

## Minutes of the First Meeting of Technical Committee on the use of sea water in concrete

■ Date: 13:00 to 15:00, Thu, July 12, 2012

■ Place: JCI Meeting Room 3

■ participants:

Chair: Nobuaki Otsuki

Vice Chair: Hidenori Hamada

Administrator: Nobufumi Takeda, Keiichi Imamoto, Toru Yamaji, Takashi Habuchi, Takahiro Nishida,

Committee member: Yoshikazu Akira, Yoshitaka Ishikawa, Tatsumi Ohta, Tadatsugu Kage, Keizaburo Katano, Kazuya Koga, Tsuyoshi Saito, Takahiro Sakai, Yasuhiro Dan, Kazuto Fukudome, Seiji Funahashi, Eiji Matsuo), Hiroshi Minagawa, Minoru Yaguchi, Hiroshi Watanabe,

Correspondent member: Yutaka Tadokoro

JCI Secretariat: Toru Kawai (Senior Director), Akihiro Kawakami

■ Handouts

1-1 General Meeting Proceedings (*in Japanese*)

1-2 Raison D'etre of Committees Newly Formed in 2012 (*in Japanese and English*)

1-3 Activity Program for Seawater Utilization Committee (*in Japanese*)

1-4 List of Committee Members (*in Japanese*)

1-5 Reference: Long-time Durability of Concrete Produced by Using Seawater as Mixing Water (*in Japanese*)

1-6 Reference: Basic Properties of Self-compacting Concrete Produced by Using Seawater and Sea Sand

1-7 Reference: Development of Concrete Produced by Using Seawater and Sea Sand

1-8 Reference: An Overview of the Commendation of Those Who Have Contributed to Reduce-Reuse-Recycle Movement (Neo Ash Concrete)

1-9 Reference: Lighthouse (Lighted Beacon Construction Works by Japan Coast Guard)

1-10 Reference: Suitability of Seawater for Mixing Structural Concrete Exposed to a Marine Environment (*in English*)

1-11 Reference: Feasibility of Concrete Mixed with Sea Water (*in*

*English)*

1-12 Reference: Concrete Materials with Higher Chloride Resistance (newspaper article from the Nishinippon Shimbun) (*in English*)

1-13 Reference: Concrete Book No. 14: Concrete in Port and Harbor Structures (*in English*)

## ■ Proceedings

### 1. Greeting by the Chair

The Chair, Prof. Otsuki greeted the membership prior to the committee meeting.

### 2. Introduction of the Members

Each member introduced themselves and their involvement in research related to concrete mixed with sea water.

### 3. Activity Plan and Discussion

#### (1) Objectives of this research committee

Prof. Otsuki explained the *raison d'être* of the committee using handout material No. 1-1. He also explained that JCI research committees requested the following issues.

- To collect information on the utilization of sea water not only to mixing water but also to curing water and cleaning water
- To collect information on alkali-aggregate reaction in concrete mixed with sea water.
- To select wide range of members in the committee activities

#### (2) Committee organization and activities (working groups and the scope of activity)

According to handout material No. 1-3, Dr. Takeda (Administrator)

explained each working group (WG) and the group members.

The scope of activities in each working group was also explained using handout material No.1-3. Activities of each working group are as follows:

WG1 (Survey WG) (Leader: Prof.Hamada)

Survey on the examples of concrete mixed with seawater and unwashed sea sand

- 1) Case studies (good and bad examples, examples in other countries), literature reviews of OTARU Port (Hokkaido Prefecture), studies on cement-grouted soil in marine environment
- 2) Survey on the codes and standards in Japan and other countries
- 3) Field survey of existing concrete structures mixed with sea water or sea sand.

WG2 (Evaluation WG) (Leader: Dr. Yamaji)

Evaluation of the properties of concrete mixed and cured with seawater

- 1) Influence of seawater as mixing water and sea sand on concrete properties and steel corrosion
- 2) Influence of seawater as curing water on concrete properties and steel corrosion
- 3) Investigation of the effect of anti-corrosion chemicals on steel corrosion in concrete mixed with sea water

WG3 (Performance Improvement WG) (Leader: Dr. Takeda)

Studies on the improvement of the performance of concrete mixed with sea water and proposal of applicable reinforcing materials

- 1) Investigation of the positive effect of seawater as mixing water in concrete and its mechanism
- 2) Investigation of the effectiveness of corrosion resistant steel and bamboo reinforcements in the case of concrete mixed with seawater
- 3) (Investigation of deterioration prediction and durability verification methods)

WG4 (Construction WG) (Leader: Dr. Habuchi)

Studies on manufacturing and casting methods for concrete mixed with

seawater

- 1) Statistics survey on the amount of water utilization (including seawater) in construction works (mixed water, curing water or cleaning water and so on)
- 2) Investigation of manufacturing process, casting methods, ready-mixed concrete production systems, seawater supply systems and seawater storage systems
- 3) Investigation of the utilization of concrete debris from the Great East Japan Earthquake

#### (4) Schedule

Dr. Takeda (Administrator) explained the schedule for the planned activities using handout material No. 1-3. It was agreed that the next committee meeting would be held in December.

The schedule is as follows:

- |                          |                                   |
|--------------------------|-----------------------------------|
| • July 12, 2012          | 1st general meeting               |
| • July to December, 2012 | WG activities                     |
| • December, 2012         | 2nd general meeting               |
| • March, 2013            | Midterm report                    |
| • March, 2014            | Reporting of committee activities |
| • Autumn of 2014         | Symposium                         |

#### (5) Introduction of research activities

Literature reviews shown in handout material No. 1-5 to 1-13 were explained by each committee member. It was agreed that literature reviews would be continued in connection with those research activities.

#### 4. Free Discussion

Based on the above contents, additional discussions were done. The topics of discussion were as follows;

- Some chemical admixtures for improving concrete properties have been

currently developed in order to use concrete mixed with seawater. What are differences between those new chemical admixtures and the conventional admixtures?

→ The details of chemical admixtures are related to new patents, and then we can't explain the detail information about new chemical admixtures now. When we developed the new admixtures, the effects of seawater as mixing water on concrete properties were considered. There are newly type of chemical additives and modified type based on conventional air-entraining high-range water reducers.

- How did you store fly ash when you use in Neo Ash concrete? The fly ash which you used in Neo Ash concrete has enough activity?

→ In the case of Neo Ash Concrete, newly manufactured fly ash within two weeks was used. So it is considered that the activity level is sufficiently high.

- → In the case of the Philippines, they store fly ash before using it as concrete materials. So we should consider the activity reduction of fly ash due to long-term storage.

- In a survey of ready-mixed concrete producers, some producers said that although it is difficult to manufacture seawater-mixed concrete during the production of the other concrete, there is no problem in producing seawater-mixed concrete on a day-to-day basis. As the final step, the equipment used such as mixers and hoppers is washed with fresh water. Neo Ash concrete is use own equipment designed specifically for that purpose.

- When seawater is used as mixing water, the quantity of water is usually controlled according to the measured quantity of seawater. On the other hand, when NaCl is added in water as an experiment, the weight of fresh water is measured and NaCl used like additional chemicals. In such cases, in view of the composition of seawater, the actual quantity of water is about 3 to 5 kg/m<sup>3</sup> smaller than the case of water with NaCl.

→ We should investigate the calculation method for concrete mixed

with seawater.

- It is believed that the usefulness of seawater-mixed concrete can be shown by evaluating the influence of magnesium contained in seawater. For example, concrete surface finishers contain magnesium, which has the effect of giving viscosity to concrete. It may also be possible to add value to concrete by adding lime to seawater.
- It is decided that we ask overseas correspondents to collect information related to standards, examples of seawater-mixed concrete, etc., in their own countries.

## 5. Discussion in Each WG

### WG1:

- It is agreed that the following tasks will be carried out by the next WG meeting.
  - 1) Collecting and collating the research results concerning Hashima (Gunkan Jima) in Nagasaki City.
  - 2) Collecting and collating information on existing facilities such as lighthouse facilities built with seawater-mixed concrete
  - 3) Drawing up survey and test plans for existing structures
  - 4) Collecting and collating case studies of chloride-induced damage attributable to sea sand in the Okinawa area
  - 5) Collecting and collating other countries' codes and standards concerning mixing concrete with seawater
  - 6) Collecting and collating case studies of ASR-induced deterioration attributable to alkalis from external sources
  - 7) Conducting research on technologies for utilizing magnesium
  - 8) Collecting case studies in other countries of the use of special mixing water other than seawater

It is agreed that the date of the next WG meeting be discussed at a later date so that it would be held sometime in September.

### WG2 & WG3:

- WG2 and WG3 will work together on the first several occasions.

- Working group members are as follows:

WG2: Yamaji (Leader), Nishida, Akira, Ishikawa, Saito, Dan, Yaguchi

WG3: Takeda (Leader), Nishida, Dan, Matsuo, Fududome

- Research is to cover the items listed below, and the research results are to be brought together at the next WG meeting.
  - 1) Fresh properties of seawater-mixed concrete
  - 2) Studies on hardened properties and their mechanisms of concrete seawater-mixed and containing different types of cementitious materials
  - 3) Steel corrosion and chloride penetration in seawater-mixed concrete
  - 4) Long-term properties of seawater-mixed concrete
  - 5) Effectiveness of rust preventive chemicals in seawater-mixed concrete
  - 6) Effects of use of seawater as curing water
  - 7) Studies on corrosion resistant reinforcing bars (epoxy bars, stainless steel bars) and non-ferrous reinforcement (bamboo, FRP)
  - 8) Performance-improving effect of seawater-mixed concrete
- Next WG meeting: 15:00–17:00, September 6, 2012 (in Nagoya [during JSCE annual conference])

WG4:

- In connection with Item (1), the condition at each site or ready-mixed concrete plant is to be roughly estimated in case studies for curing water, mixing water and cleaning water. This will be done with the aim of quantifying the advantages of using seawater as curing water and cleaning water.
- In connection with Item (2), the cautions of real construction of concrete mixed with seawater are summarized by referring to construction records, etc. For that purpose, case studies and literature research are conducted concerning the manufacture and placement of concrete using seawater. For the moment, studies and research will be conducted only in the fields which the WG members are concerned with, and the results will be reported at the next WG meeting. For the purpose of research on cases in other countries, overseas correspondents will be interviewed.
- In connection with Item (3), useful information on seawater-mixed concrete that is not covered by other reports is collected.
- Information such as construction records is collected by the next WG

meeting.

The next WG meeting: 13:00-, September 26, 2012 (at JCI conference room [subject to change])

## 6. Others

Next committee meeting: December, 2012