Urban Track

NEWSLETTER Nº 2 APRIL 2008

Network of Operators

UITP is organizing a Network of Operators to offer an opportunity to operators who are not consortium members to support, offer input into and implement the results of the project. The 2nd workshop took place on December 4, 2007 in Kalsruhe. The meeting brought together the consortium plus the members of the Network of operators, designated to suppport and guide the project in its aim to reduce LCC of urban track infrastructure by at least 25%. A technical visit was hosted by VBK. Interested metro, tram and light rail operators are invited to contact Izaskun Arenaza at izaskun.arenaza@uitp.org for more information.

Network of Industries

A Network of Industries is being established by UNIFE to bolster industry involvement in the project and increase the market uptake of technologies flowing from the project. The network will comprise of the INNOTRACK core industries, formed by the industry members in the infrastructure project for heavy rail, as well as EFRTC (Federation of European Trackwork Contractors). In addition, other small and medium sized urban rail infrastructure suppliers and contractors are being invited to participate.

The network will provide input into the project and assessment of the practicability of technologies under development. Membership of the network is currently being established and interest from prospective members is sought – interested industries in urban rail are invited to contact Mr Michael Bayley at michael.bayley@unife.org. Two workshops per year are planned and there is a proposal to stage some combined operator/industry meetings. The first meeting will take place in the first half of 2008.

Low costs modular new track systems & fast installation methods

Installation of the new iX-Modulix at Avenue Fonsny in Brussels

The development of modular track systems – allowing for fast implementation – has reached another high with the creation of the new iX-Modulix prefabricated track modules. The first iX-Modulix section was recently realised at the Avenue Fonsny in Brussels.

iX-Modulix is an extension of the CDM-Prefarails technology. It uses customized prefabricated track modules with an integrated floating slab. This ‘box in a box’ system for light rail eliminates the technical complications of classic on-site installation of floating slab.

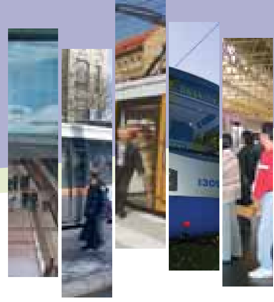
iX-Modulix is a nice example in accordance with the Urban Track objective to develop innovative track installation methods while improving technical performance. ➔

www.urbantrack.eu
For more info :
andre.vanleuven@d2sint.com

SIXTH FRAMEWORK PROGRAMME





The installation of the prefabricated concrete iX-Modulix track modules, with a length of up to 18 meters, is possible within a time window of just one hour. What's more, the iX-Modulix system is designed to reach a 20 dBv vibration isolation improvement compared to classic non-isolated track.

Four other more conventional embedded track systems with specific stiffnesses were also installed in the STIB network at Avenue Fonsny. The Urban Track goal is to validate and compare all of those systems in terms of speed of execution, installation methods, vibration isolation performance and cost. Several measurement campaigns are planned during the coming months for this purpose.

Contribution of Green Tracks to the Problem of $PM_{2.5}$

The $PM_{2.5}$-concentrations (particulate matter with particle size below 2.5 µm) in urban air are high – sometimes above the European limit values – which can cause health problems.

Traffic is one of the main anthropogenic sources and railway traffic accounts for a part of it. Particles originate from abrasive wear e.g. of brakes and as a result, $PM_{2.5}$-concentrations near to railway tracks are increased; this is of importance for people living adjacent to tracks. In roads with already high concentrations, trams might cause the limit value to be exceeded.

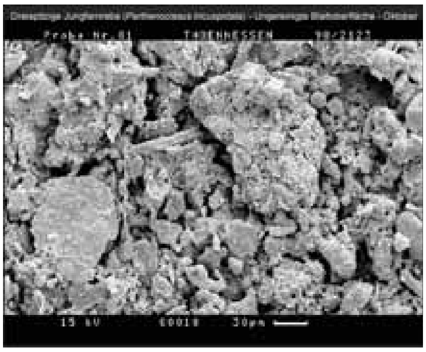


Figure 1: Dust on leaf surface of Virginia creeper. Scale: 30 µm (THÖNNESSEN)

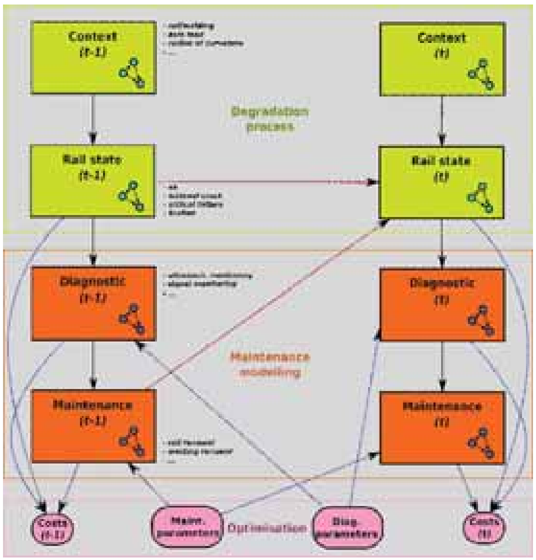
In green tram tracks, hazardous dust accumulates within the vegetation system; thus it is bound to it and cannot resuspend back into air. Mosses use dust as a nutrition source while leaves of higher plants serve as a deposition surface. Heavy metals can be taken up via roots and PM can also be bound to soil particles.

In Urban Track IASP investigates the contribution of track naturations to the reduction of PM2.5 in the air. The whole vegetation system is examined and PM-concentrations in the single system parts are quantified. To evaluate the deposition data temperature, relative humidity, wind direction and wind speed are measured by means of gauging station. Turbulences caused by trains or road traffic are likely to transport dust particles into the green track bed. Further, a green track is thought to mitigate PM2.5- resuspension compared to gravel or embedding materials.

Cost effective Track Maintenance, Renewal & Refurbishment Methods (Existing Lines)

This subproject aims at optimising maintenance in order to minimise the maintenance costs of a track. The partners RATP, INRETS and INSA have so far looked into this in two stages.

In the framework of **predictive maintenance**, a virtual maintenance tool is being developed that is able to model and integrate the track degradations in relation to inspection and maintenance rules. This decision support tool uses probabilistic methods in reliability to optimise maintenance operations, as the system state cannot be evaluated exactly; i.e. a deterministic description of the process by which each part of a complex system reaches a failure state is impossible. A Graphical Duration Model will be implemented to take into account the random behaviour of degradation processes. This kind of mathematical tool can unwind the life cycle of a specific component and carry out



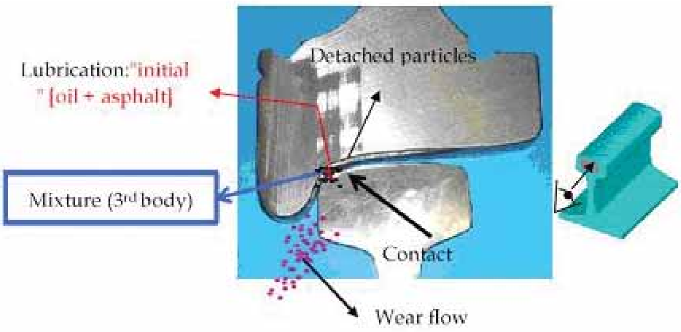
General scheme of the maintenance model

its interaction with the maintenance operations in accordance with a given strategy. Hence, optimised maintenance rules can be highlighted for given exploitation conditions. One can therefore quantitatively evaluate predictive maintenance strategies versus curative ones, in terms of financial costs as well as safety or availability costs.

The first case study of this tool elaborated by INRETS is the rail of the RATP RER tracks.

In the framework of **preventive maintenance**, the rail lubrication process is investigated in order to optimize the frequency of maintenance operations. The wear of wheels and rails is the consequence of the friction level between them. Hence, wear is a function of the contact and what 'constitutes' this contact (this is called the 'mixture' (see figure below)). This mixture is composed of metallic particles from wheels and rail, mineral particles like sand and the lubricant (in most cases oil). The aim of the study is to minimise friction (for security) and consequently wear as a function of the contact geometry, the contact conditions and the mixture rheology which depends on mechanics and chemistry. This will be based upon tribological expertises and the modelling of the wheel/rail contact. The results should also allow new lubricants to be characterised.

RATP's network was chosen for initial investigations carried out by INSA. Nevertheless, the mixture rheology is studied in such a way that the approach can be transposed to other networks involved in the project; i.e. to tram and metro tracks.



Wear phenomenon from the tribological point of view

Concerning **monitoring procedures** in a third stage, a general new processing method will be developed by INRETS going beyond the standard time-frequency approach. This data treatment will lead to an accurate estimation of wavelengths and depths of corrugation. RATP's corrugation measurement device is used for base data collection.

Design and Implementation of solutions at test sites

Manila Case

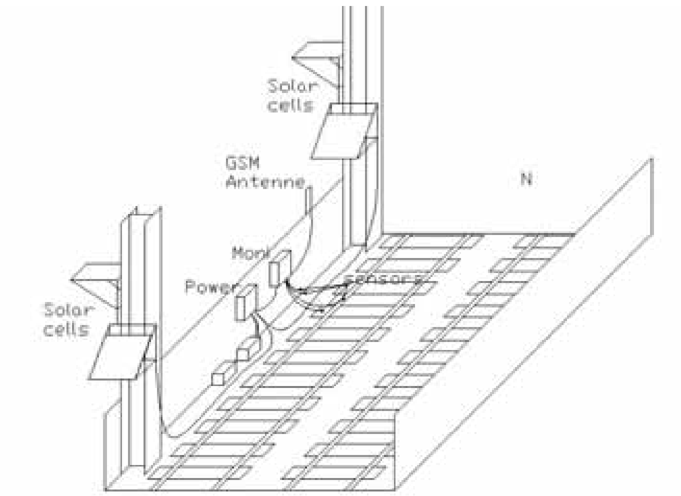
An automated track quality inspection system is developed and installed by APT in Manila, The Philippines.

The objective of this monitoring system is to perform a continuous monitoring of the track quality based on vibration levels of the rails, sleepers and the viaduct structure itself.

During set-up, rail roughness measurements are performed by the APT-RSA (Rail Surface Analyser) to determine the rail and sleeper vibrations corresponding with an unacceptable rail roughness level. Based on these measurements, threshold vibration levels were determined to alert the local operator by a text message on his cell phone to start maintenance activities.

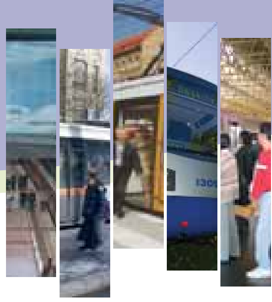
Measurement data is being transferred through a wireless internet connection to APT offices in Belgium. A database of measurement data is being built up.

A schematic overview of the installed equipment is given in the figure below:




Solar panels at two catenary poles (left picture) and power/data acquisition box (right picture)


Vibration sensors installed on rail and sleeper (left picture) and vibration sensors installed on concrete structure (right picture)



Life Cycle Costs

Considering that urban railway operation is characterised by the need for large initial investments and large annual budgets for maintenance and renewal activities, the systematic and controlled development of LCC strategies on a European level and their comprehensive implementation becomes a crucial issue for the economic sustainability of the urban railway business.

After significant efforts for the development of the LCC model, Urban Track's Team has since finalised the specification of the software tool. Initial ideas were discussed in-depth with operators across Europe and within the Urban Track consortium. Currently the software is being implemented and will be available at the latest in June. There will be an LCC calculation workshop in Frankfurt on June 9th/10th where in particular the partners from SPs 1 and 2 will be taught how to feed their data into the software and how to calculate their LCC.

The model for socio economic assessment is to allow an assessment of socio economic effects stemming from the different systems and maintenance methodologies developed in the other Urban Track SPs. It has been further developed and its basic methodology was discussed with partners and operators; it will also be discussed with other operators. A deliverable explaining the background and allowing first assessments of projects will be available at the end of the second project year of Urban Track (August).

All ongoing work in the area of the LCC model and the socio economic assessment method is frequently presented to network operators and other partners of the Urban Track project. Their comments and cristiscisms are invited to further and improve the development in these areas. There is a specific website for all SP 4 work accessible to the interested public: http://www.urbantrack-sp4.eu.

Functional requirements

As far as numerical activities are concerned, POLIMI has developed a numerical model for time-domain simulation of train-track dynamic interaction based on vehicle multi-body schematization and track finite-element modelling. Figure 1 and 2 show an example of simulation output, in the case of a metro train running on an embedded-rail track section, at 70km/h; the track response to vehicle transit is shown in terms of rail/tunnel vertical acceleration and vertical deflection.

The track parameters used for the time-domain simulations are identified through laboratory tests on small-length samples or estimated through finite-element models. One of these models is reported in Figure 3, which shows the Von Mises stresses in the rail and in the rubber compound, in case of application of combined vertical and lateral load.

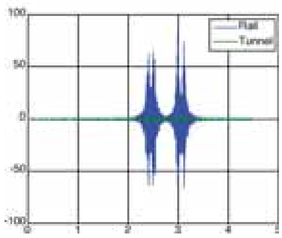


Figure 1. Track response to train transit: rail/tunnel vertical acceleration

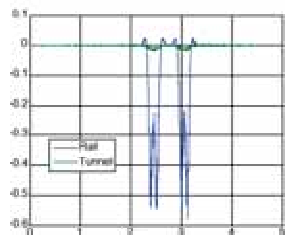


Figure 2. Track response to train transit: rail/tunnel vertical deflection

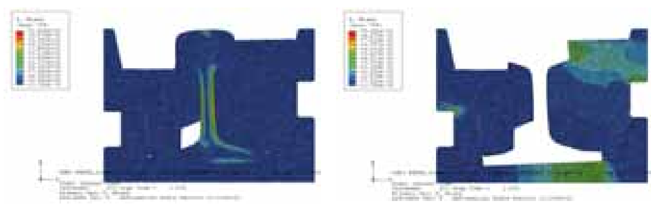


Figure 3. Embedded-rail finite-element model: stresses in the rail and in the rubber compound, in case of application of combined vertical and lateral load

APT Track Products and Measurement Devices · ALSTOM · APT2 · BSAG · CDM · D2S International · Die Ingenieurwerkstatt · FCP Fritsch, Chiari & Partner ZT GmbH · IASP · imob · Stellenbosch University · Metro de Madrid, S.A. · MIVB STIB · UCL Université catholique de Louvain · RATP · VBK · INSA Lyon · Transport for London · Consejería de Obras Públicas y Transportes · STUVA · Politecnico di Milano · TMB Transports Metropolitans de Barcelona · TTK · UNIFE · UITP · European Union