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*Commentaries*

# Outline of Revision of JSCE Recommendations for Concrete Pumping - 2012

## —Overview of transitions and key points of the Recommendations—

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and Shin-ichiro HASHIMOTO[*5]

Keywords: concrete pumps, recommendations for construction, pumping, concrete pumping pressure, mechanical efficiency, working efficiency, safety management, pumping plan, pumpability

## 1. Introduction

The Recommendations for Concrete Pumping -2012 by Japan Society of Civil Engineers (JSCE) was published in June 2012. These recommendations prescribe pumps for transporting concrete and methodologies for placing concrete. The recommendations are the second revision. This report provides an overview of history and changes of these Recommendations up to the present and key points of this revision.

## 2. History of Recommendations

The original "Recommendations for Concrete Pumping" was enacted in 1985 and the first revision was completed in 2000. The first revision sold over 300 copies in 2010 which was second only to the Standard Specifications for Concrete Structures -2007. It has been more than ten years since the publication of the first revision. The concrete pumping method presented in that revision one of the most important basic techniques in order to construct better concrete structure.

The pumpability for concrete and the need for evaluation of trial mixes for pumpability had not been changed since the first revision. The recommendations consisted of the guidelines for concrete pumping methods and referenced state-of-the-art report of the latest technology and techniques on concrete pumps.

## 3. Key Points of New Recommendations

The original and first revision dealt primarily with the rigid pipeline. In the second revision "New Recommendations", both rigid and flexible pipelines are discussed. The second revision addressed the following five points not addressed in the first revision:

1) The unification of the technical terminology and the adjustment of the text and the commentary language of the second revision to be consist with the Recommendations for Practices of Placing Concrete by Pumping Methods by Architectural Institute of Japan (AIJ) and the Guideline 2009 of Concrete Pumping Method and Explanation by JCI in order to engineers and workers engaging in pumping concrete.

2) The improvement of description for security and the environment.

3) The revision of the selection method for number and the type of the pump considering the mechanical efficiency for delivery rate of pump and the working efficiency for delivery rate of pumping on several construction stages as shown in Table 1 and Table 2.

Table 1 Mechanical Efficiency

| Sort of aggregate | Slump (cm) | Piston Pump | Squeeze Pump |
|---|---|---|---|
| Normal aggregate | 6-11 | 0.65-0.70 | |
| | 12-17 | 0.70-0.90 | 0.75-0.90 |
| | 18-21 | 0.85-0.90 | 0.85-0.90 |

Table 2 Working Efficiency

| Sort of menber for pumping concrete | Derivery by one truck agitator | Derivery by two truck agitators |
|---|---|---|
| Slab | 0.56 | 0.85 |
| Beam | 0.50 | 0.75 |
| Column and wall | 0.45 | 0.65 |
| Jonit and PC structures | 0.40 | 0.40 |

4) The placing of booms to support the pipeline which receives the discharge from the concrete pump. It prescribes materials for cleaning and grouting the entire pipeline before concrete placing begins, and improvement of description for placing concrete with a flexible hose nozzle hanging vertically to the horizontal floor on site.

5) The text and the commentary language were revised according to the Standard Specifications for Concrete Structures -2007, Materials and Construction.

## 4. Conclusions

The purpose of the second revision was to provide construction pumping recommendations that are safer and more appropriately with consideration for the environment. The recommendation also attempts to minimize misunderstand and disagreement across the competent authorities private companies' engineers, contractors' engineers and workers engaged in the pump method of construction on a real construction site, while preserving the thought and purpose of the first and original recommendation

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*Technical reports*

# Basic study on the design and construction of cementitious materials used for the low-level radioactive waste disposal

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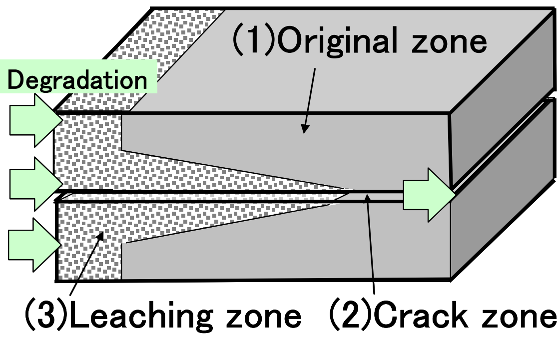
Keywords: Radioactive waste, Sub-surface disposal, Low diffusion layer, Cracks control, low leaching

This report presents the design and construction of cementitious materials used for the low-level radioactive waste disposal, in terms of the required performance and techniques. Especially from the viewpoint of system performance, long-term durability (e.g. over 10,000 years) of cementitious materials needs to be further investigated. In order to quantitatively verify the design requirement on the low diffusion layer: the leakage speed should be reduced by controlling the diffusion of radionuclides, we determined to use a diffusion coefficient as an index for the verification because it is considered as the simplest way to numerically indicate the diffusion performance of members. We deemed the diffusion coefficient of the layer can be verified by the overall equivalent value which is related to an area ratio of healthy portion to other domains that changed in state due to deterioration.

Healthy cementitious materials has a performance of constraining the diffusion migration of dissolved radioactive substances. However, the performance is only expected under the conditions of retainable physical shapes and dimensions and controllable cracks to the allowed extent. The propositions to sophisticate the engineered barrier using cementitious materials are; whether we can build, at practical level, a cementitious materials structure with fewer cracks over an extended period of time in the ground, where no maintenance is provided; whether we can incorporate the long-term durability performance into the safety assessment by kinetically verifying alteration or deterioration of the cementitious materials properties. Scientifically and technically overcoming these tasks on cementitious materials structures will enhance the reliability of the engineered barrier, which is important to dispose of radioactive waste safely and economically.

The results of this report are summarized in the following.

1. First shows the quantification of (1) diffusion coefficient, (2) cracks, and (3) cement leaching evaluation as shown in Figure.1, and verifies the long-term performance of the low diffusion layer by studying the quantificational data comprehensively.
2. Based on results of the performance comparison indoor testing and the additional review testing, a mix for the low diffusion layer was selected: a high-fluidity mortar made from low-heat portland cement, fly-ash, expansive admixture and fine limestone powder. In addition, various kinds of property such as strength characteristics, adiabatic temperature rise amount, dry shrinkage and autogeneous shrinkage were determined, and the property was confirmed to be within the range of the assumption.
3. As a full-size testing, a model of the practical construction environment was built in 100 m depth of an underground test cavern in disposal. From the test results, the following items were studied and verified, and then the initial performance was determined: construction performance during the work, compressive strength, static elastic modulus, void structure, effective diffusion coefficient, and crack control effect.
4. The existing technique to predict the cementitious materials cracks in the curing process was also applicable for the low diffusion layer made from non-rebar mortar. The result indicates that crack control for the layer can be evaluated on these systems.




If cementitious materials are used as a barrier component, the influence of leaching and crack generation must be considered.

Fig.1 Concept of diffusion coefficient

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*Technical reports*

# An Attitude Survey on Diagnosis of ASR-affected Structures

## —First-year activity of JCI-TC115FS "Research Committee on Diagnosis of ASR-affected Structures"—

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Keywords: alkali-silica reaction, diagnosis, attitude survey, mitigation methods for ASR

It is well accepted that the current mitigation methods for against alkali-silica reaction (ASR) established in 1986 by Ministry of Construction, MOC (now MLIT), give a certain level of effectiveness. On the contrary, it has been pointed out that the current mitigation methods have a limitation to mitigate ASR-induced deterioration by specific kinds of reactive aggregates. In order to judge the necessity for modification of the current mitigation methods, statistic understanding of the extent of ASR damages and their reasons in real structures whether those are expected from traditional knowledge or not are important. However, diagnosis of ASR-affected structure is scarcely carried out and it is difficult to know how much percentage of damaged structures is out of expectation from current mitigation methods.

In Japan, the survey of ASR-suspected structures is mostly made for maintenance purposes. For this purpose, only judgment of the reason whether ASR or not and the estimation of crack propagation are the major concerns but not for diagnosis of the reasons. Some engineers believe that it is possible to judge the reasons as ASR from crack patterns but some experts insist it is difficult only from appearances but possible by petrographic investigation using optical microscope. There are discrepancies of recognition on ASR diagnosis.

In such situations, some entities have been applying their original mitigation methods while petrographic method is not included. Therefore, there remains some possibilities of further deterioration by overlooked mechanism.

With the above-mentioned backgrounds, JCI-TC115FS, Research Committee on Diagnosis of ASR-affected Structures, has started its activity since 2011. As the first-year activity, an attitude survey was carried out in order to investigate the recognition of concrete engineers in regard to current mitigation methods and diagnosis of ASR-suspected structures.

As one example of attitude survey results, Fig.1 shows the attitude of concrete engineers, whether mitigation methods for ASR in newly constructed concrete structures should be tightened or not. More than half of concrete engineers recognize that the strict precaution should be applied for important structures whereas about 25 % of engineers think that prevention of ASR is difficult and exceptional ASR can be accepted. This result implies that the mitigation methods to minimize ASR risks should be classified according to importance of the structure. For cost-risk analysis, statistic analysis based on the actual situation of ASR damage of the structure is also required.

On receiving the results of this survey, this committee was allowed to keep on the activities. The methodology and procedures to diagnose the ASR-affected structures will be reflected by the survey results. Some types of diagnosing flow will be proposed according to the technical level including advanced techniques. In addition, acceptable risk and cost for new mitigation methods for ASR will be discussed.

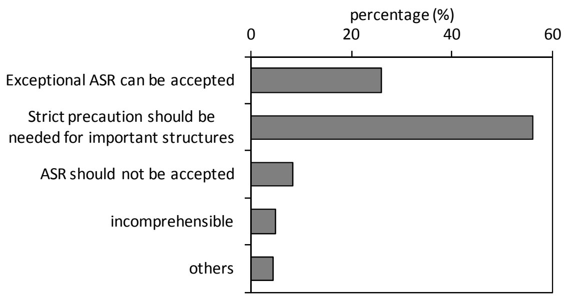


Fig.1 An attitude of concrete engineers to mitigation methods for ASR

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*Construction records*

# Design and Construction of Three-dimensional Open Space Raised Using-ultra High Strength Concrete

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Keywords: Ultra-high Strength Concrete, Fc250N/mm$^2$,Fc100N/mm$^2$,Slender PCa Column, Prestressed Precast Concrete Beam

In urban areas, the number of super high-rise residential building is increasing. The ultra-high strength concrete, with Fc greater than 100N/mm$^2$, had been applied to columns in the lower stories of 40-50 stories buildings where large axial force is imposed. Not only for super high-rise buildings, application of the ultra-high strength concrete be considered for members where high compressive strength is required. Problems such as supporting the weight of the vegetation on the artificial ground, creating an open space and securing the safety of urban open space can be solved simultaneously using a special frame. In this paper, the design and construction method of this special frame that consists of slender precast columns with ultra-high strength concrete (Fc250N/mm$^2$) and prestressed precast concrete beam (T-POP Beam,Fc100N/mm$^2$) are reported.


Fig.1 Ochanomizu Sola City

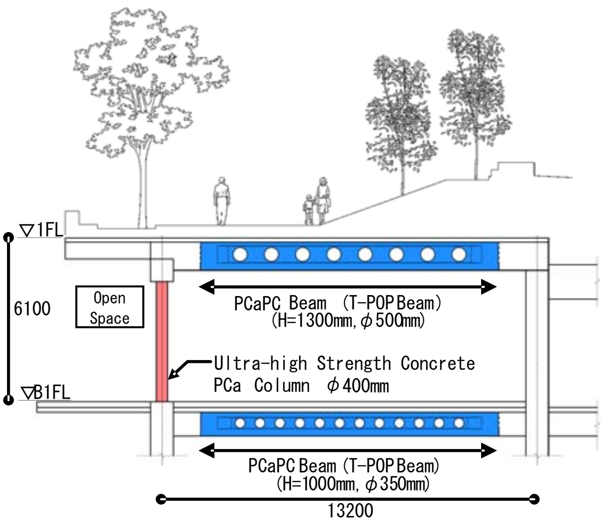


Fig.2 General Structural Framing details below artificial ground

Slender PCa Column (Fc250N/mm$^2$)

Prestressed Precast Concrete Beam (T-POPBeam,Fc100N/mm$^2$)

Fig.3 Allocation of Slender PCa Column and Prestressed Precast Concrete Beam

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