

Future Brick Panel Construction

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1: PREFACE: Significance And Purpose (Japan)

It is obvious that facing of buildings directly affects their appearance, but it largely affects their property such as durability or heat insulation at the same time.

Among many varieties of facing materials, ceramic bricks are popular as high-class facing material with their beauty and excellent durability.

However, failure is the great problem for brick facing, and the prefabricated panel construction was developed for prevention of failure. When followed by skilfull concrete cast, this method gives high bond between bricks and concrete, but it also requires minute expensive molds and careful concrete cast.

Since the Cast Concrete Brick Panel Construction method was evaluated by the Ministry of Construction (Notice 976 - 1978, Ministry of Construction), this study has been developed to improve defects of the Cast Concrete Brick Panel Construction and to spread it from one or two story houses to high-rised buildings.

This paper reports the experimental results about dynamical and physical properties of the exposed test building (two story, reinforced concrete) and its maintenance after long term observation, with expectation of spread and development of brick panel construction.

2. SUMMARY OF DEVELOPMENT

Recently, brick board construction and brick panel construction were largely developed in Japan to improve reliance on brick construction, but the prefabricated brick panel construction requires accuracy in mold works and installation in site. It also requires careful concrete cast and causes more complicated net-work for concrete cast.

There are two main systems of prefabricated panel construction - PC Panel Construction and Cast Concrete Brick Panel Construction. PC Panel Construction has longer history and more examples in Europe, and it was adopted in Japan in 1970s for mass-produced houses or PC curtain wall construction.

The Cast Concrete Brick Panel Construction does not require expert brick-layers and helps the brickwork under shortage of expert layers. There are two methods of the Cast Concrete Brick Panel Construction - the prestressed type which gives tension with PC steel bars, and the reinforced type which composes the panel with reinforcing bars. Brick panels work as outer molds for concrete cast and also as outer walls after concrete cast.

3. SUMMARY OF CONSTRUCTION

In the Cast Concrete Brick Panel Construction, brick panels composed of bricks and mortar are used as outer molds for concrete cast and they form outer walls after concrete cast. It has the following merits:

(1) Labor saving:

As brick panels work as molds for concrete cast and as the outer walls, it does not require facing work or mold dissolution.

(2) Quality control and Inspection:

Brick panels are mass-produced at factory, and their quality is easily controlled. Inspection or cleaing of the finished surface is easy.

(3) Adaptability:

As outer scaffoldings can be eleiminated under sufficient control of construction works, they are quite adaptable for high-rised buildings.

(4) Concrete works:

As it is possible to use low slump concrete or vibrators, it makes concrete works easy.

(5) Property:

With thickness of bricks, the great improvement in heat insulation, sound insulation, waterproof or durability when used for outer walls is expected.

(6) Safety:

The ordinary brick facing has problem of failure, but this method has no such problems, because bricks are united by PC steel bars or reinforcing bars.

4. COMPARISON WITH OTHER METHODS

Recently, prefabricated PC panel construction, prefabricated brick construction or cast concrete brick panel construction were greatly improved to increase reliance on brick masonry and they are now showing many successful examples.

On the other hand prefabricated brick panel construction requires accuracy in mold works and installation in site. It also requires careful concrete cast and causes more complicated net-work in site. This method is accumulation of improved techniques added to the traditional masonry construction methods. Bricks are laid on the horizontal table and mortar is cast into joints to form a panel. Therefore it does not require skilled brick layers. Brick panels are set as outer mold for concrete cast and leave as the outer wall of the building after completion.

Fig. 1 shows the comparison of working process of brick panel construction and cast concrete brick panel construction.

Fig. 2 shows the comparison of site-laying brick construction, prefabricated brick construction and cast concrete brick panel construction. It is obvious that the cast concrete brick panel construction greatly reduces the term of construction compared with other methods.

5. ECONOMICAL EVALUATION

(1) Economization by use of insulation bricks:

- * Light-weight panel
- * Conservation of resources

- * Improved heat insulation
 - * More improved heat insulation by combination of brick panels and insulating materials
- (2) Economization by using brick panels as molds:
 - * Shorter term of construction
 - * Elimination of outer molds for concrete cast
 - (3) Economization by using brick panels as outer walls:
 - * Unity of facing wall and concrete
 - * Decrease of efflorescence
 - * Easy to secure accurate finish
 - (4) Economization in manufacturing panels:
 - * Requires no skilled brick-layers

6. Future Brick Panels

The experiment of this time was done by the two story reinforced building. Our final aim is to use compound brick panels which are light-weight, superior in strength and durability for all kind of buildings.

They can be used as floor panels with sufficient reinforcements or prestressed bars. As in the case of walls, pipes can be placed in the core holes of floor brick panels.

As curtain wall construction, box-shaped brick panels can face columns and beams of the steel structure and form the fire-resistant outer or inner walls.

Bricks panels with superior durability, fire-resistance and beautiful appearance will be competent enough to develop the market. Being comparatively small unit in size, bricks can produce unlimited varieties of color, texture, bond pattern and design, which can fulfil various demands.

Brick panels can be one of the most efficient building materials to supply durable and comfortable houses and buildings with lower cost.

Fig. 1

Comparison of working process of brick panel construction (sheet method) and cast concrete brick panel construction

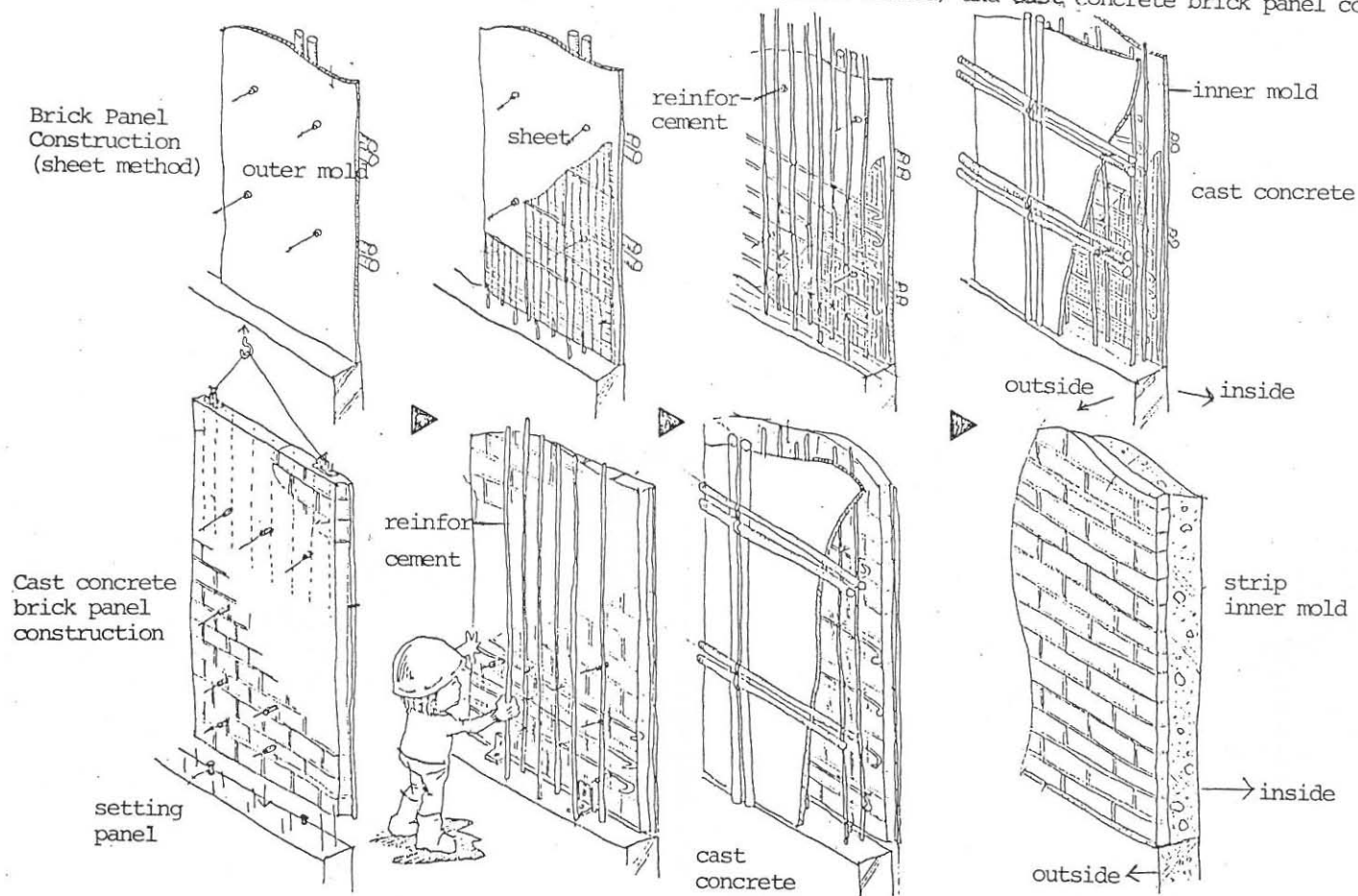
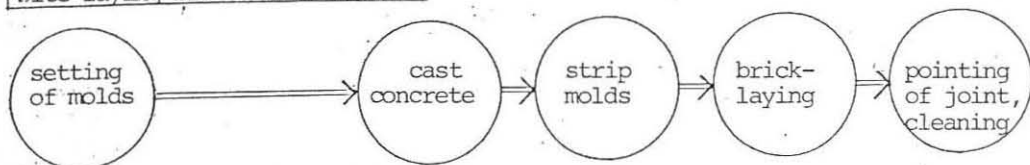


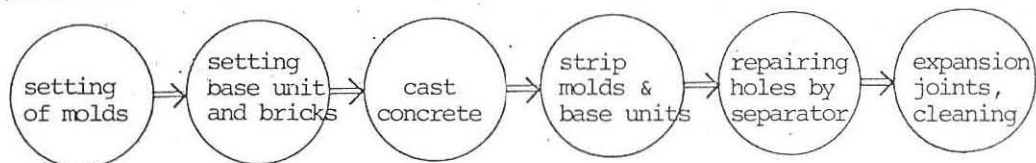
Figure 2

Comparison of working process

Site-laying brick construction



Prefabricated brick construction



Cast Concrete Brick Panel Construction

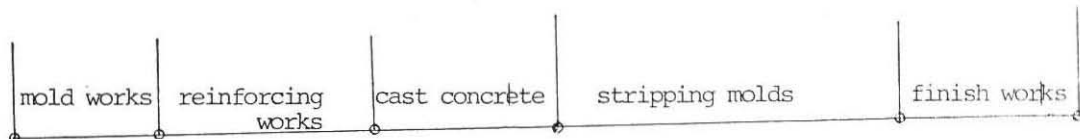
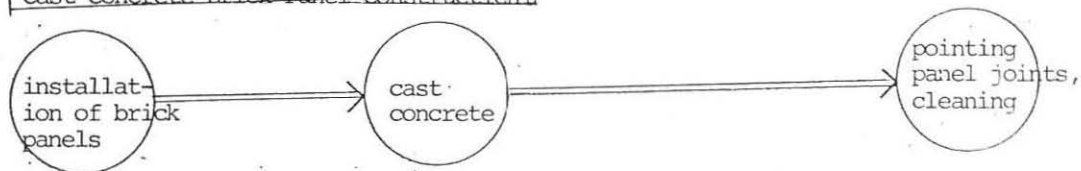


Fig. 3

Flow Chart of Cast Concrete Brick Panel Construction

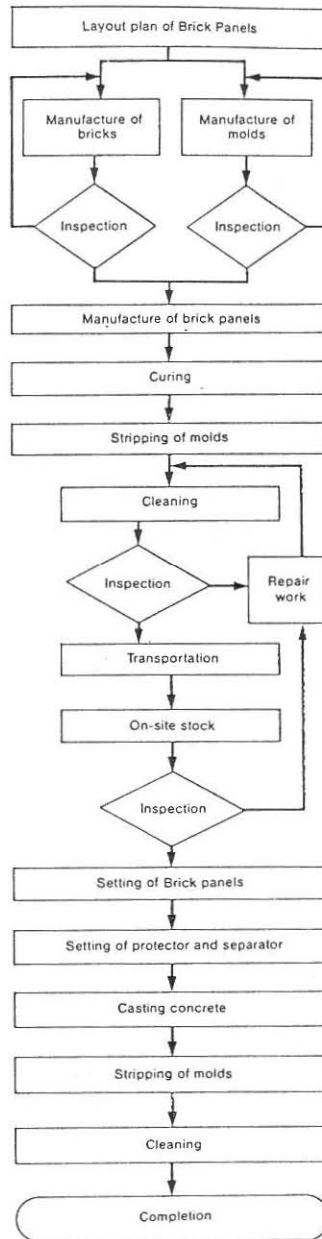
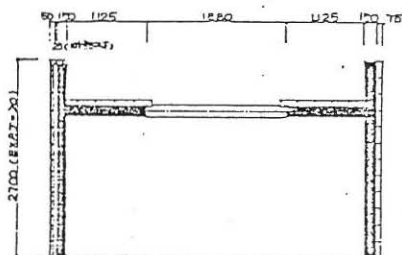
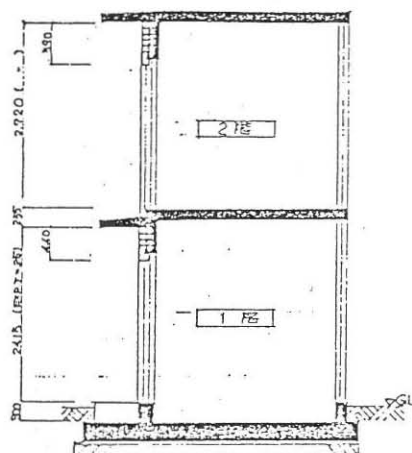


Fig. 4

Exposed test building
(Two-story, reinforced
concrete)



plan of 1f. & 2f



section

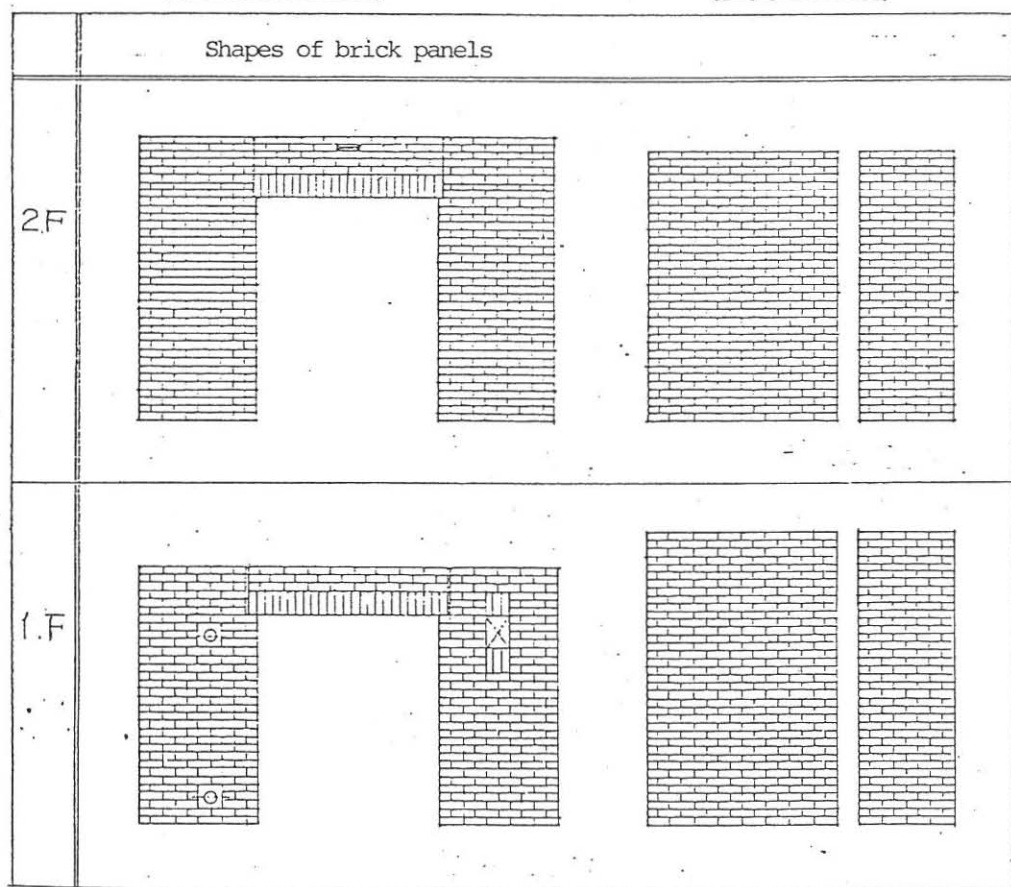
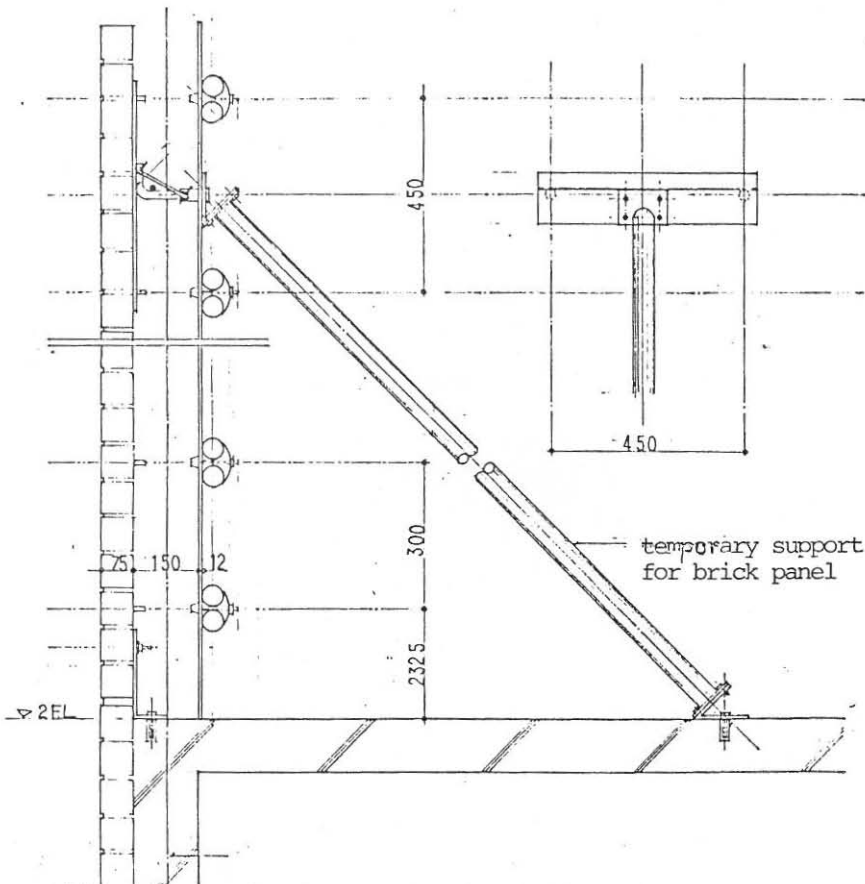
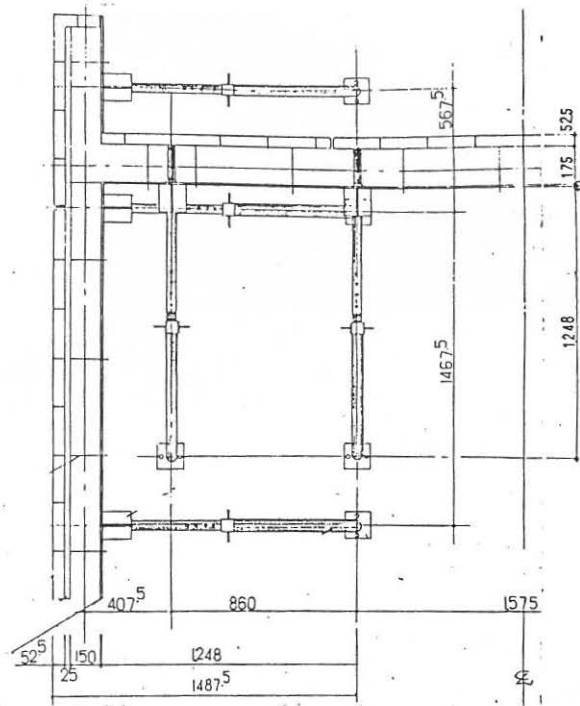


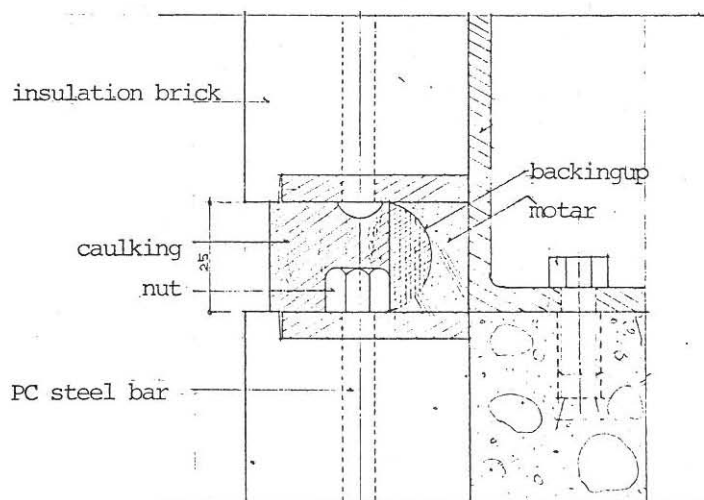
Fig. 5
Plan of the exposed
test house
(2nd floor)



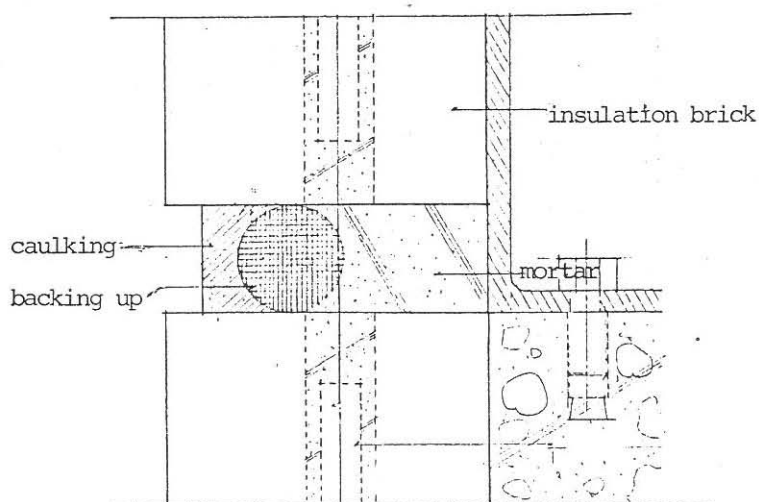
Section (2nd floor)

Fig. 6

Detail of brick panel section



Prestressed Type



Reinforced Type

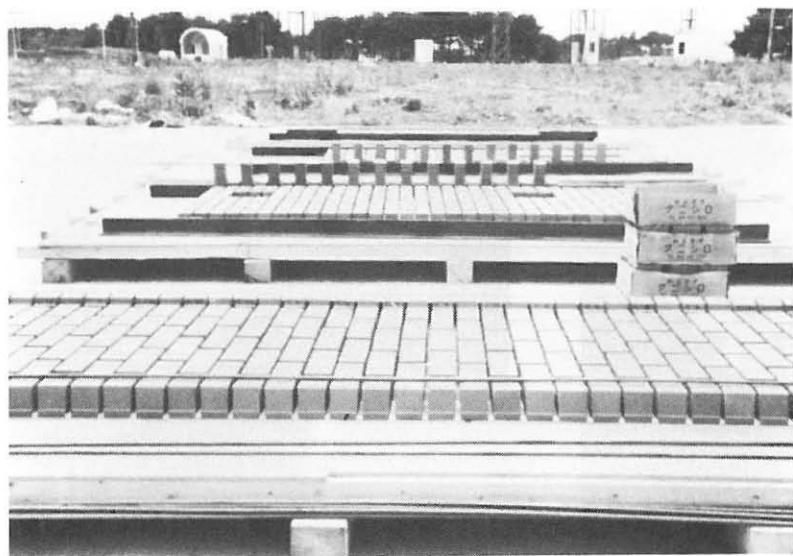


Fig. 7

Laying bricks
for manufactur-
ing panels



Fig. 8

Pour mortar
into joints

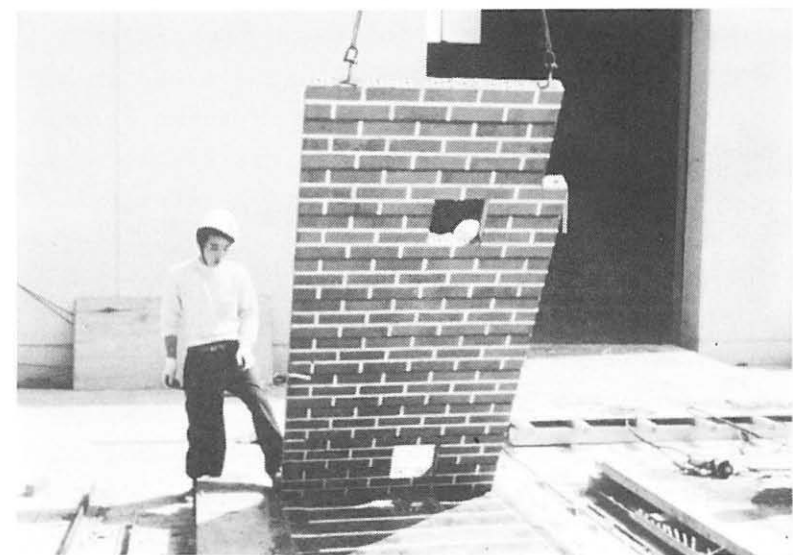


Fig. 9

Completed
panel

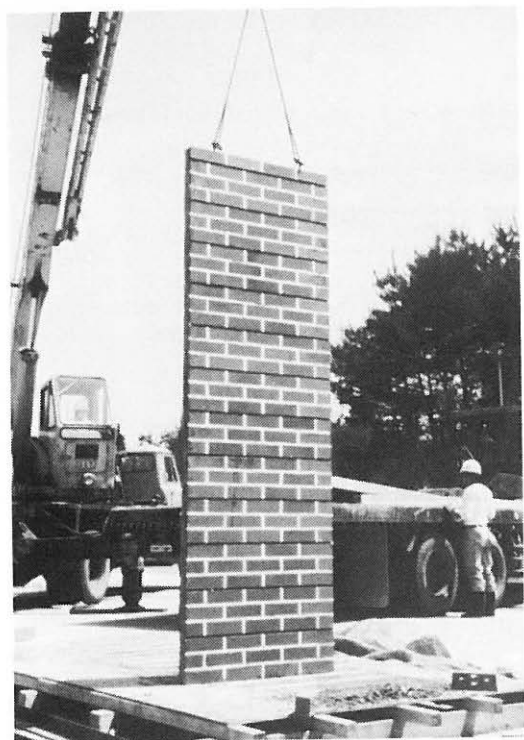


Fig. 10

Hanging panels
by crane



Fig. 11

Installation of
panels and reinfor-
cing work

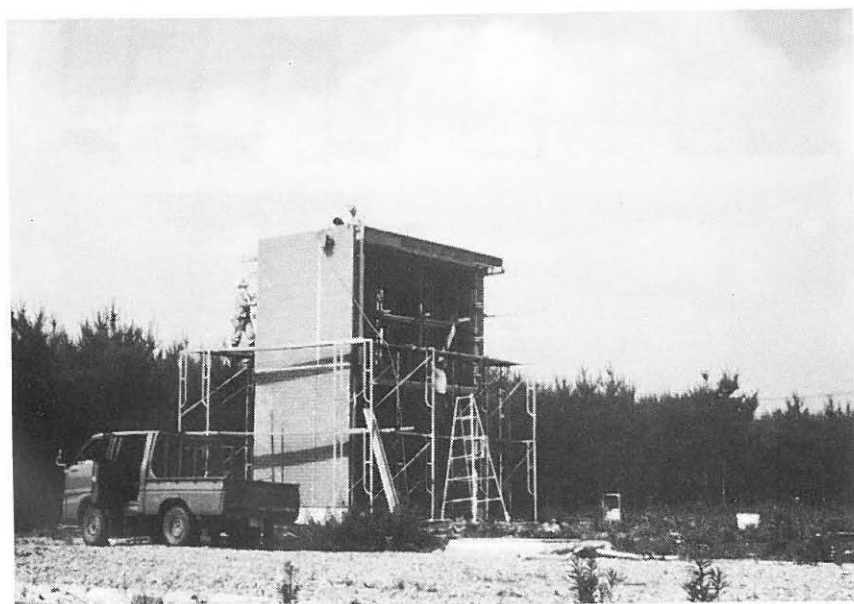


Fig. 12

Completed experimental building