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High Performance Concrete (HPC)

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HIGH PERFORMANCE CONCRETE (HPC)

THE NEED

Normal Strength Concrete (NSC) is heavy and lacks the required workability in some large concrete structures, such as high-rise buildings, bridges, and structures under severe exposure conditions. By increasing concrete strength and performance, the required thickness of concrete members and the cost of concrete structures can both be reduced.

In the U.S., a major move toward HPC is underway, especially in the manufacturing environment of precast concrete. A major demonstration precast concrete bridge is under construction in Texas.

THE TECHNOLOGY

High Performance Concrete (HPC) is the latest development in concrete. It is not just High-Strength Concrete (HSC) and has replaced HSC developed in the early 1980's. HPC can be defined as a concrete made with appropriate materials (superplasticizer, retarder, fly ash, blast furnace slag and silica fume) combined according to a selected mix design and properly mixed, transported, placed, consolidated, and cured to give excellent performance in some properties of concrete, such as high compressive strength, high density, low permeability, and good resistance to certain forms of attack.

THE BENEFITS

The benefits related to HPC include: early stripping of formwork, greater stiffness, and higher axial strength. Therefore, it allows the use of smaller columns. These factors combined lead to construction elements of high economic efficiency, high utility and long-term engineering economy.

STATUS

Several new technologies supporting HPC are on the market now and have been used for several years. In Japan, the definition of HPC combines self-placeable ability, durability and high strength. It is estimated that HPC with these characteristics may be achievable within the next five to ten years. A self-placeable concrete has been developed with the purpose of reducing construction site labor and shortening





construction time (see fact sheet on Self Placing Concrete). Several projects have been successfully completed in Japan, and moreover, precast concrete plants in Japan are preparing to take advantage of this new material to reduce noise from vibrating machines. However, this new and significant technology has not received much attention outside of Japan.

BARRIERS

Current design criteria may not clearly define the properties and usage of HPC. More research is needed in this area.

Compared to Normal-Strength Concrete (NSC), the performance of HPC is more brittle than NSC in regions with high seismic activity. This is due to the greater stiffness of HPC.

In some geographical areas, there is a Lack of suitable strength aggregate required for HPC.

REFERENCES

1. Victor C. Li, "Construction Materials Development and Application in Japan", NMCEE Report No. 95-07, March 3, 1995.
2. Stephen W. Forster, "High-Performance Concrete-Stretching the Paradigm", Concrete International.

REVIEWERS

Peer reviewed as an emerging construction technology

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