ProM@in

Deliverable D 2 (Final)
Overview on Started Tasks

Public

CONTRACT N° : **1999**

PROJECT N° : **TN.10991**

ACRONYM : **ProMain**

TITLE : ***Pro*gress in *Ma*intenance and *Ma*nagement of Railway *In*frastructure**

PROJECT CO-ORDINATOR:

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., München

PARTNERS :

Fraunhofer-Institute for Information and Data Processing (IITB), Karlsruhe

SINTEF Research Institute Industrial Management, Trondheim

TÜV Intertraffic, Cologne

REPORTING PERIOD: FROM 1 July 2000 TO 31 October 2000

PROJECT START DATE: 1 January 2000 DURATION: 4 years

Date of issue of this report : 31 December 2000

Project funded by the European Community under the 'Competitive and Sustainable Growth' Programme (1998-2002)

1. Contents

Contributions:

Draft:	H. Schaebe, J. Vatn, K. Watson, F. Quante
Internal Quality review:	K. Watson
CEC review:	U. Huismann
Quality review:	Nigel Ogilvie, Eaton Ford

2. Quality Review

2.1 Introduction

This paper is a quality review of the report delivered for project ProMain, dated 31st December 2000.

That report described the progress made within the project work in the six-month period 1 July 2000 to 31 October 2000.

The project number is TN.10991 and the project started at 1st January 2000, with an expected duration of four years.

For the avoidance of confusion, this present paper (this quality review) is referred to here as ***"the paper"*** and the report of the ProMain team is referred to as ***"the report"***. Project ProMain is referred to as ***"the Project"***.

Full definition of the project's authorisation, defined objectives and reporting arrangements are given elsewhere and are not repeated in this paper.

2.2 Overview

This paper examines the quality of the report at two levels: strategic and in specific detail.

In the period under review, the Project had spent time considering how it should address its objectives, and in defining tasks and deliverables of those tasks, that together would lead to practical and useful conclusions. Practitioners in the railways and elsewhere contributed to definition of priority areas and the Project responded to those inputs.

The tasks are appropriately defined to contribute towards the Project's general objectives, and resources are properly matched to the necessary work.

The Project is moving from the analysis of what to do and how to do it, into actual work activity. This is defined in two phases; that which is definitely to be undertaken now, and that which is expected to arise following that work, at a later date. The second phase is intentionally left flexible and will be firmed up as phase 1 proceeds and as other inputs of policy and priorities emerge.

This is considered to be a proper approach, and the remainder of this paper offers comments on the approaches outlined in the Report, and proposes issues for consideration by the Project team as they continue their work.

2.3 Strategic Issues

In section 5 of the report, the ProMain team indicate how they ensure linkage with high level EU policy priorities. Clearly this is important, and no doubt further information flows take place informally through, for example, contact with Commission officials.

Given that the Project has definite authorised objectives and of course a definite budget, it would be of value to be clear about the extent to which significant changes to the anticipate work scope might take place, and how these would be funded if extra expenditure was necessary.

So far as linkage with other influential bodies is concerned, for example in the list in section 5.1.2, consideration should be given in future work to the extent to which these contacts are formal, or involve participation by representatives of those groups at events arranged by the Project. As the Project moves from its initial exploratory stage to a phase of carrying out definite work elements, so the nature of the information flow will change.

As a Thematic Network, the Project must be clear about the extent to which new proposals for discussion or for research are helpful or may perhaps be a distraction from the task in hand.

Again, as the phasing of the Project advances, it is likely that thought can be given to the form of emerging results. Will they be entirely concrete, capable of immediate implementation by practitioners? Will they reveal major gaps in available information, and result in proposals for basic investigation to generate raw data? Or (as may be expected) something in between? According to the emerging view of the answers to this question, the Project team will need to begin to consider roll-out of the results.

Research work results are not always instantly accepted by practitioners, or even widely communicated to them. Equally, if further work is required, thought will need to be given as to how that work will be funded if, as may be expected, the Project funding does not permit major extensions of scope.

Finally on this point there is a clear trend in many railway administrations to regard current operational activity as the pressing work of nearly all engineering staff, and there is increasing reluctance to devote time and resources to feeding external project work. Consideration needs to be given to the means of responding to this trend.

In Section 6, the Report refers to response to specific policy elements. Although at this stage the ideas are general rather than specific, it is clear that they may not be without controversy from the point of view of the railway administrations. The Project team will need to ensure that they have clarity over their own role. For example, policy advice might be to progress an issue such as safety approval harmonisation, but (hypothetically) some railways may see this issue as too difficult to make progress on in the short term. The Project would need to have clear guidance on whether it should proceed in any case, to whether it was the role of the Project to generate acceptance by Administrations of policy initiatives. Obviously the latter would be a very demanding task.

2.4 Specific Project Elements

2.4.1 Task 1: Track Systems

The task objective is a valuable one, as many competing proprietary ballastless track systems are available, all of them advocated strongly by those who have ownership of the designs. Practitioners need some hard data on which to make a selection. This data needs to include experience in maintaining the respective systems. As far as possible numerate data is required, although this may be very difficult to acquire.

Careful consideration needs to be given to the rollout of this work; at what level are the decision makers? How will they be convinced that the work is authoritative and applicable to their special circumstances?

2.4.2 Task 2: Automatic Switch Diagnosis

The task objective is immensely valuable, and if anything its value when implemented is understated in the report. In particular in many countries it is rapidly becoming very expensive to allow control system maintenance staff access to trackside equipment, because of the accelerating cost of providing safe work systems, as train speeds increase coupled with increasing perceived cash value of delay while remedial attention is given.

The task description refers to a Fourth Framework project called Remain. This project was completed successfully, but hardly any adoption of its proposals took place. It is important to be quite clear about why this was, and to ensure that there is no repetition.

2.4.3 Task 3: Total Quality Management

The benefits of TQM are widely advocated by supporters of the philosophy, and the benefits are certainly real. The Report quite rightly states that this field is very wide [section 4.3.2 second bullet] and it is sensible to restrict the scope. The area selected is a valuable one, where TQM has not been well implemented in some cases.

The increasing trend towards the use of contract arrangements for much of the track maintenance and renewal makes the area selected particularly appropriate, as the benefits of TQM are especially high if the approach can be successfully implemented across contract interfaces, that is throughout a supply chain.

Considerable resource and effort was put into TQM in Great Britain in the period 1988 to 1991, and of course in several other major railways. Some elements of the staff may view it as a passing fad imposed by top management, that has now been superseded by other priorities. Care needs to be taken to understand how TQM can be presented as an issue with relevance today.

As a general philosophical approach, TQM is in danger of falling into generality and vague aspiration. The Project will need to give careful thought to what tangible deliverables they hope to present, and to test that these are desired by railway managers.

2.4.4 Task 4: IT Obstacles in International Freight

This task is also of high importance, as it is understood that considerable avoidable cost is expended in interfacing incompatible systems.

Care needs to be taken to ensure that the Project works fully with existing supra-national bodies, especially presumably the Freight Commission of the UIC. In the absence of this there is a risk of the deliverable, however good their quality, not being accepted by railway administrations.

2.4.5 Task 5: Track Inspection

For reasons similar to that stated above, this is an area of high potential for avoiding cost and safety risk to workers. Newspaper reports suggest that the tragic accident at Hatfield, UK, was influenced by suspension of full visual examination of the track because of concerns for the personal safety of staff engaged on the work.

The approach to control of risk of major track failure by different railways is very different, and numerate evaluation of the risk and therefore the valid cost to be expended on controlling it, is not always available. Alternative processes that are apparently safer and more efficient have often not been implemented because of non-numerate objections that they introduce new risks.

The Project must avoid attempting to resolve all possible trade-off evaluations, or it will get bogged down in detail and data capture. The reference to Rail Grinding ("Case Studies

Phase 1") appears to introduce a separate set of trade-offs, namely frequency of remedial or preventive maintenance work as compared with safety hazard, and this should only continue within the Project if the Project Team are satisfied it does not detract from achievability of the deliverables.

2.4.6 Task 6: RAMS Database Harmonisation

The inefficiencies in the present system are obvious and the approach of working towards commonality in a limited area (Scandinavia) is a good one. In structuring phase 2 when other Administrations are brought on board, the Project Team will need to give careful thought to he extent to which claimed national priorities can be imported or need to be resisted. Once again the most careful thought will have to be given as to who the stakeholders are; will the Project interface with railway Administration safety experts, allowing them to bring national safety enforcement bodies on board, or will the Project deal with those bodies direct?

2.4.7 Task 7: Harmonisation of Safety Approval

It is encouraging that the methodology of this task emphasises practical measures. The high level philosophies can probably be agreed instantly by anyone working in the field, but in the past the difficulty has always arisen when an effort was made to translate those philosophies into practical steps for progress.

In this task, phase 2 will be of particular interest and has high potential. The objectives of that phase are only outlined vaguely at present, and much more definite objectives and deliverables will need to be formulated, with the greatest possible care. The issues of national interest and individuals' preference for non-conformity seem to be well understood; a means to make progress is of course needed. The international bodies that can provide positive influence on this need to be identified more fully as the project phasing progresses.

(This review was copied into the final version of D2 and will be discussed and taken into account in the next reports)

3. Introduction

The reporting period of this deliverable covers the period of 1 July till 31 October, 2000.

During this period main effort was spent on the further elaboration of seven tasks, which had been roughly preselected in Deliverable 1 at the end of June 2000, and on the organisation and evaluation of a Council of Decision Makers (CDM) for the support of ProMain.

The main purpose of this report is to summarise the objectives of the seven tasks as they were presented as initial working areas of ProMain to the CDM (22 Sept., 2000) together with respective recommendations given by this Council for the future work. The recommendations were either made as oral statements at the Council itself or in written form by sending back evaluation sheets. This process took some time and therefore the original reporting period for D2 till 30 September, 2000 was prolonged in agreement with the scientific officer (Mr. Huismann) till 31 October, 2000. To conclude, the objectives and recommendations for the seven tasks are contained in chapter 3.

The subsequent chapter 4 describes the concept for the involvement of ProMain in EU policy implementation and in making policy initiatives.

All presented tasks were accepted by the Council of Decision Makers and will be pursued. As a first reaction to recommendations, it was decided to restructure the tasks into three groups, thus providing better focus and support for related tasks. This is described in chapter 5 that gives the summary and an outlook on the next period.

4. Presentation of tasks at the Council of Decision Makers

On September 22, 2000, the first of three planned Councils of Decision Makers took place in the Sheraton Hotel at Frankfurt Airport. The list of participants is attached as annex 1.

The purpose of the meeting was to

- present and discuss proposed tasks which were developed within ProMain using a questionnaire method and an evaluation of Trans-European railway lines (see Deliverable 1),
- to accept recommendations to be able to adopt the tasks or even to eliminate one if necessary,
- to hear recommendations on necessary experts to co-operate within the tasks.

The tasks were presented by the respective responsible organisations, see the following list.

Proposed Task		Responsible Partner
1	Track systems - information centre helps to choose best value for money	FhG-IITB
2	Automatic switch diagnosis - Cost efficient implementation strategy	FhG-IITB
3	TQM - A means to improve customer satisfaction and RAMS performance	SINTEF-MRS
4	Elimination of IT obstructions to international freight traffic	SINTEF-MRS
5	Track inspection - systematic RAMS approach to choose best value for money	FhG-IITB
6	European RAMS database - First step: Nordic demonstrator	SINTEF-MRS
7	Harmonisation of safety approval - Practical steps through co-ordination of certification bodies	TÜV Rheinland

In the following sections the presented contents of each task and recommendations are summarised, which were given in the discussion and through sending back of an evaluation sheet by the participants. Recommended experts are confidential and will be listed in the next progress report at the beginning of the year 2001.

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

4.1.1 Concept

This 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 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 on 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.

4.1.2 Recommendations for Task 1

As oral contributions in the discussion at the CDM and in written form in the distributed evaluation sheets the following comments were made:

- The task should involve track and turnout systems and necessary harmonisation aspects.
- Ballastless track without sleepers needs further development.
- Objectives, requirements and criteria for the evaluation of track systems have to be classified e. g. with regard to operational, technical, economical and environmental aspects.
- Tools for the simulation of system dynamics are very important together with test and measurement data from railways and related organisations for real operating conditions.
- For a comparative evaluation of conventional and new track systems technical and economic data have to be collected for the respective life cycles.
- Insight should be developed into the actual costs of building up a maintenance and renewal system and regime for high speed track systems.
- The issue of patents on slab track systems has to be dealt with. The ideal goal would be a combination of the best features of the individual systems.
- Co-operation with a related UIC investigation and with additional experts is recommended.

4.2 Task 2: Automatic switch diagnosis - Cost efficient implementation strategy

4.2.1 Concept

The interest stated in the questionnaire, D1, was highest for the cost area. It will be a specific subtask to prove LCC advantages of automatic diagnosis for switches for different railways.

State of the Art

For many years efforts have been undertaken in different countries [1] - [5] to implement automatic condition monitoring and diagnosis for switches in the field. The purpose is to have a continuous sensor-based supervision to prevent failures by the detection of slight changes in monitoring signals. This results in higher availability of the track and reduces inspection and maintenance efforts. Due to that railway staff have to spend less working hours in the track and their personal safety is increased.

In spite of these obvious advantages some obstacles to a broad introduction of switch diagnosis have to be overcome which is the purpose of this task.

The best known system [2] for switch diagnosis, which is implemented in different countries, provides a lot of information through physically heterogeneous sensors at different measuring points in a switch. These measuring points are:

- Monitoring of switch-stock rail contact area
- Monitoring of open switch
- Monitoring of switch operating rods and/or switch locking system
- Monitoring of minimum distance between open switch and stock rail (switch flangeway)
- Direct measurement of the force needed for each single operation of switches
- Residual stress in the switch and/or the rodding (retaining force)
- Current and time needed for the operation of switches
- Monitoring of the pressure needed in the switch machine for the operation of switches
- Monitoring of the position of the detector rods
- Monitoring of the strikes at the crossing point, indicating wear of the check rail and/or wing rail
- Monitoring of screw pre-loading forces in bolted compound crossings
- Longitudinal forces in the rail
- Rail temperature and ambient temperature
- Point machine current

The sensors at the measuring points and the monitoring system are connected by means of flexible cables, which are embedded in protective tubes. Special software programs combine and pre-process the collected data and prepare these for subsequent transmission. The collection system is realised in a modular open microprocessor technology and consists of appropriate bus components. The pre-processed measured data are transmitted by means of bus protocol communication to a central station for data processing (trends, statistics...) and supervision by one expert surveying many switches in the field, who takes the decision on necessary maintenance actions.

Problems to be addressed

The short description of the state of the art reveals that the diagnosis and decision making is not yet fully automated. This is one key concern of railway companies, which can be solved by adding an expert component to the system.

Another concern is the manifold of sensors of heterogeneous physical nature at different locations which may require maintenance themselves and provoke consequential costs for their reattachment in cases of repair actions. This problem can be tackled by more sophisticated information processing of sensor signals (especially of the current in the point machine) to eliminate the need for some sensors and by using geometric information from measuring cars for the same purpose.

A specific problem with the outlined measuring points is the fact that different railways follow diverging safety concepts requiring different measuring points and different levels of interaction. This divergence mainly causes that a switch diagnosis system up to now is not a standardised product with a big European market, but always needs tailoring for its specific national railway applications. The identification of requirements common to several railways would be a progress.

A last relevant problem to be mentioned here is the difference in type and value of parameters used by different railways for the calculation of life cycle costs. Therefore the big cost reductions possible through switch diagnosis (see below under Expected Benefits) and proven for DB installations is not accepted by other railways. A solution in this field would be to generalise the LCC-model used for calculations so far [6] and to make it applicable for the purposes of different railways.

Expected Benefits

An obvious benefit of automatic switch diagnosis would be great reductions in life cycle costs (LCC). Analyses for a conventional line (160 Km/h) of DB AG reveal this [6]. In this investigation the annual life cycle costs prior to installation of a Roadmaster 2000 system amounting to about 25000 Euro/year could be reduced to less than 15000 Euro/year depending on the installed option of Roadmaster 2000.

Through the harmonisation of requirements among railways a better standardised system with a bigger market and lower procurement costs is to be expected.

Finally the work on sensors and measurement procedures (type of sensors, stationary or non-stationary) will result in a simplified procedure requiring less sensors and less dedicated maintenance.

General approach offered by ProMain

To succeed in the development of a cost efficient implementation strategy for automatic switch diagnosis it is proposed to proceed in two major phases as follows:

Phase I has the general objective to analyse the requirements of different railways, to propose an integrated harmonised system and a general LCC-model (with ProMain resources). This work will be done in co-operation with additional experts and members willing to co-operate. Subtasks to be covered are:

- Compilation of concepts followed in railways today
- Comparison of functionality of existing diagnostic systems
- Collection and harmonisation of requirements from railways
- Elaboration of an integrated harmonised system
- Generalisation of the LCC model used so far for the individual application by different railways
- Dissemination of results with recommendations for future activities (phase II).

The **deliverable** of this phase will be a report on general requirements, a concept for an integrated system and a general LCC model for the use of railways. An efficient and simple dissemination will again be performed via the ProMain internet server.

It is anticipated that future activities will be necessary to solve remaining cross-company needs. This is planned in **Phase II** for which the following topics probably will deserve attention:

- Developments towards a fully automated system using advanced information technologies like automatic reasoning and expert systems
- Harmonisation efforts in safety requirements for switch diagnosis

Work of this phase cannot be done with ProMain resources exclusively.

Sources

[1]	Kusak, H.U.:	Ferndiagnose von Signalanlagen und ihre Auswirkung auf die Instandhaltungsstrategie. Signal und Draht 87, 1995, Heft 12, 5-8
[2]	Povse, H.:	Überwachung, Sicherung und vorbeugende Instandhaltung von Weichen. Zukunftsorientiertes Qualitätssicherungskonzept für Hochleistungs- und Hochgeschwindigkeitsstrecken. Eisenbahningenieur 44, 1993, Heft 8, 479-481
[3]	Redi;P.; Gaspari, S; Lori, L.:	Cedias railway Lines Diagnostic System. WCRR Firenze, 1997, vol. B, pp393-398
[4]		Cogifer: http://www.cogifer.com
[5]	Weiss, H.:	Weichendiagnosesystem SIDIS W, Motor als Sensor. Siemens Verkehrstechnik, Braunschweig, April 2000
[6]	Kreutz, J.:	REMAIN: Modular System for Reliability and Maintainability Management in European Rail Transport. Final Report. IITB Karlsruhe, 1998

4.2.2 Recommendations for Task 2

Oral and written recommendations refer to the following topics:

- Task 2 and Task 1 should be compatible.
- A pragmatic approach to reduce costs is more important than harmonisation.
- The REMAIN system (Roadmaster 2000) investigated within the 4th Framework Programme is too complex and too expensive.
- Not only components should be diagnosed but also the geometry and car reactions should be considered (This recommendation is contradictory to the previous one).
- Switch diagnosis should be compatible with ECOTRACK.
- Observe EN standards prepared by CEN/TC 256/SC1/WGs 15 (Track design alignment parameters), 18 (Switches and Crossings), 21 (Acceptance of Trackwork, Part 2)
- An alternative approach to switch diagnosis could be to build better and less switches.
- Several additional experts (names given) should co-operate.

4.3 Task 3: TQM - A means to improve customer satisfaction and RAMS performance

4.3.1 Concept

Problem description

ProMain recognised in expert discussions that TQM[1] is a possible means to increase infrastructure performance and customer satisfaction. The infrastructure managers are using TQM standards to a varying degree. This is not to say that the way to increase performance is that all use a standard. Quality and customer satisfaction are important, not the quality system as such. The ProMain partners believe that TQM with its overall thinking on optimal management, its focus on processes and on continuous improvement could be of great help to increase customer satisfaction and to ameliorate the cost situation and RAMS performance. Management of a company and involvement of all company members are often the critical success factors. TQM is a general tool to be used by railways for the optimisation of all of their processes of which two distinct examples are given:

The railway has lost market share on freight to road transport. In order to increase the competitive advantage in this example, one important element is the time spent at national borders (interoperability). The ideal is that the process times at border crossings should be minimised, where the use of TQM strategies can be of real help. The more efficient border crossings are, the more attractive and competitive the freight freeways would become. It would be an aim that the border crossings should not take any longer than the time to shift train personnel when needed. A solution could be harmonisation of processes and online provision of the requested freight documentation, which could be sent ahead of the train to prepare necessary processes at the border in advance. Information Technology would be of help to increase the interoperability and reduce the time on border crossings, which itself is in the scope of another ProMain task on elimination of IT obstructions.

The second example relates to indications that knowledge transfer from the head office to the district offices can be a challenge for amelioration. Good efforts and tasks are being produced centrally. However, when it comes to implementation, the district offices are dedicated to other tasks without having free capacity, which is not known to the central office. It has been identified in many organisations that most of the quality problems are caused by the fact that the knowledge within the organisation is not being used efficiently, for which TQM methods offer solutions.

Goals and benefits

The goal is to investigate how TQM and the use of standards could be a general framework for increasing customer satisfaction, managing costs and ensuring RAMS management.

The work ProMain wants to do is to clarify strong and weak points in TQM related to railway processes. This will make the decision on how to use and implement TQM easier.

---

[1] There is no official definition of TQM. The following definitions are often used: “Conformance to agreed customer requirements”, “Fitness for purpose of use”, and “Total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service in use will meet the expectation of the customer”. These definitions focus on the result of TQM. ProMain will also stress the importance to focus on the “content of TQM”, see section below on Phase II.

TQM has the potential to make railway processes more efficient and to ameliorate information exchange among railway departments. This will speed up internal processes in railways, improve customer satisfaction and make rail transport more attractive and competitive.

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. For the subsequent implementation of recommended TQM aspects in Phase II, ProMain will need external resources.

Case study of the work on quality and quality standards (Phase I)

A case study would be of great help to understand benefits and drawbacks of a TQM system and working with TQM in general. To convince railways that are sceptical towards TQM ProMain should focus on those railways that have implemented a standard, and answer questions like:

- Which benefits have they experienced?
- What were the critical factors for succeeding?
- What challenges do they have?
- How could cost reductions be demonstrated?
- What are the lessons learned and what can be done to improve the methods?

ProMain would interview key personnel in those railways where TQM-standards have been implemented successfully to gather the answers. The experience collected from railways, which use a TQM system, provides a useful guide for other infrastructure managers who want to implement TQM and those infrastructure managers already using a system could also benefit from a comparison of systems providing them with useful feedback on their system and possible improvements. On the results a brief **anonymous case report** would be delivered to the ProMain website and contribute to the dissemination of experience and preparation of new implementations.

Interoperability for conventional rail (Phase I)

It is of great importance that the interoperability is improved and that e. g. the time lost at border crossings is reduced. ProMain will maintain a dialogue with the European Commission and AEIF to ascertain the status at important border crossings and benchmark the different processes. Harmonisation of rules and procedures might be an answer. However, this is also a political task to agree on standards and to set service goals, therefore the communication with the European Commission is very important and a critical success factor.

TQM as a general management tool (Phase II)

In the section above TQM is proposed as a tool for improvement on interoperability. However, TQM is a general tool, or way of thinking, with emphasis on *Visions*, *Continuous Improvements*, *Change processes*, *Total Scope*, *Contribution by Everybody*, *Internal and External Customers*, *Individual Adaptation*, and *The* “*Seven Tools*” (i.e. simple tools for process control at the operator level). In ProMain we will investigate how these dimensions really can be utilised within the railway industry as a management tool to increase infrastructure performance and customer satisfaction. The problem is very often that you have the technology, the systems and the methods, but you are not able to get it implemented due to different barriers within the organisation. In this setting TQM may be viewed as the necessary “facilitator” to do this. Due to annual budget restrictions many maintenance activities are postponed although they should be recommended for economic reasons judged over a longer period. In this way the potential reward cannot be realised and infrastructure managers know that it is “expensive to be poor”.

ProMain will investigate how TQM could be helpful in such particular situations, but all types of “barriers” will be treated systematically in Phase II of the TQM activity of ProMain.

Deliverables

Case studies and reports on successful implementation strategies from Phase I will be presented on the ProMain Website.

4.3.2 Recommendations for Task 3

Recommendations and discussion items were the following:

- TQM should be a general theme of ProMain and positioned as an encompassing topic above all tasks.
- The explained concept is too complex, especially for a funded project; the considered scope should be narrowed, e. g. to the area of maintenance and renewal of track systems.
- TQM should become a general method and philosophy for all processes of work within railways; ProMain should contribute to this aim.

4.4 Task 4: Elimination of IT obstructions to international freight traffic

4.4.1 Concept

The need for this task was revealed through the study of lines selected for ProMain, especially for corridors II and IV on which work will concentrate. Co-operation with Railserv is under preparation.

State of the Art

For different reasons railways still lose too much time at national borders, both in passenger and freight transport, but especially in freight transport. Unfortunately freight traffic by rail suffers from over-long stops caused by customs control, veterinary inspections and agricultural protection measures.

These delays occur particularly at the borders of the EU and Eastern European and Newly Independent States. There are considerable time reserves at borders which can be reduced. They are due to technical problems and IT deficiencies. The technical problems causing delays are changes in gauge, in brakes, couplers and power systems. But according to discussions with experts for corridor II these technical problems cause less delay than existing IT deficiencies.

The information to be exchanged relates to technical data of the train and transported goods. It must be readily available in the different languages of the related railways and its transmission should be completed before the arrival of the train at the border. In general the freight data is more complicated, since legislative customs requirements have to be observed. Up till now there are inconsistencies in freight transport laws between Western states (governed by the CIM convention) and Eastern states (governed by the SMGS convention). Between Germany, Belarus and Russia a rail freight traffic agreement (GBRT) has been concluded to overcome these problems. But major technical problems persist: the transformation of the freight data from one system into another is paper based and done by hand in a tedious process that consumes more time than the necessary technical changes of locomotive, gauge and other systems. A working group [1] reported that railways would need to invest SFR 25 million to upgrade lines in order to reduce journey time by one minute. In contrast, a reduction of stopping times at borders is the more economic and realistic alternative.

Problems to be addressed

As solutions are especially needed for the corridors joining West and East, they shall be in the centre of interest. Work done will be in agreement with the requirements of a UIC working group for rationalisation at border crossings [2]. Formulated strategic requirements are:

- Common European IT system for long-distance traffic
- Travelling Distances of 300 - 800 km without any marshalling needs
- Common transport processes for freight and combined traffic
- Further development of marshalling yards into multi-functional centres for freight traffic.

In the future the marshalling yards will be the terminals for data collection, the centres for customs, veterinary and agricultural controls, the technical transfer point between railways and the logistic interface to road traffic. IT solutions have to take this framework into account and the following important questions have to be addressed before any new developments can be started:

- **What are the weaknesses of past approaches taken by railways?** Developments made in the past did not lead to an accepted solution. They were based on available standards (EDIFACT; HERMES etc.) which are well spread in Western countries but could not be introduced in West-East traffic. The lack of adequate IT equipment (HW and SW) in the Eastern states was one reason for the missing uptake.
- **Is it feasible to base a solution entirely on the integration of available tools?** Some experts recommend such a solution that could be very efficient. The main classes of tools that are needed for an IT solution for freight traffic are:
  - Network management tools: They have to deal with all layers 1 - 7 of the ISO standard, for which private and public networks exist. With regard to the use of public networks it has to be observed that safety critical train data (brake information, length of the train ...) have to be transmitted in a secure and reliable way. Data security, digital certificates and user authorisation are also critical issues to be addressed.
  - Data representation tools: For this purpose standards like EDIFACT and XML/EDI are available which could represent the kernel for the representation of the necessary train and freight data (ISO layer 6)
  - Application tools: Different railways in Central and Northern Europe have tools for the management of a whole railway transport chain. In addition to these specified tools a manifold of general commercial tools and developments like [3] for the management of multimodal transport chains can be exploited for the given purpose.

In general it is expected that the work in this task will have to concentrate on making existing tools applicable, not on developing new ones.

Benefits

The elimination of IT obstructions in freight traffic is a necessary contribution to better interoperability. The resulting reduction of stopping times at borders is a very economic alternative as opposed to reducing journey times via upgrading of lines.

The expected contribution to a more competitive rail freight transport is an important factor for the enhancement of the rail transport mode as intended by EU initiatives.

General approach offered by ProMain

To find out the best approach to the solution a two-phased strategy is proposed.

In **Phase I** a feasibility study is conducted, using ProMain resources and the co-operation with external experts and members. The work concentrates around corridors:

- Study of needs for corridor II and IV
- Investigation of weaknesses of earlier approaches
- Selection of a corridor and development of a feasible concept of IT use for acceleration of border crossings.
- Reporting and dissemination of results.

The **deliverable** consists of a feasibility study which can rely on earlier approaches and will avoid typical drawbacks.

In **Phase II** the realisation of an IT system for the selected corridor is foreseen for which additional resources outside ProMain must be acquired. In this phase railway operators of the related railways, railway users and freight distributors have to co-operate with an IT-system integrator. Leadership of the task will preferably be realised by a partner of an eastern railway. The realised solution shall be made demonstrable (also using the ProMain server) to motivate its transfer onto other lines.

Sources

[1]		Report of a working party of the Centre for European Policy Studies, Brussels, April 1998
[2]		UIC working groups for rationalisation at border crossings, presentation of the steering group, Paris, June 2000
[3]	Bügel et al.:	Infolog, Report on Installation and Verification, EU Project PL-97-2173, DG TREN, Dec. 1999
[4]	Breitling, W.:	AEIF FP 5 Research Fields. UIC, Paris, May 2000.

4.4.2 Recommendations for Task 4

The respective recommendations and discussion items for this task were the following:

- This task is very important. Existing possibilities should finally be used for the acceleration of border crossing freight traffic.
- The approach should be compatible with a similar UIC initiative (this initiative has been identified in the meantime. It is a working group for the rationalisation of border crossings for freight trains and co-operation has started).
- GSM techniques should be considered.

- The Public/Private Partnership Initiative for Corridor II co-ordinated by UNIFE should be involved.
- Additional experts were named.

4.5 Task 5: Track inspection: systematic RAMS approach to choose best value for money

4.5.1 Concept

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.

4.5.2 Recommendations for Task 5

The following recommendations and items were discussed:

- All basic parts of the track including signalling and overhead lines should be considered.
- The results must be compatible with ECOTRACK.
- Research projects such as ICON (degradation models), DYSAF (system dynamics of track behaviour) and a new German BMBF project should be taken into consideration.
- Most important is the collection of information with regard to optimal restoration and renewal strategies.
- Developments in the United States should be looked at, especially in image processing.
- Names of additional experts were given.

4.6 Task 6: European RAMS Database - First step: Nordic demonstrator

4.6.1 Concept

Problem description

Utilisation of reliability data is an important factor in RAMS (Reliability, Availability, Maintainability and Safety) analysis and RAMS management. There are several dimensions to discuss with regard to collection of RAMS related data. First we should ensure that we have appropriate data types to support the various types of RAMS analyses, e.g. quantitative risk assessment, human error analysis, approval of safety critical systems etc. Another important dimension is to ensure that data can support the life cycle perspective of a system.

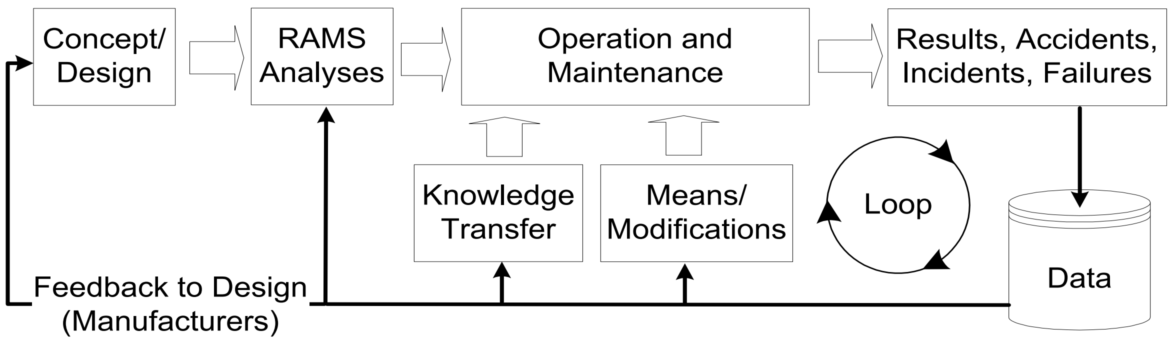

Figure 1: Use of experience (heuristic) data

Figure 1 illustrates the role of data in the life cycle perspective of a system. Most industries suffer from good data collection concepts that support and promote the various feedback loops in Figure 1. An objective of ProMain is to set a new standard at this area. For the railway industry it is also important to demonstrate that they have incident and accident reporting systems that comply with the requirements of the safety authorities. A very important question here is how data should be collected and analysed in order to verify fulfilment of the single fault principle and safety critical functions.

Goals and benefits

The goal is to establish a European database for RAMS analyses, which serves the needs of railway infrastructure owners and manufactures of railway equipment. The benefit of multinational collaboration on data collection has been demonstrated in e.g. the oil and gas industries. Case studies have been performed that especially demonstrate the benefits of good quality data when important decision about safety are to be made. With support from the data, simple and inexpensive solutions have proved to comply with the safety requirements. It is expected that similar benefits will be achieved also within the railway industry.

Since access to experience data is essential in RAMS analyses and RAMS management, the benefits of good data collection systems are obvious. The question is rather if it is beneficial to work towards a common European system. Some arguments for this are:

- better estimates for the reliability parameters due to more data,
- gives an operator in one country access to reliability figures for equipment that is in use only in other countries,
- feedback to manufactures of equipment may be more efficient, since all countries report in the same format,
- makes benchmarking easier, which helps each infrastructure operator to see his weak points compared to the “average”,
- gives a sound basis for new European research and development projects to improve RAMS performance of equipment contributing most to RAMS problems, and
- a common European Accident database will be important for the safety authorities when new systems and solutions should be approved.

Approach offered by ProMain

The work is proposed to be organised in two phases, whereby 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.

ProMain web database demonstrator (Phase I activity)

The ProMain web server using WebGenesis, is the natural environment for a database demonstrator. It should be kept simple, but advanced enough to offer a possibility to explore it and to simulate some tasks in order to test the userfriendliness in an easy way. WebGenesis will also be a platform for defining the requirements of such a database. It is expected that ProMain and a possible project launched by ProMain will be the drivers in the process of European requirements definition. However, it is important that the potential users continuously give input to this process. Important elements to include in the database demonstrator are

- what is in it now? This part of the demonstrator will exploit what really has been implemented in the ProMain prototype database as time goes by,
- what will come,
- task simulator which will allow the users (all railway stakeholders) to test the functionality of the ProMain database on the internet, and
- a site for feedback and suggestions.

The Nordic Pilot project (Phase I activity)

The ProMain objective is to work towards a European database standardisation. The realistic way to start this process is to start with a small number of infrastructure operators and gain some experience (pilot project). Since both Denmark and Norway are now working out more or less similar systems, it is therefore a ProMain recommendation to use the Nordic countries in such a pilot project. Important elements to include are

- survey the status within the different Nordic countries, investigate the possibility for harmonisation on concepts,
- investigate the possibility for sharing data (willingness to share data, pricing policies, etc),
- technical problems with sharing data, and data retrieval, and
- continuous presentation of the result on WebGenesis.

Working towards a common European database (Phase II activity)

If the feasibility study succeeds, the aim is to work towards a European dimension. It is expected that the Nordic Pilot project will have resulted in some fruitful concepts. Furthermore, the ProMain web database will have been in operation for more than one year, and European users will have given their comments, and suggestions. This will be important input to the work, but the detail planning of this activity should be postponed until completion of Phase I.

Deliverables

The Phase I deliverables will be the ProMain web database demonstrator and a report on the Nordic pilot.

4.6.2 Recommendations for Task 6

The recommendations and discussion items were the following:

- Look at examples in petro-, nuclear-, air- and space-industry.
- Search for possibilities to make this effort a commercial activity.
- Access to real data from railways is a key issue. A learning system may be of help.
- The need for a common European database must be well justified.
- The EU project INFRACOST (with UIC) and RAIL should be considered and compatibility with UIC approaches is important.
- The database may be used in analyses of the safety of new products and for setting up a maintenance regime for railway infrastructure.
- A prerequisite is the establishment of better communication among railways themselves and among railways and customers and suppliers.
- Additional experts were named.

4.7 Task 7: Harmonisation of safety approval - Practical steps through co-ordination of certification bodies

4.7.1 Concept

The need for harmonisation of safety approval has been addressed in the questionnaire as well as in discussions with responsible persons of different railways. Also, the nera study [1] has pointed out this need. The problem is closely connected with the implementation of a European RAMS database which can be used for quantitative analyses in the safety approval process.

State of the art

A unified safety approach for Europe has been addressed within the CENELEC standards EN 50126, EN 50128 and EN 50129. These standards, however, incur some problems:

Although the standard which is the basis of the work is agreed upon in Europe, certification with respect to this standard is still organised differently in each country. Some countries such as e.g. Italy have not yet set up a system or are in the process of doing so, e.g. the Netherlands. The organisations carrying out certification are the notified bodies. This raises the following problems.

- If a certificate is issued in one country, how can it be accepted in another country having a differently organised certification system?
- The quantitative analyses required for safety approval need additional guidance which is not supported by the standards.
- The CENELEC standards cover the main part of problems concerned with reliability, availability, maintainability and safety. However, additional national standards exist, e.g. for fire protection which must be followed in addition to the CENELEC standards.

From a practical point of view, manufacturers of railway equipment and railway companies have the following issues regarding certification in different countries:

The manufacturer has to bother about parallel certification in different European countries, since certification systems are different.

On the other hand, a national railway company procuring equipment from abroad has problems with foreign certificates. Formally, they are not in accordance with the national system, in addition it is not well understood to what extent they can be relied on.

The problem has been addressed in the nera study. An approach mentioned there would be a European certification system. This, however, requires delegation of national responsibility to a European organisation. Then, notified bodies could be accredited according to this European system. A European notified body would have to be able to act within most parts of Europe, partially through local representatives and have knowledge of relevant and specific national regulations. Since political decisions would have to be taken for this approach, significant time would be required before such a system could become operational.

Currently, some certification bodies or notified bodies have established loose bilateral contacts, in some cases even contracts on collaboration have been concluded.

Problems to be addressed

Harmonisation of safety approval needs to address several problems. First, the benefits of establishing joint action of some national notified bodies have to be considered.

Then, the **current experience** in working together with other notified bodies must be gathered. Trying to generalise this experience helps in defining the means for further and more intense collaboration. The approach adopted by ProMain is complementary to the approach proposed by nera. ProMain focuses on the certification bodies and their collaboration at a more technical level.

The information on the collaboration is intended to be made publicly available through the ProMain website so that a manufacturer wishing to certify his products in several countries can get information on how to do this and with the help of which organisation. On the other hand, this information is also important for the railway companies when foreign certificates must be assessed. This will then form a **support centre** for certification issues.

Also a comparison and equivalence study of national safety requirements and standards in other areas besides railways will assist in harmonisation.

In addition, guidelines on quantitative risk analysis will be given to assist in defining the safety integrity level and to prove the achieved **level of safety**. This is one of the most important problems and support is helpful for manufacturers as well as for assessors. Moreover, the information helps in applying a unified approach.

Also this information will be made available on the ProMain website.

Expected benefit

The expected benefit would be threefold:

- The collaboration of notified bodies will anticipate official regulations from the European Commission. National notified bodies will be better prepared for a European accreditation.
- Manufacturers will be able to easily certify their equipment in several European countries in parallel without having to repeat the process for each country. This will lead to substantial cost savings.
- National railways will have a better basis to trust foreign certificates and will be able to accept them also from a formal point of view if they are issued by a partner of a national notified body and possible small differences are covered by this national organisation.

General approach offered by ProMain

Phase I

In the first phase a study has to be elaborated covering the following issues:

- Current national status of existing notified bodies or organisations planning to become notified bodies.
- Gather experience of collaboration, especially on existing bilateral contacts and contracts.
- Study the means of co-ordination of notified bodies.
- Establishing a comparative list of additional national standards that have to be considered in addition to CENELEC standards, intended to be freely used from the web.
- Compiling guidelines for quantitative analysis in form of a cookbook containing examples.

Moreover,

- Contacts will be established with further railway representatives and certification bodies. A major role is to be played by UIC and UNIFE as international organisations.
- The results will be distributed via the the ProMain website, partially for free use, partially for members and experts of the website. The main intention is to develop a list of notified bodies in Europe, their contacts with other notified bodies and the current status of co-ordination of certification in different countries.

Phase II

A workshop will be conducted for notified bodies and representatives of railways and manufacturers. This workshop is intended to become the start of an international advisory group of notified bodies, driving further collaboration in a European perspective.

Possible multilateral contacts / contracts are encouraged. Therefore, a consultation group of notified bodies is to be founded.

Other work to be done in phase II is mainly based on the outcome of the study performed in phase I.

References

[1] nera study: Safety Regulations and Standards for European Railways, November 1999

[2] EN 50126, EN 50128, EN 50129

4.7.2 Recommendations for Task 7

Recommendations and items discussed were:

- This task is extremely important and all Railway Inspectorates should participate.
- The project ProMain should provide help to the Commission in selecting notified bodies.
- Progress should be made through the identification of joint certification projects.
- The articulation between regulations and TSI is a problem to be addressed.
- AEIF might have completed much of the work to be done.
- Names of additional experts were given.

5. Involvement of ProMain in EU Policies

At a meeting of the ProMain Steering group with Mr. Anselmo and Mr. Huismann of DG TREN on October 9 in Brussels, the representatives of the Commission recommended a clear involvement of ProMain not only in the implementation but also in the initiation of EU policies towards a performant rail mode. The necessity of an active integration of all relevant stakeholders was stressed.

This gave rise to some new investigations and discussions among the ProMain partners to reinforce the relation of ProMain with railway policies of the EU.

5.1 Railway Policies of the European Union

5.1.1 General ideas

There are several main ideas governing the development of railway policies by the different engaged stakeholders in the EU.

The **concept of the single market** with competitive transport models explicitly requires the interoperability of the railways, the harmonisation of safety concepts and approval rules, common specifications for railway equipment and standardisation at European level.

A further major issue is **sustainability of the growing mobility of people and goods**. This intention brings about an enhanced consideration of the social dimensions in transport, ensuring charging for marginal social costs due to accidents, environmental pollution, land use, (see e. g. problems in the Alps), congestion, low quality and unfriendliness towards consumers.

Many of these social dimensions are in favour of the rail mode, which, compared to other transport modes, guarantees e. g. higher safety and less pollution by more than an order of magnitude.

The envisaged **enlargement of the EU by the new central and eastern European states** raises the necessity of efficient Trans-European Transport networks which must serve customer and citizen needs providing e. g. goods tracking and door-to-door service. Only intelligent use of IT and telematics will enable the integration of transport systems, the interoperability of national railway systems and the linkage of rail freight transport to other modes.

5.1.2 European policy makers

The policy making develops from a number of sources, like e. g. legislative and executive political bodies, official and private organisations and of course the citizens:

- Citizens
- Parliament
- European Council of Ministers
- ETMC, European Transport Ministers Conference
- European Commission
- UIC, Union Internationale des Chemins de Fer
- UNIFE, Union des Industries Ferroviaires Européennes

- CER, Community of European Railways
- National Ministries
- Railways
- R & D organisations, experts
- AEIF, Association Européenne pour l'interopérabilité ferroviaire

These sources interact through different communication channels to start policy activities and initiatives.

5.1.3 European policy initiatives

In general the transport policy of the EU may be described as being based upon the principle that citizens and commercial enterprises should enjoy freedom of choice between efficient and competitive transport modes, paying prices that fully reflect the economic and social cost of their decisions. Policy instruments have been used since the 1990s to achieve this goal.

Directive 91/440 requires each national railway undertaking within the European Union to be established as an independent body, run on commercial management principles providing separate accounts for infrastructure management and rail operations. This directive 91/440 offers national railways open access rights to the infrastructure, but only with too restrictive limitations.

Therefore **Directives 95/18 and 95/19** were designed to complement and enhance Directive 91/440 by defining the requirements for international licensing of railway undertakings and by regulating the allocation of infrastructure fees and capacity. Although Directive 91/440 had a big impact on the restructuring of railways, the stimulation of the provision or development of competitive international rail services has been low.

Consequently in 1998 the **Infrastructure Package Com 98/480** was proposed by the Commission to offer a wider and more competitive network of passenger and freight train services within the EU. In its final version, **Com 99/616 final**, it consists of three volumes aiming at necessary amendments of the three directives 91/440, 95/18 and 95/19 towards the realisation of the single market for rail services. At the moment this package is undergoing the necessary readings in the European Parliament to be finally endorsed.

The Commission not only proposes basic directives like these above, but also develops accompanying measures for their realisation. Among these the definition of **R & D projects** serves the solution of open technical problems. Specific directives accelerate the realisation of the political ideas. In this sense **Council directive 96/48/EC** regulated for some selected subsystems the interoperability of the trans-European high-speed rail system. It was the basis for the definition under the leadership of the AEIF of the **Technical Specifications of Interoperability (TSIs)** for the subsystems.

With regard to the political enlargement of the EU and the necessity of providing better services also for other rail traffic, a proposal for a directive of the interoperability of the Trans-European conventional rail system **Com (99) 617** was presented by the Commission.

In this proposal the following subsystems are identified for future technical specification under the regime of the AEIF:

- infrastructure
- energy
- control and command and signalling
- traffic operation and management
- telematics applications for passenger and freight services
- rolling stock
- maintenance.

In addition to these mentioned initiatives a new **Whitebook on the Common Transport Policy** and two **Communications on rail freight services** and **on safety** being under preparation.

5.2 Involvement of ProMain

5.2.1 General

ProMain was designed by the Commission as a Thematic Network to enhance the performance of the railway infrastructure in maintenance and management. It is technically oriented. The possible involvement in EU policies has at least two facets:

I Policy implementation: ProMain defines and solves tasks which have a considerable impact on the realisation of EU policies.

II Policy initiatives: ProMain contributes to the development of policies in statu nascendi and makes proposals for new railway policies on its own.

Up to now ProMain has put most weight on facet I, but it is also ready to follow facet II in a wider sense than before.

5.2.2 ProMain Concept with regard to implementation of EU policies

For the implementation of EU policies the ProMain approach took into consideration right from the beginning the three major basic policy principles

- of the single market
- of sustainable mobility and
- of the enlargement of the EU.

With regard to the latter, application areas have been sought for all classes of Trans-European railway networks as there are TEN-T (4 lines, high-speed, under consideration in ProMain), TERFFs (3 lines under consideration), Pan-European lines (2 corridors under consideration). Seven tasks have been defined with regard to their impact on the implementation of the three major policy principles and their different logical consequences which are sketched in section 2.3. All tasks envisage the preparation of a field for future R & D activities which as such is itself a contribution to policy initiation.

To get access to valuable knowledge sources and to receive support for the implementation of results, ProMain has established contacts to policy makers from the groupings of section 1.2 up to the level of the European Commission.

5.2.3 Policy Involvement of ProMain Tasks so far

The following sections serve as an overview of the principal relations of ProMain tasks to EU policies with a weight on policy implementation so far.

5.2.3.1 Task 1: Track systems - Information centre helps to choose best value for money

This task is designed to promote the single market for track systems which will not be achieved through interoperability requirements alone. The provision of information through the centre on in-service performance (RAMS) for a particular track system is key to "cross-acceptance" by other railways.

5.2.3.2 Task 2: Automatic switch diagnosis - Cost efficient implementation strategy

As a subsystem of the track the single market aspects are as well relevant for automatic switch diagnosis. In fact the market for such systems is very fragmented although automatic diagnosis provides a big perspective for the amelioration of RAMS figures and the reduction of life cycle costs.

5.2.3.3 Task 3: TQM - A means to improve customer satisfaction and RAMS performance

In other industries, e. g. in the automotive area, TQM is an accepted tool under permanent evolution for the optimisation of internal business processes and the interfaces to suppliers and customers. Broader application of TQM offers a high potential for the improvement of railway performance within and across borders. TQM will make railway businesses more competitive.

5.2.3.4 Task 4 - Elimination of IT obstructions to international freight traffic

The new infrastructure package giving open access to Trans-European lines will not develop its full benefit without extended application of IT and telematics for the exchange of data between railways, railways and customers across borders. Solutions shall be proposed for corridors II and IV which are sufficiently general to be applicable to other lines.

5.2.3.5 Task 5 - Track inspection - systematic RAMS approach to choose best value for money

This task addresses not only the safety and comfort of customers but also of track workers. It will also contribute to the enhancement of cost effectiveness by the reduction of inspection and maintenance costs and by reducing the number of necessary maintenance operations.

5.2.3.6 Task 6 - European Database - First Step: Nordic demonstrator

A European RAMS database will serve several principles: The identification of equipment meeting RAMS requirements for an existing or new operational environment improves competitiveness of railways by reducing purchase and maintenance costs. Most significantly the database could form the basis of a feedback loop to manufacturers so that poor performance can be corrected. This has a link to safety issues and EU co-ordination of accident and incident investigation.

5.2.3.7 Task 7 - Harmonisation of safety approval - Practical steps through co-ordination of certification bodies

The safety requirements of each member state have been perceived as a barrier to the single market and an uninterrupted transport across borders. The High Speed and the future Interoperability directive for conventional rail give notified bodies the role of certifying conformance of equipment against the requirements in the TSIs. All equipment not specific to interoperability (such as e. g. interlockings) will not be covered by TSIs. Cross-acceptance for this broad range of equipment is needed to satisfy the single market principle and to avoid market fragmentation. The implementation of these policies is supported in this task.

.

6. Summary and Outlook

6.1 Technical Work

Looking through the recommendations in chapter 3 it is obvious that the decision makers regarded all tasks as being important for the enhancement of railway infrastructure. But some tasks will need more redirection than others. For several tasks hints were given on necessary co-operation and relations among tasks. This has led to a restructuring of the tasks into three main areas:

- Initiatives Pro Highly Performant European **Tracks**

  Task T1: Cost-effective Track Systems (former Task 1)

  Task T2: Automatic Switch Diagnosis (former Task 2)

  Task T3: Track Inspection: Better Value for Money (former Task 5)

- Initiatives Pro Effective **Management** of European Railway Infrastructure

  Task M1: European RAMS Database: First Steps in Harmonising Data Categories (former Task 6)

  Task M2: Total Quality Management: Second Tranche of Implementation (former Task 3)

- Initiatives Pro Highly Performant European **Interoperability**.

  Task I1: Towards Europe-Wide IT Compatibility for International Freight Traffic (former Task 4)

  Task I2: European Harmonisation of Safety Approval (former Task 7)

This restructuring is much more than a formal one. It enables the concentration of efforts, e. g. by holding workshops for tasks in common, since experts often represent more than one task. A more thorough consideration of the recommendation has to be performed in the task related workshops with invited experts foreseen for the end of the year 2000.

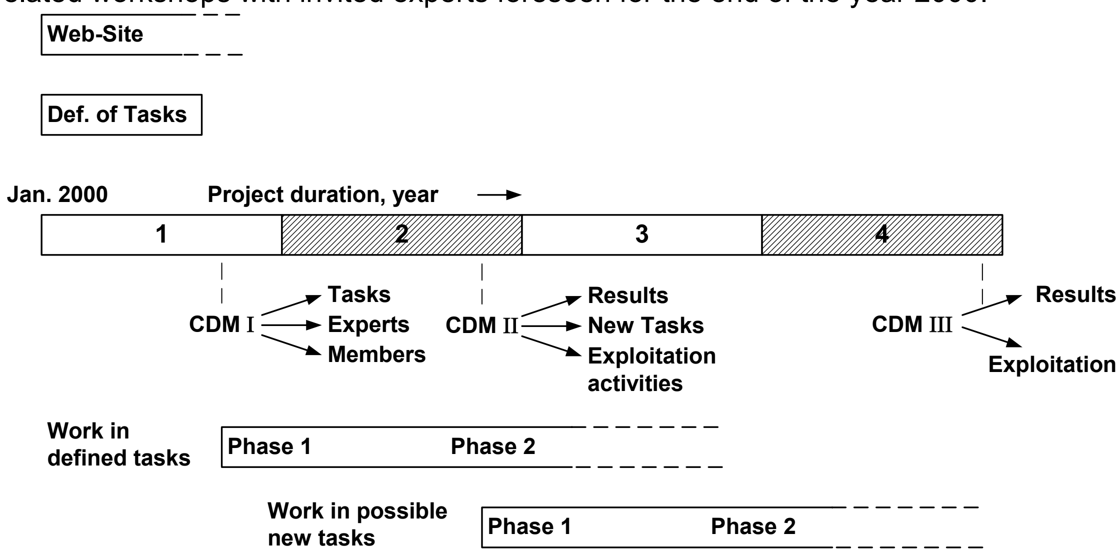

Figure 2: Project Schedule

The technical work organised in the 7 tasks described above has been structured to occur in two phases. For the first phase ProMain resources are used to elaborate the state of the art and to produce a documentation and a proposal for future activities. These results shall be available for CDM II which is planned for the end of the year 2001. The presentation of results at this CDM is the starting point of exploitation activities in phase 2 with the help of the decision makers. The general schedule is shown in Fig. 2.

6.2 Potential for policy initiatives

The ProMain contractors are adjusting their workplan to be prepared to make inputs into policy initiatives. For this purpose important persons in the field of policy makers have been identified with whom co-operation is sought.

At the moment it is too early to promise from the ProMain side concrete policy inputs which add substantially new information in addition to that what is already provided by the groupings (section 1.2) active in policy making.

But some ideas are under discussion and first results are to be expected by the mid of the year 2001 from the started tasks. Such inputs may refer to the following problems:

- Directives on interoperability only require interoperability on a technical level. Much more important may be the organisational interoperation between all parties interacting for door-to-door transport. In general TQM offers tools to optimise the interaction and task M1 shall clarify this potential and possible policy inputs.
- The TSI on conventional rail will have defined substructures. Specification has not yet started and several ProMain tasks could contribute to it, e. g. to
  - infrastructure (tasks T1, T2)
  - telematics applications (task I1)
  - maintenance (tasks T3, M1, M2)
- The notified bodies will have a key role in ensuring the safety requirements are applied in the same manner across Europe. In all cases where special operational conditions in one member state exist, technical problems are yet to be harmonised or integration with existing equipment is necessary and for all equipment not subject to TSIs, there will remain national safety rules in the foreseeable future. The EC will need to manage this period and task I2 may give valuable support:
  - In this task notified body collaboration and their current ability to deal with the interface between national and TSI requirements is assessed. Recommendation can then be made by ProMain to DG TREN for further co-ordination of NBs.
  - The availability of national standards covering those safety requirements not in the TSIs will be identified as a basis for future AEIF harmonisation work.

Human factors now receive more attention in risk assessment, but the analysis of human factors still needs further research which shall be identified. Recommendations with regards to TSIs and AEIF will be made to DG TREN.