

# Building Systems Laboratory

## ●Outline

In our country, there has been a serious problem of decrease of building workers and technicians owing to the aging or the poor working environment representing so-called three hazards such as danger, dirtiness and severe work in construction site.

For this reason, in the building production system, it is a key problem to develop a reasonable technique of building production which has high-productivity and achieves savings of workers and power.

Building Systems Laboratory is aimed to contribute to solve some problems, such as global environmental issues and waste material problems, and to conduct a development research of the economic, highly reliable and rational building production technique.

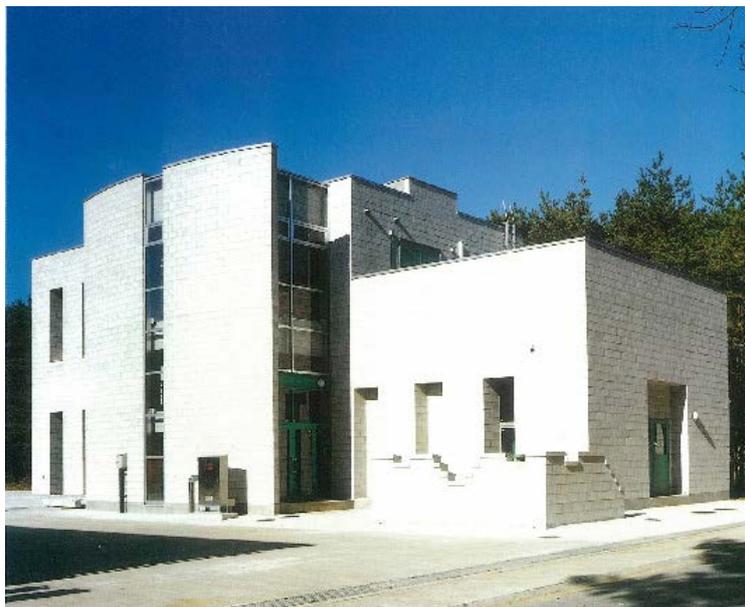
In this laboratory, the researches as below are mainly conducted.

### ■Development of high-quality building materials

In order to establish a rational technique for building production, it is necessary to use the appropriate building materials.

For achieving more rational design and construction, the study has been conducted for the purpose of developing new building materials excellent for strength, durability and workability.

In terms of building and construction (building systems) as well as material development, additionally based on status of usage, the experiments and studies on composition or combination with other materials are conducted.



Building Systems Laboratory



Durability Test Apparatus



Universal Tester



Automatically Construction Robot

### ■Performance assessment of building materials

Developed building materials have to be assessed from the various standpoints. Required performances are different depending on the elements used or the kinds of materials. In this laboratory, the experiments on mechanical performance and durability are mainly conducted.

In particular, for the durability, the testing apparatus, which can extensively and freely set air environment such as temperature, humidity, precipitation, insolation and carbon dioxide, enables the experiments on weatherability of a huge floor or wall members of 2 meters squared. In order to extend building life, these experiments are essential.

### ■Development of construction automation technique

Automation and robotics for construction will gain an important position in future building construction system as well as other production areas. In current situation, for the processes with dangerous and painful works, it is an urgent task that constructing robots will work as alternatives for construction workers.

As the first step for that, an apparatus for automating formwork construction is arranged for studies on construction automation in this laboratory. It is possible to clarify the required performances, such as flow lines or powers of the apparatus. Further, it can be positioned as a basic study for development of construction automation technique.

### ■RM constitution

RM stands for Reinforced Masonry, or “reinforced concrete masonry construction”. RM buildings are constructed with units for masonry called RM units so as to be unified by arranging matrix-like reinforcing bars across the hollow portions of the unit and filling with concrete or the like.

The features of RM are as follows: high-strength, high-accuracy and high-quality of

RM units; achieving RM with the same thickness of wall girder as the bearing wall; improving the construction reliability by using stable factory-production materials; and having the skippable processes, such as demolding formworks, wet curing of concrete and exterior packaging works.

### ■Process of RM development

Since 1979, under the auspices of UJNR (U.S. – Japan Conference on Development and Utilization of Natural Resources), Building Research Institute from Japan side and National Science Foundation from US side dominated the collaborative study between US and Japan with assistance provided by industry and academia.

Masonry construction was selected as the third phase. For five years (1984 – 1988), keeping the merits of masonry construction, the study had been proceeded for the purpose of providing seismic capacity as high as box frame type reinforced concrete construction such that the medium-rise (up to five-story) RM buildings were developed.

Then, in comprehensive technology development project named as “Development of new constructing technologies in building business” conducted by Ministry of Construction from 1991 to 1995, the casting joint method not using joint mortars has been developed for RM with self-stabilizing joint portions.



Extrusion Apparatus



Shearing Test Apparatus



The Construction site of RM building

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