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Simplified design of prestressed concrete bridges —

Part 1: I-girder bridges

Conception simplifiée des ponts en béton précontraint —

Partie 1: Ponts à poutres en I

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 5, *Simplified design standard for concrete structures*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The aim of this document is to provide rules for the design and construction of relatively short span prestressed concrete I-girder bridges. This document is developed for countries that do not have existing national standards on this subject and to offer to local regulatory authorities an alternative for the design of relatively small bridges that abound in urban overpasses and over creeks and rivers everywhere. This document may not be used in place of a national standard unless specifically considered and accepted by the national standards body or other appropriate regulatory organization. The design rules are based on simplified worldwide-accepted strength design models. This document is self-contained; therefore, loads, simplified analysis procedures and design specifications are included, as well as minimum acceptable construction practice guidelines.

The minimum dimensional guidelines contained in this document are intended to account for undesirable side effects that require more sophisticated analysis and design procedures. Material and construction guidelines are aimed at site-mixed concrete as well as ready-mixed concrete, and steel of the minimum available strength grades.

The earthquake resistance guidelines are included to account for the numerous regions of the world which lie in earthquake prone areas. The earthquake resistance for zones with high seismic hazard is based on the employment of structural concrete walls (shear walls) that limit the lateral deformations of the structure and provide for its lateral strength, in place of piers or frames that can be used in zones with intermediate, low or no significant earthquake hazard.

This document contains provisions that can be modified by the national standards body due to local design and construction requirements and practices. The specifications that can be modified are included using ["boxed values"]. The national standards body is expected to review the "boxed values" and may substitute alternative definitive values for these elements for use in the national application of this document.

Simplified design of prestressed concrete bridges —

Part 1:
I-girder bridges

1 Scope

This document provides information to perform the design of the prestressed concrete I-girder bridge for road that complies with the limitations established in 6.1. The rules of design set forth in this document are simplifications of more elaborate requirements.

Designs and details for new road bridges address structural integrity by considering the following:

— the use of continuity and redundancy to provide one or more alternate paths;

— structural members and bearing seat widths that are resistant to damage or instability; and

— external protection systems to minimize the effects of reasonably conceived severe loads.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 28842, *Guidelines for simplified design of reinforced concrete bridges*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
admixture
material other than water, aggregate, or hydraulic cement, used as an ingredient of concrete and added to concrete before or during its mixing to modify its properties

3.2
anchorage
device used to anchor a non-structural element to the structural framing

3.3
beam
horizontal, or nearly horizontal, structural member supported at one (such as a cantilever) or more points, but not throughout its length, transversely supporting a *load* (3.31), and subjected primarily to flexure

3.4
clearance
distance by which one thing clears another; the space between them

3.5
compression reinforcement
reinforcement provided to resist compression stresses induced by flexural moments acting on the member section

3.6
specified compressive strength
compressive cylinder strength of concrete used in design and evaluated in accordance with the appropriate ISO standard, expressed in megapascals (MPa)

Note 1 to entry: Whenever the quantity f_c' in under a radical sign ($\sqrt{f_c'}$), the positive square root of numerical value only is intended, and the result has units of megapascals (MPa).

3.7
confinement hook
hook (3.22) on a *stirrup* (3.46), hoop, or *crosstie* (3.11) having a bend not less than 135° with a six-diameter (but not less than 75 mm) extension that engages the *longitudinal reinforcement* (3.32) and projects into the interior of the stirrup or hoop

3.8
confinement stirrup
closed *stirrup* (3.46), *tie* (3.49) or continuously wound spiral

Note 1 to entry: A closed stirrup or tie can be made up of several reinforcement elements each having *confinement hooks* (3.7) at both ends. A continuously wound spiral should have a confinement hook at both ends.

3.9
corrosion
gradual removal or weakening of metal from its surface that requires the presence of humidity and oxygen, and is helped by the presence of other materials

3.10
cover
thickness of concrete between surface of any reinforcing bar and the nearest face of the concrete member

3.11
crosstie
continuous reinforcing bar having a 135° *hook* (3.22) at one end and a hook not less than 90° at least a six-diameter extension at the other end

Note 1 to entry: The hooks should engage peripheral longitudinal bars. The 90° hooks of two successive crossties engaging the same longitudinal bars should be alternated end for end.

3.12
deformed reinforcement
steel reinforcement that has deformations in its surface to increase its bond to the concrete

Note 1 to entry: The following steel reinforcement should be considered deformed reinforcement in this document: deformed reinforcing bars, deformed wire, welded plain wire fabric, and welded deformed wire fabric conforming to the appropriate ISO standards.

3.13
design strength
product of the *nominal strength* (3.35) multiplied by a *strength reduction factor* (3.47)