

Commission 2

Safety and performance concepts

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Recent Meetings:	Budapest (May 05), Vienna (Nov 05), Naples (June 06)

Terms of reference

Scope

Structural systems are typically designed to stay in service for at least several decades. This implies that proper care must be taken to ensure their safety and serviceability in the presence of deterioration as well as changing conditions of utilization. Over the past years, it became clear that unfortunately both deterioration as well as increasing traffic loads put severe constraints on the operating conditions of bridge structures. Without proper maintenance, the evolution of resistance and load would decrease the structural performance. Therefore, the main task of this Commission is to deal with reliability aspects that are specifically related to concrete structures and associated degradation processes.

Areas of interest

Safety concepts for new and existing concrete structures

- Safety of structures and infrastructural systems
- General principles on risk assessment for building and infrastructure systems
- Reliability assessment of existing structures
- Safety factors

Objective: Analysis of the current state of the safety concepts for new structures and existing structures, extension of safety concepts considering monitoring techniques, quality control procedures. Basic documents are: JCSS, background documents, Eurocode documents, recently performed research activities from Commission 2 members and also from other researchers.

Identification of system parameters on the basis of measured structural response

- Sensitivity factor based approaches
- Neural network based approaches
- Direct stiffness approaches
- Risk based inspection approaches

Objective: Investigation and assessment of methodologies for the identification of system parameters using inverse numerical and analytical methods based on measured structural responses.

Background of safety formats

- CEB-FIP Model Code
- JCSS Model Code

Objective: Comparison of safety formats and their backgrounds used in the European Union and other countries (e.g. focusing on various concrete types (cement-based composites): precast concrete, HSC, fibre reinforced concrete).

Design by testing for concrete structures

- Guideline
- Basic background – theory
- Definition of test parameters
- Assessment of test results
- Design format
- Examples

Objective: To elaborate a user-friendly documentation about testing concepts supporting the design of structural elements.

Monitoring-based reliability assessment

Objective: Investigation of concepts associated with the incorporation of real measured data provided by monitoring systems. This task is complex and needs a comprehensive approach. Multiple basic principles, such as the design of a monitoring system, the optimum number of sensors, the required quality of sensors, the monitoring frequency, the duration or possible interruption, the transformation of monitored physical quantities to reliability based quantities, the development of prediction functions among others have to be considered. Objectives of this topic are the presentation of concepts associated (a) determination of the optimum number of sensors, (b) effective incorporation of monitoring data in the present reliability assessment, and (c) reliability profile prediction.

Probabilistic based durability design

Safety and economy have to be ensured for the structure during its *service life*. From this emerge the necessity for:

- (i) reliability assessment technique of newly designed as well of existing structures (i.e. an assessment of *design* or *residual reliability level*);
- (ii) design of structures for durability;
- (iii) instruments for balancing service life vs. initial costs, maintenance and repair costs.

In this context, i.e. in the context of *performance-based* approaches, *sustainability* and *whole life costing* of concrete structures, time is the decisive variable and the durability issues are pronounced.

Objective: A probabilistic based standardization for the *design of structures for durability*

Working programme

The following documents are in progress:

- state-of-the-art report on the harmonization of safety concepts in case of monitoring of complex systems;
- state-of-the-art report showing possibilities of inverse analysis for inspection and monitoring and lifetime planning;
- report giving an insight in the background of the current safety concepts and application to non-traditional concretes and design situations;
- guidelines for design by testing of concrete members;
- report on safety and performance concepts.