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INNOTRACK

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Thematic Priority 6: Sustainable Development, Global Change and Ecosystems

D5.3.1 First Report on Logistics & Support

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Executive Summary

The present deliverable gives a first report on the logistics of some output developed within the SP2 Track support structure.

It will be completed by a final report which will go deeper into the details of the logistics of the selected SP2 output.

The analysis developed is based on one hand on the output of WP5.1 and on the other hand on the output of SP2.

The work achieved in WP5.1 has showed that the logistic aspects have to be considered in the development of innovative solutions especially when the LCC argument is taken in account.

From the findings of WP5.1 seven areas critical to success have been identified: Market strategy; Long-term funding, planning and contracting; Work programming; Project management and logistics; Contracting strategies; Rules and Regulations; Plant.

And a benchmark of logistics constraints could be identified as well.

The conclusions and recommendations of WP5.1 provide a reading grid, which is a help for the analysis of the logistic aspects.

The proposed study will be limited to some selected output of SP2 related to sub-grade improvement and new ballastless trackform.

It should primarily be seen as an attempt to put SP2 output in the context of the relation between Infrastructure Managers and Contractors.

1. Introduction

Following the review of existing methods and the analysis of the relation between Infrastructure Managers and Contractors, which was achieved during the development of WP5.1, WP5.3 could be presented as an application of the results and conclusions of the WP5.1 to the logistic of SP2 output.
Or it could also be presented as the logistic of SP2 output analysed through the grid of WP5.1 results and conclusions.

It will be completed by a final report which will go deeper into the details of the logistics of the selected SP2 output.

EFRTC lead this WP5.1 with the support of the University of Birmingham and BSL Consulting who both set-up a structured questionnaire, carried out interviews, etc.

The main subject was about collecting, on one hand, data pertaining to current logistics practices throughout Europe and on the other hand the relation between Infrastructure Managers and contractors.

It was aimed at identifying best practices and making proposal for promoting good management and logistical practice in track maintenance and renewal work.

The development of the work, implemented through interviews and analysis, demonstrated that there is big potential for savings in the improvement of the overall process of track maintenance and renewal. Some figures of savings between 10 to 30 % were set forth. These figures are matching with the INNOTRACK overall objective of 30% reduction in LCC and are showing that the logistic aspects have to be considered in the development of innovative solutions.

From the findings made during interviews and discussions, seven areas, critical to success, have emerged. They will be detailed below. These areas are ranging in a management level but some have an obvious and immediate impact on the work at site.

It is thus interesting to integrate those elements of WP5.1 in the development of the logistics of SP2 output.

Those elements of WP5.1 with immediate application on site have to be first identified and then crossed with the logistics required by SP2 output.

As an example, both Infrastructure Managers and Contractors predominantly requested a better track possession policy, a better planning enabling for example the implementation of high output methods, the industrialisation of processes, common rules & regulations, an optimised utilisation of fleet.

- Elements of conclusions and recommendations from WP5.1 that can have a direct application in the development of WP5.3 could be detailed below :
    - Contracting strategies of infrastructure managers e.g. long term planning, dependability, economies of scope and scale, output orientation (innovation, LCC-aspects), terms of employment/build-up and continuity of skills
    - Track possession policy : vast potential for process-innovation to make better use of operational windows
    - Industrial engineering of processes and worksites (good-practice knowledge management)
    - Rules and regulations, particularly in safety and logistics (worksite protection and material supply) have a massive impact on productivity and LCC.
    - Fleet utilisation for heavy plant are often too low i.e. high capital cost and immediate consequence for initial direct costs of track maintenance and renewal; as a consequence fleet size of some very expensive machinery is often far above real needs

- Infrastructure Managers identified the following constraints affecting logistics:
    - Fluctuating levels of funding from governments, adversely affecting the ability to plan long-term

- The loss of skilled staff through retirement and a shortage of suitable new people willing to come into the industry
- The variability of track condition resulting in relatively small and inefficient packages of work unsuitable for high-output methods of working
- A limited number of component suppliers resulting in resource shortages and poor competition

The proposed study will be limited to some selected output of SP2 related to sub-grade improvement and new ballastless trackform.

It is included, in a first step, in the present first report. This will be completed by a final report which will go deeper into the details of the logistics of the selected SP2 output.

It should primarily be seen as an attempt to put SP2 output in the context of the relation between Infrastructure Managers and Contractors.

2. Main section

2.1 WP5.1 Input and Benchmark

Different approaches have been followed to encompass the existing methods that have been developed throughout Europe: on one hand face-to-face interviews were carried out and on the other hand an online questionnaire was filled in.

Two purposes were aimed at, through these approaches: it was first to collect quantitative data with the help of questionnaires and interviews and second to collect qualitative information during face-to-face interviews.

Quantitative information collection, pertaining to support, was about procedures relating to: sleepers; ballast; machinery; and maintenance and renewal planning.

The major aspects of the qualitative information collection that were discussed at the interviews were as follows:

- What is the main product/services spectrum of your company?
- In which countries and with which type of contracts are you typically working?
- What are the typical volumes or durations and the risks of your contracts?
- In real life, what are the key discriminations between profitable and loss-making projects from your perspective?
- What are the main issues in the entire cooperation process with infrastructure managers
  - that make it unnecessarily difficult to deliver good value-for-money ("could be improved")
  - those are very helpful in optimising the process ("lesson to learn from", "good-practice").

At the conclusion of this work two deliverables were produced:

- D5.1.5 “Final Report on Existing States-of-the-Art for Construction, Maintenance and Renewal Activities and Assessment of Logistic Constraints”
- D5.1.6 “Final Report on conduct of interfaces between contractors and infrastructure managers"

The further development of logistics & support will be guided by these two reference documents.

D5.1.6 has classified the key findings of WP5.1 pertaining to the conduct of interface between Infrastructure Managers and contractors into seven clusters detailed below:

A – Market strategy

B – Long-term funding, planning and contracting

C – Work programming

D – Project management and logistics

E – Contracting strategies

F – Rules and Regulations

G – Plant

At first sight these subjects can be considered as dealing merely with management. However among these areas some apply indeed to a management level but also to a technical level and especially logistic.

To make this point clearer it would be helpful to cross the logistic of support with these seven "critical to success" areas and determine which ones could have a direct application at the worksite level.

The table below identifies the "critical to success" areas that are applicable to the current study of Logistics and Support:

	WP5.3 Logistics & Support
Market strategy	
Long term funding and strategic planning	
Work programming	X
Project management and logistics	X
Contracting strategies	
Rules and regulation	X
Plant	X

The content of the selected "critical to success" areas: Work programming, Project management and logistics, Rules and regulation, and Plant is detailed hereafter (abstracts of D5.1.6).

Work programming

The fundamental building blocks for good economics of resource deployment with a substantial impact on unit cost are:

- plant and staff deployment during track possessions
- well programmed project pipeline and sequencing of plant and staff deployment (logistics from work-site to work-site)
- minimum disturbance strategies and procedures for assessing the overall costs of the intervention into the track

Work Programming because the proper planning and programming is at the heart of all efficiency of contractors works.

- consistent sequencing of all works over time and geographically
- coordination of activities, bundling
- "a clockwork" approach to worksite logistics and work execution (mutual programme management)
- a well programmed pipeline of major projects leading to a “clockwork” approach to worksite logistics and work execution
- avoiding large programme changes resulting in increase of costs both for supply-side and the execution of work
- careful attention to all details in planning process and work programming
- Infrastructure managers’ approach in this regard is a key to create a cost efficient framework, for the execution of works by contractors primarily by
- mid-term planning and work programming
- consistent sequencing of work
- logistics and execution dependability
- an even workload distribution over the year

Project management and logistics

Multiple interfaces on site between IM, IM's suppliers and contractors introduce cost and undermine responsibility to deliver efficiency. Maintenance and renewal work is often carried out by various parties (e.g. staff of the infrastructure manager for worksite protection, contractor's staff for work execution). That increases the number of the interfaces and the effort required for coordinating work (elimination of synergies, process perturbations, etc.). Great variability in working time per possession – output can be improved by step change both in processes and technology.

Due to the fragmentation of work without clearly defined responsibilities for project management, the contractors cannot sufficiently influence the overall efficiency of the project. Moreover, they often have to take the risk for delay in the execution of the work and thus cost due to the disturbances in the logistics which are beyond of their potential intervention.

It is therefore vital that project management is clearly defined and assured by a body/person authorised by client and agreed with contractor. Logistic has to be also carefully designed in overall programming of the work jointly with contractors at a very early stage. All changes in project management and logistics have to be agreed with contractors and risk properly allocated.

Plant

The cost for moving equipment (logistics) is often very high; it consumes considerable time, often as a consequence of improper planning

Coordination between infrastructure managers and contractors in purchasing and specifications of heavy equipment is essential for "avoidance of over-sized, over-specified fleets".

From the quantitative inquiry reported in D5.1.5, it is interesting to keep the benchmark of logistics constraints identified by the Infrastructure Managers (abstract of D5.1.5 hereafter).

Benchmark of logistics constraints

Infrastructure Managers identified the following constraints affecting logistics:

- Fluctuating levels of funding from governments, adversely affecting the ability to plan long-term
- The loss of skilled staff through retirement and a shortage of suitable new people willing to come into the industry
- The variability of track condition resulting in relatively small and inefficient packages of work unsuitable for high-output methods of working
- A limited number of component suppliers resulting in resource shortages and poor competition

The input and benchmark that can be drawn from WP5.1 constitutes a helpful reading grid that will be the basis for the analysis of the logistic aspects and for the taking account of suggested ways of improvement.

2.2 SP2 output

SP2 has carried out many investigations and innovative developments on the assessment and monitoring of track sub grade and the evaluation and test of superstructure innovations.

Among this, two main subjects will the focus for the logistics assessment. These are the sub grade improvement methods and the superstructure improvements.
All the range from the new track construction to the maintenance and renewal is thus covered.

The following items will be guiding the analysis of SP2 output:

- Field of implementation : is the solution applicable to maintenance, renewal or new track construction;
- Equipment & tools : does the solution requires heavy or light equipment, high or low output rate, skilled labour or not;
- Possession and access to the track :
  - worksite area required by the solution, time from reception of worksite until handing-over for operation includes preparation of worksite, convey of equipment & tools, etc.
  - does the solution requires rail or road access, large or not, reinforced or not, which make it easily or not applicable in some configuration;
- Traffic: in case of maintenance or renewal, is there a requirement for traffic disruption or re-routing or other disturbances?

2.2.1 Sub grade improvement: inclined columns

Field of implementation

This solution is essentially applicable to the maintenance of ballasted track when the reinforcement of the sub grade is required to avoid large settlements. It is suitable when the track is laid on soft soils.
It is to be compared with a more classical solution which would consist in removing the track, reinforcing the sub grade and reinstall the track.

Equipment & tools

Heavy equipment is required (crane, specific cement columns machine).
Output rate is to be received from SP2. It can be increased by adding more equipment.

Possession and access to the track

The worksite area is of a limited length: it is a punctual site, at the moment not foreseen to be implemented lengthwise over hundreds of km.
Preparation of the worksite: stones have to be removed.
Access to the track: road access which is able to support the load and dimension of heavy equipment.

Traffic

Work can be done under traffic.

2.2.2 Superstructure innovations: steel-concrete-steel trackform

Field of implementation

This solution is applicable to new track installation or renewal. It will be tested with the renewal of a switch and crossing (to be confirmed in final report).

Equipment & tools:

Heavy equipment may be required in order to handle steel beams.

Specific installation equipment could be developed in view of a mechanised installation which would increase the output rate.

Possession and access to the track

D2.3.2 is claiming for a low track possession which could be justified by the modular aspect of the design and the use .of steel beams as structural support.

Access to the track:

- road access which is able to support the load and dimension of heavy equipment
- possible rail access

Traffic

In the case of renewal, traffic disruption is required on the concerned track, a re-routing has to be implemented to minimize delay.

Work programming in advance is then a major issue.

2.2.3 Superstructure innovations: Embedded Rail Slab Track

Field of implementation

This solution is applicable to new track installation or renewal.

Equipment & tools

It is possible to use slip-form paving machine which will provide a high output rate. Then a minimum length handed over from the preparatory civil works is required so that a high output level can be reached.

Alternative solutions are:

- installation of pre-cast elements : requires heavy cranes
- cast in situ installation : lower output rate.

Possession and access to the track

Depending on the type of installation the possession time will vary: it will decrease when using slip-form process and increase when using pre-cast elements and cast in-situ method.

The access to the track has to be adapted to the chosen installation method. Access of heavy equipment has to be considered when implementing pre-cast elements installation or slip-form process. While implementing cast in-situ method may require a lighter equipment, as the number of delivering batches is increased, this will add to the cost.

Traffic disruption

In case of renewal, traffic disruption is required on the concerned track, a re-routing have to be implemented to minimize delay.

Work programming in advance is then a major issue.

3. Conclusions

In the continuation of WP5.1, WP5.3 could be presented as an application of WP5.1 results and conclusions to the logistics of SP2 output.

The present deliverable provides a first report on this attempt and it will be completed by a final report which will go deeper into the details of the logistics of the selected SP2 output.

Subjects developed in WP5.1 which could, at first sight, be considered as merely management issues actually found an obvious and immediate impact on the work at site.

The input and benchmark that could be drawn from WP5.1 constitutes a helpful reading grid which takes account of suggested ways of improvement.

Among the seven "critical to success" areas, four were identified as applicable to the current study of Logistics and Support: Work programming, Project management and logistics, Rules and regulation, and Plant.

Among the output of SP2 some were selected to go through the reading grid drawn from WP5.1, these are related to sub-grade improvement and superstructure innovations.

The final report, which will include a more in-depth study, will benefit from the experiments that have been carried out on sub-grade improvements and those which will be carried out on superstructure innovations. The points raised in the section 3.2 will be confirmed and detailed by a real case study.

In addition, it is an asset to consider the relation between Infrastructure Managers and Contractors in the development of innovative track solutions as there is an obvious impact on LCC, thought it is often qualitative.

Finally as a contribution to SP6, WP5.3 will help in

- Identifying the need for investing or not in heavy equipment, with subsequent impact on initial cost.
- Identifying possible additional cost incurred because of track access and/or possession.
- Refining the boundary conditions.

4. Bibliography

INNOTRACK deliverable D2.3.2 – Optimised design of steel-concrete-steel trackform

INNOTRACK deliverable D2.3.3 – Design and Manufacture of Embedded Rail Slab Track Components

INNOTRACK deliverable D5.1.5 – Final Report on Existing States-of-the-Art for Construction, Maintenance and Renewal Activities and Assessment of Logistic Constraints

INNOTRACK deliverable D5.1.6 – Final Report on conduct of interfaces between contractors and infrastructure managers