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Commentaries

Revision point of Specifications for Highway Bridges and Revision summary of Part3 Concrete Bridges

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Keywords: Specifications For Highway Bridges, Concrete Bridges, Revision Outline, Maintenance, Hybrid Structure, External Cable, Composite Girder

In order to assure safety and durability of road bridges for a long term, structural redundancy and effectiveness of maintenance need to be considered in initial design and construction stages.

Revision of specification of highway bridges in 2001 aimed at facilitation of introduction of newly acquired idea regarding to design rationalization and sophistication of design. The revision included clarification of performance required by performance based specification and change in format of the provisions.

New revision includes attention to maintenance from initial design stage and reflects new knowledge which has been acquired from investigations, researches, experiences since the previous revision and major disasters recently experienced in Japan. The revision of the Part3 Concrete Bridges of the Specifications includes introduction of requirements which corresponds to adoption of newly developed structure and aims at improving durability.

Major revisions are as follows:

(1) Inclusion of new provisions which states fundamental policy of design should include effectiveness of maintenance in addition to easiness of maintenance
(2) New provision that states design of bridges should include maintenance methods planned to be carried out during the service. Equipments necessary for the maintenance also should be coordinated in the design of bridges.
(3) New provision that states structural design should consider possibility of disastrous failure such as collapse due to damage of a part or parts of bridges
(4) New provision that states records of study, design, construction, quality control and so on which are used for maintenance carried out during service should be maintained
(5) Revision of provision regarding design seismic waves and rapid restoration after earthquakes, which reflects results of analysis of actual damages highway bridges have suffered recently from disasters such as the Great Tohoku Earthquake

Major revisions the Part3 Concrete Bridges of the Specifications are as follows:

(1) Inclusion of new provisions that states general requirement regarding safety and durability of connection between different materials in hybrid structure
(2) New stand-alone provision of structure using external cables to enhance provisions regarding external cable arranged with large eccentricity
(3) Enhancement of provisions to improve durability from construction viewpoint
(4) Revision of connection between girders and deck slab to rationalize design of composite bridges
(5) Inclusion of provisions regarding application, allowable stress, bending radius and so on of high yield reinforcement bar such as SD390 and SD490 which was added to the general part of the specifications

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Technical reports

Repair Performance of Re-injecting of $LiNO_2$-containing Solution and Grout into Incomplete Grouting Area and Its Example of Application to an Actual PC Bridge

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Keywords: incomplete grouting, antifreezing agent, corrosion, repair, $LiNO_2$, re-passivation, execution

INTRODUCTION

In some PC Bridges, incomplete groutings, like poor procedures, poor mixtures and so on, formed the voids in the post-tensioning duct. The PC tendons suffered corrosion damages due to chloride ions invaded into the voids in the area spraying antifreezing agent in winter season. The authors proposed re-injecting of $LiNO_2$-containing solution and grout as a countermeasure against the voids and corrosion of PC tendons. In this paper, The experiment with concrete specimens to verify repair performance of this new method and its example of application to an actual PC bridge are introduced.

FLOW OF NEW METHOD

1.Injection of solution containing $LiNO_2$ into incomplete groutings area in sheath
2. Holding of solution containing $LiNO_2$
3. Removing solution containing $LiNO_2$
4. Injection of grout containing $LiNO_2$

In the process of No.2, re-passivation of PC tendons occurs by the penetration of NO_2^- into the rust.

REPAIR PERFORMACE OF NEW METHORD

Fig.1 shows the polarization resistance of new method using $LiNO_2$ and existing method (re-injection of normal grout) in the experiment using rebar corroded by solution containing Cl^-. The corrosion rate of new method is smaller than existing method. Furthermore it is confirmed the amount of macrocell corrosion of new method is smaller than existing method.

APPLICATION TO AN ACTUAL PC BRIDGE

The authors applied new method to an actual PC bridge shown in Photo.1. Two PC cables corroded by antiflreezing agent like Photo.2. Re-passivation of the cable is confirmed by measure of potencial shown in Fig.2. It takes about 10 minites with 40% $LiNO_2$ solutions. After the procedure, re-injection of grout containing $LiNO_2$ is executed and it is confirmed that the void is grouted very near to anchorage.

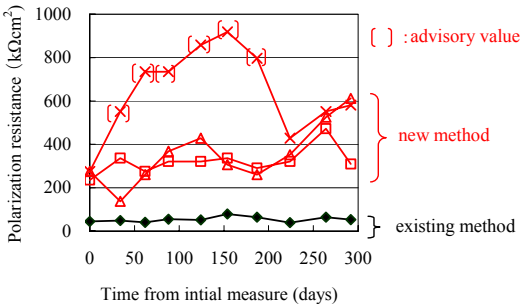

Fig.1 Polarization resistance of new method and existing method

Photo.1 The PC Bridge applied new method

Photo.2 Corrosion of PC cable

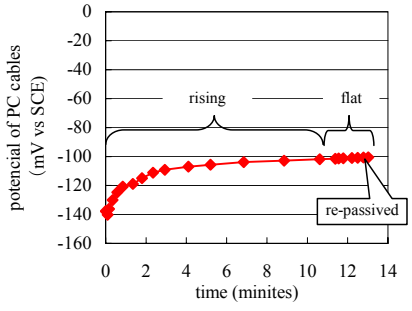

Fig.2 Potencial of actual PC cable re-passived by holding of solusion containing $LiNO_2$

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Construction records

Structural Design and Construction of a High-rise Building using Concrete Filled Tubular Column with Fc150N/mm^2 High-strength Concrete and 780N/mm^2 class High-strength Steel

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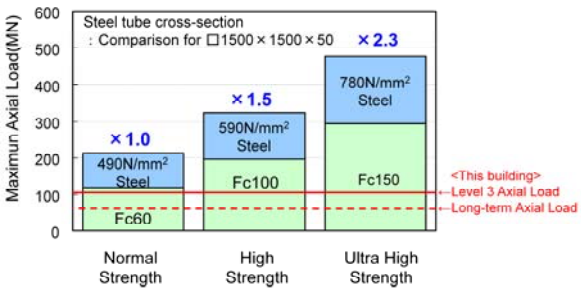
Keywords: high-strength concrete and steel, concrete filled tubular column, pumping-up method, expansive additive

Ultra high-strength concrete filled tubular (CFT) columns have been developed and applied for high rise building of 200m height, which is under construction in Otemachi town, a major business district of Japan. This CFT column is constituted of high-strength concrete with specified standard strength Fc150N/mm^2 and high-strength steel material with tensile strength of 780N/mm^2. In lower stories of this building, generous continuous space between 3,600 m² forest created on artificial ground at the first floor and the concourse of the Metro was required as an underground plaza which attains station strengthening of subway 5 adjoining stations. This developed CFT columns enable the construction of large atrium with few columns in lower stories where high loads are applied.

The paper is intended first to provide the outline of development of the ultra-high-strength CFT column and second to provide the structural design and construction of the high-rise building using the CFT columns.



The maximum axial load of the ultra-high-strength CFT column is 2.3 times than that of the ordinary strength CFT column, so it has an extremely high axial load bearing capacity.

Fig.1 Comparison of axial load resistance of CFT columns

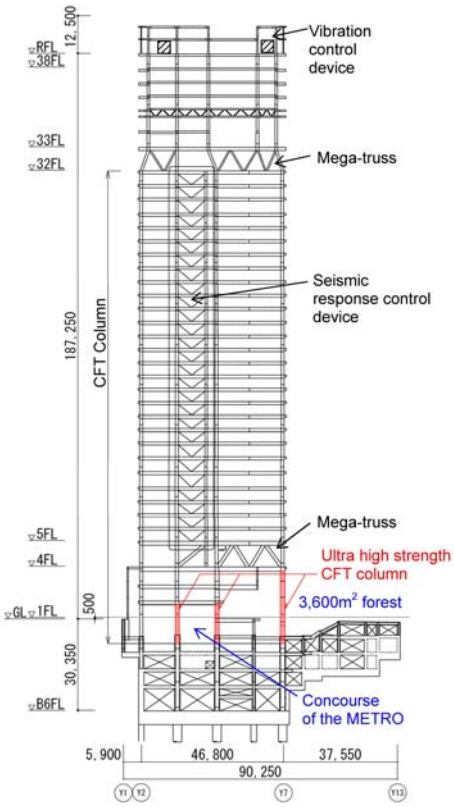


Fig.2 Framing elevation

Left: The slump flow and the air content tests of Fc150N/mm^2 concrete. Right: Concrete inside the steel tube has been pushed up by pumping-up method.

Fig.3 Fc150N/mm^2 high-strength concrete

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