

A large, grayscale point cloud visualization of a bridge structure, likely a suspension bridge, is positioned on the left side of the slide. The point cloud is composed of numerous small dots, creating a textured, three-dimensional representation of the bridge's form. A white diagonal line cuts across the point cloud, separating it from the text area on the right.

Monitoring of European transport infrastructure : from needs to standardisation

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H2020 Project IM-SAFE - 958171

Context

Transport infrastructure is facing **major challenges** due to ageing, rapid growth of traffic loads and natural and man-made resilience threats.

Safety risks have become critical in the recent years and manifested in major disasters caused i.e. by structural failures due to maintenance deficiencies.

The resources for management of infrastructure are limited and **backlog of maintenance is rapidly growing**.





Context

Optimal maintenance is only possible with the right policies and decisions enabled by **timely and accurate information**.

Standardisation in monitoring is a key enabler for optimal maintenance strategies, strengthening or retrofitting measures to be applied **for ensuring the safety of the infrastructure**.

The existing knowledge and experience with monitoring is **not consistently interpreted and implemented** in different European countries.



UNI ENTE ITALIANO DI NORMAZIONE

UNI Standard

Technical number: UNI EN 13296
Title: Guiding for structural health monitoring (SHM) of bridges

Summary: The scope of the Technical Specification is for governments, contractors and consultants identifying the design and/or the use of a health monitoring system. It is suitable for construction of new or existing structures and structures for which the possibilities of use of structural health monitoring. The document identifies design and/or requirements of key components of the system and methods for data acquisition and data storage, in order to be suitable for identifying damage and structural degradation.



EN 13296

Guiding for the assessment of existing bridges

EN 13296:2018 (EN) Guidance for the assessment of existing bridges

EN 13296-2018 (EN) Guidance for the assessment of existing bridges



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GB

EU DIRECTIVE 2004/39/EC

EUROPEAN UNION

EUROPEAN PARLIAMENTS AND COUNCIL

Directive 2004/39/EC of the European Parliament and of the Council of 29 April 2004 on market abuse (market abuse directive)

Adopted in Luxembourg on 29 April 2004

ENacted by the European Council at Brussels on 29 April 2004



JRC SCIENCE FOR POLICY REPORT

Research and innovation in bridge maintenance, inspection and monitoring

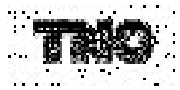
EN

European Commission

Joint Research Centre

Information and Communication Technology Division

2020



H2020 CSA IM-SAFE aim

Support the European Commission and the European Committee for Standardization (CEN) in preparing new standards enabling monitoring for optimal maintenance and safety of transport infrastructure

- deliver input for mandate for CEN

Enable transition from corrective maintenance **towards risk-based maintenance management & preventive maintenance strategies**

- change of the current practice will lead to higher reliability and availability of the infrastructure and more cost-optimal asset management
- **formulate principles & requirements** for:
 - structural monitoring
 - data-informed safety assessment taking into account inspections, monitoring and testing
 - risk-based maintenance management and condition-based maintenance strategies

Achieve broad acceptance for new standardization

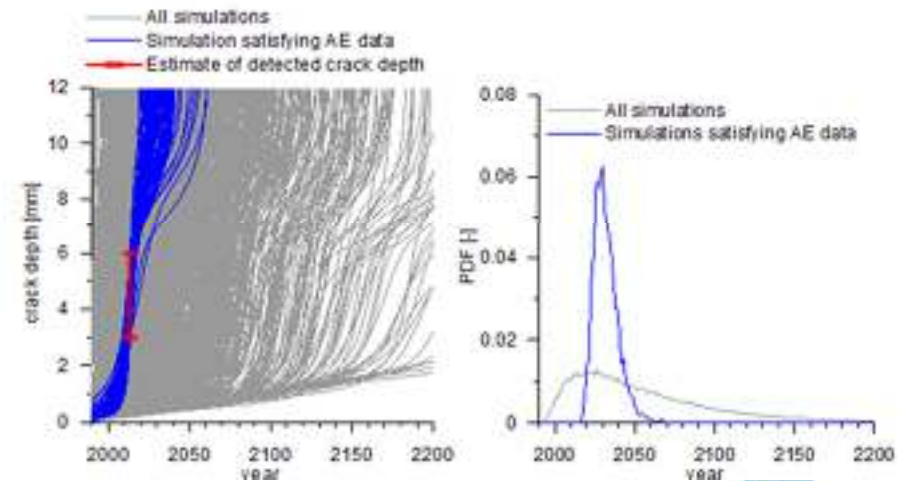
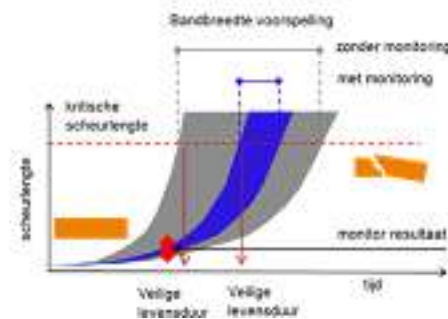
- enable Community of Practice to contribute to standardization, roll-out, and implementation

Best practices (example)

The data-informed service life prediction for fatigue in orthotropic bridge decks

Potential use of data: improving understanding of steel bridges behaviour and improving performance prediction

- ⊞ detection of fatigue cracks orthotropic bridge decks
- ⊞ early warning system
- ⊞ real-time prediction of fatigue service life



Field-lab fatigue service life prediction based on crack growth monitoring and modelling (NL)



Best practices (example)

The traffic load information for optimized use and maintenance of pavements and structures

Potential use of data: improving understanding of live loads on infrastructure

- underpinning development of 'lighter' traffic load model for specific objects
- improved predictive traffic load models for transport networks
- real time integration with digital twin models



Application of Loadmap and Bridge-WiM in field-lab Moerdijk (NL)

Best practices (example)

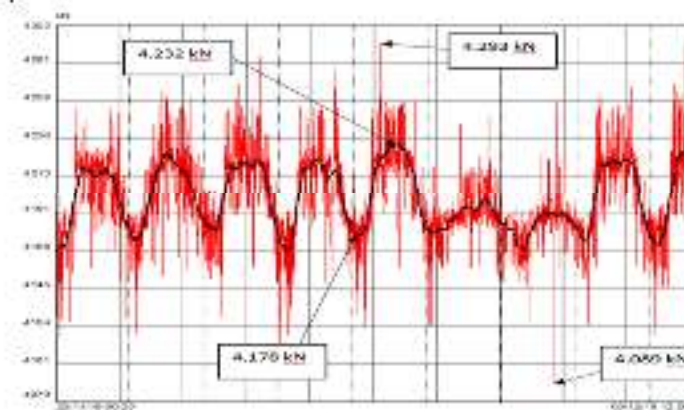
The real-time monitoring and analysis platform for infrastructures

Potential use of data: improving understanding of infrastructure assets condition and performance

- construction monitoring
- pathologies monitoring & patterns identification
- centralizing the management of monitored structures



Stray cable monitoring of the Centenario bridge in Seville (ES)





IM-SAFE online best practice guide

<https://imsafe.wikixl.nl/>

IM-SAFE IM-SAFE Knowledge Base

Log in:

Home • About • Best practices • Survey techniques • Risk management • Technical


IM-SAFE aims to support the European Commission and the European Committee for Standardization (CEN) to preparing a new standard in monitoring for optimal maintenance and safety of transport infrastructure based on a comprehensive insight into the trends, challenges, best practices, and technology developments, including the integration of digital innovations.


IM-SAFE aims to achieve broad acceptance for new standardization and to enable public authorities and industries to contribute to standardization, roll out, and implementation.

This **IM-SAFE Knowledge Base** supports the pan-European Community of Practice (CoP) activity involved in the development and implementation processes of the new standards on monitoring of transport infrastructure.

For more information, visit the project website at <https://imsafe-project.eu>

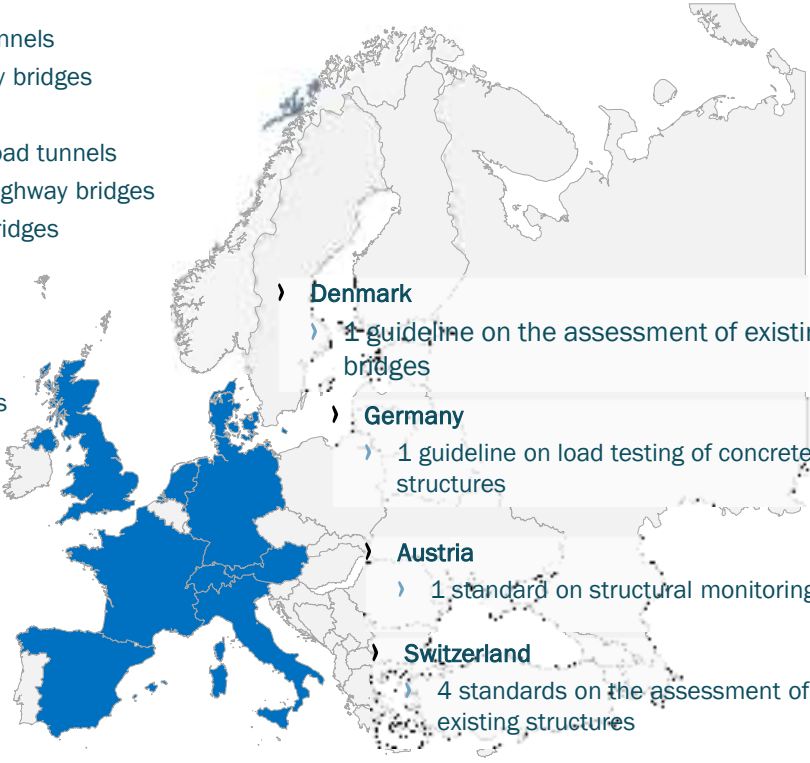
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Current state of standardization (ongoing review)

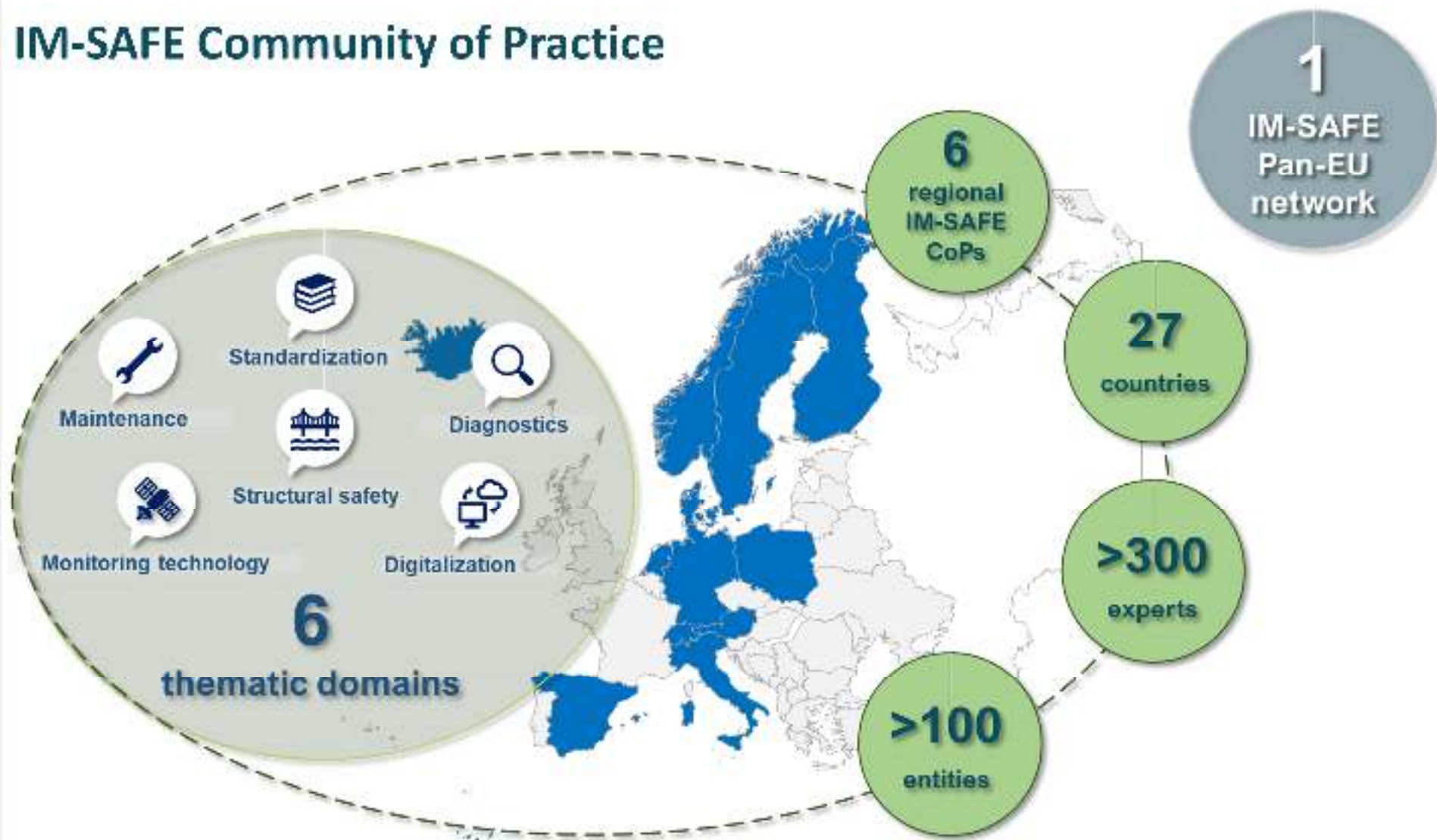
- 
- The map shows the following standardization status by country:
- UK**
 - › 1 guideline on inspections of road tunnels
 - › 2 guideline on inspections of highway bridges
 - › 1 guideline on load testing of bridges
 - › 1 guideline on the management of road tunnels
 - › 6 guideline on the management of highway bridges
 - › 8 guidelines on the assessment of bridges
 - The Netherlands**
 - › 1 guideline on inspections
 - › 2 standards on the assessment of existing structures
 - › 1 guideline on the assessment of existing bridges
 - › 1 guideline on performance-based risk analysis
 - › 1 guideline on inspection of civil structures
 - France**
 - › 1 guideline on load testing of bridges
 - › 1 guideline on inspection of road tunnels
 - › 1 information note on the safety assessment of existing bridges
 - Spain**
 - › 2 guideline on inspection of bridges
 - › 3 guidelines on inspection of road tunnels
 - Denmark**
 - › 1 guideline on the assessment of existing bridges
 - Germany**
 - › 1 guideline on load testing of concrete structures
 - Austria**
 - › 1 standard on structural monitoring
 - Switzerland**
 - › 4 standards on the assessment of existing structures
 - Italy**
 - › 1 guideline on structural monitoring
 - › 1 guideline on risk management, safety assessment and monitoring of existing bridges
 - › 1 guideline on maintenance of steel bridges
 - › 1 guideline on inspection of concrete bridges
 - CEN**
 - › 1 technical specification on the assessment of existing structures
 - › 1 standards on risk-based inspection planning
 - › 2 standards on maintenance
 - ISO**
 - › 2 standards on structural monitoring
 - › 1 standard on the assessment of existing structures
 - › 1 standard on risk assessment
 - › 3 standards on asset management
 - SAMCO**
 - › 1 guideline on structural health monitoring
 - › 1 guideline on the assessment of existing structures
 - DNVGL**
 - › 1 guideline on inspection planning
 - › 1 guideline on sensor systems
 - › 1 guideline on data-driven algorithms and models
 - › 1 guideline on data quality assessment
 - › 2 guidelines on risk-based verifications

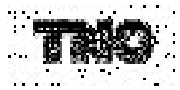


Standardization outlook

- **New standard on structural monitoring**
 - decision-making regarding the design of the monitoring strategy
 - effective use of monitoring data to produce useful and meaningful information relevant for diagnostics of structures, safety assessment and maintenance approaches
- **Further amendment to the existing Eurocodes on safety assessment taking into account inspections, monitoring and testing**
 - full utilisation of structure-specific data in the safety assessment of existing structures
 - assessment of actual safety through consideration of deterioration and damage by models
 - better prediction of end-of-service life by appropriate choice of the safety framework
- **New standard for risk-based maintenance management and preventive condition-based maintenance of transport infrastructures**
 - improvement of the decision-making process regarding maintenance at network and object level

IM-SAFE Community of Practice





Conclusions

- **Unprecedented technology advances** can enable the change towards new data-informed and risk-based approaches to **safety control and maintenance decision-making** for transport infrastructure, **supported by monitoring systems**.
- There is a **sufficient know-how across Europe** and there is the **common will to reach consensus among the stakeholders**
- CSA IM-SAFE contributes to **political commitment and societal acceptance** of the future standards at European and national level, by supporting **EC and CEN** in preparing **new standards in monitoring for optimal maintenance and safety of transport infrastructure**



IM-SAFE.EU

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<https://www.linkedin.com/company/im-safe-project/>

<https://cordis.europa.eu/project/id/958171>