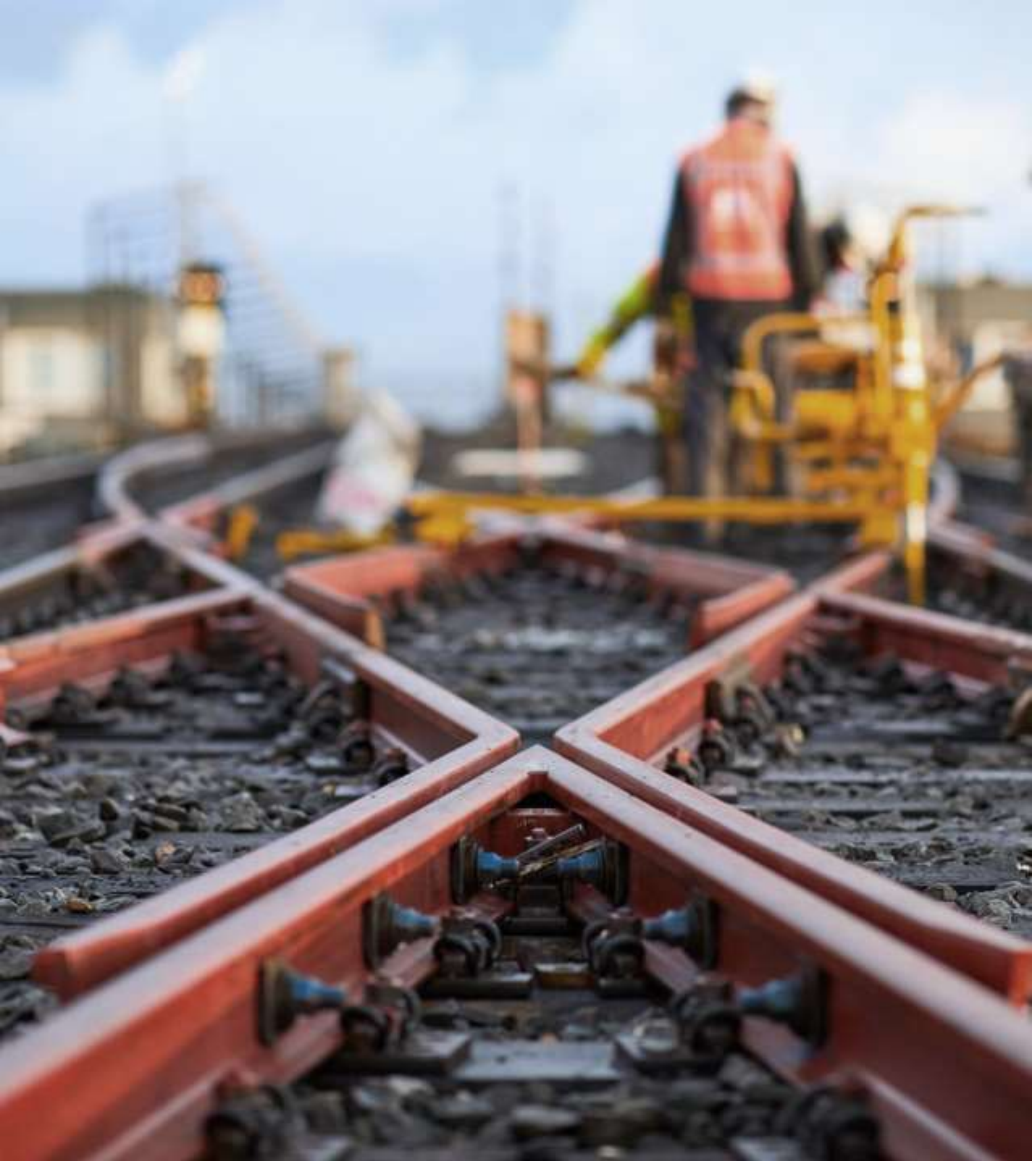

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XCROSS

XCROSS Economic Assessment

Mid-term event

UIC, Paris / Online
February 5, 2026

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Agenda

- Objectives – Economic Assessment
- CBA Methodology
- Current Maintenance Practices
- Potential Benefits & Costs of XCROSS innovations
- Econometrics
- Some examples from previous work
- Any questions

XCROSS Objectives – Economic Assessment

- Develop an impact assessment model for the technical innovations. The model will be based on life-cycle costs (LCC) as well as capturing associated impacts on reliability, availability and safety – Rail and Metro

- Provide empirical evidence for the impact assessments by using an econometric approach to understand the key drivers of crossing maintenance and renewal costs

CBA Method: Key steps

Define Scenarios

- Do-Minimun = "as is; i.e. no innovation"
- Do-Something = "with the innovation"

Identify potential costs and benefits from the innovation

- E.g. Investment costs
- Maintenance costs
- Renewal costs
- Delay reductions

Quantify and Value all costs and benefits, where feasible

Consideration of all costs and benefits

- CBA outcomes

Current maintenance practices of frogs on ProRail & RET networks

ProRail network

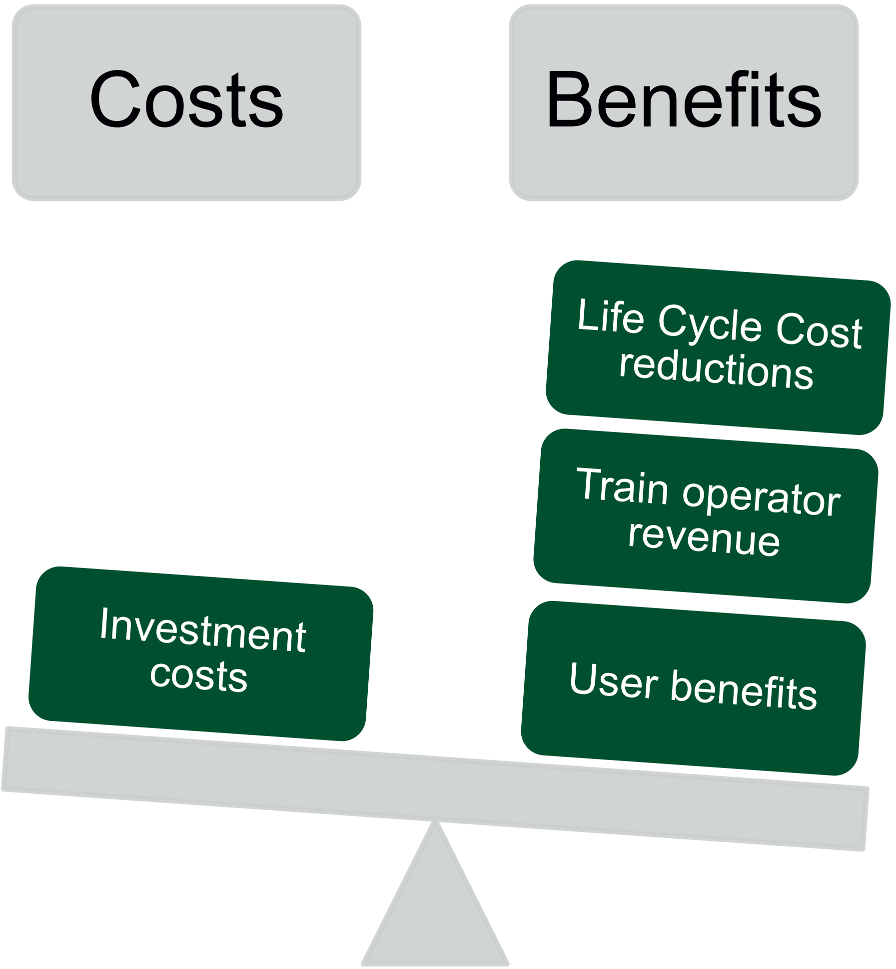
- Track maintenance contracted out to firms (lumpsum contracts)
- If deviation is found grinding is undertaken and welding if needed
- Maintenance frequency and time for fixing defect depends on level of defect
- Nose lifetime -> direction of travel (5-7 yrs) opposite (7-15 yrs)

RET network

- Track maintenance is undertaken in-house
- Frequency of maintenance and renewals higher than ProRail
- Limited access/space which limits maintenance efficiency
- Fixing time for defect -> small 1 hr, large 4 hrs

CBA Method: Contrasting Potential Costs and Benefits of XCROSS

Safety?



CBA: Potential Costs and Benefits of XCROSS

Category	Impact
Investment cost	• Increase in investment cost
Life cycle cost	• Reduced frequency of renewals of crossing noses at switches and crossings – **asset life** • Reduced frequency of maintenance • Extension of inspection intervals
Train operator revenue	• Increase in revenue resulting from increase in availability of track
User benefits	• Cost savings – link to price • Service improvements due to increase in track availability • Improved reliability due to fewer speed restrictions (i.e. delays)

Developing inputs to use in CBA: Econometrics

- Purpose: provide estimates of track maintenance costs at S&Cs under varying conditions such as traffic volume and maximum line speed
- Estimate track maintenance costs (C) for given traffic (Q) and infrastructure characteristics (X) such as line speed, etc.:

$$C = f(Q, \boldsymbol{X})$$

- ProRail have detailed cost, traffic and infrastructure data for 19 districts
- Similar cost models estimated using SNCF Reseau data – show how S&C maintenance costs vary with cost drivers. **Can be used for developing scenarios for impacts under different circumstances**
- **Prorail also has data on failures by cause and delays – could be used to study the impact of S&C failures on delays for example**

Examples from IN2ZONE (transition zones) [1]

	Coef.	Std. Err.
(log) Passenger traffic (tonne km per track km)	0.1842***	0.0238
(log) Freight traffic (tonne km per track km)	0.0383***	0.0100
(log squared) Passenger traffic (tonne km per track km)	0.0089***	0.0022
(log) Maximum line speed on section in km/h	0.3429***	0.0935
(log) Density of switches and crossings	0.2250***	0.0305
(log) Average age of rail	1.0005***	0.2127
(log squared) Average age of rail	-0.1300***	0.0367
(log) No. of structures per track km	0.1315***	0.0392
Proportion of track that is in a curve	0.3574**	0.1385
Proportion of continuous welded rail	-0.3837***	0.1141
Dummy Metropolitan regions	0.1812*	0.0808
Dummy HS railway line	-8.9323***	2.0700
Dummy year 2018	-0.3614***	0.0253
(log) Maximum speed on the section in km/h x Dummy HS railway line	1.8376***	0.3330
(log) Average age of rail x Dummy HS railway line	-3.3039***	0.8008
Proportion of track that is in a curve x Dummy HS railway line	0.2048	0.2072
Dummies for all other regions†		
(Zero dummy) Passenger traffic (tonne km per track km)	-0.9910***	0.1189
(Zero dummy) Freight traffic (tonne km per track km)	-0.4498**	0.1735
(Zero dummy) Density of switches and crossings	-0.3806***	0.0910
(Zero dummy) No. of structures per track km	0.0337	0.1010
Constant term	6.4691***	0.5113

***, **, *: p<0.001, p<0.01, P<0.05
† All non-significant

Table 4 The impact on costs of traffic and technical variables, random effects

From IN2ZONE (transition zones) [2]

UIC Category	% track maintenance cost reduction needed for NPV>0	% track maintenance cost reduction needed for NPV>0
	SL sleeper = €900	SL sleeper = €675
2	16.7%	9.9%
3	23.6%	13.9%
4	23.9%	14.1%
5	31.5%	18.6%
6	35.3%	20.9%
7AV, 7SV	39.7%	23.5%
8AV, 8SV	48.3%	28.5%
9AV, 9SV	64.3%	38.0%

Table 7 Estimated % track maintenance cost reduction per TZ required for NPV > 0 with new sleepers relative to conventional plastic sleepers

From IN2ZONE (transition zones) [3]

	Values of time per passenger by purpose			
	BL: Plastic		BL: Concrete	
	Without additional benefits	With additional benefits	Without additional benefits	With additional benefits
Capital Investment Costs	-622	-622	-837	-837
Maintenance Costs (20% replacement SL sleeper parts)	-106	-106	-106	-106
Maintenance Costs (other)	446	446	571	571
Disposal Costs	-2	-2	-4	-4
Residual (remaining service life)	138	138	138	138
Fewer Delays*	N/A	22	N/A	22
Increased Track Availability*	N/A	1,307	N/A	2,178
NPV	-146	1,183	-238	1,961

* Indicative estimates

Table 29 Impacts on CBA of additional potential benefits in scenarios with MGT=30