

## Perspective on concrete research

At the beginning of a new year, the Newsletter Editors try to foresee the short-term research trend on concrete for civil engineering .

In order to understand the recent trend on concrete research, we conducted a survey on the papers presented in JSCE Annual Meetings. The results are as follows:

From 1988 to 2007, 9,381 papers were presented in the concrete engineering sessions of JSCE Annual Meetings. These papers can be classified according to the topics shown in Fig.1.

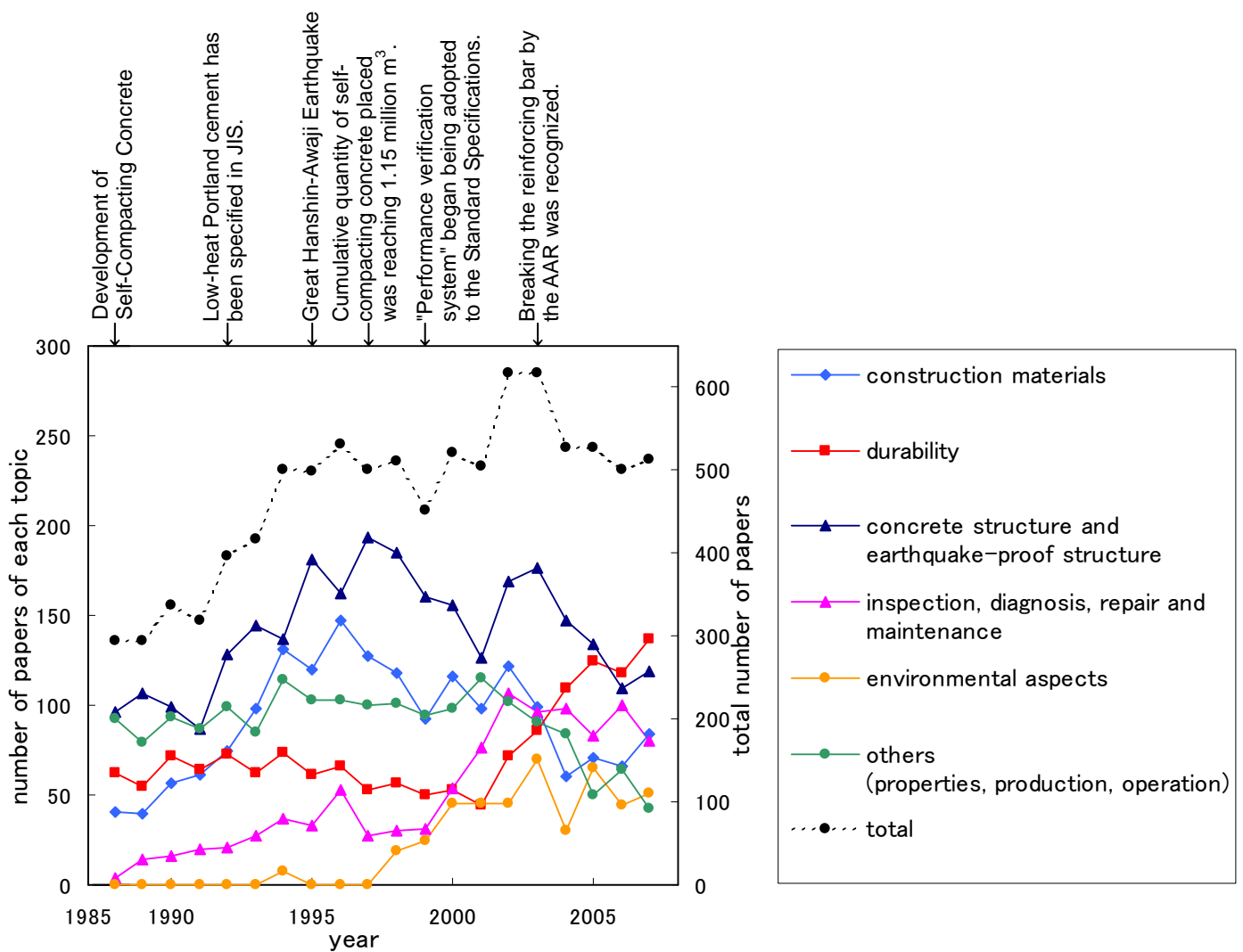


Fig.1 Changes in the number of papers presented in JSCE Annual Meetings

It seems that the trend of changes in the number of papers can be classified into two groups. The first group has the same trend as the increase of total number of papers, as seen in "Construction Materials," "Concrete structure and earthquake-proof structure,"

and "Others." The second group shows a sharp increase for the last ten years, as seen in "Durability of Concrete," "Inspection, diagnosis, repair, and maintenance," and "Environmental aspects."

Our perspective on the 2008 and future research trend in Japan

Construction Materials: The development of self-compacting concrete was one of the most important technological innovations. The research was energetically conducted in the 1990's. By 1997, self-compacting concrete of 1.15 million m<sup>3</sup> (cumulative quantity) was used. Recently, the development of high performance concrete, which used to be the main topic, has shifted to high strength, because of its increased need as a material in buildings. As regards high strength concrete, vapor does not transpire in case of a fire. This means that the fire causes the pop-outs by vapor pressure in the concrete. The improvement of fire resistance was also required with the process of the new technology development. For the high strength and/or high fire resistance, various types of short length fibers have been tested. These R&D works in buildings have affected the R&D activities in Civil Engineering. The editors think that the development of high strength concrete and the studies for utilization of fiber materials into concrete will continue in the field of Civil Engineering.

Durability: The number of papers on this topic increased in the past ten years. Especially, the papers concerning chloride ion penetration and reinforcement corrosion have remarkably increased. In addition, as the failures of re-bar by ASR were found, the number of studies on ASR increased again. The first peak of ASR studies was in the 80's. The papers on durability were divided into two types including research on materials and structural performance.

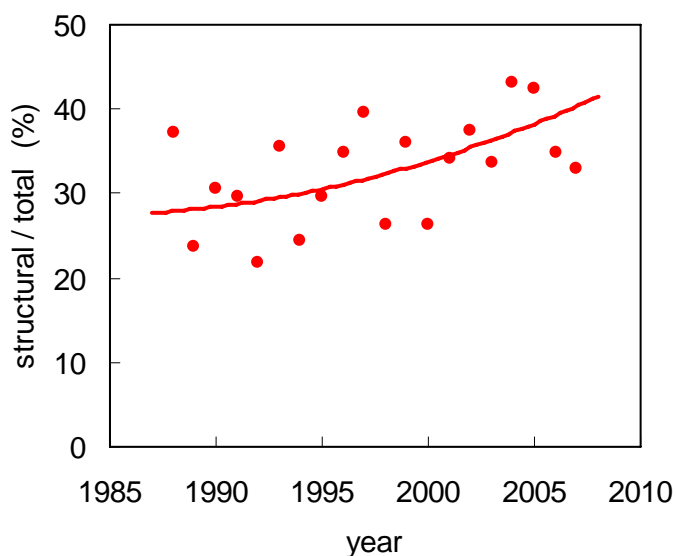


Fig.2 Ratio of structural performance-dealt papers against total number of papers in "Durability"

Figure 2 shows the ratio of structural performance-dealt papers to the total number. From the results, the editors expect that this trend will continue in the future, and also that the research on deterioration by a complex cause, such as combination of carbonation and chloride ion penetration, will be conducted.

Concrete structure and earthquake-proof structure: We have experienced a lot of earthquakes, and Great Hanshin-Awaji Earthquake was one of the most devastating earthquake to hit Japan. After the earthquake, in the late 90's, many research work regarding earthquake-proof structure were reported at the annual meetings. This earthquake also gave an opportunity to revise the JCSE Standard Specifications for Concrete Structures.

Recently, the development of hybrid structures with steel and concrete has been developed to apply to the construction of the new expressways, such as the New Tomei and the New Meishin.

The editors believe that the research on the simulation technique for improvement of earthquake -proof structure will be conducted in the future.

Inspection, diagnosis, repair and maintenance: The number of papers on this topic has been increasing for the past twenty years; remarkably so in the past ten years. The editors think that the research and development in this topic will become more and more important because of the increasing age of existing concrete structures.

Environmental aspects: The research on this topic includes

- recycling and reuse of concrete and reduction of the waste,
- concrete with by-products,
- design of concrete structures from the environmental performance point of view,
- cement and concrete which reduce impact on the environment,
- concrete which improves the natural environment,
- others.

The number of papers on this topic has also increased since the mid-90's. The environmental aspects on concrete and concrete structure are important for the sustainable development of human society and are deeply related to the global environmental issues. Therefore, the editors hope that the research and development in this topic will continue expanding as a responsibility of the concrete sector.