
Structural intervention of existing concrete structures using cementitious materials —

Part 4: Jacketing

*Intervention structurelle sur les structures en béton existantes
utilisant des matériaux cimentaires —*

Partie 4: Chemisage





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Foreword

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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 document 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).

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A list of all parts in the ISO 5091 series can be found on the ISO website.

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

As a repairing and strengthening method, attaching of cementitious material layer to surface of existing concrete structures has been widely accepted. Since the cementitious layer does not have enough tensile strength, tension reinforcement is generally placed in the cementitious layer. There are two types of attaching way. For the first way, the cementitious layer is attached either on top surface or bottom surface of horizontal concrete members, especially slabs, while, for the second way, the cementitious layer is attached to jacket vertical concrete members, especially columns. There has not been any ISO standard on design, execution and maintenance for this method with attaching cementitious layer. The ISO 5091 series serves as the first ISO standard for the intervention by attaching cementitious material layer with tension reinforcement inside.

At the same time, the ISO 5091 series is the first ISO standard developed for a specific intervention method, which conforms to the umbrella code, ISO 16311, especially ISO 16311-3 and ISO 16311-4.

The ISO 5091 series consists of four parts. ISO 5091-1 provides the issues common to all three parts, while ISO 5091-2, 3 and 4 provide the issues specific to each attaching way of cementitious material layers.

The jacketing is cases of intervention in which the jacketing method is used to repair or strengthen concrete structures such as reinforced concrete bridge piers damaged by seismic actions. When a damaged concrete structure is repaired or strengthened using the jacketing method, the status of damage such as concrete cracking and spalling are grasped through a prior investigation and crack injection or sealing, patching repair and other measures are taken in advance as necessary.

The ISO 5091 series can serve as a practical standard for construction industry, such as client, design consultant and general contractor, to apply the structural intervention with externally attached cementitious layer. Additional technical information, which is not provided explicitly in the ISO 5091 series, needs to be provided in each application case with consideration of the provisions of the ISO 5091 series.

Structural intervention of existing concrete structures using cementitious materials —

Part 4: Jacketing

1 Scope

This document specifies the standard requirements regarding design, construction and maintenance to be applied for structural intervention using the jacketing method, which places reinforcing materials such as reinforcing steel or fibre-reinforced polymer (FRP) grids around the periphery of existing concrete column or beam and jackets these members with cementitious materials.

This document specifies structural intervention of existing concrete structures using cementitious materials design and execution principles, and strategies for defects and on-going deterioration including, but not limited to:

- a) mechanical actions, e.g. fatigue, impact, overloading, movement caused by settlement, blast, vibration, and seismic actions;
- b) chemical and biological actions from environments, e.g. sulfate attack, alkali-aggregate reaction;
- c) physical actions, e.g. freeze–thaw, thermal cracking, moisture movement, salt crystallization, fire, and erosion;
- d) reinforcement corrosion;
- e) original construction defects that remained unaddressed from the time of construction.

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 5091-1:2023, *Structural intervention of existing concrete structures using cementitious materials — Part 1: General principles*

ISO 22966, *Execution of concrete structures*

3 Terms and definitions

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

ISO and IEC maintain terminology 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
jacketing**

method in which additional cementitious materials and associated reinforcement are added to the periphery of the existing concrete member to increase its strength, stiffness and/or ductility

Note 1 to entry: It is applicable to columns, bridge piers, rigid-frame pier beams, etc.

**3.2
bonding product**

material, such as a primer or adhesive, that is applied to bond concrete and mortar

Note 1 to entry: The grouting material for bonding concrete and reinforcing material is also included in this term.

**3.3
filling material**

material injected to fill the gap between a reinforcing material, such as intermediate penetrating tie, and concrete

**3.4
intermediate penetrating tie**

reinforcing member, generally made of steel or fibre-reinforced polymer (FRP), that is installed inside the drilled hole and glued into the concrete substrate to improve the ductility and shear strength of bridge piers

**3.5
reinforcing material**

steel or FRP material used to sustain, restore or improve the mechanical performance of a structure

**3.6
polymer hydraulic cement mortar**

hydraulic composition made cementitious materials and fine aggregate modified by the addition of a polymer

**3.7
FRP grid**

resin-impregnated FRP reinforcing materials formed into a grid shape

4 Investigation of existing structure

4.1 General

The investigation of the existing structure for which to consider intervention using the jacketing method shall be conducted as set forth in ISO 5091-1:2023, Clause 4.

When an earthquake-affected structure is repaired or strengthened using the jacketing method, the status of damage to that structure shall be studied in detail.

4.2 Investigation

4.2.1 Investigation using documents, records

An investigation using documents, records, etc. shall be conducted in accordance with ISO 5091-1:2023, 4.2.1.

Details of the materials used in the target existing structure and the structural specifications shall be understood from the design documents created at the time of construction, the design documents for the intervention work performed before the consideration of intervention.

4.2.2 On-site investigation

The on-site investigation on the existing structure shall be conducted in accordance with ISO 5091-1:2023, 4.2.2. Specifically, an earthquake-affected structure shall involve studying the status of damage caused by the earthquake in detail.

In the structural performance evaluation based on the appearance changes, the grades of structural performance shall be established on mechanical grounds taking into full consideration the degree of each graded appearance change and the impact of the changed region on structural performance. Appearance changes can be classified into the following three grades.

- Grade I: No or minor damage
- Grade II: Moderate damage
- Grade III: Severe damage

The mechanical resistance of the change region should be classified into the following four levels.

- Level a: Resistance remaining intact
- Level b: Slightly degraded resistance
- Level c: Significantly degraded resistance
- Level d: No resistance

5 Intervention design

5.1 General

In the intervention design using the jacketing method, a rational structural plan shall be formulated, and structural details shall be established based on that plan so that the structure after intervention fulfils the required performance throughout the remaining design service life.

When an earthquake-affected structure is repaired or strengthened using the jacketing method, it is necessary to take appropriate measures for the members damaged by the earthquake first. The intervention plan shall be considered.

5.2 Structural plan

In the intervention plan using the jacketing method, the intervention method shall be selected, taking into consideration the structural properties, materials, construction method and restrictions, maintenance method, economy to ensure that the required performance is fulfilled under the environmental conditions of the structure, factoring in the structure's importance.

In the design phase, it can be considered that the public safety requirements regarding the spalling off of the jacketing part and other public disaster risks for users of the structure, third parties, etc. are met if the requirements set forth in [8.3](#) are met.

5.3 Structural details

In intervention using the jacketing method, structural details shall be determined so as to ensure the integrity between the existing members and jacketing parts.

The members to be repaired or strengthened using the jacketing method, the range of intervention, the arrangement of reinforcing materials around the periphery of the existing members, the thicknesses of reinforcing material covering and jacketing material, etc. shall be established appropriately so that the performance requirements of the structure are met.