ASCAM
Asset Service Condition Assessment Methodology

Deliverable No.5b

ASCAM demonstrator User Guide
Final report
November 2012
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1 Introduction

This introduction is split in a general introduction equal for all reports and a specific one for each specific report.

1.1 General Introduction to the ASCAM reports

The aim of the ERANET ROAD program “Effective asset management meeting future challenges” is to improve the management of the European road network; resulting in an improvement of the performance of the network. One of the topics within this program is the development of a framework for optimized asset management [ref: Effective asset management meeting future challenges, Description of Research Needs (DoRN), version 3.3, January 2010].

Maintenance managers on all levels are faced with the same dilemma. On the one hand they are given “end-user services levels” (objectives like reliability of traffic time, traffic safety, sustainable maintenance program) on the other hand they have their assets, the asset condition and a (dynamic) portfolio of measures which can be taken to ascertain the “end-user service levels”. The dilemma arises through the need for an optimal trade-off between budget available and budget needed for ascertaining the service levels.

ASCAM focuses on a framework for optimized asset management. ASCAM will relate asset condition prediction to measures and network value (end user service levels). It will create a framework to connect existing asset management practices into a holistic, integrated cross asset, pro-active approach. It will relate technical to societal issues, like pavement degradation or failures in the “dynamic traffic management systems” to end-user service levels such as efficient traffic flow, safety, reliability of travel time, noise hindrance or environmental issues. It will link micro, meso and macro levels in asset management and the aims and objectives on the different levels, linking existing knowledge, tools and practices. The framework will enable policy makers, maintenance managers and their specialist to communicate on different levels and to overcome the boundaries between fields of knowledge.

In this study a proof of concept of the framework is developed in which existing knowledge, tools and practices are implemented and linked to end user service levels.

The following approach was followed within this project in order to develop and deliver the proof-of-concept of this framework. Five work packages were established. In one (WP5) all management and dissemination activities were performed. In three of the remaining four work packages (WP2, 3 and 4) an inventory of existing asset management practices in the EU was made, divided over asset management type; pavement, structures and road equipment. The results were intended and used in the last work packages (WP1) for assessing the feasibility and appropriateness of the framework which was developed in this work package. Also in work package 1 a proof-of-concept in the form of a numerical implementation was made. With this demonstrator the effects and possibilities of applying the framework on asset management was demonstrated. The project lay out is given in the figure below.
The work done is reported in 5 reports, a power point presentation and demonstrator with a user guide. The 5 reports are:

- Framework principles
- Inventory Pavement Management practices
- Inventory Bridge Management practices
- Inventory Road Equipment Management practices
- End report ASCAM

The inventories performed in work packages 2, 3 and 4 will deliver a representative view on the asset management in Europe including its diversity over the different countries. Such an inventory is efficient and effective for assessing the feasibility and appropriateness of the framework and to deliver the proof-of-concept. They are not intended and do not deliver a full comprehensive inventory of these asset management systems. Therefore it is possible that NRA’s will miss certain information or systems.

The terminology used in asset management is not consistent over Europe. This is due to the diversity in e.g., approach, level of implementation, etc. In our reports no attempt is made to identify these discrepancies. This was by no means the purpose of this project. However this necessarily compromises the readability of these reports.

In the reports of WP2, 3 and 4 an attempt was made to develop the existing asset management systems a step further towards the framework principles, by developing relations between asset conditions and EUSL. This is an innovative more creative step, which asked for temporarily abandoning conventional definitions of sometimes well established concepts as for instance safety.

This is the “User’s Guide for the ASCAM Demonstrator”.

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Reports

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1.2 Introduction to User’s Guide for the ASCAM Demonstrator

1.2.1 Aim of the ASCAM Demonstrator
With the input gathered from the work packages a demonstrator of the framework is developed in EXCEL. It is used to demonstrate the concept and show the possibilities and barriers to implement it in asset management practices. In the demonstrator, information, relations and cost estimates from different countries are combined. The demonstrator is meant show the feasibility of the principal. The results do not represent realistic cases. Conclusions related to the results of the calculations in this report cannot be drawn.

1.2.2 Guide to the User's Guide
Basically the excel demonstrator consists of three parts
   The databases (as tables in worksheets)
   The calculus or program (as Visual Basic Code)
   The user interface (as Visual Basic Forms)
For more information on how the data and the calculus are organized reference is made to the WP1 report “Framework principles”.
This report puts its focus in running the demonstrator, i.e. defining the project settings by means of the graphical user interface, perform the corresponding calculations and view the graphical user interface.
2 ASCAM Graphical User Interface

Based on the VB implementation of the calculus and the predefined data in the excel sheets, a user interface can be run in order to perform the ASCAM calculations and assess the cross asset performance in terms of EUSL in relation to the assets condition and corresponding measures.

2.1 Starting the program

The excel tool is a Microsoft Excel 97-2003 Worksheet (.xls). It can be run in office 2010 in compatibility mode.

Open the excel workbook by double clicking it. Be sure to enable/trust the macro’s it contains.

Next start the ASCAM macro:

- In Microsoft Excel 97-2003 this can be done by selecting
  - ‘Tools → Macro → Macros → ASCAM → run’
- In office 2010 this is achieved by respectively:
  - ‘View → Macros → View Macros → ASCAM → run’

The graphical user interface will appear with its start up screen, Figure 2.1.

Figure 2.1 Start up screen of the ASCAM demonstrator.
Shown are 8 tabbed-panes labeled respectively as “GENERAL”, “ASSETS”, ……”RANDOMIZE”.

Each pane will be described in a separate paragraph, from paragraph 2.2 onwards.

Also visible are the file options Open; Save and Save as. With these buttons the user can save the input and reload it on demand.

Starting from scratch, one would work from left to right through the tabbed panes.
2.2 GENERAL

Some ‘general’ information is needed in order to define a project. Part of it can be selected from drop-down menus whose values are defined in excel tables. Others consist of free input. The values asked for are respectively:

NAME some text for reference
ROAD TYPE selection of road type (2, 3 or 4 lane highway)
TRAFFIC selection of traffic intensity (#vehicles per year)
TRUCKS amount of heavy traffic as percentage of total traffic intensity
ANNUAL TRAFFIC GROWTH annual traffic growth in percentage per year
PERIOD the period (ahead) for which the calculations are made, in years
DISCOUNT RATE the discount rate in percentage.

Figure 2.2 Example of input values for ‘GENERAL’ data
2.3 ASSETS

Figure 2.3 shows the second pane ‘ASSETS’. In this pane, the user can define a small network made out of sections of certain length, each embedded in a certain environment and each populated with a number of assets.

Most of the input options are again drop-down lists from which one has to select the values present in the data-base (in our demonstrator: the tables in the excel-sheets). Only the length of the section can be defined by directly typing in numerical values.

The user interface allows 5 sections to be defined (R01 to R05).

As the environments and the objects in the drop-down lists contain references to the excel tables, the user can inspect the (candidate) selections in the property viewer at the bottom half of the screen.

Figure 2.4 shows some example values.
Figure 2.4 Example of sections and objects for ‘ASSETS’ data
2.4 MEASURES

Objects can be decomposed into components, e.g. pavement into foundation and top layer. The components are in a certain (time dependent) condition with respect to certain aspect, e.g. aspects like rutting or cracks for the top layer. These aspects and their condition influence the EUSL’s and hence one is bound to take measures to keep them in ‘condition’.

The pane ‘MEASURES’ enables to define scenario’s for measures to be taken on ‘aspects of components of objects’

Figure 2.5 shows the input screen for this.

One sees three sub panes, so one can define three different scenarios for comparison.

Per pane a maximum of 12 measures may be defined (although a measure can be defined based on the condition of one aspect, it can when applied affect multiple aspects, e.g. renewal of a pavement’s top layer).

Figure 2.5 Input screen for ‘MEASURES’

Again most input consists from drop down menus with references to predefined items. Compared to the previous pane (‘ASSETS’) the items ‘component’, ‘aspect’ and ‘measure’ are now introduced. Once more reference is made to the data contained in the excel tables.

The user can define a aspect, once a component of an object is selected. After doing so, the list with candidate measure will be populated and can be chosen from.

Next the user can decide at what moment the measure has to be taken. This can be time based or condition based. Condition based is steered through either of the last two columns.
Each aspect has an absolute minimum condition value at which the measure will be applied. This, however, is interpreted by the tool as an unplanned maintenance action and will as such be penalized by extra costs. In the fore last column one can steer condition based as being planned actions, so no additional costs. Time based scenarios are also interpreted as planned actions and for this one can define a first time at which a measure is applied combined with a period with which the measure is repeated.

In deciding for measures and moments at which they have to take place, use can be made of the aspect viewer at the bottom part of the screen. Once a component is defined in one of the upper rows (M01 .... M12) it can be selected in this viewer and one can inspect its aspects, see Figure 2.6.

As stated on can define three different scenarios in the available sub panes. If one wants a scenario to be a (small) variation of another scenario, the input is facilitated by the enablement of copied values (see the buttons at the top right of the screen).

![Figure 2.6 Input example for 'MEASURES'](image-url)
2.5 DEGRADATIONS

Once we are past the first three panes (‘GENERAL’, ‘ASSETS’ and ‘MEASURES’) we are finished with project specific input. All that follows is inspection of results.

The first means for this is the pane ‘DEGRADATIONS’. In this pane one can inspect the condition over time of a certain aspect as maintained by the different scenarios.

Figure 2.7 shows an example of such a view.

One can select an aspect by the drop down menu at the bottom of the screen or use the ‘Prev.’ and ‘Next’ buttons.

![Figure 2.7 Example of ‘DEGRADATIONS’ pane](image-url)
2.6 MAINTENANCE COSTS

Next inspection pane is the pane ‘COSTS’. Each measure will cost money and can cause hindrance. These yearly direct and indirect costs (with the discount rate incorporated) for each scenario as calculated by the demonstrator are visualized. Inspecting the legends is facilitated below each graph. Relations for these costs are defined in the excel tables.

Figure 2.8 Example of ‘COSTS’ pane
2.7 **EUSL**

In this pane the costs for the EUSL’s are added. Again, relations between conditions of aspects and EUSLs are defined through the excel tables.

As a result the total costs of each scenario are visualized (cost of measures, plus cost of service decrease).

![Figure 2.9 Example of EUSLs over time](image-url)
2.8 SUMMARY

The results are also summarized in another view, in 'summary' pane, see Figure 2.10. Here, the total costs over the period at hand are shown per category. So a direct view of the differences in the scenarios can be seen and main contributions can be identified.

Also in this view one can select a combination of scenario and EUSL and see what aspects or conditions contribute the most in the costs, giving incentives for optimizations. This second graph shows the influence of each aspect on the EUSL chosen. In this case the blue section of the circle shows the influence of the rutting of the pavement.

Figure 2.10 Example of ‘SUMMARY’ pane
2.9 RANDOMIZE

The uncertainty of all the elements in the framework are the reason that maintenance management is not as easy as it seems to be. The demonstrator illustrates what the effect of this uncertainty will be for each maintenance scenario and what extra costs or service can be expected for each scenario. For a proof of concept the ability to randomize the events is necessary. To be able to show the effect of monitoring (a risk quantification measure), also the randomizer is essential.

With a Monte Carlo simulation the uncertainty of the degradation curves is modeled. This results in a series of values (a mean value and the uncertainty) for the cost of the measures and each EUSL. The influence of monitoring in the demonstrator is modeled as a decrease of the uncertainty of the degradation behavior.

The figure 2.11 shows that monitoring will decrease the uncertainty of the final result of the “total costs” and that the expected value of the “total costs” will decrease. The cost of monitoring itself is not included in the total cost!

![Figure 2.11 Example of ‘RANDOMIZE’ pane](image-url)