



# IM-SAFE<sup>.EU</sup>

IM-SAFE (ref. 958171)

[www.IM-safe-project.eu](http://www.IM-safe-project.eu)

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

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



Co-funded by the Horizon 2020  
Framework Programme of the European Union

# Inhalt

## Agenda

### **Block A**

Überblick IM-SAFE-Projekt

Erhebungsstatus „aktuelle Standards und Richtlinien“

### **Block B**

Fallstudien

Forschungsprojekte

PEST Barrieren

Offene Fragerunde



# **H2020 CSA IM-SAFE**

## **Harmonisierung der Bauwerksüberwachung der europäischen Verkehrsinfrastruktur für eine optimale Wartung und Sicherheit**



# H2020 CSA IM-SAFE Kontext

JRC SCIENCE FOR POLICY REPORT

Research and innovation in bridge maintenance, inspection and monitoring

A European perspective based on the Transport Research and Innovation Monitoring and Information System (TRIMIS)

Gkoumas, K., Marques Dos Santos, F.L., van Balen, M., Tsakalidis, A., Ortega Hortalano, A., Grossi, M., Had, G., Pekar, F.

2019



**Support The Guardian**  
Available for everyone, funded by readers  
[Contribute](#) [Subscribe](#)

Search jobs [sign in](#) [Search](#) International edition

**The Guardian**

News Opinion Sport Culture Lifestyle More

World Europe US Americas Asia Australia Middle East Africa Inequality Cities Global development

Italy

Jennifer Rankin in Brussels  
The 16 Aug 2018 17.07 BST



EU rejects claim Genoa bridge collapse linked to its spending rules

European commission rebuffs minister's jibe, saying it has backed infrastructure outlay



▲ The collapsed Morandi Bridge in the port city of Genoa. Photograph: Stefano Rellandini/Reuters

Brussels has dismissed claims by Italy's populist government that spending rules prevented the country from spending enough to keep infrastructure safe, two days after a devastating bridge collapse killed 39 people in Genoa.

Italy's far-right interior minister, Matteo Salvini, who is also a deputy minister, has firmly pointed the finger at Brussels over the disaster. Wider attention turned towards the company responsible for the

"Spending that saves lives, jobs and the right to health must not be rigid calculations and of rules imposed by Europe," he said on Wednesday. On Thursday I public money

EU COMMISSION ISSUES STUDY ON BRIDGE MAINTENANCE, INSPECTION AND MONITORING

Feb 26, 2019 | Policy News



Europe's aging transport infrastructure needs effective and proactive maintenance in order to continue its safe operation during the entire life cycle. This report focuses on research and innovation (R&I) in bridge maintenance, inspection and monitoring in Europe in the last quarter of a century. The assessment follows the methodology developed by the European Commission's Transport Research and Information Monitoring and Information System (TRIMIS). The report critically addresses issues and techniques, and also highlights new technological developments and future oriented approaches.

Home World News

One year after Genoa tragedy: Are Europe's bridges any safer?

14 Aug, 2019 12.08 / Updated 3 months ago

Get short URL



Grandi bridge, Genoa © Reuters / Stefano Rellandini

THE GUARDIAN

Read the full article  
Free for 30 days

News

GENOA BRIDGE COLLAPSE | ANALYSIS  
ABOUT 34 DEAD, 120 INJURED, THREE TROUBLES  
Genoa bridge collapse: Is the EU to blame for Italy's infrastructure problems?



The European Commission has rejected Italian claims that spending constraints imposed from Brussels played a part in the collapse of the Genoa road bridge.

Matteo Salvini, Italy's deputy prime minister, has claimed that EU pressure to cap government budgets has prevented vital infrastructure improvements. His attempt to link the deaths in Genoa to EU budget rules follows months of attacks on Brussels by his party, the League, which has formed Italy's first populist administration in alliance with the anti-establishment Five Star movement.



# H2020 CSA IM-SAFE Kontext

**Die Standardisierung der Bauwerksüberwachung ist ein Schlüsselement für optimale Erhaltungsstrategien und daraus abgeleiteten Maßnahmen zur Gewährleistung der Sicherheit der Verkehrsinfrastruktur.**

## Handlungsfelder:

1. Performancebewertung der Tragsstrukturen
2. Auswirkungen sich ändernder Anforderungen
3. Auswertung der Überwachungsdaten und Ableitung von Erhaltungsstrategien
4. Adäquate Nutzung der Digitalisierung

The screenshot shows the homepage of the UNI Standard website. At the top, there is a navigation bar with links to Home, Chi siamo, Associazione, Normazione, Catalogo, Formazione, and Aree. Below the navigation bar, a banner for 'F08a the Assessment of Existing Structures' is displayed. The main content area features a summary of the report, including its title, 'Guidelines for structural health monitoring', ICS code '91.010', and validity period from April 28, 2016, to April 28, 2019. It also includes a detailed description of the scope and objectives of the monitoring system. On the right side, there is contact information for the authors and a link to the full document.

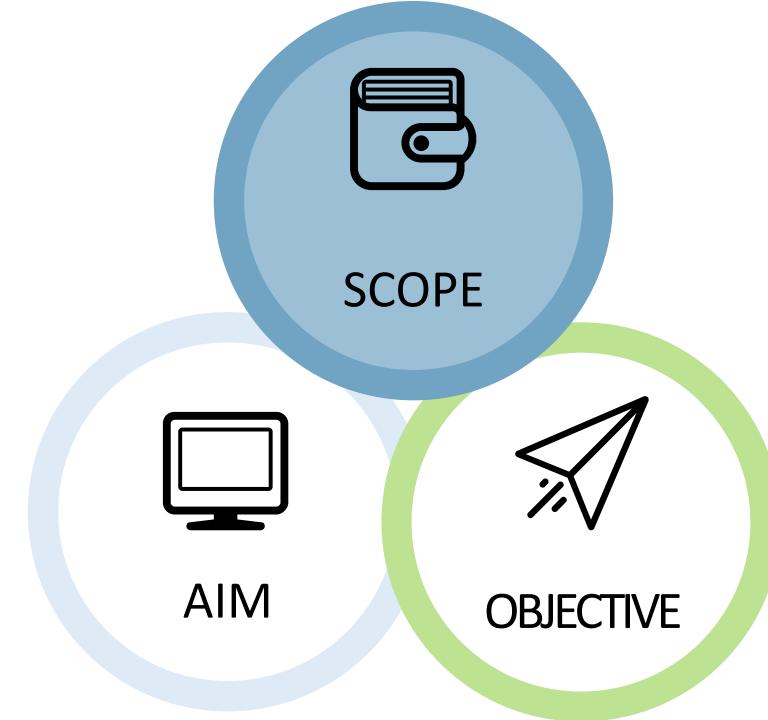
This screenshot shows the cover page of the Chinese standard GB 50982-2014. It includes the title 'Technical code for monitoring of building and bridge structures', the date 'October 09, 2014', and the implementation date 'August 01, 2015'. It also lists the issuing bodies: Ministry of Housing and Urban-Rural Development of PRC, General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, and the standard number 'GB 50982-2014'.

This screenshot shows the cover page of the RVS 13.03.01 Monitoring of Brücken und anderen Ingenieurbauwerken report, dated February 2012. It includes the title, date, and a brief description of the report's purpose. The table of contents lists various sections such as 'Monitoring of bridges and other engineering structures', 'Assessment routes', and 'Reliability verification'.

# H2020 CSA IM-SAFE Projektorganisation

IM-SAFE möchte die **Europäische Kommission und das Europäische Komitee für Normung (CEN)** bei der Ausarbeitung eines **neuen Standards im Bereich der Bauwerksüberwachung mit dem Ziel einer optimalen Instandhaltung und Sicherheit der Verkehrsinfrastruktur** unterstützen, unter Berücksichtigung aktueller Trends, den zu erwartenden Veränderungen, bewährter Verfahren und technischen Entwicklungen, einschließlich Anwendung der Digitalisierung.

Projektziel ist es, eine **breite Akzeptanz für neue Normung zu erreichen** und es **Behörden und Industrie zu ermöglichen, zur Normung, Einführung und Umsetzung beizutragen**.



# H2020 CSA IM-SAFE Projektorganisation

IM-SAFE umfasst:

**Brücken, Tunnel und andere große Infrastrukturprojekte im Straßen- und Schienennetz.**

IM-SAFE umfasst den Hoch- und Tiefbau der Verkehrsinfrastruktur und gegebenenfalls ergänzende Elemente wie z.B.: Eisenbahn Oberleitungsbau.

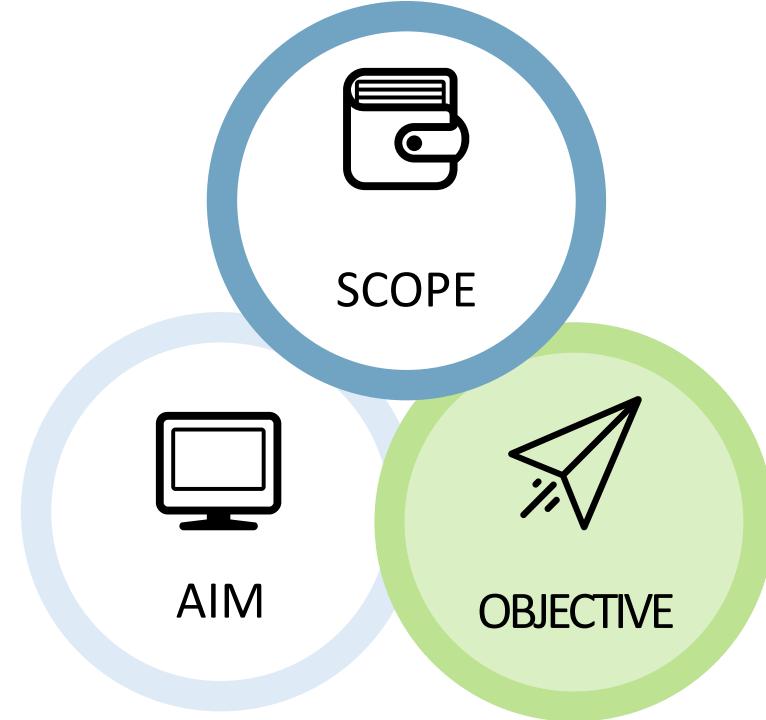


# H2020 CSA IM-SAFE Projektorganisation

Ziel ist die Vorbereitung eines **neuen, harmonisierten europäischen Standards für die Bauwerksüberwachung** inkl. einheitlicher Nutzung der Digitalisierung, um die Anforderungen in Bezug auf Sicherheit und Leistungsfähigkeit der Verkehrsinfrastruktur bei gleichzeitig verbesserter Kosteneffizienz zu gewährleisten.

IM-SAFE ermöglicht einen Paradigmenwechsel von der **zeitbasierten, korrigierenden Wartung zur risikobasierten, vorausschauenden Wartung durch datenbasierte Entscheidungsfindung.**

Der **neue Standard wird** von den Behörden und den Interessengruppen der Industrie in ganz Europa **kohärent unterstützt und umgesetzt.**

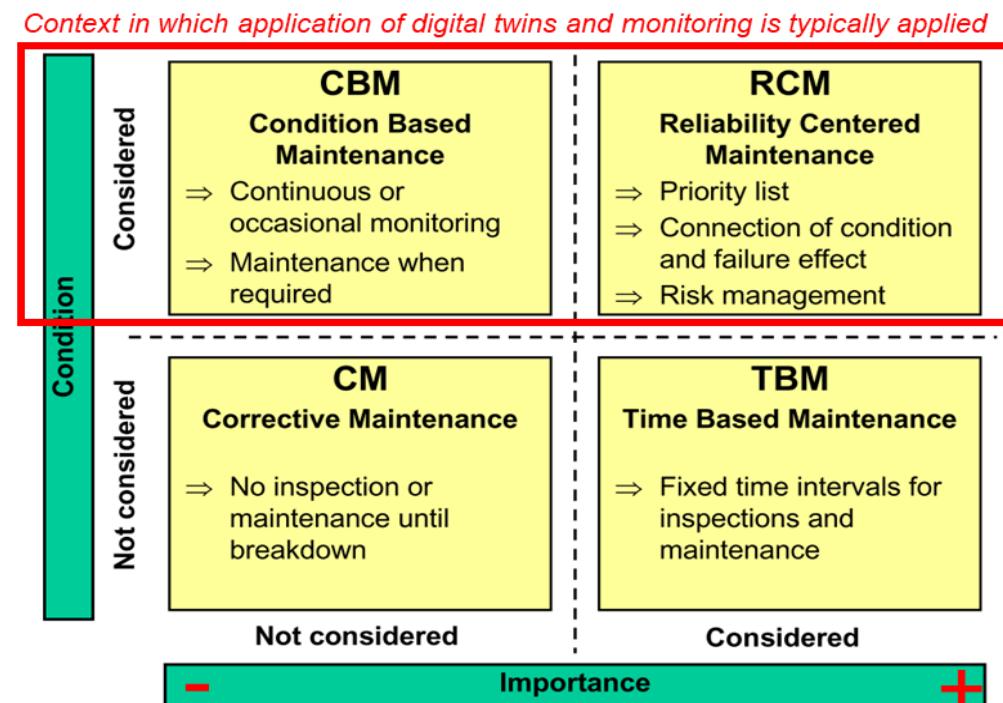


# H2020 CSA IM-SAFE Ergebnisse

## STANDARDISIERUNG: neuer Standard für die **zustands- und risikobasierte** Instandhaltung von Verkehrsinfrastrukturen

Ziele:

- Übergang von korrigierenden und zeitbasierten Wartungsansätzen zu **zustandsbasierten und risikobasierten Ansätzen**
- Standardisierung von **Grundsätzen und Anforderungen** für datengestützte Entscheidungen (Inspektion, Überwachung und Prüfung)
- Verbesserung der Kosteneffizienz der Verkehrsinfrastruktur



# H2020 CSA IM-SAFE Projektorganisation

## PROJEKTPARTNER



### Nederland

TNO Niederländische Organisation für angewandte wissenschaftliche Forschung  
CROW Wissensplattform für Infrastruktur, Verkehr, Verkehr und öffentlichen Raum



### Norwegen

NTNU Norwegian University of Science and Technology



### Spanien

UVIGO Universidad De Vigo  
FER Ferrovial Agroman S.A.



### Österreich

BOKU Universität für Bodenkultur Wien



### Italien

SAC SafeCertifiedStructure Ingegneria S.r.l



### Deutschland

AEC3 AEC 3 Deutschland GMBH



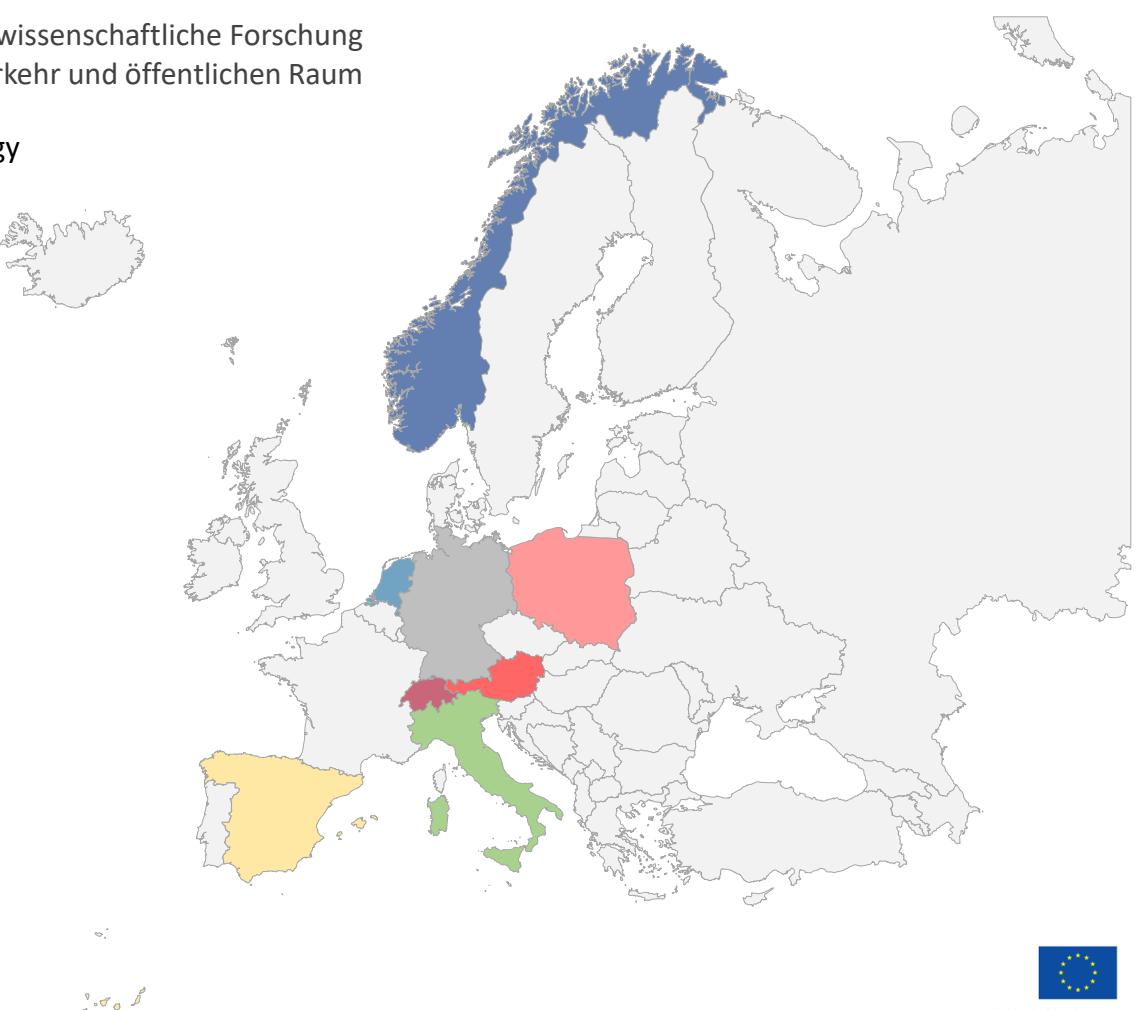
### Schweiz

IBM IBM Research GmbH



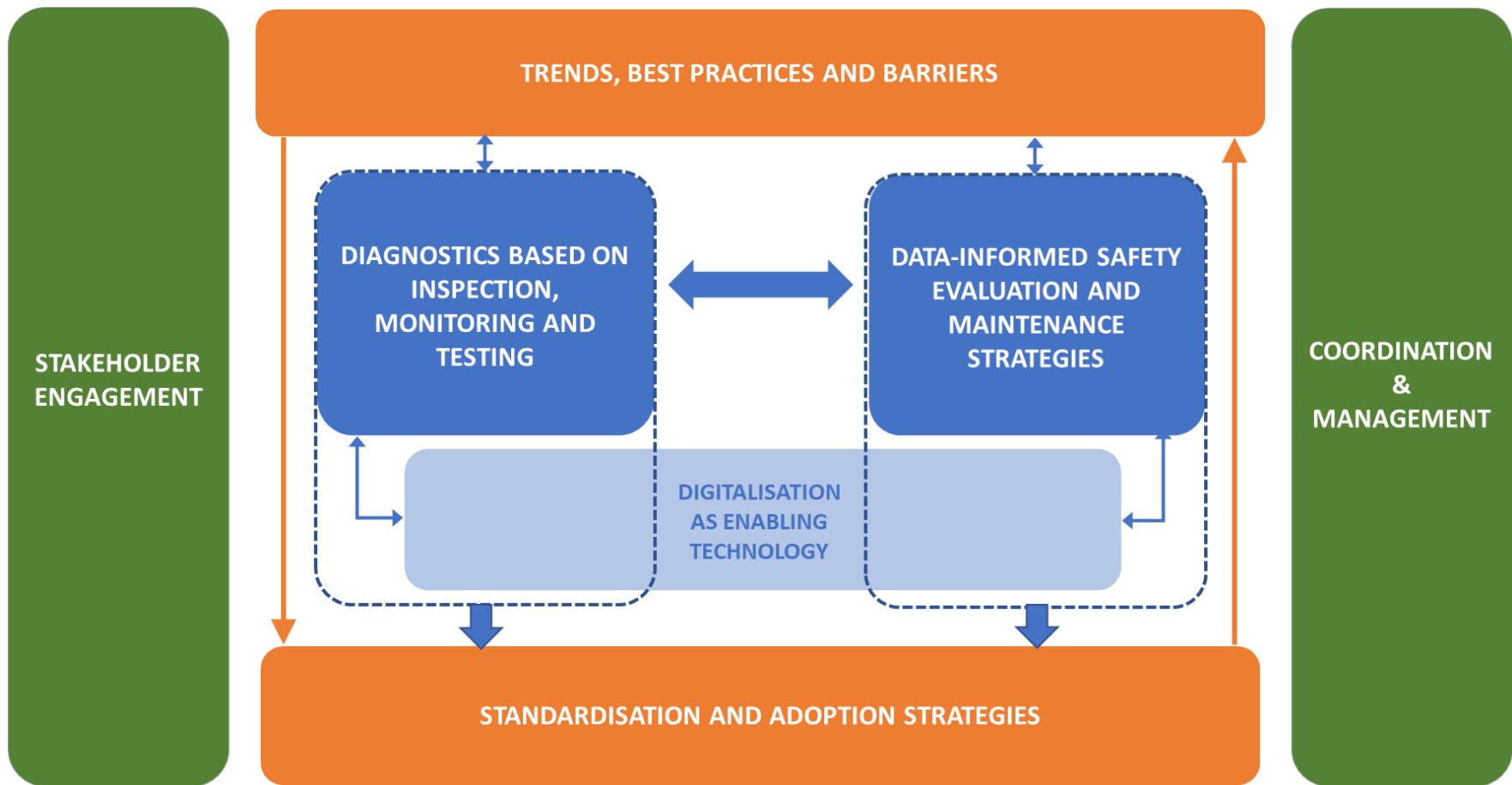
### Polen

MOW Mostostal Warszawa S.A.



# H2020 CSA IM-SAFE Projektorganisation

## PROJEKTSTRUKTUR



# H2020 CSA IM-SAFE Ergebnisse

## STANDARDISIERUNG: Projektergebnisse

- Zusammenstellung von technischen Empfehlungen für EU-Standards in den Bereichen Inspektion, Überwachung, Prüfung, Sicherheitsbewertung und proaktive Instandhaltung von Brücken, Tunneln und anderer relevanter Verkehrsinfrastruktur.
- Vorbereitung von **Vorschlägen an das CEN** mit folgendem Inhalt:
  - **neuer Standard für die Bauwerksüberwachung (structural monitoring)**
  - **neuer Standard für die zustands- und risikobasierte Instandhaltung von Verkehrsinfrastrukturen**
  - **weitere Änderung der bestehenden EU-Normen** zur Sicherheitsbewertung unter Berücksichtigung von Inspektionen, Überwachung und Prüfung
- Unterstützung der CEN durch:
  - Vorschlag eines Ansatzes für die Ausführung des Mandats durch das CEN
  - Zusammenarbeit mit den CEN-Arbeitsgruppen

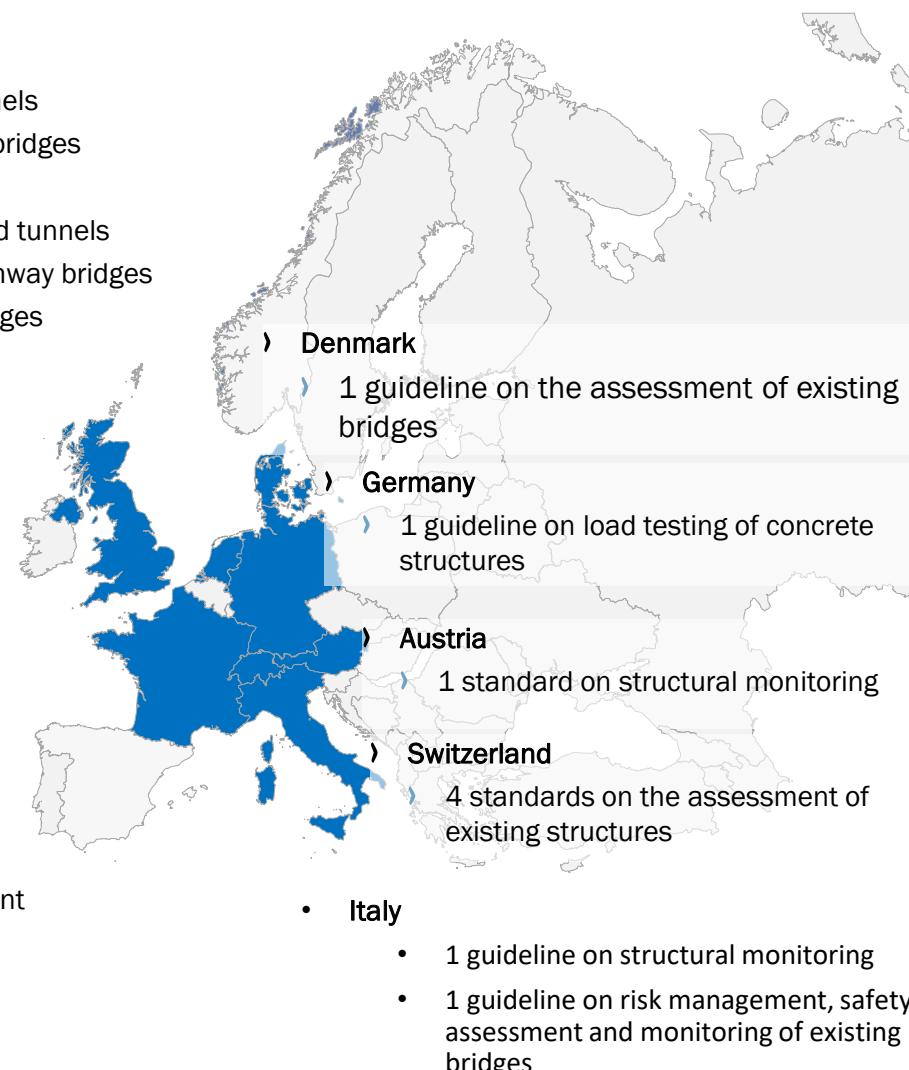


# Übersicht aktuelle Normen



# Überblick über den aktuellen Stand der Normung (ongoing)

- › 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
- › France
  - › 1 guideline on load testing of bridges
  - › 1 guideline on inspections of road tunnels
  - › 1 information note on the safety assessment of existing bridges



- › China
  - › 1 standard on structural monitoring
- › CEN
  - › draft versions of 2 standards on the assessment of structures
  - › 2 standards on inspection and maintenance
- › ISO
  - › 2 standards on structural monitoring
  - › 1 standard on the assessment of existing structures
  - › 1 standard 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

# Überblick über den aktuellen Stand der Normung

## Structural monitoring

- **Standards and guidelines on structural monitoring**
  - China: Technical code for monitoring of buildings and bridge structures
  - Italy: UNI/TR 11634:2016 Linee guida per il monitoraggio strutturale (Guideline for structural health monitoring)
  - Austria: RVS 13.03.01 Monitoring von brücken und anderen ingenieurbauwerken (Monitoring of bridges and other engineering structures)
  - ISO: ISO4866 Mechanical vibration and shock - Guidelines for the measurement of vibrations and evaluation of their effects on structures
  - ISO: ISO14963 Mechanical vibration and shock - Guidelines for dynamic tests and investigations on bridges and viaducts
  - SAMCO: Guideline for Structural Health Monitoring
- **Standards and guidelines with provisions about structural monitoring**
  - UK: CS 470 Management of sub-standard highway structures
  - UK: CS 464 Non-destructive testing of highways structures



# Überblick über den aktuellen Stand der Normung

## Structural monitoring

Country / Standardisation body	Standard / guideline	Definition of monitoring
	Technical code for monitoring of buildings and bridge structures	Frequent, continuous observation or measurement of the state of the structure
	UNI/TR 11634:2016 Linee guida per il monitoraggio strutturale (Guideline for structural health monitoring)	Detection of the condition or behaviour of a structure and its evolution over time through instrumental acquired measurements by means of sensors
	RVS 13.03.01 Monitoring von brücken und anderen ingenieurbauwerken (Monitoring of bridges and other engineering structures)	Non-destructive, measured value-based automated investigation and control of engineering structures
	ISO4866 Mechanical vibration and shock - Guidelines for the measurement of vibrations and evaluation of their effects on structures	Not given
	ISO14963 Mechanical vibration and shock - Guidelines for dynamic tests and investigations on bridges and viaducts	Not given
	Guideline for Structural Health Monitoring	During condition monitoring of structures global and local structural properties are evaluated based on continuously measured values
	CS 470 Management of sub-standard highway structures	The periodic or continuous observation and recording of information pertaining to structural behaviour
	CS 464 Non-destructive testing of highways structures	<b>Global</b> monitoring: acoustic emission monitoring technique to identify the presence of active defects in a structure with a minimum number of sensors over long distances <b>Local</b> monitoring: Acoustic emission monitoring technique to provide detailed information on source location, orientation and on the characteristics of defects and failure.

# Überblick über den aktuellen Stand der Normung

## Structural monitoring

Country / Standardisation body	Standard / guideline	Goal of monitoring	Monitoring types
	Technical code for monitoring of buildings and bridge structures	1) ensuring safety during construction and operation 2) structural damage identification 3) provide input for repair and maintenance	Construction / post-construction Continuous / frequent Global / local
	UNI/TR 11634:2016 Guideline for structural health monitoring	1) control of structural condition during operation 2) identification of deterioration	Continuous / periodic / temporary Global / local
	RVS 13.03.01 Monitoring of bridges and other engineering structures	1) documentation of construction stages 2) monitoring of the condition development during operation 3) early recognition of critical conditions	Continuous / periodic / temporary Global / local
	ISO4866 Mechanical vibration and shock - Guidelines for the measurement of vibrations and evaluation of their effects on structures	1) problem recognition 2) control of condition during operation 3) Assessing severity of vibrations	Continuous / periodic / temporary Global / local
	ISO14963 Mechanical vibration and shock - Guidelines for dynamic tests and investigations on bridges and viaducts	1) evaluating the safety of bridge structures under construction and during operation 2) confirming after construction the values used in design 3) monitoring of real bridges in-service and detecting any damage	Continuous / periodic / temporary Global / local
	Guideline for Structural Health Monitoring	1) improved knowledge of the current state and long-term behaviour 2) evaluation of current safety 3) input for maintenance planning	Continuous / periodic / temporary Global / local
	CS 470 Management of sub-standard highway structures	1) to detect deterioration or distress if it occurs 2) to determine the extent, severity and rate of deterioration, and to determine whether a critical limit state or other criteria are at risk of being reached	Continuous / periodic / temporary Global / local
	CS 464 Non-destructive testing of highways structures	to identify the presence of active defects in a structure	Continuous / periodic / temporary Global / local

# Überblick über den aktuellen Stand der Normung

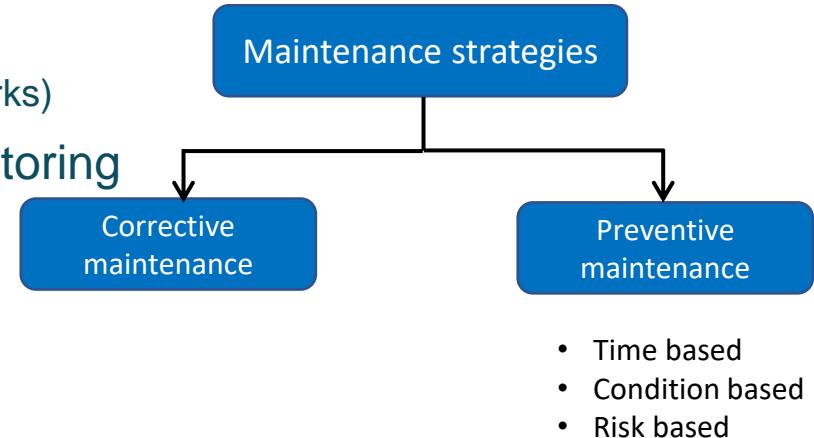
## Structural monitoring

Country / Standardisation body	Standard / guideline	Field of application	Measured physical quantities	Requirements on measurement accuracy	Guidelines on data acquisition, cleaning and pre-processing	Guidelines on use of monitoring data for structural diagnostics / safety evaluation / asset management
	Technical code for monitoring of buildings and bridge structures	High-rise buildings, long-span bridges	Loads and load effects	Yes	Yes	No
	UNI/TR 11634:2016 Guideline for structural health monitoring	Engineering structures	Loads and load effects, effects caused by physical - chemical processes	Yes	Yes	structural diagnostics
	RVS 13.03.01 Monitoring of bridges and other engineering structures	Engineering structures	Loads and load effects	No	No	structural diagnostics
	ISO4866 Mechanical vibration and shock - Guidelines for the measurement of vibrations and evaluation of their effects on structures	Engineering structures	Loads and load effects	Yes	Yes	structural diagnostics
	ISO14963 Mechanical vibration and shock - Guidelines for dynamic tests and investigations on bridges and viaducts	Bridges	Load effects	No	Yes	structural diagnostics
	Guideline for Structural Health Monitoring	Engineering structures	Loads and load effects, effects caused by physical - chemical processes	No	Yes	structural diagnostics
	CS 470 Management of sub-standard highway structures	Highway structures	Physical-chemical processes	No	No	structural diagnostics, asset management
	CS 464 Non-destructive testing of highways structures	Highway structures	Effects caused by physical-chemical processes	No	No	structural diagnostics

# Überblick über den aktuellen Stand der Normung

## Zustandsorientierte und risikobasierte Erhaltung

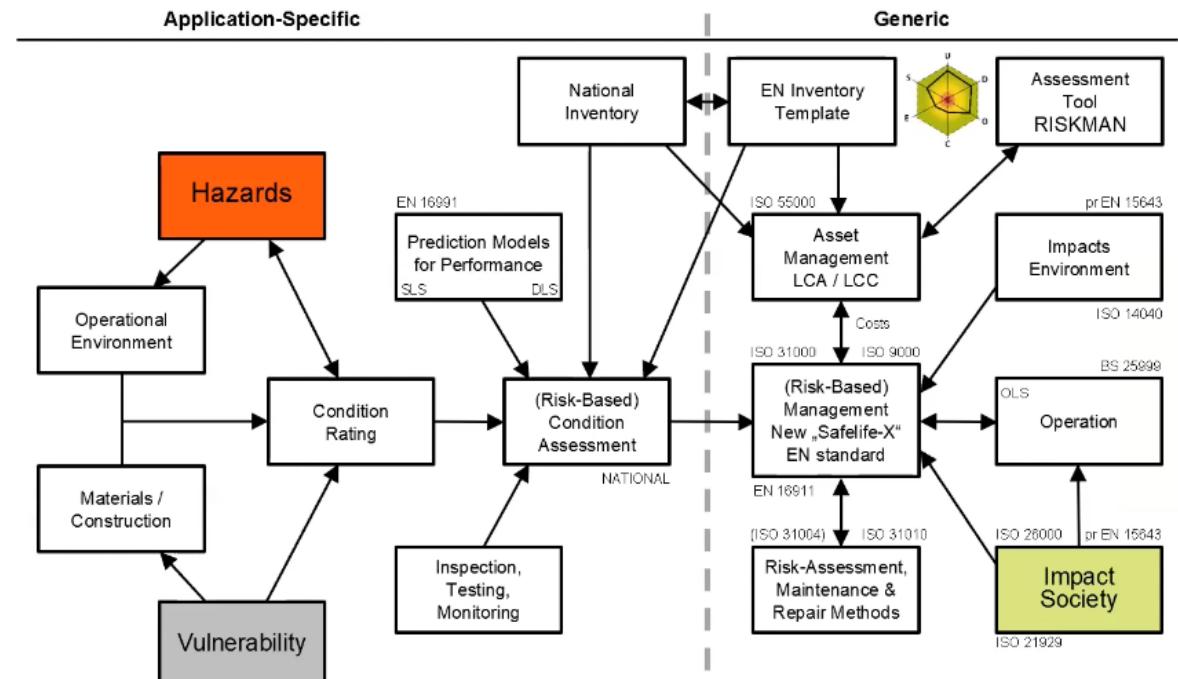
- Lebenszyklus/erhaltungs-Prozesse
  - condition survey (Zustandserhebung)
  - condition assessment (Zustandsbewertung)
  - condition evaluation and decision making (Entscheidungsfindung)
  - execution of interventions (Interventionen)
    - planned interventions: **preventive maintenance**
    - unplanned interventions: corrective maintenance (remedial works)
  - undertaking through-life condition survey and/or monitoring



# Überblick über den aktuellen Stand der Normung

## Zustandsorientierte und risikobasierte Erhaltung

- Relevante Themen
  - classification of hazards
  - risk rating
  - risk management plans
  - performance and condition evaluation
  - inspection & monitoring
  - interventions



# Überblick über den aktuellen Stand der Normung

## Zustandsorientierte und risikobasierte Erhaltung

- **Standards and guidelines**

- ISO: ISO 55000 Asset management - Overview, principles and terminology
- ISO: ISO 31000 Risk management - Principles and guidelines
- ISO: ISO 31004 Risk management - Guidance for the implementation of ISO 31000
- ISO: ISO 31010 Risk management - Risk assessment techniques
- CEN: EN 16991 Risk-based inspection framework
- CEN: EN 15341 Maintenance - Maintenance Key Performance Indicators
- Italy: Guidelines for risk classification and management, safety assessment and monitoring of existing bridges
- UK: CS 462 Repair and management of deteriorated concrete highway structures
- UK: CS 465 Management of post-tensioned concrete bridges
- UK: CS 466 Risk management and structural assessment of concrete half-joint deck structures
- UK: CS 467 Risk management and structural assessment of concrete deck hinge structures
- UK: CS 470 Management of sub-standard highway structures
- UK: CM 430 Maintenance of road tunnels



# Überblick über den aktuellen Stand der Normung

## Zustandsorientierte und risikobasierte Erhaltung

Country	Standard / guideline	Steps of the decision-making process	Objective	When	Types of measures
	CS 462 Repair and management of deteriorated concrete highway structures	1) Condition survey	To gather information on the current condition	Not specified	<ul style="list-style-type: none"> <li>• Reactive essential maintenance</li> <li>• Preventive maintenance</li> </ul>
		2) Condition assessment (desk study)	To evaluate the current performance		
		3) Additional investigations of concrete condition	To gather additional information on the current condition in case of doubts		
		4) Structural assessment	To assess load bearing capacity based on semi-probabilistic approach		
	CS 465 Management of post-tensioned concrete bridges	1) Risk review	To identify the needs for a further risk assessment	6 years, if risk-based inspection planning is not applied	<ul style="list-style-type: none"> <li>• Inspection (incl. structural monitoring)</li> <li>• Assessment</li> <li>• Remediation (maintenance, repair, strengthening, replacement)</li> </ul>
		2) Risk assessment	To identify hazards, risk events, likelihood, consequence and risk levels		
		3) Risk management	To define measures for mitigating or removing identified risks		
		4) Decision regarding prioritisation and risk management measures			
	CS 466 Risk management and structural assessment of concrete half-joint deck structures	1) Initial review	To assess whether the information available is 1) sufficient to enable a risk assessment to be carried out; 2) current; 3) valid	Not specified	<ul style="list-style-type: none"> <li>• Inspection</li> <li>• Maintenance activities</li> <li>• Monitoring</li> <li>• Interim / long term measures</li> <li>• Investigations</li> <li>• Repair</li> <li>• Strengthening</li> <li>• Replacement</li> </ul>
		2) Risk assessment for structural assessment	To prioritise half-joint structures for structural assessment		
		3) Structural review	To determine if a new structural assessment is required		
	CS 467 Risk management and structural assessment of concrete deck hinge structures	4) Structural assessment	Assessing load bearing capacity based on semi-probabilistic approach		
		5) Risk assessment for management	To prioritise structures with half-joints for management and interventions		
		6) Management plan (decision regarding risk management measures)			

# Überblick über den aktuellen Stand der Normung

## Zustandsorientierte und risikobasierte Erhaltung

Country	Standard / guideline	Steps of the decision-making process	Objective	When	Types of measures
	CS 470 Management of sub-standard highway structures	1) Identification of immediate risk structures	To identify structures that need urgent application of load mitigation measures	<ul style="list-style-type: none"> <li>The structure does not satisfy the UC</li> <li>Accidental damage</li> <li>Observation of adverse state during inspection</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring interim measures</li> <li>Load mitigation interim measures</li> </ul>
		2) Risk assessment	Classification of low/high risk structures		
		4) Decision regarding mitigation measures			
	CM 430 Maintenance of road tunnels	1) Risk review	To identify the needs for a further risk assessment	Not specified	<ul style="list-style-type: none"> <li>Inspection</li> <li>Maintenance (corrective, planned and preventive)</li> <li>Major overhaul and refurbishment</li> <li>Monitoring</li> <li>Testing</li> </ul>
		2) Risk analysis	To identify hazards, risk events, likelihood, consequence and risk levels		
		4) Decision regarding maintenance and planning			
	Guidelines for risk classification and management, safety assessment and monitoring of existing bridges	1) Census of all structures	To determine the number of structures to be managed and their properties	Not specified	<ul style="list-style-type: none"> <li>Inspection</li> <li>Maintenance activities</li> <li>Monitoring</li> <li>Investigations</li> <li>Repair</li> <li>Strengthening</li> <li>Replacement</li> </ul>
		2) Visual inspections and relief of the structure	To assess damage state		
		3) Definition of attention class	To perform risks assessment of bridges		
		4) Preliminary structural assessment	To determine if a detailed structural assessment is required		
		5) Detailed structural assessment	To identify the needs for interventions		
		6) Evaluation of network resilience			

# Überblick über den aktuellen Stand der Normung

## Data-informed Sicherheits-Analyse

- **Standards and guidelines**
  - ISO: ISO 13822: Bases for design of structures — Assessment of existing structures
  - CEN: prEN1990-2: Eurocode - Basis of assessment and retrofitting of existing structures: general rules and actions
  - CEN: prEN1992: Eurocode 2: Design of concrete structures
  - The Netherlands: NEN 8700: Assessment of existing structures in case of reconstruction and disapproval - Basic Rules
  - The Netherlands: NEN 8701: Assessment of existing structures in case of reconstruction and disapproval – Actions
  - The Netherlands: Guideline for the assessment of structures
  - Switzerland: SIA 269-0: Existing structures - Bases
  - Switzerland: SIA 269-1: Existing structures - Actions
  - Switzerland: SIA 269-2: Existing structures - Concrete structures
  - Italy: Guidelines for the risk classification and management, safety assessment and monitoring of existing bridges
  - UK: CS 454 Assessment of highway bridges and structures
  - UK: CS 455 The assessment of concrete highway bridges and structures
  - UK: CS 456 The assessment of steel highway bridges and structures
  - UK: CS 459 The assessment of bridge substructures, retaining structures and buried structures



# Überblick über den aktuellen Stand der Normung

## Data-informed Sicherheits-Analyse

- **Relevante Themen**
  - assessment levels
  - partial factors for existing structures
  - updating of basic variables (loads, geometrical dimensions, material properties)
  - monitoring
  - consideration of deterioration



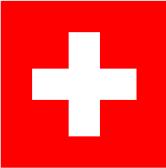
# Überblick über den aktuellen Stand der Normung

## Data-informed Sicherheits-Analyse

Country / Standardisation body	Standard / guideline	Levels of assessment	Reliability levels	Types of structure-specific information	Parameters considered for updating	Consideration of deterioration
	prEN 1990-2 (2nd draft)	1) Preliminary assessment 2) Detailed assessment	May be lower than those used for the design	<ul style="list-style-type: none"> <li>Available information from the original design and construction</li> <li>Inspection outcomes</li> <li>Test results</li> </ul>	<ul style="list-style-type: none"> <li>Geometric data</li> <li>Material properties</li> <li>Permanent, imposed and variable actions</li> </ul>	General principles
	prEN 1992-1-1	Not specified	Not specified	<ul style="list-style-type: none"> <li>Inspection outcomes</li> <li>Material test results</li> </ul>	<ul style="list-style-type: none"> <li>Geometric data</li> <li>Material properties</li> </ul>	No
	Guidelines for risk classification and management, safety assessment and monitoring of existing bridges	1) Preliminary structural assessment 2) Detailed structural assessment	Same levels used for design	<ul style="list-style-type: none"> <li>Available information from the original design and construction</li> <li>Inspection outcomes</li> <li>Test results</li> </ul>	<ul style="list-style-type: none"> <li>Geometric data</li> <li>Material properties</li> <li>Permanent actions</li> </ul>	General principles
	CS 455 The assessment of concrete highway bridges and structures  CS 456 The assessment of steel highway bridges and structures-web	1) Simple structural analysis methods 2) Refined structural analysis methods, including non-linear or plastic analysis methods 3) Assessment based on material properties derived from testing samples of the structure, or use of bridge-specific assessment live loading models derived from the measurement of loading data	Same levels used for design, but reduced partial factors for materials if the "worst credible strength" is used in the calculations	<ul style="list-style-type: none"> <li>Available information from the original design and construction</li> <li>Inspection outcomes</li> <li>Test results</li> </ul>	<ul style="list-style-type: none"> <li>Geometric data</li> <li>Material properties</li> </ul>	<ul style="list-style-type: none"> <li>Alkali-aggregate reaction</li> <li>Delayed ettringite formation</li> <li>Thaumasite</li> <li>Corrosion of the reinforcement</li> <li>Fatigue</li> </ul>

# Überblick über den aktuellen Stand der Normung

## Data-informed Sicherheits-Analyse

Country / Standardisation body	Standard / guideline	Levels of assessment	Reliability levels	Types of structure-specific information	Parameters considered for updating	Consideration of deterioration
	Reliability-based classification of the load carrying capacity of existing bridges	Not specified	Same levels used for design	<ul style="list-style-type: none"> <li>Available information from the original design and construction</li> <li>Inspection outcomes</li> <li>Test results</li> </ul>	<ul style="list-style-type: none"> <li>Geometric data</li> <li>Material properties</li> <li>Actions</li> <li>Events (load testing, cracking)</li> </ul>	No detailed rules are given
	SIA 269 Bases for examination and intervention SIA 269/1 Existing structures – Actions SIA 269/2 Existing structures – Concrete structures SIA 269/3 Existing structures – Steel structures	1) Preliminary structural assessment 2) Detailed structural assessment	May be lower than those used for the design	<ul style="list-style-type: none"> <li>Available information from the original design and construction</li> <li>Inspection outcomes</li> <li>Test results (incl. NDT)</li> </ul>	<ul style="list-style-type: none"> <li>Geometric data</li> <li>Material properties</li> <li>Actions</li> </ul>	<ul style="list-style-type: none"> <li>Alkali-aggregate reaction</li> <li>Corrosion of the reinforcement</li> <li>Fatigue</li> </ul>