CROSS ASSET MANAGEMENT IN PRACTICE
RECONSTRUCTION CONCEPT A23 VIENNA

MSc. PhD. Alfred Weninger-Vycudil
PMS-Consult GmbH, Engineering Office for Traffic and Infrastructure
AT-1010 Naglergasse 7/9 VIENNA Austria
E-mail: office@pms-consult.at

MSc.Brigitte Müllneritsch
ASFiNAG Bau Management GmbH
AT-1030 Modecenterstrasse 16, VIENNA Austria
E-mail: Brigitte.Muellneritsch@asfinag.at

Karin Vycudil
ASFiNAG Bau Management GmbH
AT-1030 Modecenterstrasse 16, VIENNA Austria
E-mail: Karin.Vycudil@asfinag.at

ABSTRACT

The Viennese urban motorway A23 is one of the most important roads of the Austrian motorway network (operated by motorway company ASFiNAG) with an AADT of more than 145‘000 vehicles per day. Erected in the years 1970 to 1973, an essential part of this strongly distressed motorway is the “Hanssonkurve” and the tunnel “Laaerberg”, which must be fully reconstructed under traffic within the next 2 years.

An intensive planning and design process including cross asset management was carried out as a basis for finding the optimum maintenance strategy for all assets. The different possible technical maintenance alternatives were assessed including performance prediction of safety, comfort and structural related indicators. The requirements for the optimization were on the one hand the application of durable and sustainable maintenance technologies and on the other hand the minimization of all negative effects to user, neighbours, environment, etc. The goal of the “top-down – bottom-up process” was a combination of pre-defined strategic targets with the maintenance needs of all assets, derived from the technical assessment processes using e.g. life-cycle-cost analysis.

The great challenge for the planning and management team of ASFiNAG was the requirement to pass 145'000 vehicles per day through the construction site and the tunnel without major disturbances for the road users and the insert of slipform pavers for a high quality of the new cement concrete pavement. Based on a special traffic concept it was decided that the main work will be carried out mostly during night.

The A23 pavement reconstruction of “Hanssonkurve“ is an excellent example how integrated life-cycle-analysis and cross asset management can be used within a user-oriented road maintenance approach in practice. In October 2012 the reconstruction will be finished completely.

1 PROJECT DESCRIPTION

Erected in the years 1970 to 1973 the motorway section Hanssonkurve is an essential part of the urban motorway A23, which crosses Vienna from south-west to north-east. The high traffic volume with approx. 145'000 vehicles per day and a high percentage of heavy vehicles has distressed the existing cement concrete pavement construction in a very extensive way. Thus, it was decided to make a complete reconstruction of the pavement together with additional improvements of all affected engineering structures and other assets.

Within the period of reconstruction works the entire cement concrete pavement will be renewed between Absbergtunnel (km 7.2) and Laxenburger Bridge (km 3.9). With regard to the planned extension of underground line U1, crossing the Laaerbergtunnel underneath the motorway, necessary preparatory operations for the underground will also be carried out together with the reconstruction works of the Hanssonkurve. This will avoid further traffic disturbances in this area after the construction site Hanssonkurve.

In parallel to the reconstruction of the pavement the Laaerbergtunnel, built in 1973, will be improved and extended to the technical state of the art, especially including full fire protection equipment of the tunnel, the reconstruction of retaining walls at the intersection Favoriten and replacement of the lightning system. Besides the general reconstruction works on the motorway five bridges, crossing the motorway A23, will be renewed. Furthermore, a new noise protection wall with a total height of approximately 4 m will be errected between Laxenburger Bridge and Selma Lagerlöf Bridge. The full reconstruction is scheduled to be completed in October 2012.

The following Figure 1 gives an overview of the construction site and the local situation of motorway A23 in the urban area of Vienna.

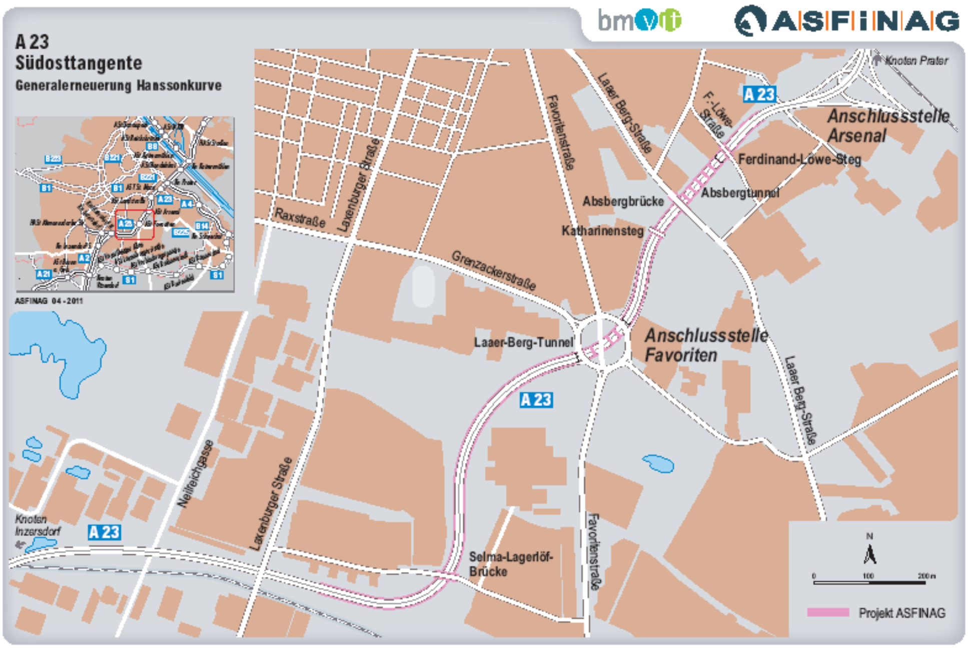

Figure 1: Site map motorway A23, construction site “Hanssonkurve” (Image ASFiNAG)

2 OBJECTIVES OF CROSS ASSET MANAGMENT

The main objective of the intensified cross asset management activities was to minimize the negative effects especially on the high number of road users (approx. 145'000 vehicles per day) and the affected neighbours of the adjacent urban area. In the context of this comprehensive motorway reconstruction it was necessary to develop and implement procedures for the cross asset management coordination within the planning process and the execution of works. An essential part of the planning process was the integration of all stakeholders and affected parties from the beginning:

- Users (represented by ARGUS, ARBOE, OEAMTC, Committee for Road Safety and VCOE)
- Neighbors (represented by City of Vienna and Economic Chamber)
- Executive authority (Police Department of Vienna)
- Public Transportation (Vienna Lines)
- Road owner and operator (ASFiNAG)

The communication between ASFiNAG and other administrations and parties was circumstantial for the whole cross asset management process. After commitment of construction site schedule and planning of the traffic phases the project was introduced to the Professional Commission of Traffic, where the whole traffic control was reviewed from the road safety and net availability point of view. The Professional Commission of Traffic consists of experts of different departments representing the different stakeholders.

Beside the coordination of the different stakeholder requirements it was necessary to assess the maintenance needs of the following different assets from the technical and maintenance point of view:

- Reconstruction of pavements
- Reconstruction of tunnels and replacement of tunnel equipment
- Reconstruction of bridges
- Reconstruction of retaining walls
- Replacement of noise barriers

The different maintenance needs had to be combined into a comprehensive and complex project plan aiming at a short reconstruction period and a holistic traffic concept, which enables to pass the high number of users through the construction site without a massive loss of capacity.

3 STEPS OF CROSS ASSET MANAGEMENT

3.1 Top-down and bottom-up approach

The cross asset management approach on A23 was the output of a long-term planning process, which is based on the experiences of the local engineers and external experts, which are engaged in asset management for many years. At first, it must be stated that there was no similar project available, which could help to make a clear definition of steps for cross asset management coordination under these comprehensive requirements. The result could be seen as the output of a pragmatic approach, the experiences of all stakeholders and the flexibility of the applied methods.

In general, the solution is based on a “top-down – bottom up” approach which enables to integrate the strategic targets with the technical requirements from the different assets or sub-assets respectively. The following Figure 2 gives a schematic overview of this approach and where the different requirements were allocated.

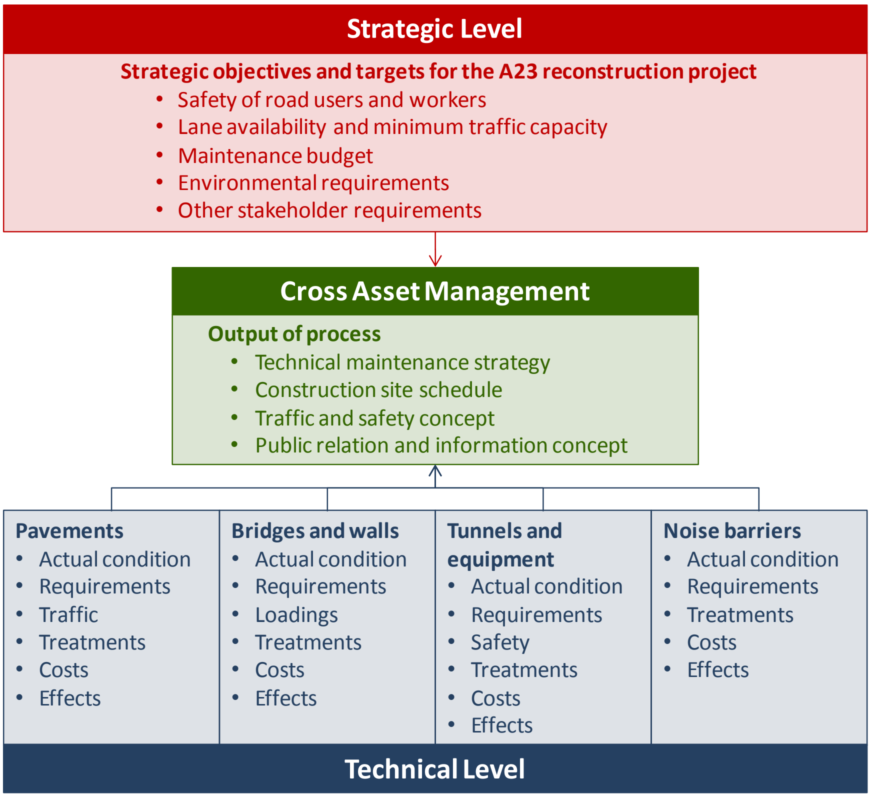

Figure 2: Schematic figure of cross asset management approach

Of course, there are additional steps needed to reach a full cross asset valuation, especially unified optimization procedures and instruments are still missing.

3.2 Planning steps

Both, on strategic level and technical level the following tasks had to be prepared before the cross asset management coordination could be carried out.

On the strategic level different planning steps were carried out in advance and could be summarized as follows:

- Identification of maintenance needs based on the results of the ASFiNAG Asset Management System (further information see Eberl, et al. (2011))
- Traffic modeling, which gives an overview about the effects of the construction site on traffic relocations or diversion distances. These models include also first capacity calculations for the construction phases.
- Definition of safety requirements for road users and workers
- Assessment of environmental impacts and definition of requirements for noise protection systems
- Assessment of tunnel safety improvements according to Austrian and European guidelines
- First consideration of possible traffic controls on the basis of cross section information and planning requirements.
- Definition of budget/investment frames
- Definition of requirements of underground line U1 extension under Laaerbergtunnel

The basis for the bottom up approach is the technical analysis and assessment of the different assets. Within this project, pavements, bridges, tunnels, retaining walls and noise barriers were assessed and the output had to be taken into consideration. In general, for each single assets or sub-asset the following planning steps were carried out:

- Control and assessment of current condition of all objects/elements in form of visual inspections, engineering judgment and testing of materials
- Detailed specification of necessary construction measures on the basis of economic efficiency calculations or life-cycle-cost analysis (LCCA) taking into account the technical state of the art (guidelines, standards and directives). The following Figure 3 shows the output of LCCA and performance prediction on the pavements for different reconstruction alternatives over a period of 30 years, as an example of this step. For the evaluation of the performance different performance indices were used, which are based on the recommendation in COST action 354 [COST (2008)].

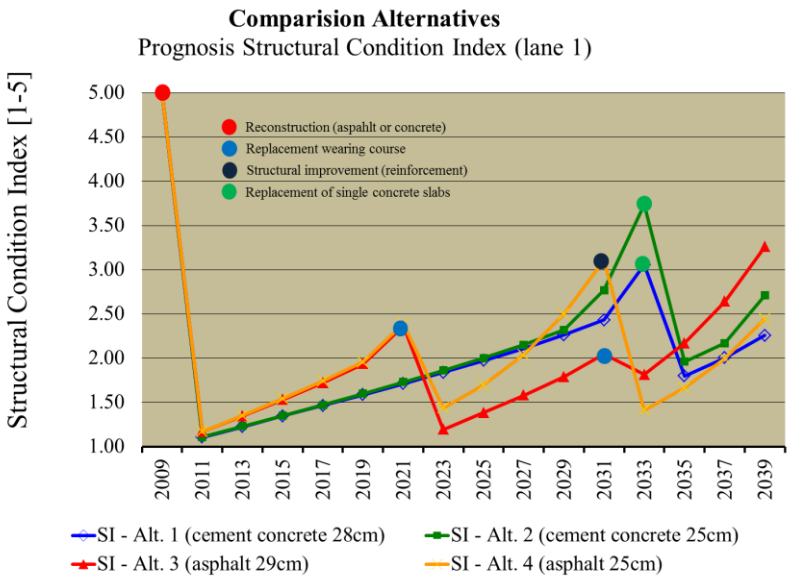

Figure 3: Performance prediction Structural Condition Index (SI) motorway A23, “Hanssonkurve” [Weninger-Vycudil, et al. (2009)]

- Cost estimation of recommended maintenance treatments
- General assessment of effects on road users and other stakeholders as a basis for the comparison and adjustment with the strategic targets (e.g. durations)

The last step was the combination of the results from the technical level with the strategic requirements in the context of the cross asset management approach. It aims at the

- Definition of technical maintenance solutions (measures)
- Construction site schedule
- Definition of traffic phases
- Definition of safety measures
- Definition of communication between the different stakeholders

Because of the complexity of the local situation and the high number of requirements the cross asset management coordination was carried out mainly by engineering judgement and technical support from the different asset management experts using special decision support tools (e.g. Pavement Management System VIAPMS^{TM}, BAUT^{TM} engineering structure management tool). For the practical execution of this process specific ASFiNAG manuals are available and mandatory (see ASFiNAG Planungshandbuch (2011), ASFiNAG Baustellen-handbuch (2011)).

At the moment there is no holistic optimization tool used in practice, which enables to run a mathematical cross asset optimization for finding the most efficient maintenance strategy under the given strategic requirements.

4 OUTPUT CROSS ASSET MANAGEMENT PROCESS

The combination of technical and strategic requirements enables to define a holistic maintenance concept for all affected assets. Nevertheless, to apply the output in practice different sub-concepts and solutions were defined and could be used as the basis for the final adjustment with all parties. It includes:

- Technical maintenance strategy
- Construction site schedule
- Traffic and safety concept
- Public relation and communication concept

4.1 Technical maintenance strategy

For each single asset or sub-asset the maintenance measures were defined in detail. Additional investigations on project level were used to define construction processes, to select the most durable and appropriate materials, to calculate the exact duration of the activities, costs, etc. The committed measures provided the basis for the tendering process.

4.2 Construction site schedule and traffic concept

The construction site schedule is strongly related to the traffic concept, which is split into 7 main phases. These phases had to be in accordance with the necessary time frames for the reconstruction but also with the periods of low and high traffic volume during the year. Finally, it was decided to carry out the main activities during night within the following 7 phases:

- Phase 1 (April 2011 – June 2011): In the daytime three lanes are available for the road users as actual. These lanes had to be narrowed for necessary work space. During nighttime (lower traffic) two lanes were closed in each direction (see Figure 4).
- Phase 2 and 3 (July and August 2011): During summer period 2011 and 2012 (July and August) the free traffic flow in the two-way traffic area must be guaranteed with two lanes in each direction only. The two-way traffic routing means a total of three lanes on one carriageway, where one of these lanes leads to the other direction. One lane remains on the carriageway which will be reconstructed. That kind of traffic routing is only possible during the summer months with lower traffic volume (see Figure 5).
- Phase 4 and 5 (September 2011 – June 2012): The phases 4 and 5 correspond to phase 1.

- Phase 6 and 7 (July and August 2012): The phases 6 and 7 correspond to phase 2 and 3 (see Figure 6).

Figure 4: Narrowed lanes, northbound and southbound carriageway (Photo ASFiNAG)

Figure 5: Two-way traffic area in the Laaerbergtunnel, northbound carriageway (Image ASFiNAG)

Figure 6: Two-way traffic area, view from intersection „Favoriten“ direction south (Image ASFiNAG)

4.3 Safety concept

Because of the restricted space conditions in the whole construction area a holistic safety concept has to be developed for the road users but also for the workers along the construction site. Within the safety concept the following requirements were defined:

- 24 hour video control of the entire construction sites, the entries into the tunnels and the ramps of intersection Favoriten
- Direct connection to Oe3 traffic information radio
- Limited access of people to construction site (only staff of CJV and ASFiNAG)
- Pre-information of traffic routing via Internet and other media
- Special emergency doors within critical traffic phases
- Speed control in the area of the entire construction site by section controls
- Intensive PR actions (see below)

Especially during the summer periods, when the lanes were reduced to a minimum, special emergency doors which can be used in case of traffic accidents were installed (see Figure 7). These emergency doors enable ambulances, fire brigades and police a quick and easy access to the affected areas and to save injured people within a short time in case of accident.

Figure 7: Installation of emergency doors (Photo ASFiNAG)

4.4 Public Relation Campaign

Because of the high importance of this project and the high number of affected users an intensive PR campaign was started already 1 year before the beginning of construction. The milestones of this campaign were as follows:

- The information of the project occurred on television as well as in print media.
- In March 2011 planning exhibitions were held. Within these planning exhibitions the construction site, the works and the traffic phases were introduced to the public.
- Shortly before the beginning of the reconstruction works a press conference was held by the chairman of the ASFiNAG.

- A few days before the construction site started users got additional informed by a brochure campaign.
- At the beginning of the works different reports on television and radio were sent and articles in newspapers were printed.
- On the ASFINAG website the different construction phases were installed in form of videos to give the users an understanding of the traffic phases. That visualization of the reconstruction and traffic phases won the Ottocar trophy in silver at the 10th AutoVision Film and Multimedia Festival during the 64th International Motorshow (IAA) in Frankfurt/Main.

5 CONCLUSION

The ASFiNAG motorway reconstruction project A23 Hanssonkurve is an excellent example how state of the art methods in design, planning and execution brought together in a holistic cross asset management process. From the beginning, the main objective was given to find a solution where the disturbance of the road users and the neighbours can be minimized. The combination of results from the technical (maintenance) point of view (bottom up) with pre-defined strategic targets and requirements (top-down) seems to be the most future oriented approach for such a project.

The methods and tools for single asset assessment are developed and available, but the instruments for cross asset management optimization are still missing. The manual coordination of strategic targets with maintenance needs of assets is possible, but limited to a certain number of information and data. It could be seen, that will be a big need in the future to develop on the one hand standardized procedures for cross asset management optimization and to extend existing or develop new decision support tools for these tasks.

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