



Mapping of EU Regulations and Best Practices about Transport Infrastructure Management

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Key Performance Indicators to Access and Manage Transport Infrastructure

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WP1: Development of Advanced Asset Integrity Management AAIM Framework

Objectives:

- Map and compare European practices, recommendations, standards and tools on the management of transport infrastructures
- ↘ Identify management needs ...
- ▶ Identify gaps related to governance management risks
- ↘ Overview of the existing framework in the risk analysis of transport infrastructure ...
- ↘ Identify technical management risks...
- Identify and define Key Performance Indicators to assess and manage transport infrastructure...





Task 1.1: Mapping of EU practices, recommendations, standards and tools on the management of different sectors of transport infrastructures (D1.1)

- **Task 1.2:** Management needs of the owner or operator of the transport infrastructure of each sector (D1.1)
- **Task 1.3:** Identification of governance management risks (D1.2) **Task 1.4:** Current and future framework in the risk analysis in transport infrastructure projects (D1.3)
- **Task 1.5:** Identification of technical management risks (D1.4) **Task 1.6:** Identification and definition of Key performance indicators to assess and manage the different transport infrastructure (D1.5)









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D1.1: Mapping of European practices, recommendations, standards and tools on the management and the management needs of different sectors of transport infrastructures

Aim: to identify specific management characteristic of transport infrastructures from the owner/operator perspective. Literature review surveys and interviews with targeted experts.







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Existing management framework Standards and other international frameworks

- ISO 55000 series standards represent a global consensus on what asset management is and what it can do.
- Several frameworks developed for use:
 - Road mode (PIARC AM Guide, AASHTO TAM Guide, CEDR TG N2 Asset Management Model)
 - Rail mode (Railway Application Guide)
 - Air mode (Asset and Infrastructure Management for Airports—Primer and Guidebook)
 - Water mode (Infrastructure Management Maturity Matrix)
- Mode specific European legislation/regulations are mapped against different life cycle phases, related to the three RAGTIME modules and all four transport modes.
- National legislations (based on national interests) & common EU legislation





Existing management framework Asset Management tools

- LCA approach, GIS and BIM tools are quite common to all transport modes and are often used in the management of different types of infrastructure.
- Different software tools are used:
 - Road mode (Highway Development and Management Model (HDM-4))
 - Rail mode divided in groups: strategic, planning, delivery and operational tools (Maximo, Ellipse and SAP)
 - Air mode strategic, planning, delivery and operational tools (CoBALT, Maximo, Scada, Dali, BIM, Mercury)
 - Water mode (Infrastructure Management Maturity Matrix (IM³) and the KMS Quaywall Modelling System)





Existing management framework Best practices

- Three life cycle stages highlighted:
 - Design (144 best practices),
 - Construction (154 best practices) and
 - Operation & maintenance (120 best practices)
- Practices were analysed with regard to different transport modes:
 - Road (133),
 - Rail (100),
 - Air (53) and
 - Water (36),
- and in the scope of the RAGTIME project
- H2020 project REFINET served as main reference
- Built-in sensors, remote sensing, BIM, sub-balast, tunnels, pavements, breakwaters, viaducts, risk assesment, preventive maintenance ...



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Risk based approaches for asset integrity multimodal transport infrastructure management

Main management needs (RAGTIME survey & other sources)

Infrastructure Asset Management top priorities (2015)

(survey completed by 500 professionals from asset owning and supporting organisations)





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D1.2: Governance management risks for transport infrastructures along whole lifecycle

The analysis includes the description of the lifecycle of the works, the role of each stakeholder and the current legal framework on infrastructure projects. It concludes with the identification and classification of the risks:



- The legal framework significantly affects the governance risk and is considered as the main risk mitigation method to apply.
- The greater risks of governance can occur in the concession contracts, where the concessionaire is involved in the planning of the infrastructure.
- The governance risk is greater during the decision-making and planning phase, and coincides with the legal framework of the concession.





D1.3: Overview of the existing framework in the risk analysis in transport infrastructure projects

Investigating good practices, regulations & standards, case studies and research work in this field

		seismic	flooding	hurricanes	anthropic	landslide	fire
Research projects	SINER-G	1					
	HAZUS	~	1	~			
	STRIT	1	1		1		
	RESIS	~					
	PEC	1	1		~		
Design construction projects	A4 HIGHWAY	1	~			1	
	PISA PEOPLE MOVER	1	1				~
	TEMPA ROSSA OIL TANK AREA	1				1	

- > The lack of a unified risk-based approach to enable decision support
- No clear framework / legislative provision regulating risk assessment in transport infrastructure projects at a European level
- > Regulations and standards are partial and sector specific





D1.4: Technical management risks for transport infrastructures along whole lifecycle

Aim: Identification of the most impactful threats that affect every day technical management; during the exploitation phase

- > Extensive review and analysis of historical records, and future projections.
- Identification and quantification of climate related risk sources, risk factors and hazards taking into account the different stakeholders points of view and degree of exposure of infrastructures along the WLC.
- 104 causes of risks or technical risks have been identified, and grouped into 5 clusters depending on their nature: Contractual, Data, Design and calculations, Building and civil works, and, Unintentional hazards, natural disasters and intentional threats.





D1.5: Key performance indicators to assess and manage the different transport infrastructure

	LIFE-CYCLE STAGES		STAKEHOLDERS	RAGTIME MODULES	
	EVALUATION/PLANNING		OWNER/CITIZENSHIP	GOVERNANCE	
	PROCUREMENT/DECISION		CONTRACTOR	ECONOMIC/FINANCIAL	
PERFORMANCE	DESIGN/PROJECT		FINANCER	TECHNICAL	
GREEN (measures effects on the environment, including air quality, noise, protected spices, natural vistas, etc.) COST-EFFICIENT	CONSTRUCTION OPERATION & MAINTENANCE				
(measures the effectiveness of the transportation system in to and travel costs and revenue, direct and indirect impacts of the economy, etc.)	rrms of throughput transportation on	TRANSPORT MODE		ANSPORT MODE	
SOCIAL / INCLUSIVE (measures the ease of movement of people and goods, effect society (e.g. neighborhoods adjacents to transport facilities) groups (e.g. disadvantages), etc.) RESILIENT	ts on broader or on population	Exc2		ROAD RAIL AIR WATER	
(measures the condition of the transport system and actions in a state of good repair, delivery of transportation projects customer, measures the resilience of the system and mainter SAFE / SECURE	to keep the system and services to the nance needs, etc.)		337 performance i	ndicators	
(measures the quality of the transport service in terms of cra that are harmful to people and damaging to freight, vehicle infrastructure, measures protection of travelers, freigikt, veh infrastructure from criminal and terrorist actions. etc.)	shes or incidents s and transport icles and system		were collected and analysed		





D1.5: Key performance indicators to assess and manage the different transport infrastructure

Categorisation through filtering

First stage: scores are assigned through a scale where "0" represents the noninfluence and "1" is the maximum value that indicates the influence of the KPI according to the corresponding criterion

$$T_j = \sum_{i=1}^{14} a_{ij}$$

- Score: > 7 priority KPI; 6 7 valuable KPI; < 6 expendable KPI
- Second stage: to priority KPIs only a weight is given to distinguish between the most important ones and perform the next step mapping





D1.5: Key performance indicators to assess and manage the different transport infrastructure

Barcode for Priority KPIs for Roads and Rails: graphic visualization against 14 perspectives: WLC phase, stakeholder, RAGTIME module, scale of the approach (network, asset, component)



Barcode from RAGTIME perspective: Caution for Evaluation/Planning is needed; under control for Design/Project phase, under control for the Financer; Intervention is needed from the Contractor at Network, from the Technical point of view





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Conclusions:

- Mapping of EU Regulations and Best Practices about Transport Infrastructure Management has been performed within WP1
- Literature review surveys and interviews with targeted experts enabled good overview of existing standards, regulations, asset management tools and best practices.
- Key performance indicators (KPI) were collected, analysed and categorized regarding their importance









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