Urban Track

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Advanced maintenance strategies

This project activity searched to study the organizational aspects of track management and particularly the link between design/construction and operations/maintenance. The final objective of this deliverable is a list of recommendation and of best practice examples in relationship to the way the maintenance department within an urban transport operator or separate maintenance company is handling its resources.

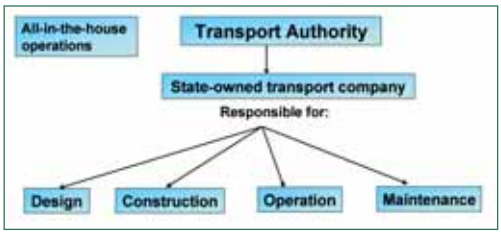
Eleven interviews were carried out with European tram operators, all with different organizational schemes, going from in-the-house operations to complete segregation of major activities of construction, operation and maintenance.

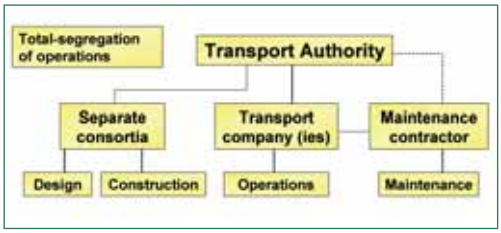
Through these interviews and research regarding the regulation framework of tramway infrastructure construction and maintenance, a growing interest from the side of transport authorities of integrating a chapter of maintenance in current calls for tenders of new tram infrastructure construction in Europe was identified.

As a result of this work package two lists of recommendation were developed regarding track design and track infrastructure maintenance.

In addition, the main conclusions regarding track management and maintenance are the following:

- There is a great need of implementing tools of internal track maintenance knowledge within operators: the real knowledge of the tracks' conditions is often being held by a reduced number of personnel (tracks' conditions and development). When this personnel leaves the network (retirement, change of work), this "precious knowledge" leaves with them. This is why it is very important to register tracks' aging and development plus the maintenance applied in specific software (containing the tracks' history).
- It is important to keep good channels of communication between the maintenance and the construction department: The closer the relationship between the maintenance and the construction department the better it is for implementing accurate maintenance plans and for producing more efficient track design.





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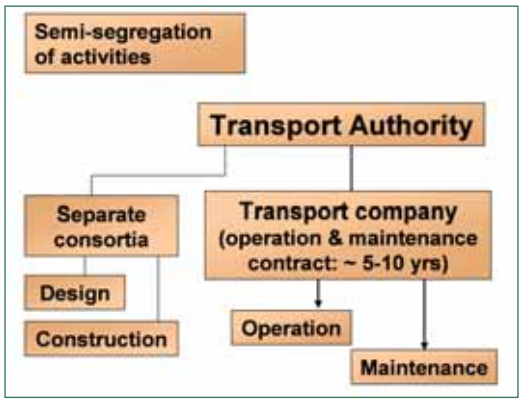
SIXTH FRAMEWORK PROGRAMME





- Different organisational schemes produce different overall public costs (construction + operation + maintenance): The way of conceiving public transport services varies considerably according to the organisational scheme chosen. For each scheme different human, technical and financial resources are required. Each scheme has its advantages and disadvantages regarding overall costs, level of transparency and level of implication and responsibility of the contracting authority.

In order to allow a transfer of useful information regarding maintenance methods and strategies, the results obtained in this work package, as well as those obtained in four other SP2 deliverables, will be presented to specific test sites of SP3 during the fourth year of Urban Track. This aims at an additional long term LCC reduction for the test cases.

Re-Modulix installation in the Karlsruhe network

The development of the Re-Modulix reusable prefabricated track modules, has entered the validation phase. In just a few days eighteen prefab Re-Modulix elements of 32t each have been successfully installed in the heart of the very busy Karlsruhe tram network.

With Re-Modulix CDM has developed a track concept which is similar to that of model trains: prefabricated rail elements are quickly and easily assembled to create an urban track which can after some time be disassembled and re-used to create another line again. In the Karlsruhe case the existing worn down rails had to be urgently replaced knowing that an underground public transport solution is going to be implemented in the near future.

Re-Modulix is a nice R&D example in accordance with the Urbantrack objective to functionally develop track systems while keeping life cycle cost in mind. The easy and fast installation and re-use of 18 meter long prefabricated track sections is the main technological challenge addressed by the project. The Re-Modulix concept is an extension of the existing CDM Modulix technology. It uses very strong integrated hoisting anchors and a special coating, preventing concrete adherence, to allow the removal of the prefab elements from the track bed after some years of operation.

The project in Karlsruhe represents:

- 751 lmst of RI59R2 rail
- a total of 42 Modulix including 18 Re-Modulix, transported from Belgium by boat
- installation at an average of 2 modules/hour
- 88 rail weldings
- 19 trucks from Belgium with 210 fill-in elements, concrete beams, accessories and equipment

The track installation in Karlsruhe is the main part of the validation process of the Re-Modulix system. The practical installation issues, speed of execution and noise and vibration performance are monitored. This Urbantrack development aims the application of embedded resiliently supported rails, where a fast installation and re-use is of major concern for the operator.

The works for the test site began at Monday august 10th and were finished at Friday august 28th. Nearly 30 persons from the construction company Heilit+Wörner (Munich), the producer of the prefabricated elements CDM (Brussels) and the public transport company of Karlsruhe (VBK – Verkehrsbetriebe Karlsruhe GmbH) were involved. They worked in two shifts from 6 a.m. to 10 p.m. (except Sundays). VBK was especially responsible for project leadership and construction surveillance.

In spring 2010 the construction of a tram tunnel under the pedestrian zone in the city centre of Karlsruhe will begin. In one of the several construction phases the Re-Modulix elements will be removed and used at another place again.

Assessment tool for Socio-economic costs and benefits: the Karlsruhe case

During the last year we have improved the socio-economic cost-benefit assessment tool and Karlsruhe was one of the interesting test cases. We compared the installation of the prefabricated track modules from CDM with a classic floating slab system.

The installation took place between the 10th and the 28th of August and the works can be divided into different phases each having their own impact on the traffic system, public transport and the neighbouring functions.

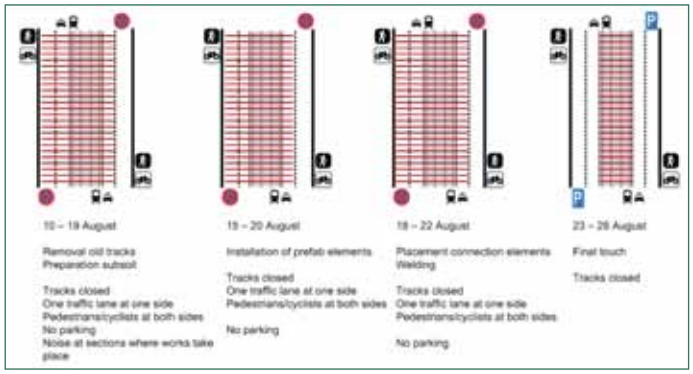


Figure 1: Overview of impact per phase

At averages days about 8.600 cars pass this section of the Kaiserstraße between 6:00 and 20:00. Because of the works, only one lane was available for cars and during the first three phases, it wasn't possible to park at both sides of the road. Cars driving in the direction of the city centre had to follow a detour. The works had a considerable impact on public transport as the average frequency is 46 vehicles per hour. Some lines got a detour and other lines where shortened and passengers had to continue on another line. Because of the dense public transport network of Karlsruhe, for most passengers it didn't cause a lot of problems. During the works two stops which were lying close to each other where out of service which had impact on residents and business in the vicinity of those stops because of the reduced accessibility by public transport. For bicycles and pedestrians though, it was possible to use both sides of the street which compensated a bit for the reduced accessibility by public transport and car.

The two graphs with monetized aspects show the costs for Modulix and the traditional reference system. One of the mayor socio-economic advantages of the tested Modulix system is the very fast installation time having a positive impact on the costs caused by detour for car traffic, less public transport and the hindrance for adjacent functions. The transportation of the prefab modules is an important socio-economic costs compared to a traditional system, mainly because of the distance over which the modules had to be transported. The choice of CDM to transport 42 modules over water contributed to a significant reduction of the socio-economic cost caused by transport of the modules. During operation the most important socio-economic advantages are caused by a lower frequency of maintenance activities and an expected reduction of hindrance caused by noise and vibrations.

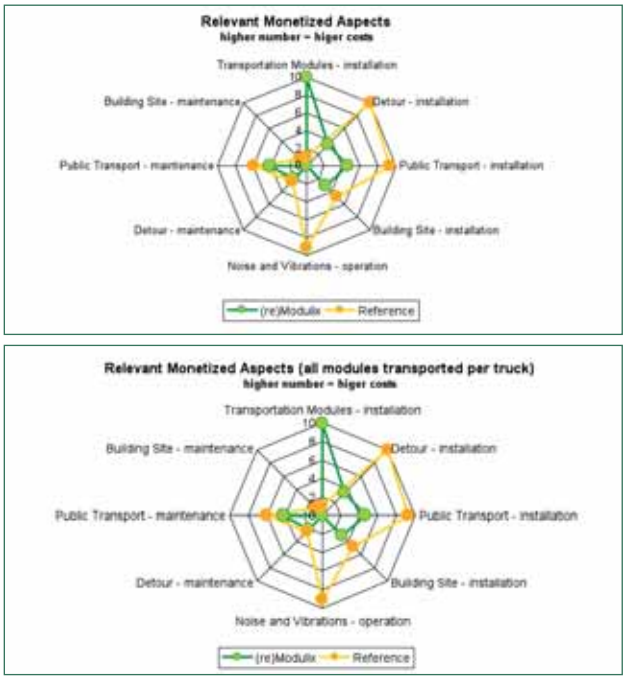


Figure 2: Monetized aspects with transport of all modules per truck

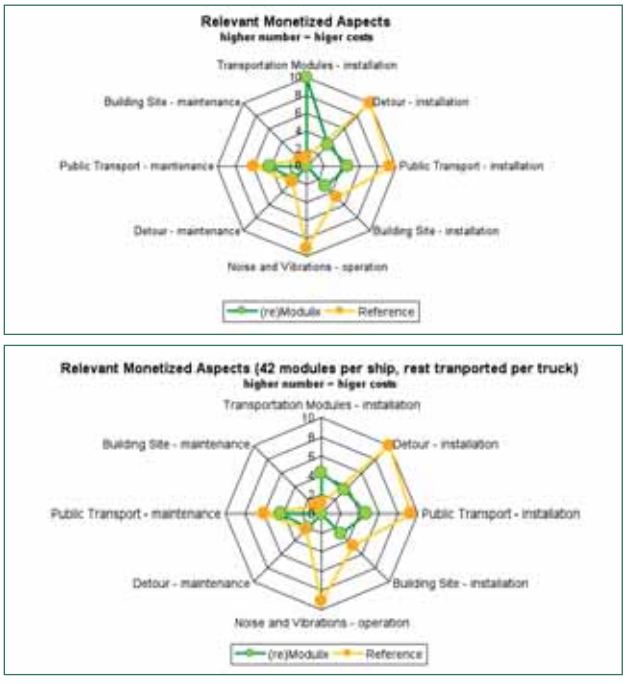


Figure 3: Monetized aspects, with transport of 42 modules per ship and rest per truck

As not al socio-economic impacts can be monetized, we also looked at qualitative impacts. During installation, one of the advantages of the prefab installation is the fast installation time causing less hindrance and annoyance for residents. The prefab elements are not stored or assembled at the building site but are placed immediately after arrival which means that there has to be enough space for large truck with cranes. For some locations this might be a disadvantage, especially when there are a lot of trees, lampposts or overhead wires. But on the other hand does it mean that the space next to the rail bedding is relatively empty which can be an advantage in case of emergencies. Both the performance of the system and the quality on the long term is expected to be higher than for a traditional system because of the controlled production of the elements and reduction of mistakes at the installation phase.

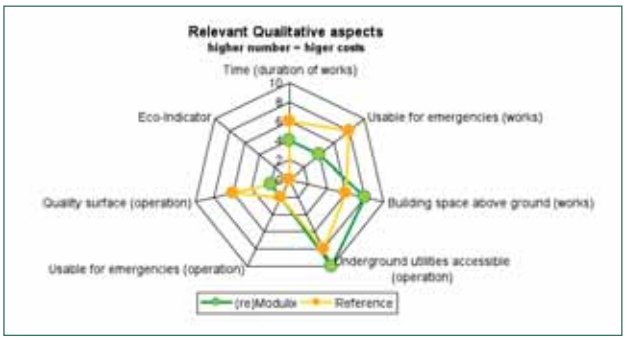


Figure 4: Qualitative aspects

The test case showed that the prefab elements are very interesting because of the fast installation time and the expected long term quality of the system. Those advantages are even more interesting in areas with a lot of businesses, a high traffic volume and a heavily used public transport: the shorter the disturbance, the lower the socio-economic costs.

Thin foundation slabs under tram tracks at STIB (Brussels)

APT-Track Products & Measurement Devices (www.aptrail.com) devellopped a new concept of load redistribution plates (LRPs) as an alternative for floating slabs at grade. The thin slabs are positioned in between the subsoil and the track superstructure.

The concept was devellopped in the beginning of the Urban Track project (SP1) and demonstrated to be effective through advanced simulation tools, achieving a reduction of vibration levels between 5 dB to 10 dB as from 40 Hz, compared to the same track without the load redistribution plates.

A life Cycle Cost Calculation of the system (LCCA) demonstrated an expected 26% drop in life cycle cost compared to a standard floating slab in the same area.

In order to achieve the expected vibration isolation performance, the LRPs are to be dimensioned taking into account the specific project parameters such as rolling stock charactaristics, operational conditions and track charactaristics.

The concept will be demonstrated in real life conditions at STIB tram network in Brussels (Rue du Chateau d'Or). The installation of the LRPs took place in September 2009 (within SP3). The performance of the slabs will be tested and reported before the end of the Urban Track Project. The pictures illustrate the installation of the slabs.

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