ProM@in

Task M1:

Track Inspection -

Better Value for Money

Track Inspection - Systematic RAMS Approach to choose best value for money

Problem description

Monitoring of the track, tunnels, bridges and earthworks is important as input for maintenance and renewal and to ensure a safe interface to the rolling stock and the environment. Decisions about track inspections and operative restrictions on train passage are therefore extremely important both from the safety point of view and the availability of the track.

There are basically two principles for monitoring of the track and surroundings:

- **Inspections by measuring vehicles.** The main objective is to ensure that the geometry of the rail remains within accepted limits for the rolling stock, and to detect any deficiencies in the rails. But the use of measuring vehicles may also give access to information on possible environmental hazards.
- **Visual inspection of the track and surroundings by foot or by vehicle/foot.** The main objective is to ensure that the substructure does not degenerate due to environmental hazards like snow, rain, water, frost etc. A major issue is to verify that line ditches, culverts, cuttings etc can withstand possible threats.

In order to establish a sound inspection program for the entire track it is of utmost importance to understand the degradation mechanisms and degradation speeds (for rail geometry, sleepers, bed etc). There are modelling systems (e.g. TETRAS of Deutsche Bahn) which can handle degradation. However, this is a complex area where a lot of degradation mechanisms are not well understood, and hence it is a challenge to establish an inspection program where causes and effects are systematically documented.

The information gathered by the various inspection methods will be used to make “optimal” decisions related to train passage, track restoration, and track renewal. A formalised risk-based approach should be used to make decisions about track restrictions. The problem of optimal track restoration and renewal is also a large problem area that has to be addressed. Here ProMain will work in collaboration with UIC which is currently addressing related problems in various survey studies.

Goals and benefits

The objective of this activity is to develop a common framework for track inspection based on a systematic RAMS approach for choosing best value for money.

The infrastructure managers are under constant pressure to cut costs. This puts pressure on inspection activities. With a well-structured approach to strategic planning of track inspection, there is a chance for the infrastructure managers to carry out the inspections with fewer personnel than they had before and to allocate their resources in an optimal way. Given the high number of problems with landslides, avalanches etc. in certain types of terrain, the costs of delays or collisions are large. The improvement of inspection methods along with the use of new technology in general will contribute to reduced costs and delays.

Such a framework will also be an important basis for systemising research results in this area (e.g. measuring principles, degradation mechanisms, trade-off analysis etc) and proposing new research activities.

Approach offered by ProMain

The work is proposed to be organised in two phases, where Phase I could be viewed as a feasibility study financed by internal ProMain resources. If this succeeds, ProMain will work with external resources to continue into Phase II.

Conceptual Framework (Phase I)

In order to make optimal decisions related to track inspection, it is necessary to establish some kind of generic cost model. Important elements of such a cost model are

- the value nodes (e.g. track unavailability, risk picture and cost)
- the variables defining track status
- the functional description of track degradation mechanisms
- the actual measurement principles and inspection strategies.

All these elements must be integrated into a conceptual model, and the use of so-called **influence diagrams** has proved beneficial as a communication tool between the analyst, the maintenance department, the geologists, and the system manufacturer (e.g. of measurement wagon).

Case studies (Phase I)

It is proposed to test out the methodology by case studies. The problem of landslide in a cutting is a problem of current interest in Norway and is therefore proposed as one of the case studies. (In spring and autumn in countries like Norway, significant portions of delays are caused by inspection of track, or degraded track due to e.g. backslides. Furthermore, a significant portion of derailments is caused by different kinds of slides.)

Another case study will deal with the problem of rail grinding. It is well known that periodic rail grinding will increase the life length of the rail. There are also adequate models to describe the relationship between rail grinding and life length of the rail. However, there is a lack of models utilising this knowledge in order to establish “optimal” intervals between rail grinding. An objective of this case study will be to establish a life cycle cost model for optimising rail grinding intervals in co-operation with interested infrastructure managers.

Making the conceptual framework operational (Phase II)

The conceptual framework developed in Phase I will be a starting point when developing a sound framework that enables the infrastructure manager to describe an “arbitrary” problem. In Phase II we will therefore work towards a set of operationalised models that fit into the generic framework.

Deliverables

The deliverables from Phase I will be a conceptual framework for optimal decisions related to track inspections. The results from the case study will be presented in accordance to this framework.

Further information on this task

can be obtained from:

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