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INNOTRACK

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Thematic Priority 6: Sustainable Development, Global Change and Ecosystems

D 1.4.9
Infrastructure Maintenance Cost Breakdown Structure – Guidance Note

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Glossary

LCC	Life cycle costing
IM	Infrastructure manager
UIC	International Union of Railways
LICB	'Lasting Infrastructure Cost Benchmarking' project
GB	Great Britain

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1. Executive Summary

Track maintenance is one of the major cost items for Europe's railways. This is therefore, a key area for efficiency improvement and Innotrack has set a target of reducing costs by 30%. Innovation will play a crucial part in improving maintenance efficiency.

Innotrack has investigated using life cycle costing (LCC) to assess innovation impact; however, in order for all European Infrastructure Managers (IM) to use it, a Europe-wide approach to the categorisation and recording of costs is required. Innotrack carried out its own investigation into this problem and found that although a set of common, high-level cost categories was potentially available, it was insufficient to allow work on LCC to progress.

An alternative approach was required and after identification and review of the options, it was decided to proceed using the track maintenance cost categories developed by the Great Britain (GB) IM, Network Rail. This is based on a common framework of maintenance activities, with the activity attributes clearly defined to help to ensure that the right costs are allocated to the right job.

Cost data comes from two main sources. For staff directly employed by Network Rail, time sheet data is used, with staff booking time to pre-defined work items, which are factored to take account of overheads. For staff and equipment employed by contractors, data from the accounts payable system is used. Processing of the data to calculate unit costs has been automated.

Network Rail continues to improve its process for calculating unit cost. An important part of that is identifying the problems and then clearly specifying the work required to solve them.

2. Introduction

One of the aims of the European Commission's transport policy is to reduce reliance on automobiles and trucks by encouraging a shift to rail transport. Rail must offer a competitive alternative to the other two modes if this goal is to be achieved. Rail needs therefore, to improve its operational efficiency and reduce its costs.

Track maintenance is one of the major cost items for Europe's railways. This is therefore, a key area for efficiency improvement and Innotrack has set a target of reducing costs by 30%. Innovative technologies and processes will be necessary to achieve this, but they should only be adopted if they demonstrate clear advantages over existing methods.

Innotrack has investigated using life cycle costing (LCC) to assess innovation impact. In order for all European Infrastructure Managers (IM) to use it, a Europe-wide approach to the categorisation and recording of costs is required. However, the International Union of Railways' (UIC) 'Lasting Infrastructure Benchmark Project' (LICB) [(1)] has found a wide variation in how each IM records cost

Innotrack has carried out its own investigation into this problem, involving an analysis of cost data from participating IMs. The aim was to see to what extent the data could be used to create a common set of cost categories. The detailed research and results are described in Innotrack deliverable D1.4.6 [(2)]; however, in summary, although a set of common, high-level cost categories was identified, this was insufficient to allow work on LCC to progress.

An alternative approach was required therefore and after identification and review of the options, it was decided to proceed using the track maintenance cost categories developed by the Great Britain (GB) IM, Network Rail.

This Guidance Note explains the background to the development of Network Rails cost structure. It describes the on-going processes that are used to improve the structure's usability and provides outline details of the work activities for which Network Rail collects unit cost information that could be useful to an LCC analysis of innovative new maintenance techniques and processes. It is hoped that the approach described here will be one that other European IMs will want to adopt, and will lead to more uniform and transparent recording of costs.

3. Network Rail's Cost Categories

3.1 Background

Network Rail has long recognised the importance of having available accurate unit costs for its track maintenance activities. They can be used as the basis for benchmarking the efficiency of maintenance groups working in different parts of the country, and provide an important source of data for long-term, strategic planning. Finally, they are also an important tool for managers to use to monitor variations in performance of their particular group over time.

The problem has always been how to generate unit costs that are robust: an essential first step if people are to have confidence in the results of any efficiency analysis. The problem was brought into sharp focus in 2004 with the publication of the UK government's White Paper, 'The Future of Rail' [(3)]. This described a process where the government would specify the outputs (for example, in terms of train kilometres and passenger kilometres) that it wanted the railway to provide and the funding available to deliver them: obviously the cost of the outputs and the funds available had to match and therefore, the availability of robust unit costs to support accurate budgeting became very important.

Work to develop the unit costs focused initially on the approximately twenty five track maintenance activities that accounted for the highest proportion of the annual track maintenance budget. The situation was complex; maintenance work involved directly employed staff as well as contractors, using a small range of different types of plant and equipment and operating on sites with a wide range of differing physical conditions. It is therefore, not surprising perhaps, that early unit costs showed a wide range of variability: too wide to be of use when calculating national budgets.

Since then work has concentrated, among other things, on reducing this spread of results. The result has been the development of a specification [(4)] for a common framework for the breakdown of key activity types to be used for the identification and reporting of maintenance volumes and associated costs. This is described in more detail in the following sections of this deliverable.

3.2 Calculation of Unit Costs

The common framework referred to in Section 3.1 above is a list of the maintenance activities that account for a high proportion of the annual track maintenance budget. The activities are shown in the table in Figure 1. For each one, a clear set of attributes has been developed, defining the work to make it clearer under which activity a specific piece of site work should be logged. An example of the defining attributes for the activity 'manual ultrasonic inspection of rail' is provided in Figure 2. In adopting the framework to other IMs considerations of regional conditions need to be accounted for. For example, most IMs would adopt the unit "Rail kilometres" over "Rail Miles". Nevertheless, adhering to a common framework makes comparisons / conversions between the different IMs rather straightforward even when local differences exist.

For its own staff, Network Rail gathers data on time spent on site via their timesheet system. The type and volume of work carried out is recorded through a system called Ellipse. Recording of time and volume is done at a level of detail greater than the activities described in the common framework. Individual work items therefore, have to be mapped onto the appropriate activity as part of an automatic, unit cost calculation process. The costs recorded under these work items are factored to take account of overheads. An example of work items relating to the 'manual ultrasonic inspection of rail' activity is shown in Figure 3.

For work carried out by contractors' staff, Network Rail does not have access to timesheets. Therefore, their costs are accounted for through analysis of accounts payable: this includes costs relating to both contractors' staff and their plant and machinery.

As already mentioned, the process of calculating unit costs is automated and involves summing the costs of work for in-house and contractor's staff and equipment, then dividing by the volume of work recorded in Ellipse

3.3 On-going Improvements to Unit Costs

Network Rail continues to work to improve the robustness of its unit costs. Improvement is an important part of the unit cost process that has been developed and which is shown in the diagram in Figure 4. Improvement occurs principally in three places: the first is the Improvement Activities stage in the top left of the diagram; these are things that were identified as needing attention in the change review. The items to be addressed might include things like: how to reduce the risk of timesheets data being input incorrectly; how to avoid double-counting work activities, and; how to remove the confusion arising from the use of multiple units of measure. The second is Review stage in the bottom right of the diagram, which focuses on the quality of the output and looks for problems and their underlying causes. The final stage in the top right, involves looking at where changes need to occur, rather than the detail of the changes themselves. This requires examination of the organisation's culture, processes and technology.

4. Conclusions

Network Rail has developed a process for calculation of track maintenance unit costs to help it improve the efficiency of its business. Innotrack recommends this approach as being a suitable basis for the development of a European methodology for calculating track maintenance unit costs.

Bibliography

1. UIC, 2005, 'Lasting Infrastructure Cost Benchmarking – Summary Report', Paris, France.
2. Innotrack, 2008, 'D1.4.6 - A Report Providing Detailed Analysis of the Key Railway Infrastructure Problems and Recommendation as to how Appropriate Existing Cost Categories are for Future Data Collection
3. United Kingdom Department for Transport, 2004, 'The Future of Rail', July 2004, Her Majesty's Stationery Office, London
4. Network Rail, 2010, 'Maintenance FRM702 Version 11.1', Network Rail Company Specification (draft).

Figures

Ellipse Ref	Description	Units
Pway Activities		
MNT01	Manual Ultrasonic Inspection of Rail	Rail mile
MNT02	Rail Changing	Rail yard
MNT03	Manual Spot Re-sleepering	No of sleepers
MNT04	Plain Line Tamping	Track mile
MNT05	Stoneblowing	Track mile
MNT06	Manual Wet Bed removal	No of bays
MNT07	S&C Tamping	Point ends
MNT08	S& C Unit Renewal	S&C unit
MNT09	Mechanical Spot Re-Sleepering	No of sleepers
MNT010	Replacement of S&C bearers	No of S&C bearers
MNT011	S&C weld repairs	No of repairs (weld)
MNT012	Mechanical Wet Bed removal	No of bays
MNT013	Level 1 Track Inspections	Track miles Inspected
MNT014	Mechanised Track Inspections	Track miles Inspected
MNT015	Weld Repairs of Defective Rails	No of repairs (weld)
MNT016	Installation of pre fabricated IRJs	No of joints
MNT017	Mechanical re-profiling of ballast	Track miles
MNT019	Manual correction of plain line track geometry	Track yards
MNT020	Manual re-profiling of ballast	Track yards
MNT 021	Transportation of Materials	Hours
MNT 025	Replenish Ballast Manual (manual)	Tonnes
MNT 026	Replenish Ballast Manual (train)	Tonnes
MNT 027	Maintenance of Rail Lubricators	Each
MNT 029	Replacement of Pads & Insulators Plain Line	Numbers of sleepers
MNT 030	Maintenance of Longitudinal Timbers	Each
MNT 022	Other Pway	Various
Off Track New		
MNT 070	Inspections (fencing, vegetation, drainage)	Miles
MNT 071	Inspections (level crossing – access points)	Each
MNT 072	Fences and Boundary Walls	Boundary yards
MNT 073	Drainage	Draining yards
MNT 074	Vegetation Management	yards
MNT 075	Level Crossing	Each
MNT 076	Lift & Replace Level Crossing for Pway	Each
MNT 077	Signs	Each
MNT 078	Litter Stations	Platform
MNT079	Spoil & Debris Clearance Outside Station Area	Location
MNT 080	Graffiti	Location
MNT 081	Vegetation removal of boundary trees	Each
MNT 082	Vegetation management by Train	Mile
S&T Activities		
MNT050	Point End Routine Maintenance	Services
MNT051	Signals Routine Maintenance	Services
MNT052	Train Detection	Services
MNT053	Other S&T	Services
MNT054	Rapid Response (S&T)	Each
MNT 056	Level Crossings	Services
MNT 057	Train Protection	Services
MNT 058	Equipment housing	Services

Figure 1: Network Rail Common Framework of Track Maintenance Activities

Z567-001 / MNT001 Manual Ultrasonic Inspection of Rail

Unit – Rail Miles

Description – Rail miles recorded (including joints) by manual Ultrasonic Methods

Item Coverage – Inspection of rails by ultrasonic inspection by suitably competent people to detect and quantify rail defects, to be done to the frequencies and scope set out in Network Rail Company Standards and Standard Procedures.

Item Excludes: Trainborne Ultrasonics

Item Includes
Activity includes recording and reporting of all defects and follow up activities including arranging speed restrictions and special reporting to Rail Management Engineers. This unit will include Ultrasonic Testing of CWR, Jointed Track, Adjustment Switches, rail head repairs, fishplate limits and other holes.

Figure 2: Activity Attributes for Network Rail Track Maintenance Activity MNT001 Manual Ultrasonic Inspection of Rail

MNT CODE	MNT DESC	STD_ JOB	NORM_REF_DESCRIPTION	ST JOB UOW	PSJ_ UOW	Con-version rate
Z567_ 01	Manual Ultrasonic Inspection of Rail	009017	URFD - U6 - WELD DEFECT TEST	WD	MIL	0.000568
		009220	URFD U1&U2 FP JTS & BOLT HOLES - TEST	RM	MIL	1
		009255	URFD U1&U2 FP JTS & BOLT HOLES TEST PL	RM	MIL	1
		009256	URFD U1&U2 FP JTS & BOLT HOLES TEST S&C	NO	MIL	0.011363
		009257	URFD - U3 - FULL RAIL SECTION TEST	RM	MIL	1
		009258	URFD - U4 - CRACK SIZE ESTIMATION IN AMS	DF	MIL	0.000568
		009259	URFD - U5 - SQUAT & RAIL HEAD REP - TEST	DF	MIL	0.000568
		009260	URFD - U5A – MACHINED RAIL TEST FOR RCF	RY	MIL	0.000568
		009261	URFD - U6 - WELD DEFECT TEST	WD	MIL	0.000568
		009262	URFD - U7 - RAIL DEPTH MEASUREMENT	RY	MIL	0.000568
		009263	URFD - U8 - VERT LONG DEFECTS TEST	DF	MIL	0.000568
		009264	URFD - U10 - ADJUSTMENT SWITCH TEST	EA	MIL	0.011363
		009265	URFD - U15 SPERRY FULL RAIL SECT TEST PL	RM	MIL	1
		009266	URFD - U15 SPERRY FULL RAIL SECT TEST SC	NO	MIL	0.011363
		009267	URFD - U16 - SPERRY STICK BOLT HOLE TEST	JT	MIL	0.011363
		009269	URFD - ATTENDANCE AFTER UTU RUN	EA	MIL	0.025
		009270	URFD VISUAL INSPECTION OF UTU ROUTE PL	RM	MIL	1
		009271	URFD MANUAL RECOVERY AFTER UTU RUN	RM	MIL	1
		009272	URFD - U15 RCF RETEST PL	RY	MIL	0.000568
		009273	URFD - U15 RCF RETEST S&C	NO	MIL	0.000568
		009306	URFD - U16 - SPERRY BOLT HOLE TEST PL	RM	MIL	1
		009307	URFD - U16 - SPERRY BOLT HOLE TEST S&C	NO	MIL	0.011363
		009346	RCF SITE - URFD & VISUAL INSPECTION S&C	NO	MIL	0.000568
		009347	RCF SITE - URFD & VISUAL INSPECTION PL	RY	MIL	0.000568

Figure 3: Work Items Relating to Network Rail Common Framework Activity ‘Manual Ultrasonic Inspection of Rail’

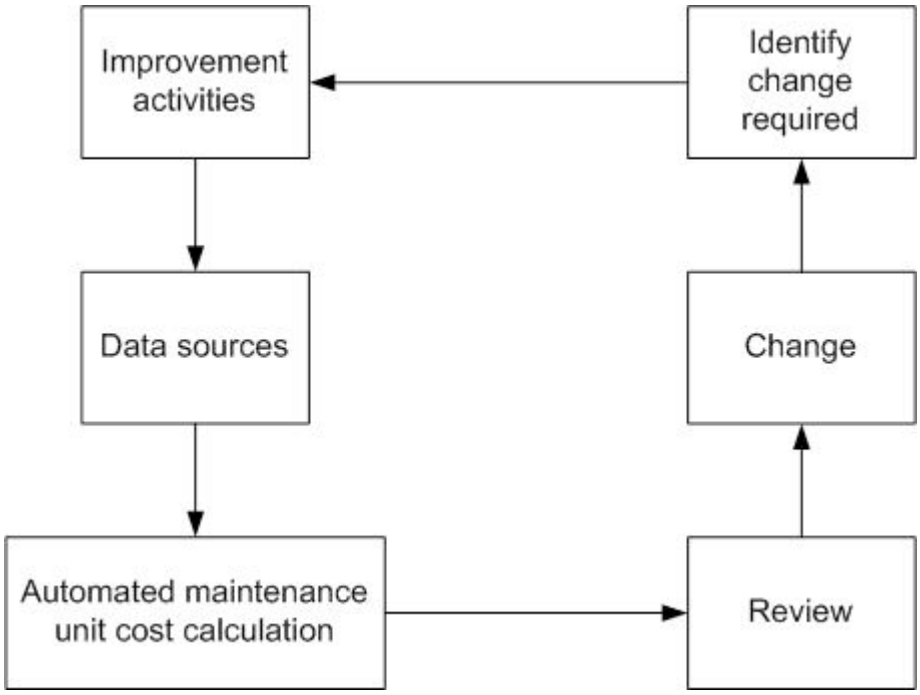

Figure 4: Network Rail Unit Cost Development Improvement Process

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