fib BULLETIN NO. 108 TITLE: PERFORMANCE-BASED FIRE DESIGN OF CONCRETE STRUCTURES

STATE-OF-THE-ART-REPORT

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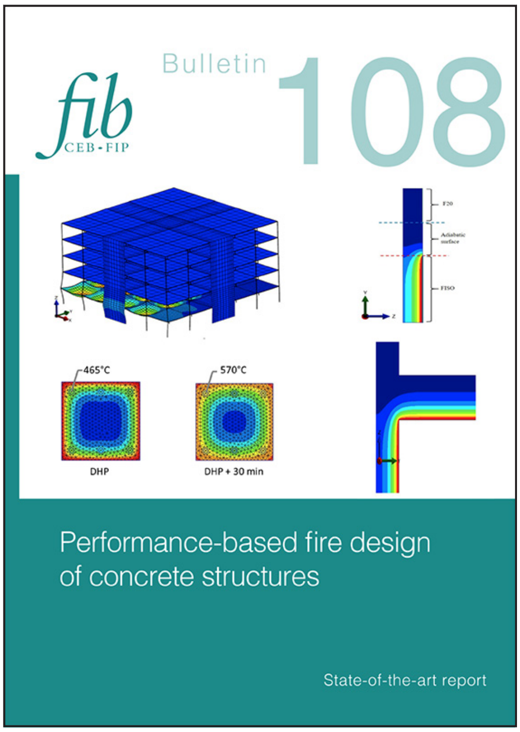
Abstract:
Fire is a major hazard for structures and must be considered as a possible loading case in the design. Recently, performance-based design approaches have been increasingly adopted, for the flexibility and opportunities they provide. A performance-based strategy relies on the explicit definition of design objectives and the demonstration that these objectives are fulfilled by the design. The performance-based strategy offers the double advantage of explicitly evaluating the performance and providing freedom to the designer. However, freedom comes at a cost, and implementation of a performance-based design is more demanding for the designer than following prescriptive rules. The purpose of this bulletin is to provide guidelines on the use of performance-based methods for designing and assessing concrete structures in fire.

This document is structured to provide a practical guidance to designers and users interested in applying a performance-based strategy for fire design. The scope and objectives are detailed in Chapter 2. Chapter 3 describes the effects of fire on the thermal and structural response of concrete structures. Chapters 4 and 5 address the design strategy and quantification of the performance of concrete structures in fire, with Chapter 5 describing a step-by-step approach to explicitly assess the fire performance. Finally, an Appendix provides detailed information on two essential engineering methods in performance-based design, namely advanced calculation methods and probabilistic methods.



fib BULLETIN NO. 109 TITLE: EXISTING CONCRETE STRUCTURES LIFE MANAGEMENT, TESTING AND STRUCTURAL HEALTH MONITORING

STATE-OF-THE-ART-REPORT

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Abstract:
The through-life management of our constantly ageing infrastructure is a basic requirement in order to ensure their structural safety and serviceability. Each structure experiences deterioration processes with time leading to a decrease of structural safety and serviceability. The design of new structures considers the expected deterioration for a defined period, the design service life. However, a frequent survey of structural safety controlling structural condition should be mandatory and a maintenance plan should be an integral part of the design. In addition, many structures have exceeded their design service life already or are very close to it leading to an increasing demand for condition assessment. On the one hand, assumptions made during design are not valid any more due to change of the loads, e.g., increasing traffic loads in terms of number and weights. On the other hand, design codes evolved over time in such a way that existing structures do not comply with today's standards. In all these cases, the through-life management is an important tool to maintain the accessibility of existing structures with known reliability.

In line with the new Model Code for Concrete Structures, which includes guidance for both – design of new structures and assessment of existing structures, the Task Group 3.3 focused on the compilation of a state-of-the-art guideline for the through-life management of existing concrete structures, including:

Data acquisition by testing and monitoring techniques;

Condition assessment for the evaluation of existing structures;

Performance prediction using advanced methods;

Decision-making procedures to perform a complete assessment of existing structure.

The overall objective of the through-life management is the assessment of the current condition and the estimation of the remaining service life under consideration of all boundary conditions.

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fib BULLETIN NO. 110 TITLE: MANAGEMENT OF POST-TENSIONED BRIDGES

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Abstract:
One of the big issues worrying the entire modern world is the increasing number of bridges in a bad or disrepair condition, which is arising the questions about the safety and reliability of our infrastructure in the upcoming years. Within the entire stock of bridges, the post-tensioned concrete bridges are a specific group, which require special attention. During their first, but at the same time numerous applications in the post-war period, the post-tensioning technology was only in a developing stage. Deficiencies of the technology of prestressing and grouting led to shortened service life of these bridges and in some cases even to their sudden collapses. Nowadays, many post-tensioned bridges built in the 1950s, 1960s, and 1970s are reaching the end of their service life, that is reflected in their reduced load-bearing capacity and necessity of adequate measures to be taken for their further safe operation. Massive reconstruction or complete rebuilding is unavoidable in many cases.

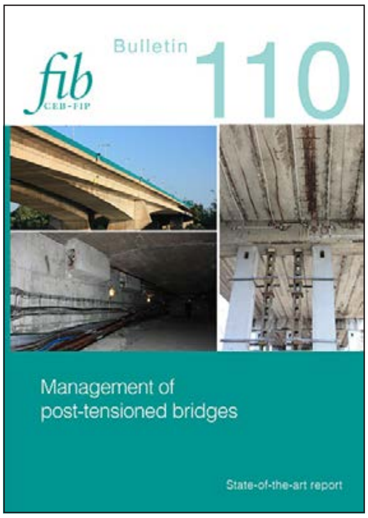
Special problems also arise during inspection of post-tensioned bridges. If the tendons are not grouted, the corrosion occurring even at a small location along the tendon leads to a loss of prestressing force on the entire un-grouted section. Corrosion of un-grouted tendon is often invisible at first glance. The reason is, that there is enough space for corrosion products in the duct and thus the concrete cover layer, , being the most unmissable indicator of steel corrosion, does not fall off. Another reason is the fact, that the decrease in the prestressing force is not followed by significant deformations of the structure, even in advanced stages. For example, in the case of segmental precast girder bridges, which had some pre-camber at the time of assembly, small deflections will mean only the loss of the camber and the girders would seem to be straight even after significant loss of prestressing force. Cracks, that indicate a serious problem of deteriorating prestressing tendons, are often just of hairline width and visible only from a close distance. From all these points of view mentioned above, it is clear, that an extra attention should be paid to the post-tensioned bridges and especially to the segmental structures, during their inspection, diagnostics, and reconstruction.

This bulletin is expected to cover the current practices, risk assessments, inspections, investigations, and interventions in managing new and existing post-tensioned bridges to address their durability issues. If a problem is detected at an earlier stage, repairs can be made to maintain the intended service life of the structure.

Figuratively speaking, knowing your specific "patients" based on their "predisposition to their most common serious diseases", the possibilities and limits of their "diagnosis" and "treatment" is a basic prerequisite for being good "bridge doctors".

This bulletin should serve to bridge managers, designers, and contractors, as an overview of the current state-of-the-art in the field of post-tensioned concrete bridge management. To serve as a guide, when dealing with this type of deteriorated bridges.

Peter Paulík
Convener of fib Working Party 1.1.5 "Management of of prestressed concrete bridges"



fib BULLETIN NO. 111 TITLE: MODELLING STRUCTURAL PERFORMANCE OF EXISTING CONCRETE STRUCTURES

STATE-OF-THE-ART-REPORT

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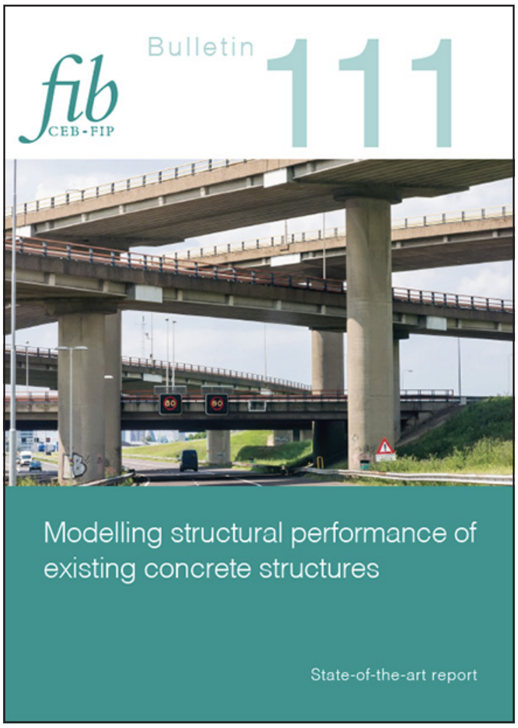
Abstract:
Many existing structures have to be assessed to find out whether they still satisfy the demands of structural safety. There are various possibilities to be regarded: structures can be still in good condition, but exposed to traffic loads which are larger than assumed in the original design. Moreover structures can sufferer material deterioration, reducing the bearing capacity. Finally structures may originally have been designed according to rules which are not anymore in agreement with the actual demands. So, non-compliant details may lead as well to insufficient structural safety.

In order to be able to determine the actual structural safety, the structural performance of existing structures should be described as realistically as possible. The bulletin is a state of-the-art report treating many subjects related to structural safety of existing structures. This includes determination of the residual capacity of structures subjected to higher loads than initially assumed. Moreover it deals with the change of the properties of structural materials suffering deterioration and the determination of the residual bearing capacity of structures with those deteriorated materials. Also examples are given with regard to the determination of the structural safety of structures with various types of non-compliant details.

Finally attention is given to assessment of existing structures by numerical simulation and by proof loading.

Joost Walraven
Editor of fib Task Group 3.2 " Modeling of structural performance of existing concrete structures"



fib BULLETIN NO. 112 TITLE: *fib* MC(2020) COMPLEMENTARY GUIDANCE ON CONCRETE DURABILITY

TECHNICAL REPORT

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Abstract:
When the fib decided to develop a new Model Code addressing both new and existing structures—including the design of new structures and the various activities related to the assessment, interventions, and life-cycle management (LCM) of existing concrete structures—it became evident that a chapter on durability would be essential. The fib Model Code for Concrete Structures 2020 (MC2020) highlights the importance of durability, particularly for existing structures.

Durability aspects are crucial when managing existing structures. Within the fib, a dedicated technical working group, Commission 8, focuses on the durability of concrete structures. Led by Lionel Linger, with significant contributions from Mouna Boumaaza, the Commission 8 members developed numerous contributions for the fib MC2020. These contributions were eventually distilled into a set of procedures and guidelines.

Commission 8 recognised the need for a technical background document to support future users of MC2020. This document compiles all the concrete durability aspects discussed in MC2020 and includes the contributions from all Commission members. It serves as an essential resource for those who will apply MC2020 and seek detailed explanations.

fib BULLETIN NO. 113 TITLE: POLYMER-DUCT SYSTEMS FOR INTERNAL BONDED POST-TENSIONING

RECOMMENDATION

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Abstract:
Thick-walled polymer ducts have been used since early 1990 for internal bonded post-tensioning applications. Based on the first ten years of experience, fib Bulletin 7 Corrugated plastic ducts for internal bonded post-tensioning was published in 2000. Since then, polymer ducts have found their way into several national standards and recommendations and are to be found on the market in various products (ducts and accessories) that differ in material and geometry details. The fib Bulletin 7 was updated and extensively amended in 2014 and published as recommendations in fib Bulletin 75.

Since initially, experience with fabrication of these polymer ducts was quite limited, a number of system tests were specified not only for initial approval but also for factory production control during regular fabrication. This is in fact quite exceptional since approval procedures for post-tensioning systems typically specify material and geometrical checks for factory production control only (except single tensile element tensile tests). Now, another ten years later, and with significant experience gained with the fabrication of polymer ducts, time has come to adapt the factory production control procedures of polymer ducts to those typically used for post-tensioning systems. Hence, all system tests were removed from factory production control except one which verifies geometrical fit of duct and duct couplers which is difficult to verify by dimensional checks only.

In addition to these changes to factory production control, the current content of fib Bulletin 75 has been mostly kept but critically reviewed and amended or corrected where necessary. Test procedures for dimensional requirements, and leak tightness of duct system and of anchorage-duct assembly have been modified in order to obtain a quantitative result from a pressure reading rather than a qualitative visual observation of leakage only. However, the actual performance requirement has not been changed, hence results of testing to fib Bulletin 75 can be considered still valid also under the now updated specification.

We acknowledge the valuable contributions of all the members of Task Group 5.11 and the support of Christian Krebs as expert for questions regarding polymer material properties.