SUPPLEMENTARY REPORT

ON THE CASE STUDIES

CEDR

road ERA net

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1. Executive Summary

The Transnational Research Call in 2010, under ERANET Road II (ENR), 'Effective Asset Management to Meet Future Challenges' had a strong emphasis on implementation and the direct relevance of results to working road administrations. The results of the seven projects that comprised the programme were presented at the final Symposium in Copenhagen 22-23rd May 2013 to an audience comprising mainly representatives of National Road Administrations (NRAs) from around Europe.

Towards the end of the Programme, while plans were being formed for a final symposium and dissemination, the Programme Executive Board decided to instigate a brief, and highly focussed series of case studies that would help to demonstrate the challenges and opportunities of implementation. The case studies (or trials) would take selected deliverables from the projects, and, working with volunteer NRAs, apply real-world data to the new models, concepts and processes.

Six case study proposals were accepted by the PEB to proceed, and work started early in 2013 with a tight schedule to complete by the time of the Symposium in May. The Technical Adviser (TA) was appointed to oversee this programme of activity and to draw conclusions for presentation to the programme stakeholders. All six project case studies were completed on time and their results disseminated in various ways at the Symposium, ranging from papers given by the projects, PEB members, and the TA, to workshops and hands-on simulation exercises.

The event was very well received and this Supplementary Report by the Technical Adviser summarises the findings and makes some observations concerning the way the case studies have helped bridge the gap towards implementation.

2. Aims and Objectives of the Case Studies

The ERANET Road Asset Management Programme was reaching its planned conclusion at the end of 2012 when the PEB turned its focus upon implementation of the results. A closing Symposium was planned, to which practitioners as well as senior managers from Road Administrations would be invited. The goal of the event was that the participants, representing the key stakeholders in the ERA-NET ROAD Asset Management Programme, would leave with a real understanding of new asset management tools and processes that they can put into practice. For the event to succeed, the PEB had to consider ways in which the results of the research projects could be communicated in a very practical manner.

Thus, the idea evolved of establishing cases studies (or trials) using 'real world' data and examples that would enable participants to see at first hand what is possible and what could be of benefit to them.

It was stressed from the outset that the case studies were not intended to develop any further new deliverables or models, but rather to test the outputs already developed in the projects, using 'real world' data. Each project was allowed to put forward its own methodology for achieving this, and this resulted in each project taking a slightly different approach. The proposals were put formally to the PEB, and following some discussions and negotiation, six case studies were accepted and given the go-ahead in early 2013.

The final, and important stage of establishing the case studies, was to assign one or more NRA to work with each project to help in the case studies, provide data, feedback and conclusions to disseminate at the Symposium. Six NRAs willingly put themselves forward for this role, and were assigned to a project of interest to them and for which they had relevant data and experience to contribute.

The aim of the case studies was to provide information that would be useful to NRAs when considering the outputs from the research programme, including how they;

- fit with processes familiar to NRAs
- fit with data typically available within and NRA
- could improve their 'take-up' of new asset management practices
- could provide benefit to the organisation

3. Case Study Commentaries

In this section of the Supplementary Report, each project is examined, key conclusions reported by the participants cited, and comments made by the Technical Adviser on the way the case studies were carried out, their outcomes, and observations on future implementability.

3.1. Stakeholder Expectations; SABARIS

(Stakeholder Benefits and Road Intervention Strategies)

Project Coordinator;
University of Twente (Netherlands)
NRA Partners;
Rijkswaterstaat (Netherlands)

In addition, various NRAs participated in the application of the case study 'live' with delegates at the Symposium in Copenhagen

One of the key deliverables of the SABARIS project was a model for stakeholder-oriented optimisation of maintenance intervention strategies at a project level. This was put to the test using two real-world examples from Belgium and the Netherlands during the main project. One of the conclusions was that in order to introduce infrastructure managers to such new concepts and processes requires a good communication approach and teaching aids.

A20 Case Study location showing locally-impacted stakeholders

The SABARIS trial was therefore framed around the demonstration of such a simulation aid, which was designed to showcase the guidelines and processes developed during the project for optimisation of intervention strategies for maintenance schemes. Specifically, the trial simulation took its base data from the A20 Netherlands case study, in collaboration with Rijkswaterstaat. Details of the case study project can be found in the SABARIS project deliverables, but it was essentially a section of the arterial ring-road around Rotterdam, and in a densely populated area.

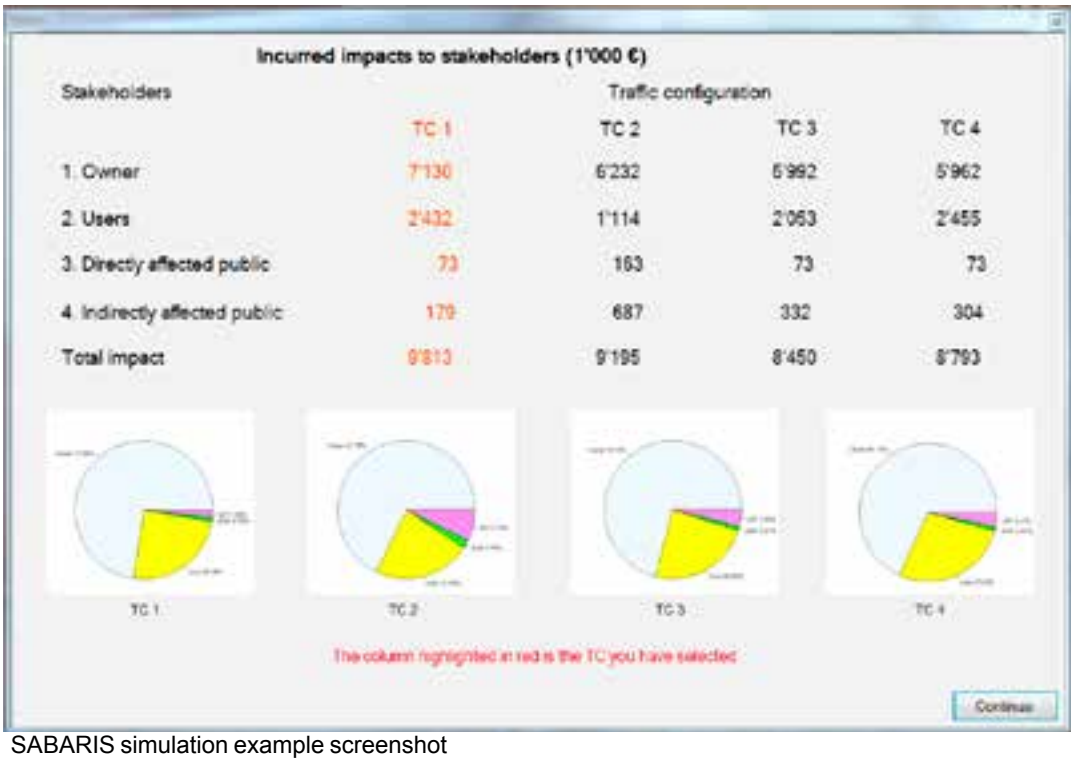
The participants in the simulation exercise were given some guidance by the project expert, and then allowed to run the self-guided interactive tool on-screen. Options were presented to the user at each key stage in the prioritisation process, and by running iteratively through this process several times, the user was able to observe the impact of changing his/her strategy and options. The four key decision points were;

1. Intervention strategy:
   1st option: combining interventions for road and bridges
   2nd option: doing interventions for road and bridges separately
2. Intervention return period: years after which an intervention is repeated
3. Traffic configuration during intervention: Choice between 4 different traffic configurations
4. Stakeholder engagement strategy during intervention: Choice between information, communication, participation and compensation measures
5. A combination of first and second decision round

The two key outputs from the simulation were; firstly, an overall 'satisfaction score' representing the predicted stakeholder reaction to each given intervention strategy, and secondly a Net Present Value 'impact' of the strategy, considering the whole life cycle of the asset for which the intervention is planned. The focus of SABARIS is on the stakeholders, and the impact on four types/groups of stakeholders of each 'traffic configuration' was evaluated, as illustrated in the screenshot below;

Graphs are then produced by the simulation software, of which an example is given below, showing the cumulative sum of the impacts over the intervention period/lifecycle (expressed in economic terms (€) – selected scenarios being able to be compared clearly with the 'optimal' result which is the configuration and intervention period which returns the lowest cumulative economic impact.

SABARIS simulation opening screen



SABARIS simulation example screenshot

The SABARIS simulation was run in a workshop environment at the Final Symposium for around 5 participants on each of three occasions. The simulation generated much interest, and showed how important communication in a practical, hands-on environment is when seeking to educate practitioners in the concept of optimisation of scheme-level asset intervention strategies based on stakeholder benefits.

This points towards two main ways that practising NRA's could make use of the SABARIS research; one is to employ the stakeholder benefit model to evaluate scheme options, and the other is to use simulation exercises similar to that constructed for the case study trial as part of their education programmes in asset management.

SABARIS simulation example screenshot


SABARIS simulation workshop underway at the Symposium in Copenhagen

3.2. Stakeholder Expectations; EXPECT

(Stakeholder Expectations and Perceptions of the future Road Transport System)

Project Coordinator; TRL (United Kingdom)
NRA Partner; FTA (Finland)

The EXPECT methodology for gathering stakeholder expectations and assessing perceived levels of service is illustrated below;

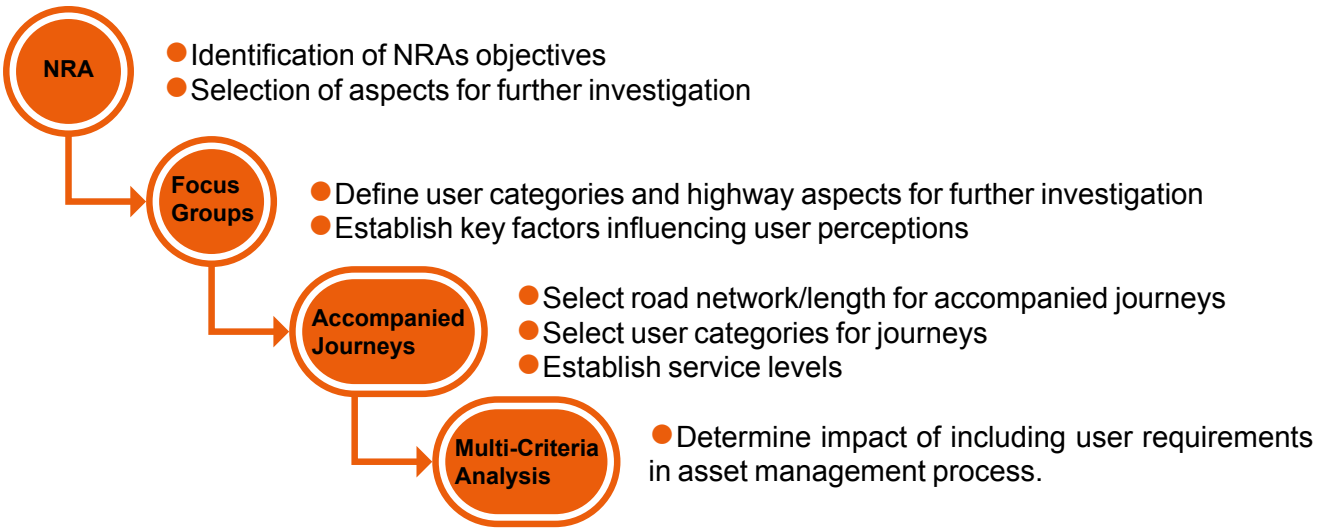
Two of the key deliverables from the EXPECT project were;

- Guidance for the use of Focus Groups in gathering stakeholder expectations
- A methodology for gathering stakeholder perceptions of road condition using 'accompanied journeys'

The case study proposal was to provide information to allow a Road Administration to apply these two methodologies in a real working environment, and gauge (a) the ease of taking up the approach and level of technical capacity required, and (b) the relevance and usability of the results obtained.

The Finnish Transport Agency, FTA, working with its contractor Destia, undertook the case study trial using existing local resources based at a maintenance centre just outside Helsinki. The FTA had an additional aspiration for the trial 'to evaluate whether it could also be used for other types of user expectation studies in our organization, e.g. prioritization between different traffic modes (roads, railways, waterways), or finding out what are the key services in building seamless travelling chains'.

Technical support was provided at each stage by the Project team's experts, however a relatively 'hands off' approach was taken deliberately to enable an assessment of how easy the methodology was for the users to understand and put into practice from the documentation provided. This aspect of the trial proved very successful, with technical personnel from the FTA and Destia quickly able to grasp what was required and to design the case study trial using local networks and conditions. A further positive aspect of the trial was that IT experts from the FTA were able, with relatively little effort, to set up a software application in the local language and to suit available mobile hardware for data collection on the accompanied journeys.

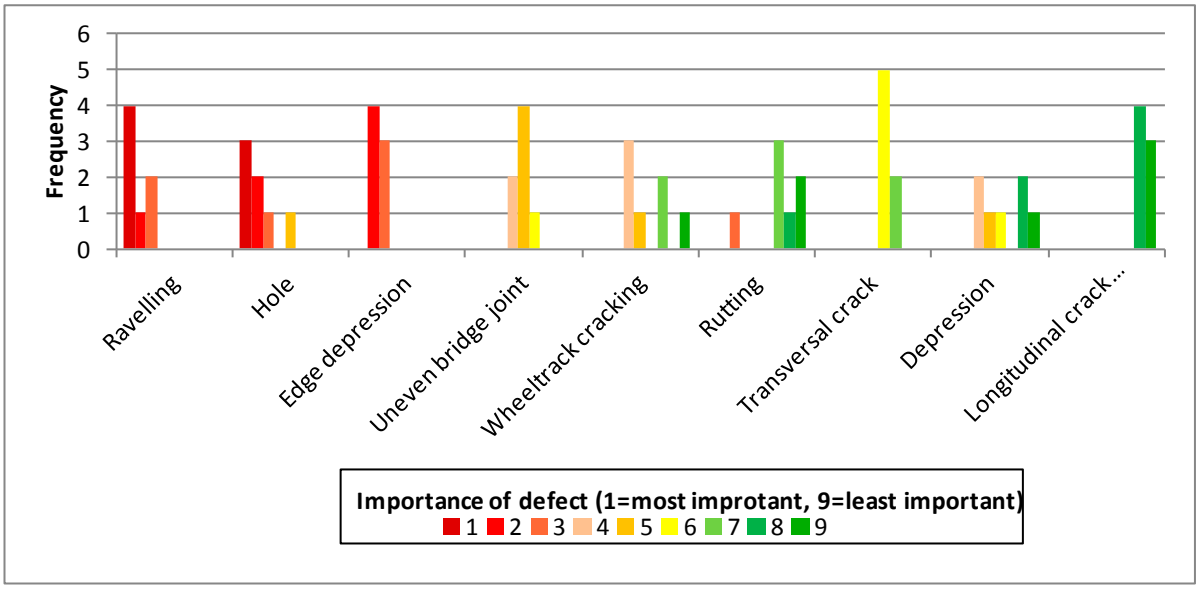


The trials commenced with focus groups which involved a number of stakeholder groups. An example output from this exercise is illustrated in the graph below;

The driver experience, designed to be recorded during the accompanied journeys, was set up to record the occurrence of the defects in the list agreed with the stakeholders, together with a severity score (1-4). These occurrences were all treated as 'point' events, rather than 'start/finish' continuous defects. This approach fitted best with the practicalities of the driver perceiving the defect and calling it out for recording purposes by the researcher, while still giving adequate attention to driving safely.

The route to be used for all the accompanied journeys was planned and set up in a GIS, as illustrated below;

The accompanied journeys were made in a standard saloon car (i.e. the normal vehicle driven by the stakeholder/driver), with a local researcher in the passenger seat to record the data. This was done using the locally-developed bespoke software on



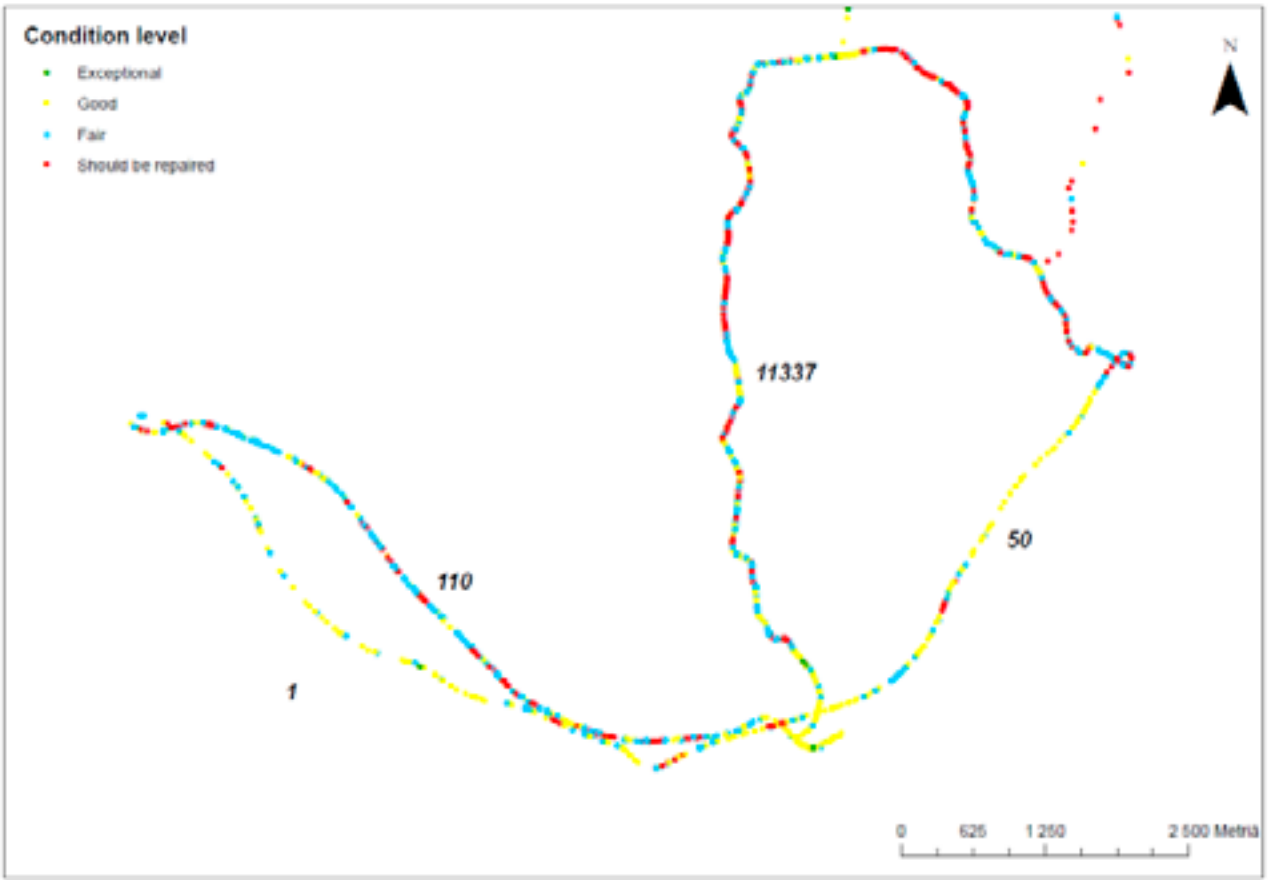
Stakeholder Ranking of Defects - Minor Roads

Accompanied journeys – the route taken

a laptop computer, connected to a GPS location recording device, as illustrated to the right;
Since all the data recorded was thus accurately locationally-referenced, GIS plots of the condition scores were able to be produced within a short time of returning to the office. An example is illustrated below;

The final step in the case study trial process was to explore correlations between the stakeholder/ driver perceptions of condition with existing technical condition survey data routinely collected by the FTA. The following example shows the results of the driver defect scores overlaid on the IRI condition measures, over a selected section of the route, from which a good correlation is apparent;


Interior of accompanied journey car showing researcher using laptop to record defects.

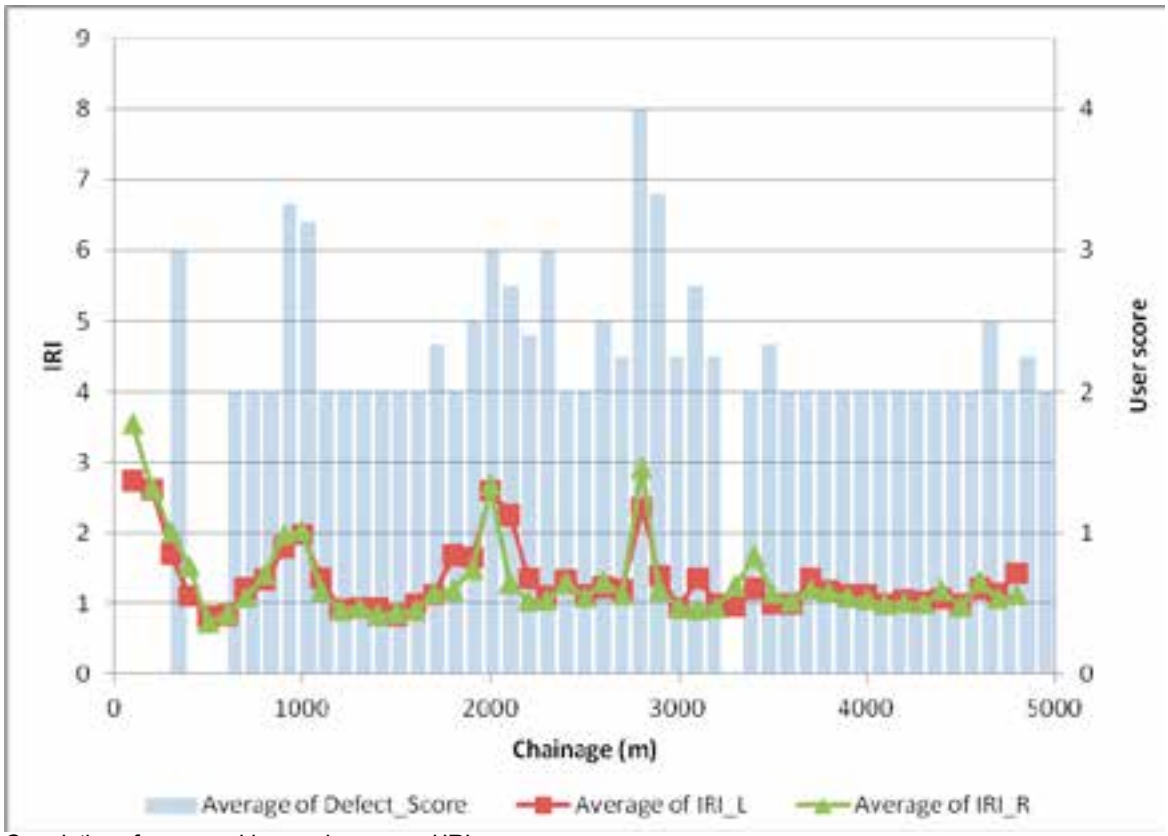


Example GIS output of user condition levels

The conclusions of the case study trials were summed up in the project team's own words as follows;

Overall the trial was a success, demonstrating that the EXPECT methodology can be successfully implemented. FTA concluded that the method can be used in these types of studies and that it is generic enough that it could be extended to other situations and transport modes (e.g. railways, waterways). The methodology could also be extended in its reach to understand how users interact with different transport models on one journey.

Whilst FTA have a comprehensive knowledge of their network even this trial revealed new results; that is, contrary to their prior beliefs, road users might not be so tolerant of partial repairs on their roads. If a full study followed on from this trial, this highlights a more focussed question that could be asked of the users as part of the focus groups. If possible, the journey could be adapted to try and incorporate sections of road that have had partial repairs.



Correlation of average driver and measured IRI scores

In the project's 'Implementation Trial Report' (available on the project deliverables library), a number of lessons learned are cited, which will be of particular interest to NRAs considering adopting the EXPECT techniques;

- Recruitment of suitable participants
- Consistency in running Focus Groups, including use of terminology and Topic Guides
- Use of a defect picture-bank pooled by several NRAs would be helpful
- Data Capture would be improved by using a touch-screen
- Preliminary drive-over of route by research team is essential
- Planned stops along route would be useful for discussions/reviews
- Availability of contemporary technical condition surveys for the route is very useful

The Technical Adviser additionally concluded;

- The data capture approach, including locational referencing was found to be particularly easy to implement and shows that, with a relatively small amount of additional effort it would be possible to produce a robust set of tools, perhaps to be made commercially available if a suitable partner could be identified, that would provide an interface to an organisation's asset management system. Were such a link to be available, the complete cycle from identifying stakeholder aspirations, to measuring driver experiences, could be linked to technical condition surveys and hence engineering solutions for maintaining the asset.

- When considering the application of new principles and in particular explaining terms and concepts in group sessions with stakeholders, language can sometimes be an issue. The case study trial, however, showed that the EXPECT deliverables (in English) could relatively easily be translated and used in the Finnish context. The question of language and understanding was the subject of a recommendation for a common Data Dictionary (4.1.4) made in the Technical Report (May 2013).

3.3. Key Performance Indicators; SBAKPI

(Strategic Benchmarking and Key Performance Indicators)

Project Coordinator; TRL (UK)
NRA Partner; (not applicable)

The key output of the SBAKPI project was a set of ten KPI themes and a benchmarking framework in the following technical domains;

- Noise
- Air Quality
- Water Quality
- Waste/Natural Resources
- Climate Change
- Biodiversity
- Stakeholder Satisfaction
- Safety
- Development
- Travel

The project was completed early in the programme (in April 2012) and so some time had elapsed between then and the proposed Final Symposium in May 2013. In the Final Report, it was reported that NRAs consulted would be likely in many cases not to be ready to implement the KPIs and recommendations were made for further development necessary to achieve a better take-up. It was therefore decided that, rather than implement a case study trial of the KPI's in an NRA, there would be a follow-up exercise to establish what progress had been made in the NRA's since publication of the report, and if any other European research was underway which was building on the SBAKPI recommendations.

The work undertaken was based on sending a follow-up questionnaire to the six NRA's which had previously been consulted. The questionnaire contained ten questions, as follows;

Question 1 – Did your NRA take forward any of the KPIs produced by the project, if so which ones and why? If you did not take the KPIs forward it would be useful to know why not.

Question 2 – Is your NRA currently using any (other) strategic KPIs relating to environmental and social issues?

Question 3 – If your NRA does not currently have any strategic level environmental or social KPIs are there any barriers preventing the NRA from having them? If so, what are they?

Question 4 – In general, do you think that environmental and social KPIs are (or are not) a useful management tool for NRAs? Please give reasons for your response.

Question 5 – Several of the KPIs developed in the SBAKPI project were based on the requirements of EU environmental legislation, such as the one for noise. Do you think that linking KPIs to relevant EU environmental and social legislation is a useful approach? Please give reasons for your response.

Question 6 – If you could pass on three tips or suggestions for best practice to other NRAs on key performance indicators, what would they be?

Question 7 – Is your NRA strategically managing environmental and social issues?

Question 8 - Does your NRA have a coordinator for dealing with environmental/social issues or sustainability?

Question 9 – How should organisations such as CEDR (Conference of European Directors of Roads) support the development of a strategic approach to environmental and social issues and key performance indicators in the future? Are there any other organisations which should also be supporting NRAs develop and use KPIs?

Question 10 – If we were to carry out the trial again, how could we encourage greater participation by NRAs?

Unfortunately the response rate to the questionnaire was poor, with replies received only from Denmark, France and Ireland, and some of these responses were incomplete. This followed a pattern experienced in the main project, which was picked up in Question 10 (above). The importance of stakeholder involvement in research such as the ERANET/CEDR Transnational programmes, is, in the view of the Technical Adviser, crucial. A recommendation to this effect (4.1.3) was made in the Technical Report (May 2013).

The questionnaire exercise did, however, point up some interesting comments and conclusions, including the following;

Reporting of environmental and social KPIs; 'Safety' and 'Noise' were the only two KPIs being used. (Lack of) data was cited as a key reason for non-take-up. Other locally-developed KPIs were in use in some cases.

Barriers to environmental and social KPIs; One response mentioned time and resources.

The usefulness of environmental and social KPIs as a management tool; two affirmative responses.

Linking KPIs to relevant EU environmental and social legislation; mixed response one NRA remarking useful, one not. Conclusion was that while links could be useful, KPIs should be pushing NRAs beyond simply legal requirements.

Best Practice in relation to KPIs; one NRA responded (three suggestions, as given below)

Tip/good practice suggestion	What are the benefits of this?
Give early consideration to environmental issues in the planning phase.	Helps in route selection and allows for a more integrated approach to designing mitigation measures.
Be mindful of the type of contract you are applying KPIs too.	Can be difficult to monitor delivery of KPIs in design and build type contracts.
KPIs must be flexible.	Allows for modification in scheme specific situations where either social or environmental indicators may need to be augmented.

Management of environmental and social issues by NRAs;
two positive responses.

Supporting the development of environmental and social KPIs in the future;
three responses; 'by CEDR providing benchmarking and accounting', extending support through PIARC, and 'transnational research and working groups appear to be working well'.

E**ncouraging greater participation by NRAs;**
two responses; 'face to face meetings in advance of survey to ascertain extent of available information', and 'working groups with delegates from each NRA'.

Some reference was made to other ongoing European research on this topic (for example, SUNRA), however no specific examples of SBAKPI KPI's having been taken up or developed were given.

The conclusions from the follow-up work, were summarised by the project as follows;

- At present, there has been limited take up of the KPIs developed by the project and the KPIs that were developed to accompany the topic areas could not all be universally adopted;
- The original recommendations for each of the KPIs are still relevant. Many of the proposed KPIs need further discussion between NRAs to determine the most appropriate metrics, and forums such as CEDR subgroups could be used to discuss options; and
- There remains a mixed commitment to and implementation of environmental and social KPIs, although it appears that with some NRAs it is seen as a useful management tool.

There are necessarily some limitations in terms of the conclusions that can be drawn due to the low response to the follow-up questionnaire. Nevertheless this follow-up work, along with the original SBAKPI project, has shown that NRAs in Europe have an interest in this topic, indicating that work should continue in this area to further support NRAs in taking this forward such that they can improve their environmental and social performance and benchmarking.

The full report by the SBAKPI project on this Follow-Up Work is available in the project deliverables library.

The results of the SBAKPI project (as well as EVITA) do have direct relevance to CEDR and are the subject of another recommendation concerning future performance monitoring across Europe (4.3.2) which is made in the Technical Report (May 2013).

3.4. Key Performance Indicators; EVITA

(Environmental Indicators for the Total Road Infrastructure Asset)

Project Coordinator;
IFFSTAR, formerly LCPC (France)

NRA Partners;
DRSC/DARS (Slovenia)
Danish Road Directorate (Denmark)
Swedish Transport Administration (Sweden)

The EVITA project developed 10 e-KPIs across four key domains; noise, air quality, water quality and natural resources. For each of the e-KPI's, a practical 'Application Sheet' was produced that was intended to assist a practitioner wishing to put the indicator into practice.

The aim of the EVITA case study was therefore very simple; to provide the Application Sheets to the partner NRAs, and allow them to follow the calculation methods using their own data and report back on how easy or otherwise this proved to be. While technical assistance by the project experts was made available on a call-off basis to the NRAs, it was not found necessary to use this facility hardly at all during the trials; this is a good demonstration in itself of the effectiveness and understandability of the project deliverables.

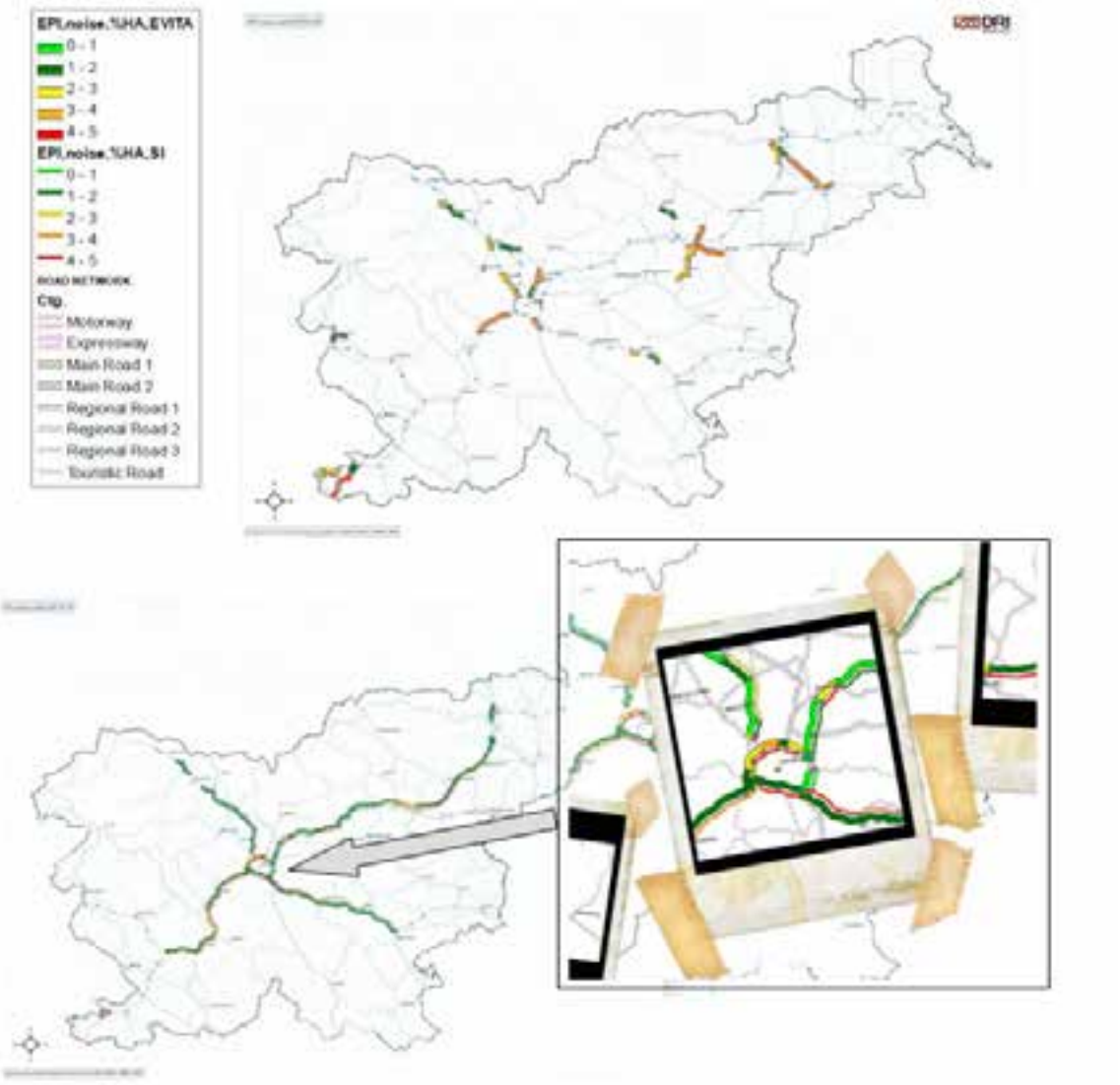
Communication between the three NRAs during the trials was facilitated via conference calls, with the involvement of the Technical Adviser. Each of the three NRAs found different experiences of using the e-KPI's. In all cases, feedback about the guidance documentation provided by the project, including the application sheets, was positive. The first difficulties encountered were, perhaps predictably, on the question of data. Data availability proved an issue in several cases, and the format and nature of data posed a problem in other cases.

Example EVITA Application Sheet

	DRSC/DARS (Slovenia)	Danish Road Directorate (DK)	Trafikverket (Sweden)
Noise	EU Directive good policy driver; data available; Trial calculations made; can be used on network level	Data available, but doing it in different way	Data available only for den; measuring in different way, legal requirements different
Air Quality	Few data available; estimated high costs to complete data	No data available, but strong interest	Good availability for CO_2, NO_x, PM; using Swedish dispersion model (developed by SMHI); not available for NO_2, PM_{10}; interested in calculation of health impact. Questioned purpose and areas of use (emissions and exposure not good enough to be basis for decisions) e.g. when to communicate air quality problem, to evaluate/ predict effects. Also no connection to legal requirements or (national) air quality goals.
Water Quality	Some data available on water; high interest on water drinking supplies, low elsewhere; salt - high data availability and interest Trial calculations made; water - major water retaining basin example; salt - can be used on network level	Almost all data available, interested to explore further	Good data availability on water drinking supplies, low/medium elsewhere; salt - high availability Resemblance with a risk assessment system that is developed and used by STA
Natural Resources	Low data availability and low interest (some for recycling)	Data difficult to retrieve, very interested to explore further	Low data availability (for certain projects, in general no); area of high interest and focus – STA developing a climate calculator (CO_2 emissions from construction, maintenance and operation – road & rail)

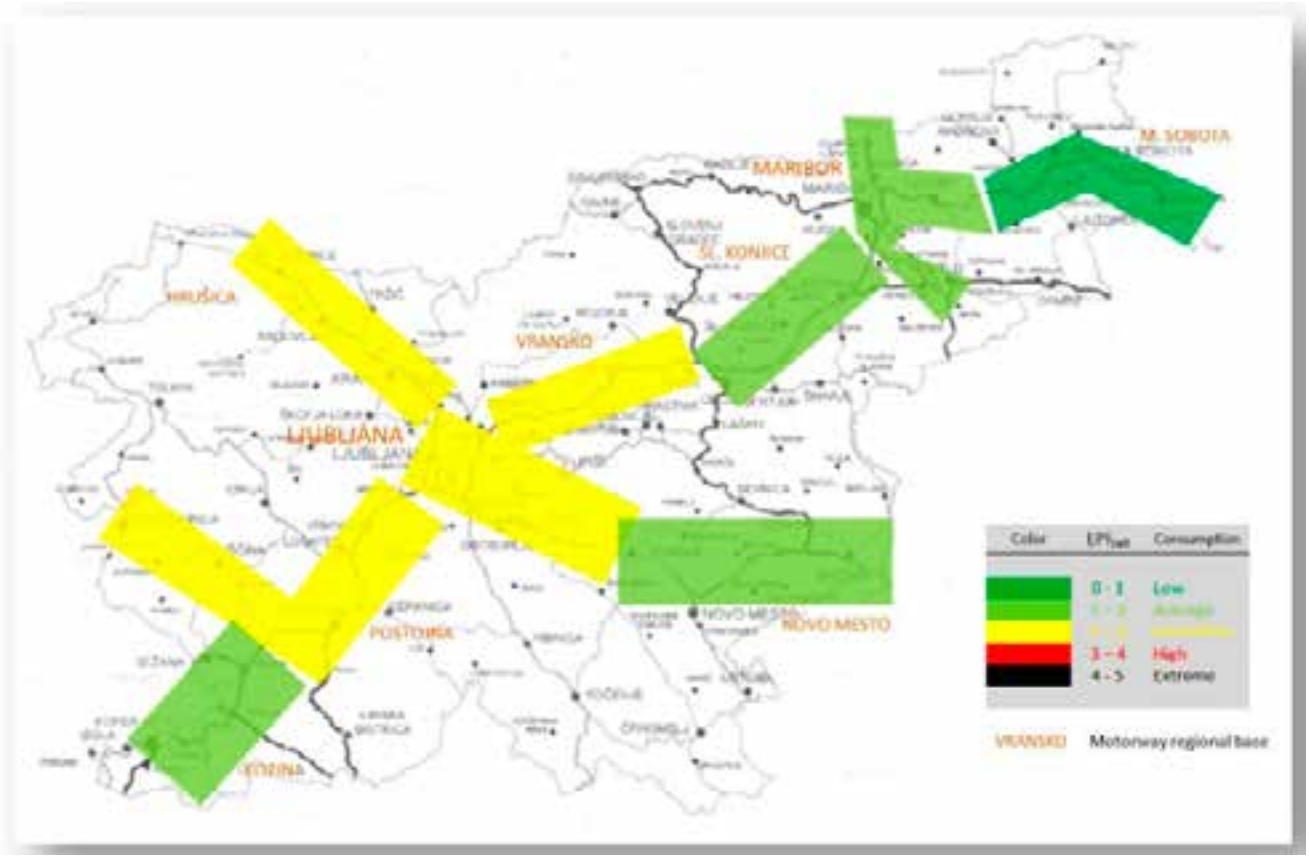
Summary feedback from EVITA e-KPI trials

Some examples were presented by the Slovenian Road Administrations (DRSC/DARS) and are re-produced below;



Example; Noise e-KPI (Slovenia – Motorways and National Roads) with a zoomed-in example

Example; Water pollution e-KPI (Slovenia)



Example; Salt e-KPI (Slovenia)

Where data were found to be available, calculations were generally found to be straightforward (noting in particular the trials reported by Slovenia). However, one general conclusion was that the new e-KPIs sometimes did not fit comfortably with the business priorities and processes of the particular NRA, even though the topic may be one of interest to that NRA. This is a similar experience to that found previously in CEDR when developing KPI's that may be suitable for pan-European application.

The uniform dimensionless scale (0 to 5) proposed by the project to apply to all e-KPIs was considered in the trials and a comment made by one NRA that a more finely-graduated scale might be more useful, and some flexibility for local variations may be desirable.

A key question whenever considering the application and use of KPIs is whether they are locally-specific, or network-wide. This question was also raised during the case study trials.

Overall, however, EVITA presents a good technical foundation for preparing the way for potential pan-European indicators, but with additional work required to fit each indicator to the widest possible range of countries.

3.5. Cross Asset Management; ASCAM

(Asset Service Condition Assessment Methodology)

Project Coordinator;
TNO (Netherlands)

NRA Partners;
DRSC/DARS (Slovenia)
Danish Road Directorate (DK)

In the ASCAM project, a software demonstrator tool was developed, using a relatively easy-to-understand spreadsheet interface. The demonstrator was used to show how asset deterioration over time could be related to the concept of End User Service Levels (EUSLs) , and how effects of alternative maintenance scenarios, could be assessed..

Since the project used 'realistic' but not 'actual' real-world data, it was proposed to run case studies with two NRA's to further extend the relevance and identify the data need of the innovative demonstration framework.

The trial

The trial considered a maintenance project of a 10.5 km road stretch, in which one bridge is present, and one detour route. A limited number of alternatives for a time based reference maintenance scenario for the pavement and the bridge joint were assessed:

- Postponement of asphalt overlay and effect on the risk of emergency measures (effect of maintenance postponement)
- Performing repair work during the day and night (effect of night work on availability)
- Combining asphalt overlay on the bridge with bridge repair, (cross asset)

The ASCAM demonstrator, while capable of evaluating a range of asset types, was configured to focus on pavements for the purposes of the trial. The condition parameters considered were as shown in the following table;

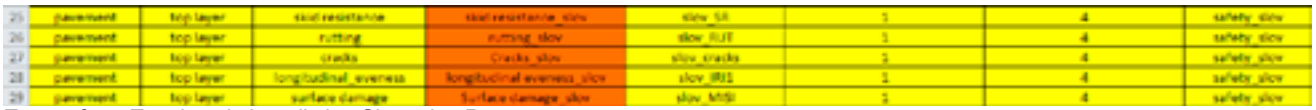
Component	Aspects
Pavement	skid resistance
	rutting
	longitudinal evenness
	cracks
	surface damage
Joints	impermeability
	mechanical damage

The EUSL considered were safety, noise, accessibility (additional travel time).

The first key challenge to the NRAs was to establish whether they had the necessary data, in a suitable format, that could be used to run the trials. The findings were mixed (see table below), and in order to fully populate the model it was necessary in some cases to use 'assumed' values where actual data was not available.

Required data for ASCAM trial case	Slovenia	Denmark
Traffic intensities		
Road type		
Direct costs measures		
Indirect costs measures		assumed
Degradation curves		assumed
Emergency repairs	assumed	assumed
Relation degradation/EUSL	assumed	assumed
EUSL values	assumed	

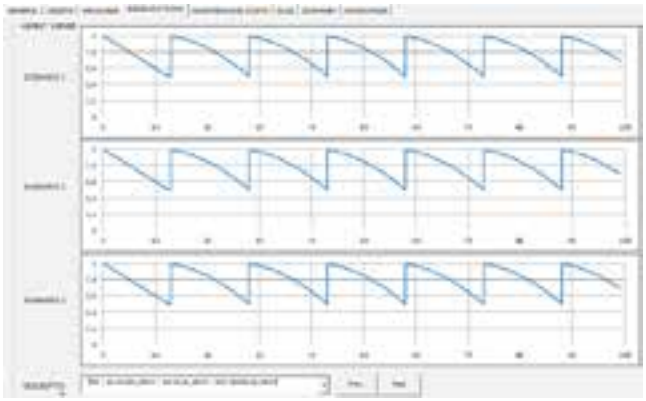
The demonstrator required a significant amount of 'meta data' to set the parameters for the prioritisation modelling, for example degradation relationships and a library of maintenance measures for each type of asset. This was found to be one of the key challenges by the participating NRAs. Extracts of the example NRA meta data are illustrated below;



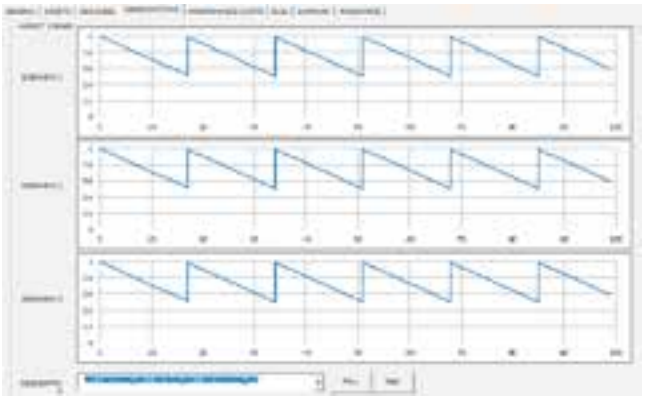
Extract from Excel worksheet listing Slovenian Pavement measures

The ASCAM demonstrator was able to project, over time, the expected maintenance costs of a number of maintenance scenarios and the 'costs' associated with risk of not meeting End User Service levels . Examples of these are illustrated below;

The final results, comparing costs and benefits of three scenarios in each case, are illustrated in the screen shots on page 22;

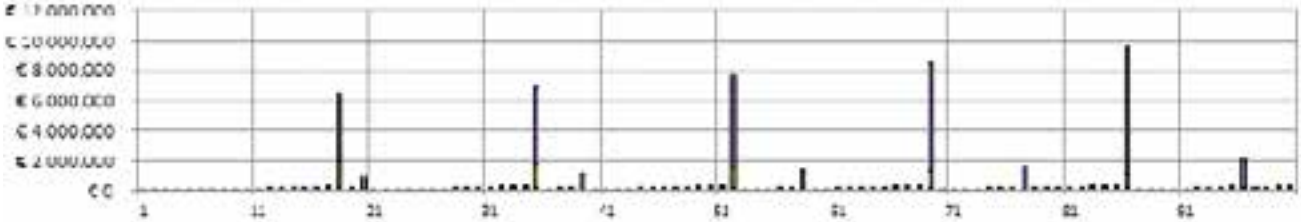


Danish degradation curves for skid resistance (assumed)

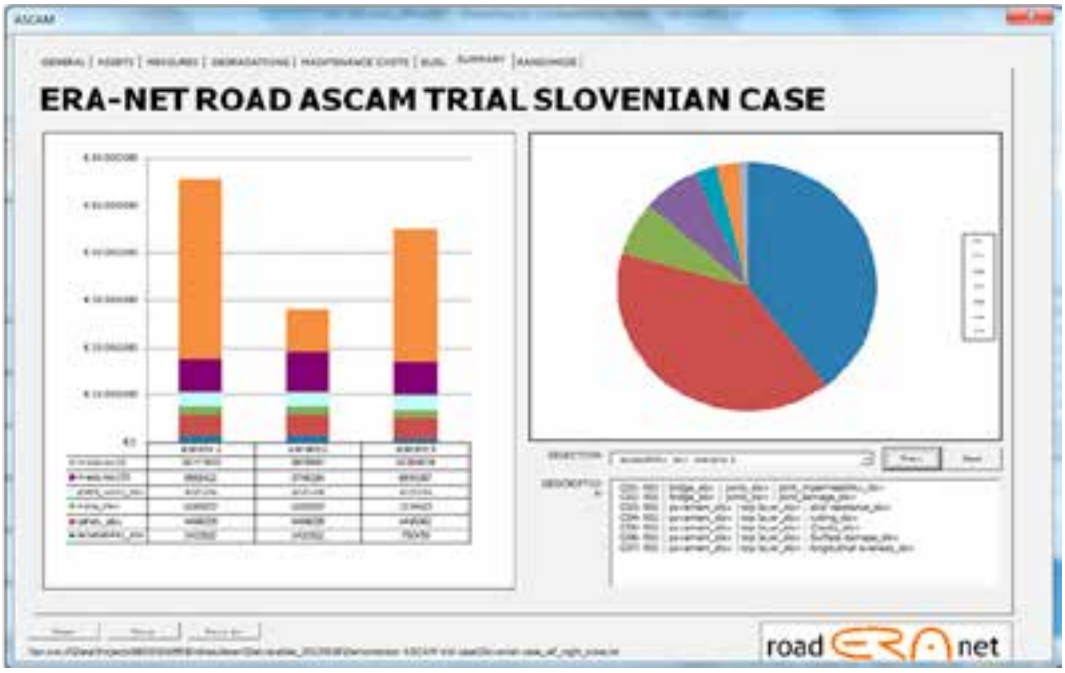


Slovenian degradation curves for skid resistance

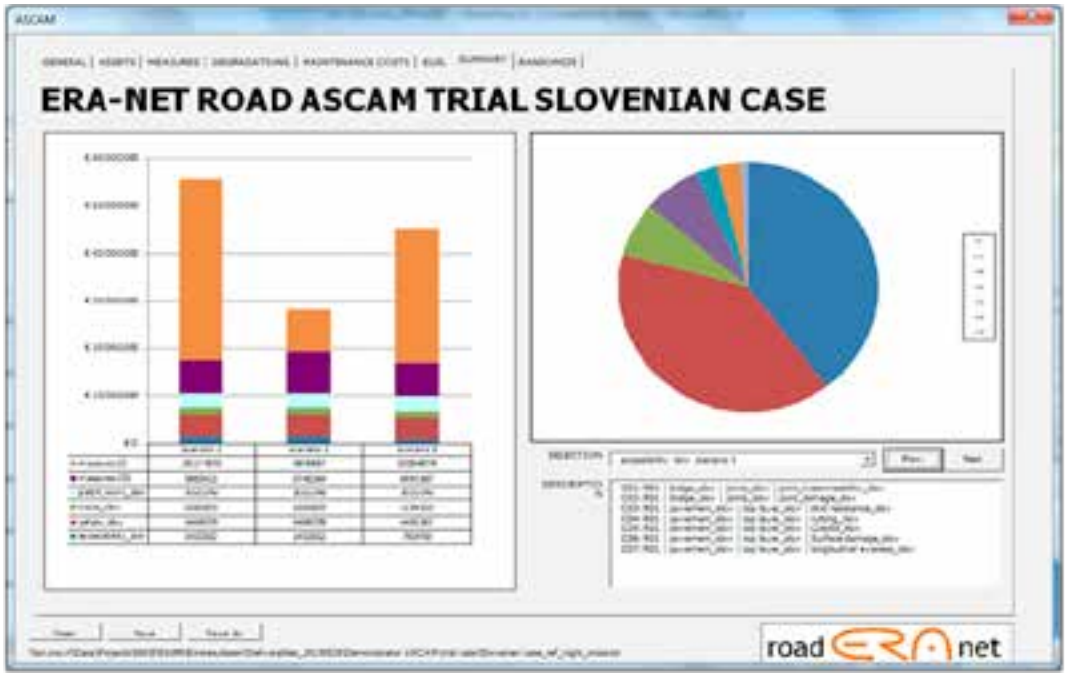
Maintenance costs in time, Slovenian case, reference scenario.



Costs associated with EUSL in time, Slovenian case, reference scenario.



Present value of costs of maintenance and risk of; patch work, non-availability, safety and noise (left) Sensitivity of different maintenance measures on safety (right)



Present value of costs of maintenance and risk of; patch work, non-availability, safety and noise (left) Sensitivity of different maintenance measures on safety (right)

The ASCAM case study trials added a better understanding of the role of the 'demonstrator' software and its potential use to help in the development of a framework applicable to a particular NRA. However, the trials perhaps produced less specific outputs than the NRA's had originally anticipated.
The NRA's conclusions may be summarised as follows;

Slovenia
The concepts used in the ASCAM framework sound very promising for application on the Slovenian DARS and DRSC networks.
To fully understand the framework and get a clear picture of the added value and ways for practical implementation, would require time and further effort to get more familiar with it.
The demonstrator calculations produced in the Trial case are a start for this and give an indication.

Denmark
For the DRD the concept of the framework is promising. This was again demonstrated in the trial case. We have established that the data need is large compared to what is readily available.

3.6. Cross Asset Management; PROCROSS

(Development of procedures for cross-asset management optimisation)

Project Coordinator; AIT (Austria)

NRA Partner; Highways Agency (UK)

The issue of optimising maintenance strategies across different asset types present on the same road is perhaps one of the most challenging facing maintenance engineers and planners. The PROCROSS project not only developed procedures for addressing this challenge, at the project option level, but also created a prototype model using proprietary off-the-shelf software to demonstrate how the procedures might be applied.

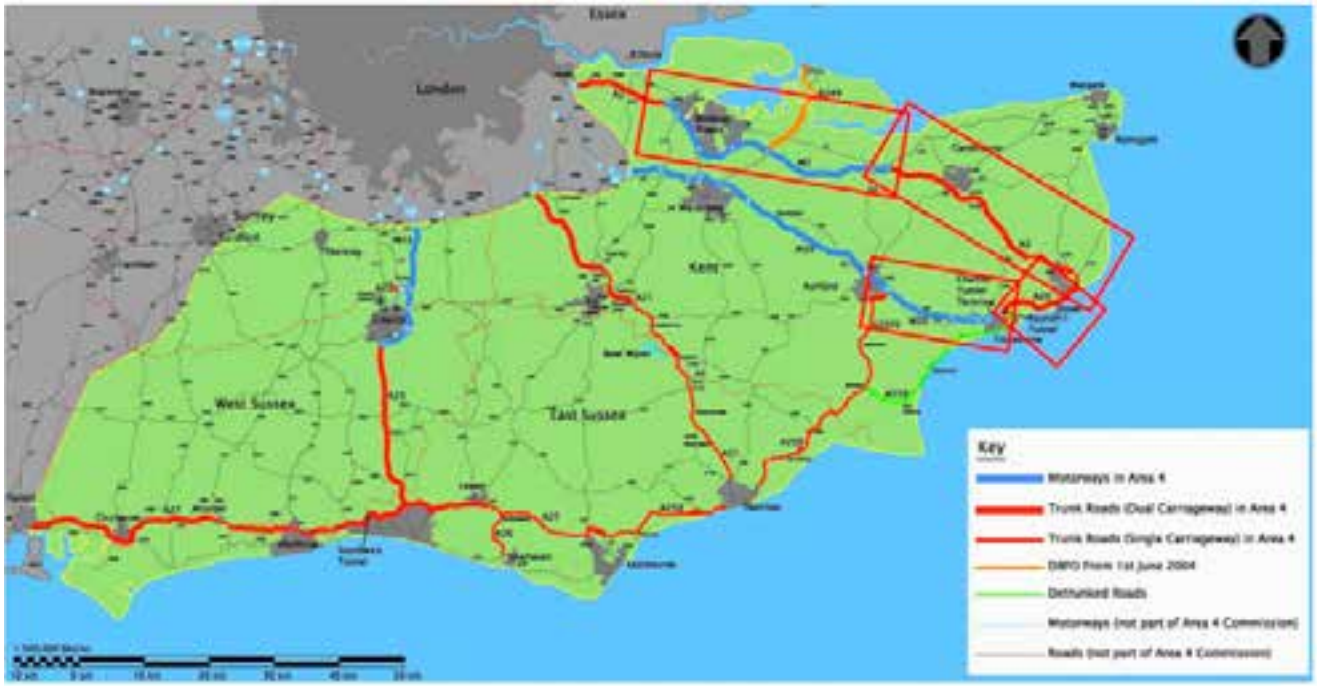
The Case Study put forward was designed to make use of existing data, in this case provided by the Highways Agency (HA) in the UK, concerning a set of real scheme options on a range of assets associated with a real sub-network in south-east England.

The research contractor (AIT) made use of a proof-of-concept software model developed during the project and built on a proprietary software platform (though any similar product would do the same job). The data required for the model was specified and the HA, working with its service provider on the Area 4 (South East England) maintenance contract, extracted the necessary data on each section of the selected network from its current working asset databases.

What was discovered at an early stage in the trial, was that the existing process (called 'Value Management') developed and used by the HA to rank its scheme options, provided an excellent data 'fit' to run the PROCROSS prototype model. Moreover, one of the challenges that the HA was already aware of in the way it runs its Value Management process, is that the evaluation of different asset types differed, and was completed in isolation without reference to cross-asset optimisation. The only cross-asset considerations encouraged in the existing VM process is the creation of 'hybrid' schemes in which more than one asset is treated at the same time – however these schemes are developed by engineering judgement rather than a rigorous optimisation methodology.

The HA's VM Score is a combination (for each scheme option) of;

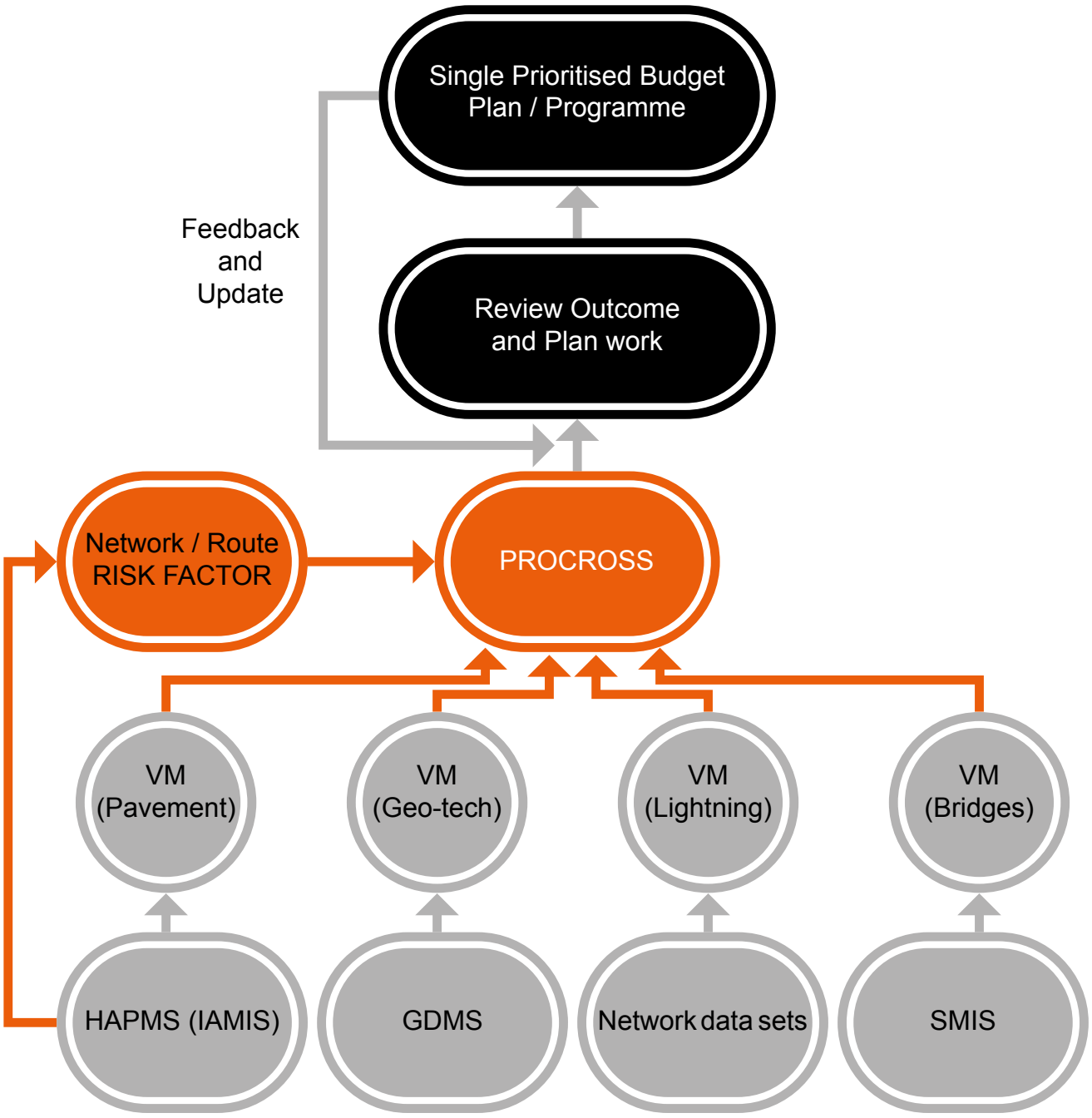
- Value for Money (50%)
- Safety (30%)
- Environmental Sustainability (20%)



Network Segments selected for PROCROSS Trial

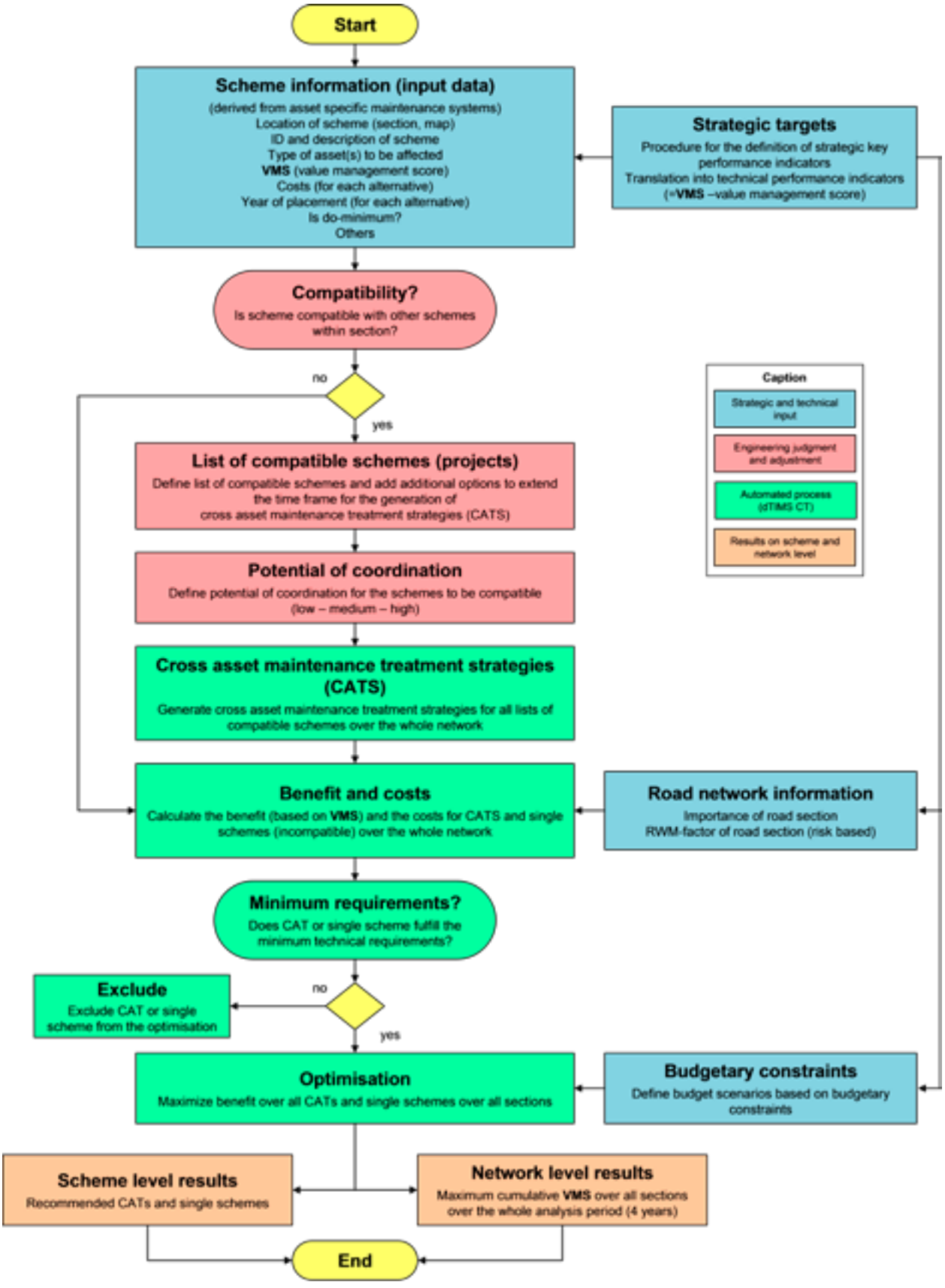
In the Case Study, the list of VM scores associated with each scheme in the chosen real sub-network's maintenance plan, was imported into the proof-of-concept software, along with an inventory of the road sections comprising that sub-network. The schemes included those concerning pavements, bridges, tunnels and other key asset inventory, and covered a four-year planning time horizon (although the year 1 schemes were more numerous and more developed).

This 'bottom-up' process is illustrated in the flow diagram below, which also illustrates how, when combined in the single prioritisation model based on PROCROSS, the aim was to consider many options and scenarios. Ultimately, this leads to a single prioritised list of schemes for budget planning and prioritisation purposes.



Fitting HA data streams into the PROCROSS process

A more detailed description of the steps involved in the PROCROSS trial process is provided in the flow diagram below. This illustrates using colour-coding which steps are data input, which are engineering judgement inputs, which are automated software stages and which are outputs.

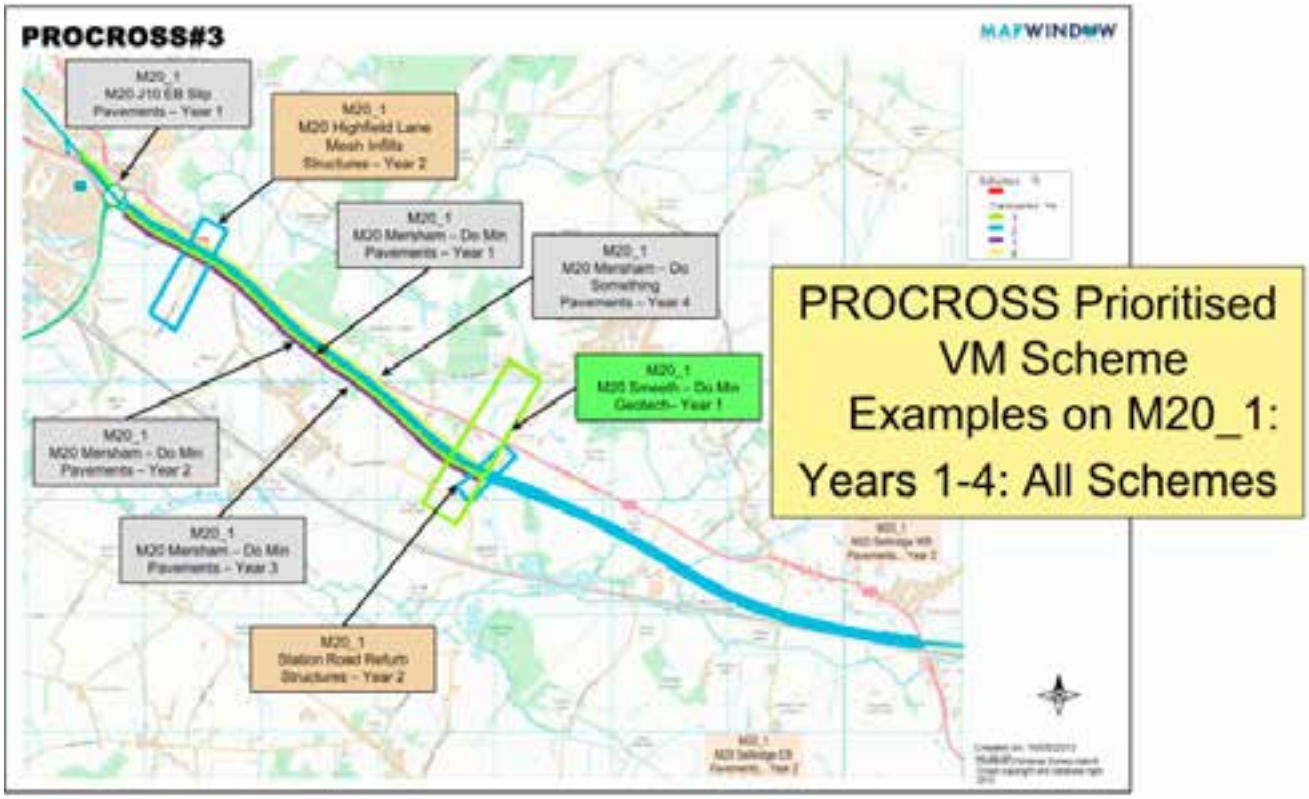


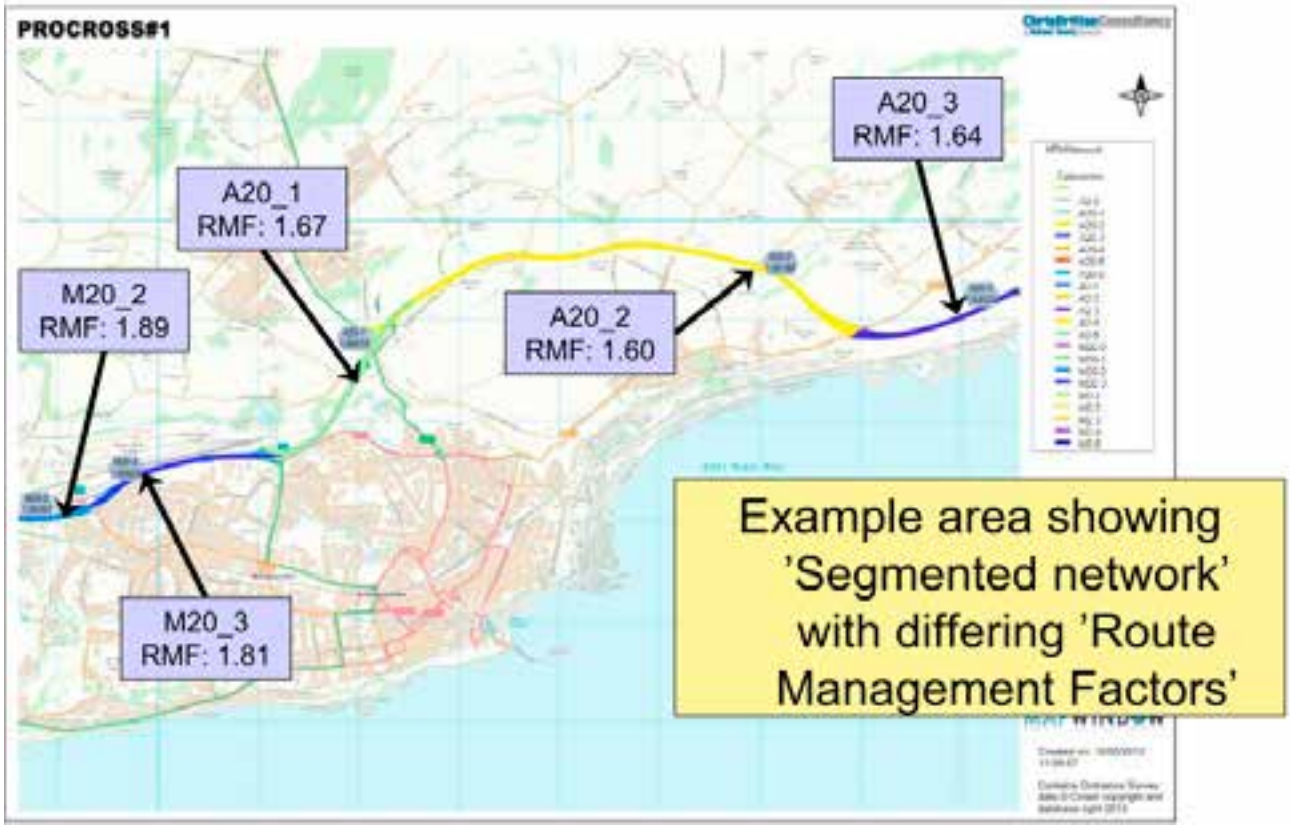
An example of the location of schemes to designated 'segments' on the network for a section of the A20 is shown below. A key factor which is user-defined is the potential to coordinate/combine schemes, and clearly this has both a geographical dimension as well as a time dimension. In addition, the user specifies whether the scheme is a 'Do Minimum' option in each case. This, and other 'rules' for combining schemes on different assets are factors which then govern the PROCROSS model optimisation process.

An example of schemes for different assets, on the same section of network, and nominally allocated to years 1 to 4 for planning purposes, is illustrated below.

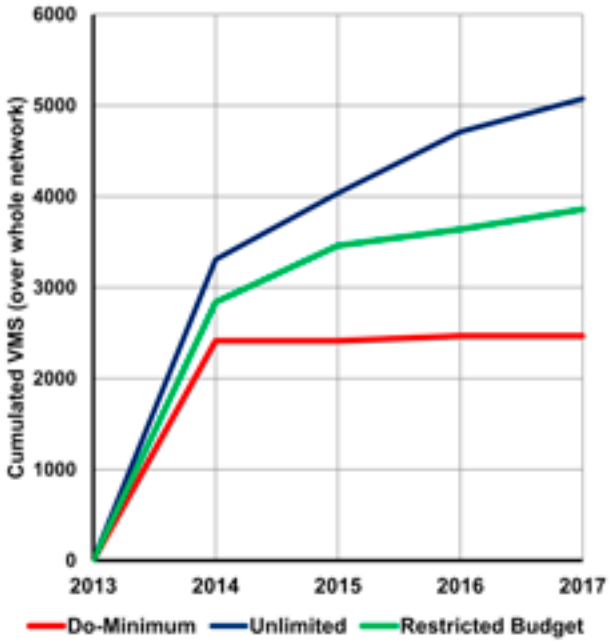
Once the PROCROSS model is run, the potential benefit of combined scheduling of some of these schemes is identified (and called a 'Cross Asset Treatment Strategy or CAT). In total, over all sections and over all CATs, including also single schemes, more than 2000 combinations were identified on the tested network. This is a typically large number of options and underlines why a software tool is necessary to process the options.

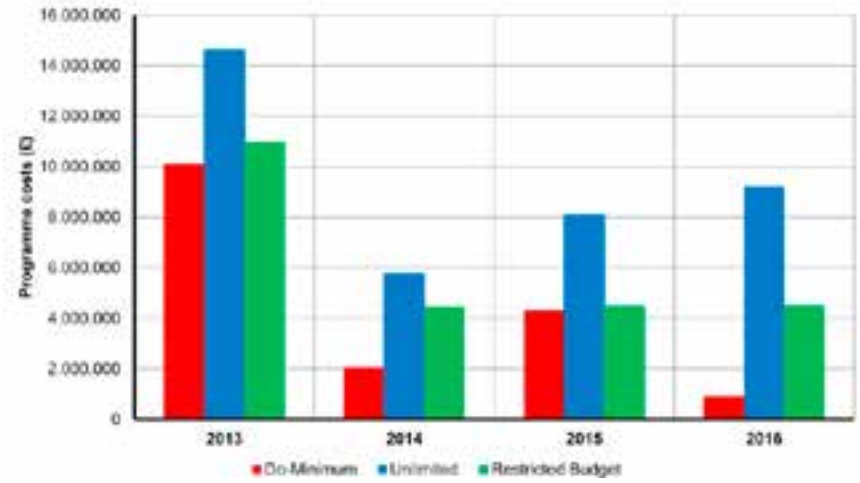
The additional 'Route Works Management Factor' which was derived from the prototype Network Risk Model was also assigned to lengths of network with a consistent risk rating; this is illustrated on the example GIS plot below;





Finally, when the data has been processed for the whole network, under different budget scenarios, it is possible to plot the cumulative 'benefit' of the scheme options selected under each scenario. In this context, the benefit was described by using the VM score of the selected schemes as a proxy measure, and cost is the estimated scheme delivery cost. These results using the Area 4 data are shown in the graphs below;





To summarise, the PROCROSS trial was able to;

- Demonstrate the feasibility of cross-asset scheme prioritisation which can provide decision support at both network and project levels
- Use existing NRA data on scheme options and rankings (based on a locally-derived 'Value Management' score) but additionally to;
  - Combine schemes for different assets at the same location
  - Consider options for the timing of schemes over a 4-year time horizon
  - Incorporate other local risk factors in the overall prioritisation process
- Consider more combinations of options by use of a computer model than would be possible by hand
- Demonstrate the feasibility of incorporating such an approach into existing or in-development asset management systems, while still recognising the need for engineering judgement at various stages in the process

A more detailed report on the PROCROSS 'Implementation Trial' is available in the project deliverables library.

4. Conclusions

In most Research Programmes, dissemination of the results is given a high priority. However, going the 'next step' to providing real-world examples of how those results might be used to the benefit of the stakeholders is often overlooked.

When the ERANET Road Asset Management Programme decided to expend a small amount of effort at the end of the projects on developing case studies with the direct involvement of practitioners from the stakeholder NRAs, it presented a novel and exciting opportunity to change the emphasis to implementation, rather than simply dissemination, of the research. It was going to be risky – what if an NRA came to the conclusion that the research was impractical to implement? – but it became clear that, whatever the conclusions, the learning gained could be extremely helpful when considering 'next steps' towards implementation.

The six case studies undertaken by the programme, and summarised in this supplementary report, demonstrated almost without exception, the benefit of taking time to evaluate the potential of using innovative models and concepts in the real working environment. Examples were in some cases successful to the extent that the NRAs involved have decided to take the matter further outside the project programme (FTA Finland with EXPECT and Highways Agency UK with PROCROSS). It will be very interesting to follow up these initiatives over a period of time to see what progress has been made.

The Executive Board and the stakeholders can say with confidence that the relatively small investment in these case studies, has already shown a benefit and has provided a platform for NRA's to continue to reap further benefits as implementation of the research outputs is taken up. Future CEDR Transnational Research Programmes can learn from this experience and consider setting up case studies and a final interactive symposium or workshop at the end of the programme, following the successful precedent of the Asset Management Programme.

Chris Britton, Technical Adviser
#1/11.7.13

Technical Adviser's
Supplementary Report
on the Case Studies

ERANET ROAD II SRO4
Effective asset management
meeting future challenges
2010 – 2013