entered in cell BO15 (see the yellow box in Figure 36).

![Figure 36: Indicating that a Functioning Finish Freezes Deterioration of the Component/Material Type](image)

B.3 ‘Reference_03&04_ii’ Worksheet

B.3.1 This worksheet presents the service life and deterioration rates for each component/material type in different exposure environments.

B.3.2 Columns C to S in the ‘Reference_03&04_ii’ worksheet show the time taken (as fractions of the mean time to failure) for a component/material type to deteriorate from condition 1A to other conditions if no maintenance/replacement is carried out. For example, aluminium in a mild exposure environment is expected to reach condition 3B in 80% of the mean time to failure from condition 1A if no maintenance/replacement is carried out (see the red box in Figure 37).

![Figure 37: Defining the Condition Deterioration Profile of a Component/Material Type](image)

B.3.3 Column T in the ‘Reference_03&04_ii’ worksheet gives the mean time to failure of a component/material type if routine maintenance takes place.

B.3.4 If limited or no routine maintenance takes place, the mean times to failure should be adjusted. Column V in the ‘Reference_03&04_ii’ worksheet should be used to give the appropriate reduction factor.

B.3.5 If new component/material types have been defined (Section B.2.3), then it is necessary to define appropriate deterioration profiles for them in rows 317 to 414.

B.3.6 The following must be followed when defining new or modifying existing deterioration profiles in the proof-of-concept model:

- For consistency with the default exposure rules in the proof-of-concept model, NO exposure classification should be specified for any type of waterproofing (e.g. mastic asphalt, boarded systems, sheet systems, spray systems, other/unknown waterproofing, etc.).
For all other component/material types, an exposure classification must be specified for each deterioration profile. At least three deterioration profiles should be defined for each component/material type – for Mild, Moderate and Severe exposure environments. A deterioration profile for a Protected exposure environment should only be defined if a functioning finish freezes the deterioration of the component/material type.

B.3.7 If the error message ‘The component/material type is not recognised.’ appears in column X of the ‘Reference_03&04_i’ worksheet, then the data entered in column A are invalid. Enter an appropriate component/material type in column A. The component/material type in column A of the ‘Reference_03&04_i’ worksheet should appear in column B of the ‘Reference_03&04_i’ worksheet.

It is only acceptable for this error message not to be addressed in rows that do not contain defined deterioration profiles.

B.3.8 If the error message ‘This is an ambiguous deterioration rule.’ appears in column Y of the ‘Reference_03&04_i’ worksheet, then two or more deterioration profiles have been defined for the same combination of component/material type and exposure. Only one deterioration profile is permitted for each combination of component/material type and exposure.

B.4 ‘Reference_05&07’ Worksheet

B.4.1 The unit costs of works and the work rates for different maintenance/renewal activities are provided in this worksheet.

B.4.2 Details of new maintenance/renewal activities can be defined in rows 72 to 209.

B.4.3 Data may be added to or modified in cells with a blue background in the ‘Reference_05&07’ worksheet. No other cells should be changed. Entering a ‘Cost Type’ in column D of the ‘Reference_05&07’ worksheet changes the background colour of cells in columns E to J to indicate which cells need to be populated.

B.5 ‘Reference_06’ Worksheet

B.5.1 This worksheet presents the intervention levels and effects for each component/material type in different exposure environments.

B.5.2 If new component/material types have been defined (Section B.2.3), then it is necessary to define appropriate intervention levels and effects for them in rows 3275 to 3402.

B.5.3 The following must be followed when defining new or modifying existing intervention levels and effects in the proof-of-concept model:

- For consistency with the default exposure rules in the proof-of-concept model, NO exposure classification should be specified for any type of waterproofing (e.g. mastic asphalt, boarded systems, sheet systems, spray systems, other/unknown waterproofing, etc.).

- For all other component/material types, an exposure classification must be specified for each intervention rule. Three intervention rules should be defined for each component/material type – for Mild, Moderate and Severe exposure environments.

- Intervention profiles for a Protected exposure environment need not be defined. It is assumed that a Protected exposure environment means that deterioration of the component/material type is frozen. Furthermore, it is assumed that a finish cannot be maintained/replaced without the component/material type that it is protecting being maintained/replaced as well if the component/material type has reached or exceeded its intervention threshold condition.
B.5.4 If the error message ‘The maintenance action is not recognised.’ appears in column J of the ‘Reference_06’ worksheet, then the data entered in column H are invalid. Select an appropriate item from the drop-down list in column H.

It is only acceptable for this error message not to be addressed in rows that do not contain defined intervention rules.

B.5.5 If the error message ‘The component/material type is not recognised.’ appears in column K of the ‘Reference_06’ worksheet, then the data entered in column F are invalid. Enter an appropriate component/material type in column F. The component/material type in column F of the ‘Reference_06’ worksheet should appear in column B of the ‘Reference_03&04_i’ worksheet.

It is only acceptable for this error message not to be addressed in rows that do not contain defined intervention rules.

B.5.6 If the error message ‘This is an ambiguous intervention rule.’ appears in column L of the ‘Reference_06’ worksheet, then two or more intervention rules have been defined for the same combination of strategy, condition, component/material type and exposure. Only one intervention rule is permitted for each combination of strategy, condition, component/material type and exposure.

B.5.7 In columns B to E of the ‘Reference_06’ worksheet, enter all the conditions of the component/material type at which maintenance/renewal works may be carried out under Planned Preventive, Planned Targeted, Planned Do Minimum and Unplanned Reactive strategies, respectively. Enter ‘N/A’ in columns B to E if the intervention rule (i.e. combination of condition, component/material type, exposure, maintenance action and condition after application) does not apply under one or more strategies.

B.5.8 For each combination of strategy, component/material type and exposure, an intervention rule must be defined for conditions 5B, 5C, 5D and 5E.

This is for consistency with the SAMPt’s assumption that works must be undertaken on an element that has reached or exceeded condition 5B, regardless of the budget.

B.6 ‘Reference_08’ Worksheet

B.6.1 This worksheet presents the size formulae for each element from Structures Asset Management Planning Toolkit, Part C: Supporting Information[9].

B.6.2 Column B of the ‘Reference_08’ worksheet provides the element size formulae in a format that is easily understood by a user. Columns E to K of the ‘Reference_08’ worksheet are used to translate the element size formulae to a format that can be easily understood by the proof-of-concept model.

B.6.3 If the element size formulae in the ‘Reference_08’ worksheet are modified, then the unit costs of works and the work rates in the ‘Reference_05&07’ worksheet may also need to be revised.

B.7 ‘Reference_09’ Worksheet

B.7.1 This worksheet contains the formulae for calculating preliminaries cost, design cost and other costs.

B.7.2 The ‘Reference_09’ worksheet also gives the permissible traffic management arrangements for each element, the corresponding unit costs of traffic management and the location of traffic management arrangements.

The only acceptable combinations for traffic management arrangement and location of traffic management arrangement are given in Table 5.
Table 5: Acceptable Locations for Traffic Management Arrangements

<table>
<thead>
<tr>
<th>Location of Traffic Management Arrangement</th>
<th>Traffic Management Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>RouteAndObstacle</td>
<td>• Retaining Wall Traffic Management</td>
</tr>
<tr>
<td>Route</td>
<td>• Contraflow</td>
</tr>
<tr>
<td></td>
<td>• Shuttle Working / Lane Closure</td>
</tr>
<tr>
<td></td>
<td>• Hardshoulder Closure</td>
</tr>
<tr>
<td>Obstacle</td>
<td>• Contraflow</td>
</tr>
<tr>
<td></td>
<td>• Shuttle Working / Lane Closure</td>
</tr>
<tr>
<td></td>
<td>• Hardshoulder Closure</td>
</tr>
<tr>
<td></td>
<td>• Waterway Possession</td>
</tr>
<tr>
<td></td>
<td>• Railway Possession</td>
</tr>
</tbody>
</table>

B.8 ‘Reference_10’ Worksheet

B.8.1 This worksheet contains the formulae to calculate traffic delay costs from Structures Asset Management Planning Toolkit, Part C: Supporting Information[3].

B.9 ‘Reference_11_i’ Worksheet

B.9.1 This worksheet contains the prioritisation algorithm from Structures Asset Management Planning Toolkit, Part C: Supporting Information[3], used to prioritise condition-triggered maintenance/renewal works.

B.9.2 The prioritisation algorithm includes priority weighting coefficients; the factors for different traffic categories, the factors for different routes supported and for different routes and obstacles adjacent to or crossed by the structure, and the factors for different structure types.

B.9.3 The ‘Reference_11_i’ worksheet also gives the permissible traffic management arrangement for different structure types, different routes supported and different routes and obstacles adjacent to or crossed by the structure.

B.9.4 Finally, the ‘Reference_11_i’ worksheet provides the asset value factor (AVF) for different structure types and authority types and the structure size formulae associated with the AVFs. These are used to weight the condition of individual structures to determine the overall condition of the structure stock.

B.9.5 There are two ways to ensure that the condition of a structure type has no impact on the overall condition of the structure stock:

- In cells D49 to D69 of the ‘Reference_11_i’ worksheet, do NOT assign an AVF structure type to the structure type for Modern Equivalent Asset given in cells B49 to B69.
- In cells C73 to D78 of the ‘Reference_11_i’ worksheet, set the appropriate AVF to a very small non-zero value (e.g. 0.000000000001). Do NOT set an AVF to zero as this will corrupt the model.
B.10  ‘Reference_12’ Worksheet

B.10.1 This worksheet contains the formulae for calculating GRC, including the basic unit rates of GRC for different structure types and the adjustment factors for different criteria, from Structures Asset Management Planning Toolkit, Part C: Supporting Information[3].

B.10.2 New adjustment factors can be added in cells B42 to D47 (see the red box in Figure 38) of the ‘Reference_12’ worksheet.

![Figure 38: Adding New Adjustment Factors](image)

B.11  ‘Reference_14’ Worksheet

B.11.1 This worksheet presents the importance of each element to the integrity of the overall structure and the type of life of each element as either finite or indefinite life.