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Outline of revision of Japanese Industrial Standard for cement quality

Makihiko ICHIKAWA*1, Hiroshi OMORI*2, Hiroyuki ANZAI*3

Keywords: Portland cement, Portland blast-furnace slag cement, Portland pozzolan cement, Portland fly-ash cement, Ecocement, cement quality


In these revisions, the overall provisions were reexamined in a periodical review, and some provisions concerning production methods were deleted because they do not fit in the diversification of production technologies since the previous revision.

Brief descriptions of the revisions are as follows:

1 Deletion of clauses for cement production process
   • The clauses for the cement production process in the old standard were deleted, and the composition of cement was more clearly defined. (JIS R 5210 through JIS R 5214)

2 Clarification of cement composition
   • It was allowable to add minor additional constituents (limestone powder, blast-furnace slag, fly-ash and high-siliceous pozzolanic material) in high-early and ultra high-early Portland cement of up to 5 percent by mass in the same way as in ordinary Portland cement. (JIS R 5210)
   • It was allowable to add limestone powder in normal Ecocement of up to 5 percent by mass. (JIS R 5214)
   • Two types of composition were defined for blended cement: “Portland cement and admixtures” and “clinker, gypsum, minor additional constituents and admixtures”. (JIS R 5211 through JIS R 5213)
   • The quality specifications for minor additional constituents were revised as follows: “limestone shall contain at least 90 percent of calcium carbonate and at most 1 percent of aluminum oxide,” “the use of granulated blast furnace slag for concrete specified in JIS A 6206 is allowed, and the degree of basicity is changed from 1.4 to 1.6 or higher,” and “only Type I and Type II fly-ash specified in JIS A 6201 should be used”. (JIS R 5210 through JIS R 5214)

3 Revisions of chemical requirements
   • The maximum content of sulfur trioxide in ordinary portland cement was changed from 3 percent to 3.5 percent. (JIS R 5210)
   • The maximum ignition loss of ordinary Portland cement, high-early Portland cement, ultra high-early Portland cement, normal Ecocement, Portland blast-furnace slag cement, Class A Portland pozzolan cement and Class A Portland fly-ash cement was changed from 3 percent to 5 percent (JIS R 5210 through JIS R 5214).

4 Revisions for Ecocement (JIS R 5214)
   • The measuring method for the ratio of insoluble chloride ion in water was newly specified for Ecocement in the Annex. A column headed “percentage of remaining chloride ion” was added to the standard form for the test result table.
   • The note on the use of normal Ecocement stating that “reinforced concrete using high strength concrete and high fluidity concrete is excluded for the use” was deleted.

5 Reporting
   • It was required that the range of content of admixtures in blended cement be shown in the remarks column in test reports. (JIS R 5211 through JIS R 5213)

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Keywords: JCI, Basic Technology, Concrete Pump, Pumping Method, Guideline, Explanation

1. Introduction
In order to construct better concrete structure, it is necessary to consider each basic technology, the concrete quality and the concrete pumping method. Japan Concrete Institute organized the research committee of concrete pump construction technology in research committee of basic technology. Japan Concrete Institute published 「The Guideline 2009 of Concrete Pumping Method and Explanation」 at June 2009, and hold workshop at July 2009.

2. Background of the publication guidelines
(1) A specialist division of labor due to lack of cooperation in construction and construction supervisor.
(2) The number of accidents has increased due to lack of coordination of Concrete Pumping work.
(3) Concrete pumping boom is damaged, breakage, by the fatigue fracture.
The guideline offers the engineer in the actual construction of concrete pumping information and practical reference for these problems.

3. Outline of guideline
「The Guideline 2009 of Concrete Pumping Method and Explanation」 is constructed in six chapter.
(1) First chapter: General Provisions
In the first chapter, as a general rule, said that the case illustrates the standard for concrete pump used to transport concrete guidelines in this field.
(2) Second chapter: Regard for safety • environment
In the second chapter, the Pumping is a priority along with safety, stated that it must be done to reduce the load on the environment.
(3) Third chapter: Pumping plan
The construction management is a skill in conjunction with pumping, concrete pumping and set the appropriate models, and to determine whether the feed system, and to ensure that the quality of the concrete after pumping. Away from work safely and to prepare and to not damage the quality of the concrete.
(4) Forth chapter: Plan of construction
Pumping skilled workers, according to pumping plan, safer, and that the work that must be done without harming the quality of the concrete pumping and the like.
(5) Fifth chapter: Control of pumping works
Construction administrator, according to pumping plan, to secure and manage the work and doing so does not compromise the quality of the feed system and concrete.
(6) Sixth chapter: Response of trouble
Trouble when the accident occurred, construction administrator, corresponding with the cooperation of skilled workers and officials from pumping.

4. For quality and securing of safety(features)
This guideline has four features.
(1) Clarifying roles
(2) Concrete pumping load calculation diagram
(3) Criteria for the selection of pipe and splicing
(4) Standard values of slump loss

5. Conclusion
Pumping in the construction, the main work is done at the end of the hose. The accidents have increased due to breakage of the boom in decrepit concrete pump. However workers can’t work under the boom can never get away, should strive to secure safety and quality of Concrete Pumping Method.

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Quality Assessment of Ready Mixed Concrete by Constructor

Hideaki TANIGUCHI*,1, Masanori HIGUCHI*1, Manabu FUJITA*1 and Hirotaka KAWANO*2

Keywords: ready mixed concrete, aggregate, compressive strength, Young’s modulus, autogenous shrinkage, drying shrinkage, coefficient of thermal expansion

Since the quality of the ready mixed concrete is considerably in each concrete plant different, the constructor should accurately understand several information of the concrete. This report describes the quality of the ready mixed concrete from public works constructor's standpoint based on the results of the plant investigation and the examinations of concrete used aggregates of various places.

As a result of the plant investigation, the distribution of water content, cement content and water-cement ratio in a standard mixture of factory was confirmed as shown in Fig.1. The water content, the cement content and the water-cement ratio on the concrete of 8cm in the slump value were greatly in each plant different. The concrete of water content which exceeds value (175kg/m³) standard as maximum provided by JSCE standard specifications concrete for construction exists. The concrete of about 30% in the water-cement ratio exists even if specified design strength is 40N/mm².

The examination was targeted in compressive strength, Young’s modulus, autogenous shrinkage, drying shrinkage and the coefficient of thermal expansion of concrete. The aggregates of 31 places were used. On a low strength region, the quality of the aggregate exerted the influence on the compressive strength. The experimental value of Young’s modulus had the range of ± 30% for a standard value.

Test result of concrete shrinkage is shown in Table-1. There exists a relationship between the quality of the aggregate and the shrinkage of concrete. The minimum and the maximum of autogenous shrinkage are about three times different. The drying shrinkage of the mixture for RC has the tendency which grows compared with the mixture for PC. However, drying shrinkage is influenced easily from mixture by the aggregate. The drying shrinkage had something about the twice different though mixture is the same.

![Fig.1 Investigation result of mixture of ready mixed concrete](image)

**Table.1 Test result of concrete shrinkage**

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Autogenous Shrinkage</th>
<th>Drying Shrinkage</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>PC</td>
<td>RC</td>
</tr>
<tr>
<td>Cement</td>
<td>High Early Strength</td>
<td>Ordinary</td>
</tr>
<tr>
<td>W/C(%)</td>
<td>40</td>
<td>55</td>
</tr>
<tr>
<td>Age(day)</td>
<td>28</td>
<td>162</td>
</tr>
<tr>
<td>Average</td>
<td>183</td>
<td>531</td>
</tr>
<tr>
<td>Minimum</td>
<td>74</td>
<td>392</td>
</tr>
<tr>
<td>Maximum</td>
<td>241</td>
<td>788</td>
</tr>
</tbody>
</table>

PC: Mixture of Concrete used for Prestressed Concrete Bridge, RC: Mixture of Concrete used for Reinforced Concrete Structure

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Technical reports

Compressive Behavior of Joint Mortar in Ultra High Strength Precast Concrete Columns

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Keywords: joint mortar, precast, high strength concrete, compressive strength

A compression test for concrete-mortar-concrete specimens has been developed to investigate the compression behavior of the joint mortar between two ultra-high-strength precast concrete columns (Fig.1). A method for estimating the compressive strength from the strength values of constituent materials is proposed (Fig.2). Long-term loading tests confirmed that the joint mortar remains stable over a long period of time even under high stress. The compression test was also used as a joint mortar strength control test for a practical building (Photo 1). The test results indicate that the newly developed test can be used to obtain reliable strength test results under accuracy conditions of specimen fabrication and precise loading.

Fig.1 Concrete-mortar-concrete specimen

Fig.2 Failure mode

Photo 1 Fabrication of specimens

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Keywords: base isolation retrofit, occupied state, top-down construction, wire saw, hydraulic rock and concrete splitter, expansive high-fluidity concrete

The 40-year-old annex building of Ministry of Economy, Trade and Industry (METI) was seismically strengthened by installing base isolators under the existing mat foundation (Fig. 1). The building was occupied and operated around the clock, seven days a week. The base isolation retrofit construction of an occupied building requires minimizing the building vulnerability, impact on brittle elements and the settlement of the building during and after construction. The sequence of operations, the temporary lateral strengthening and selection of the cutting method of existing piers were very important issues.

As the bottom of the existing foundation was 13.35m below the ground level, deep excavation around and under the existing building was required to install base isolators under this building. The resistance of the building to the lateral forces was extremely diminished due to the deep excavation. Top-down construction method was adopted so as to keep almost the same resistance to the horizontal force during construction. The sequence construction began with retaining wall installation, and then the excavation around the building. After the excavation to each sub-grade level, the temporary slab was constructed to connect the retaining wall and the existing basement wall. This temporary slab at each basement floor worked as the lateral bracing and supported the building.

The existing building was supported caisson foundation piers with large diameter. Fig. 2 shows the transfer sequence of the building load from the existing pier to the newly installed base isolator. In this process, about 2,000 m$^3$ concrete was demolished and removed in total. To minimize the noise and vibration due to the demolition, the wire saw method was used to cut off the large part of piers. Then the hydraulic rock and concrete splitter and the giant breaker were used to break this block cut off into small rubble.

As the diameter of base plates for isolators were very big, expansive high-fluidity concrete was used to minimize the possibility of void developing under the base plate due to bleeding of concrete. A concrete placing test using full scale model was carried out to confirm the effect.
Construction records

Rationalization of the countermeasures for the salt damage under the earthquake strengthening of reinforced concrete piers of the Seisyo-Bypass Toll Road

Osamu SANADA*1, Mayuko TAKAGI*2, Hiroshi YANAGISAWA*3 and Takehiro KAMAMOTO*4

Keywords: salt damages, flying salt, grading of re-bar corrosion, critical density of chloride ion

Flying salt and dash of saltwater is causing salt damages of road bridges along the Pacific coastal areas.

To start the earthquake strengthening project for the Seisyo-Bypass Toll Road after 37 years since the opening in 1971, proper measures for the salt damages were required.

In this report, we proposed the rational countermeasures for salt damage of reinforced concrete piers based on the amount of salt penetration, grading of corrosion in the steels by destructive investigation on a part of head of piers, estimation of the reaching process about the corrosion volume of steels, and, the fix of new critical density of chloride ion for the growth of corrosion in the steels.

Fig. 1 Consideration flow

Photo.1 Condition of location

- Detailed investigation
- Estimation of the reaching process about the corrosion volume of steels
- Grading of corrosion of steels and the fix of new critical density of chloride ion for the growth of corrosion in the steels
- Rationalization of the cutting the surfaces and the formation of a rust-proofness atmosphere

Photo.2 An example of corroded re-bar diagnosed with grade III to IV

Fig. 2 Average density of chloride ion in within each corrosion grade and local critical density of chloride ion for the growth of corrosion of the re-bars

Fig. 3 Effect due to this institutive technique

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Osaka City's waterfront area provides numerous trade functions at Yumeshima and logistics facilities at Sakishima. The Yumesaki Tunnel is being constructed to link the 2 districts to facilitate the smooth flow of transport, increase the volume of container cargo and other port-related freight for the benefit of the people involved in the increasingly advanced and diversified port activities at Yumeshima (Hokkou Minami District) and Sakishima (Nankou District).

Composite member made of steel and concrete are adopted in the bottom of sea part of the Yumesaki Tunnel. The steel board is exposed to the road side in the carriageway area in the tunnel. To prepare for the fire accident in the tunnel, the fireproofing protection was given in the roadway part. This paper reports the specification and the construction technique of the fireproofing protection.

**Fig.1 Arrangement of fireproofing protection**

**Fig.2 Fireproof board installation situation**

**Fig.3 Shotcrete concrete installation situation**

**Fig.4 Finished photograph of YUMESAKI TUNNEL**

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**Keywords:** steel-concrete composition structure, fireproofing protection, fireproof interior board, fireproof mortar

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