ProM@in

Task T1:

Cost-effective Track systems

Track systems - Information centre helps to choose best value for money

This comprehensive task was not addressed explicitly in the ProMain questionnaire, but the importance of single subtasks like ranking of track systems, new switch systems, etc. was outlined. The task is also related to renewal strategies and should give answers to urgent problems when selecting and installing a new track system.

State of the art

World wide the most common track system is ballasted track [1], [2]. The development of the track system has been mainly empirical. Empirical testing of tracks with their long life span takes a long time to recognise reliable trends with regard to traffic loads. Axle loads have increased to 22.5 tonnes nowadays, aiming at 25 tonnes. Today top speeds in passenger traffic are about 280 km/h (Germany) and 160 km/h for freight trains. In addition the length and density of trains is growing.
These modern tendencies have a big influence on track stability. Experience in Japan, France and Germany has shown that this leads to increasing maintenance needs with high life cycle costs on frequently used lines which are caused by different effects [3], [4]:

- **Instability of the ballast:** The loose packing of ballast is disturbed due to vibrations and to relative moving (different substructure at bridges, viaducts; temperature effects) of the structures. This leads to ill-supported sleepers resulting in track irregularities.
- **Crushing of the ballast:** Especially for those lines where high speeds and high axle loads are combined and where the ballast is in contact with concrete (sleepers), the ballast can be crushed. The worn ballast has to be exchanged after a short life-span.
- **Imprints:** This phenomenon occurs where crushed ballast is thrown onto the rail by a passing train. The next wheel presses the small ballast particles into the surface of the rail. The result is an increasing need for rail grinding.

All of these effects decrease the availability of frequently used lines with ballasted track due to intensive maintenance. As a general remedy the use of ballastless track is recommended. But a number of open questions exists with regard to an economic track system, which shall be addressed in this task.

Problems to be addressed

The choice of a track structure depends on many factors [5] in different areas influencing the life cycle costs. Therefore one goal in this task shall be to **compile the empirical knowledge** on which track system fits best to a given set of factors from a technical and economic point of view. This knowledge is based on experience data from tests and even for slab tracks durability data has been available for more than 20 years.

In parallel the needs for empirical testing should be reduced through the consequent **use of computer modelling**, e. g. [6]. A second topic in this task provides knowledge on available simulation tools which model the behaviour of a track system under realistic load assumptions and which can predict the resulting life cycle costs for the compliance with a defined track quality standard. Different railways and consultants are working on the development of such tools.

The final goal of knowledge dissemination will use modern Internet technologies. They provide the possibility of distributing papers and of having forums of experts on selected topics and also enable the creation of a **virtual information centre** on track systems. The centre shall be realised to support the comparison and selection of a system by showing permanently for important track types:

- measured and simulated performance data
- necessary maintenance activities
- technical construction and
- actual cost data.

Expected benefit

Very often the selection of track systems is based on experience gathered in the past. This approach cannot cover all requirements to be met in the future under changing boundary conditions. Therefore it is expected that a simulation under realistic assumptions will lead to a layout of a track structure that is economic over a long period and must not be upgraded at additional high cost in the future.

For all track types a considerable variety of systems exist in different countries. The intended compilation of empirical knowledge on best suited track systems will result in a concentration on a reduced number of possible systems with the positive effect of increasing their market share and reducing their costs.
Knowledge dissemination via Internet and especially the creation of a virtual information centre will be of considerable help for a more efficient use of knowledge and for the promotion of systems recommendable under technical and economic aspects.

General approach offered by ProMain

From the side of ProMain partners it is offered to proceed in two major phases as follows:

Phase I has the general objective to exploit and disseminate available knowledge on economic track systems. This work in co-operation with additional experts and members willing to co-operate (in case of interest please send back the attached response sheet) shall be done with ProMain resources. Subtasks to be covered are:

- Selection of representative track systems to be dealt with
- Collection and interpretation of available
  - test data
  - simulation results
  - cost data
- Conclusions o n state of the art and planning of necessary activities
- Dissemination (via Internet).

Phase II aims at the execution of activities (with additional resources) for the acquisition of necessary knowledge and its dissemination through the virtual information centre. From discussions with experts it is obvious that the following subtasks will need further elaboration:

- Definition and agreement on technical and economic data for a comparative evaluation on a European basis
- Installation of data acquisition equipment at selected lines
- Technical and economic evaluation of measured data
- Realisation of a virtual information centre in Internet for the permanent demonstration of track features.

Sources

[1]	Darr, E.; Fiebig, W.:	Feste Fahrbahn. Tetzlaff Verlag, Hamburg, 1999.
[2]	Schooleman, R.:	The development of ballastless track for the High Speed Line South in The Netherlands. WCRR 1999, Tokio, Japan, Session on Infrastructure.
[3]	Esveld, C.:	Ballastless Track Offers Long-Term Advantages. International Railway Journal, pp. 23 – 25, Sept. 1997.
[4]	Leykauf, G.:	Schotteroberbau und Feste Fahrbahn im Vergleich. ETR 48, Heft 5, pp 265 - 23, 1999.
[5]	Zoeteman, A.; Esveld, C.:	Evaluating Track Structures: Life Cycle Cost Analysis as a Structured Approach. WCRR 1999, Tokio, Japan, Session on Infrastructure.
[6]	Zacher, M; Reinecke, M. J.:	Vertikale Kräfte am Oberbau - Messung und Rechnung. ETR 45, Heft 1/2, pp. 75 - 80, 1996.

Further information on this task

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