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Commentaries

Overview of Revision of "Recommendation for Mix Design and Construction of Self-Compacting Concrete" published by JSCE

Noboru SAKATA[*1], Toshiharu KISHI[*2] and Masahiro OUCHI[*3]

Keywords: self-compacting concrete, self-compactability, flowability, resistance to segregation, mix-design, manufacturing, construction

"Recommendation for Mix Design and Construction of Self-Compacting Concrete" was published by Concrete Committee of Japan Society of Civil Engineers (JSCE) in March 2012. It is a revised edition of "Recommendation for Self-Compacting Concrete" published in 1998.

The subject of this recommendation is high-fluidity concrete with self-compactability, which is supposed to require no vibrating compaction. "Self-Compacting Concrete (SCC)" is defined as concrete in which resistance to segregation is sufficient despite of its high fluidity and the fluidity shall be indicated by slump flow value in this recommendation.

There are two components in this recommendation: "General Requirements" for performance verification and "Standards" for specification following the same concept as that of "Standard Specifications for Concrete Structures" set up by JSCE. The standards contains chapters on "Mix-design Standards," "Production and Construction Standards," and newly edited "Inspection Standards" including "Testing Methods" related to SCC specified by JSCE. In addition, there are four chapters of "Examples of application of SCC both in and outside Japan," and "Durability of SCC," "Examples of application of moderate-fluidity concrete (high-fluidity concrete requiring vibrating compaction)," and "References" as "Material Data."

Main revised items are as follows:

1. Procedure of mix-design: Ranking of self-compactability shall be fixed according to conditions of the structure like minimum spacing of reinforcing bars at first (Table 1) and then type of SCC (powder-type, combination-type, or viscosity agent-type) shall be fixed following materials in use and mix-design method.

2. Mix-design shall be carried out based on each characteristic value obtained from the test result.

3. Poly-carboxylate type of superplasticizer is treated as the main one for SCC in the examples of mix-design and adjustment. Another type of poly-carboxylate type of superplasticizer to which viscosity agent is pre-mixed is newly mentioned.

4. Two types of allowable lateral flowing distance of SCC are specified according to condition of construction: 8 meters or less in principle into spacious area, and 15 meters or less in principle into small cross-sectional area by long-distance one-way casting.

Table 1 Ranking of self-compactability according to condition of structure

Ranking of self-compactability	Approx. minimum spacing of reinforcing bars	Main subject type of structures
1	35 to 60 mm	Structures with confined zone of reinforcing bars or with deformed formwork/complicated shape
2	60 to 200 mm	Ordinary RC structures or steel-concrete composite structures
3	200 mm or more	Mass concrete structures with small amount of reinforcing bars or plain concrete structures

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Technical reports

On present state of demand and supply for aggregates in Kinki region, and drying shrinkage of mortars made of them.

—Report by Kinki affiliate “Research study committee on aggregates for performance evaluation-concrete”—

Yoshiteru OHNO, Koji KATAOKA, Tomoji KUMANO, Shinichi TAKAMI and Takayuki FUMOTO

Keywords: dry shrinkage strain, fine particles, composite model, elastic modulus of aggregate, dry shrinkage of aggregates

In JCI Kinki, “Research Study Committee on Aggregate for Performance Evaluation-Concrete (chairman : Yoshiteru OHNO ; professor emeritus at Osaka University)” had been set up for three years since 2009. In the committee, a research group and an experiment group were organized. In the former group, current status of demand and supply for aggregate in Kinki region has been assessed, while the effect which is wielded to drying shrinkage of concrete made of typical aggregate has been evaluated experimentally in the latter.

In the research group, we assessed the present state of demand and supply for aggregate in Kinki by conducting a survey in the form of a questionnaire and statistical. Accordingly, it turned out that supply-demand for sea sand still remains, and it of Kyusyu origin consists one-quarter of all fine aggregates, though the amount of aggregate for concrete tends to decrease. As to use rates, reduction of crushed-stone is small, 90% of all coarse-aggregate contents still use it (Fig.1). Crushed sand is rather increasing to 42% of all fine-aggregate contents (Fig.2). In Kinki, coarse aggregate is almost enough, but fine aggregate is not. From now on, higher accurate investigation is expected.

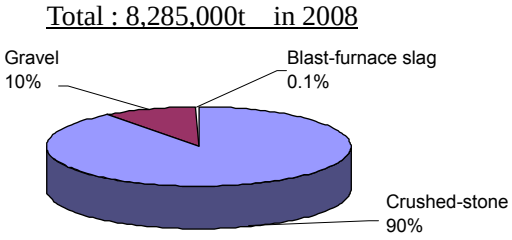

Fig.1 Coarse-aggregate content used in ready-mixed concrete plant

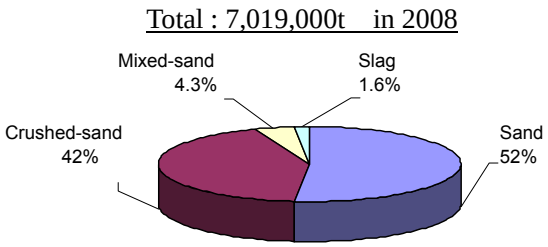

Fig.2 Fine-aggregate content used in ready-mixed concrete plant

In the experiment group, we experimentally considered drying shrinkage of mortar and concrete made of general aggregate currently used in Kinki region. Then we especially analyzed the effect of fine particle, even as demonstrated that drying shrinkage amount of mortar differs according to types of aggregate, its origin, and with or without of particles (Fig.3). We demonstrated that apparently increase of paste volume should be considered, along with pore structure due to subsistent of fine particles. Furthermore, we examined the method which can easily estimate drying shrinkage strain and elastic modulus which is input property values of aggregates for composite model focused as approximation process for drying shrinkage strain of mortar and concrete.

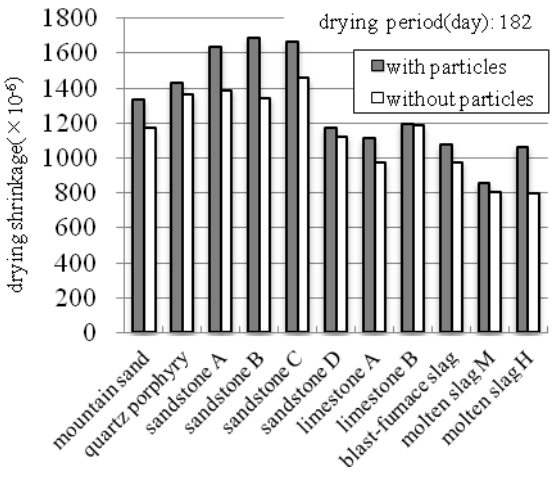

Fig.3 Drying shrinkage strain

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Construction records

Adoption Case of Precast Concrete Product in Oyama Dam Construction Work

Hazumu OKAMOTO[*1], Futoshi KOBAYASHI[*2], Atsushi SUZUKI[*3] and Tuyoshi KATAYAMA[*4]

Keywords: Oyama dam, precast, high-place work reduction, gallery, elevator shaft, spillway, downstream slope change of the dam

Because the dam construction extends over a long period of time, early-stage operation is one of ongoing challenge in Japan where a lot of natural disasters exist. Under construction of Oyama Dam (Japan Water Agency) in Akaishigawa Chikugo River aimed at the flood control, conservation of river environment and stabilization of vested water-intake, and new water for domestic, completed the dam body concrete placement in December 2010 through the temporary preparation work, base excavation work and construction of the dam body which started in 2007. As the main body construction, the safety control was a most important item in the pressed work stage at that time for reducing the high-place work in overhanging structure and the shape change unit of dam. In Oyama Dam, precast concrete is adopted in various places including precast concrete adoption from the original design and also in a part where inclination in the dam downstream changes, as for example (Photograph 3). Adoption part of the precast concrete of the dam body is shown, as follows. (Photograph 1, 2)

1) Horizontal gallery in dam body
2) Elevator shaft
3) Extended part of orifice flood spillway bottom of inlet
4) Extended part of emergency flood spillway bottom of inlet
5) Slab part of orifice spillway
6) The part where downstream inclination changes
7) Extended part of wheel guard of dam crest road and bridge railing
8) Dam crest bridge

The disassembly work reduction countermeasure of high places and the process securing by mitigation of the critical path were able to be achieved by precast concrete adoption in the Oyama dam. In public construction in recent years, the use of a precast concrete product is one of the effective methods to enable the division of labor of the construction site and the factory. It is one of the techniques for demonstrating the effect of the business at the early stage safely.

Photo-1 Precast concrete adoption part in the downstream side

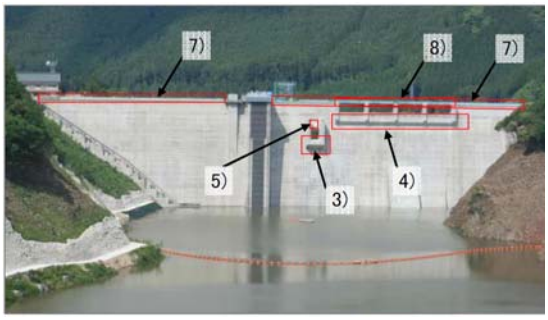

Photo-2 Precast concrete adoption part in the upstream side

Photo-3 Precast concrete adoption part in the downstream side

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Construction records

Construction of a high durable apartment building by Precast-Prestressed Concrete Structure on isolated systems

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Keywords: high durability, high accuracy, Precast-Prestressed Concrete Structure, crimp joint, construction in tiered

Precast concrete members (PCa) is durable, that it is high quality and high accuracy can be mentioned as a feature. Here, we report on the construction of this building using PCa members, was joined by crimping pre-stress. This matter is a 10-storey apartment building in a small block. A precast prestressed construction method (hereinafter referred to as PCaPC) has been adopted for designability by finishing touches of concrete, ensuring high durable, shortening the construction period, and realizing the environment. Construction of the member is in the floor over the seventh floor, was constructed by the shape of the tiers for the small block. Joint of PCa member, use the prestressing steel bar, and was joined by crimping pre-stress.

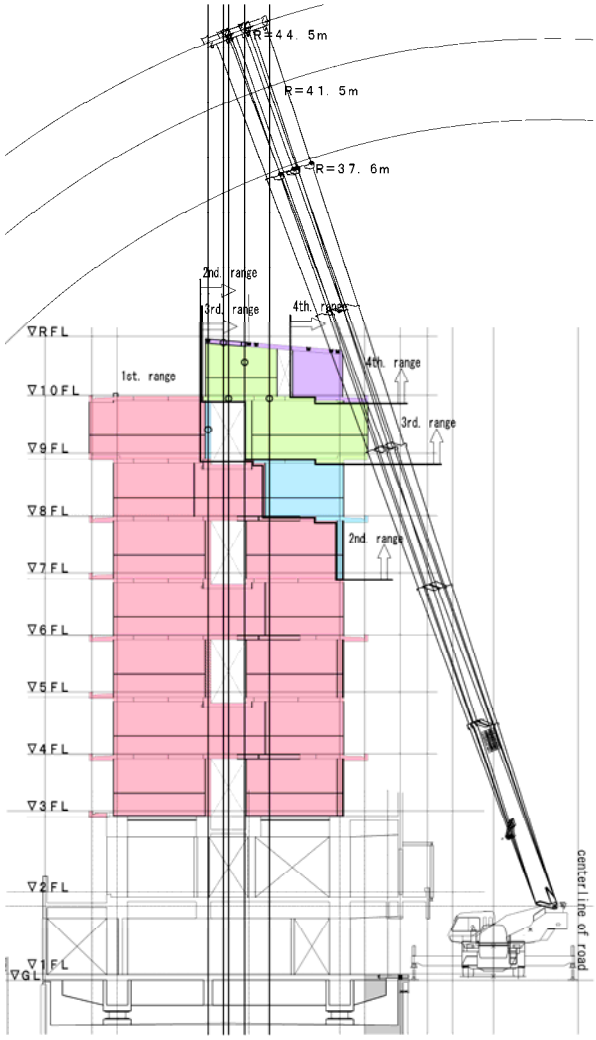

Fig.1 Construction in tiered

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