New Products & Technologies

Autoclaved Lightweight Precast Concrete Curtain Wall with Fire Resistant and Drained Joint, "WALL 21"*

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1 Introduction

Pre-cast concrete curtain walls are currently being applied for the exterior of multi-storied buildings because of their aesthetic appearance, reduced installation time, atmospheric durability, and other factors. While existing ordinary precast-concrete curtain walls are generally very heavy and weak at the joints, WALL 21 solves these problems with the use of light-weight porous concrete and a "drained joint system" which has been newly developed. In addition, WALL 21 is designated as one hour fire rating material by the Ministry of Construction (material designation number Wn 1125).

2 Outline of Fabrication Process

WALL 21 is made from super light-weight porous concrete. The materials used for this product are cement, pearlite, quartzite, and a foaming agent. The foam is added to the concrete in advance. The fabrication process is shown in **Fig. 1**, and has the following features:

(1) Since the width and length are standardized for 100 mm modules, the mold is not produced at the individual job site. Standard panels, therefore, are produced using a regular mold.

(2) The concrete is autoclaved at high temperature and pressure, speeding up fabrication, and offers very light weight with superior quality.

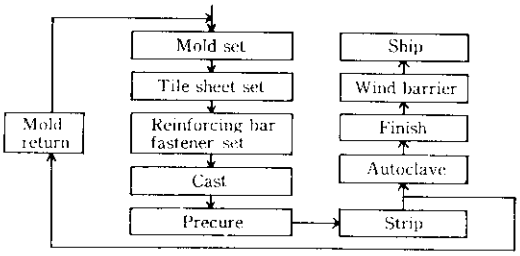

Fig. 1 Production flow chart of WALL 21

3 Summary of Fabrication

3.1 Waterproof Capacity

In waterproofing the panel, a sealing joint (closed joint) is usually used. However, experience indicates that it is difficult to maintain the joint fully closed over long periods of time, the drained joint has drawn attention recently. The construction of the drained joint in WALL 21 is shown in **Fig. 2**. In concept, the drained joint has a mechanism for draining water which enters the joint. The mechanism consists of a rain barrier, wind barrier, and side shape of the panel as shown in Fig. 2.

The waterproof capacity of (WALL) 21 has been demonstrated in a water proof test as shown **Fig. 3** at the General Building Research Corp. in Japan. The test results are shown in **Fig. 4** and **Table 1**. Table 1 indicates test results with the typical specification of WALL 21; no water leakage at the joint was seen. Figure 4 shows the results of a measurement of the difference between the external pressure and pressure within the joint when the opening ratio of the vertical joint is changed. The opening ratio is the ratio of the opening

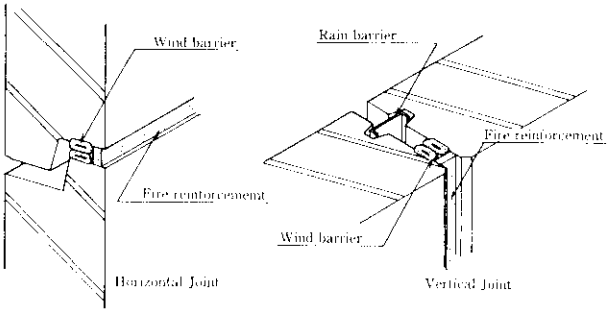

Fig. 2 Joint details of WALL 21

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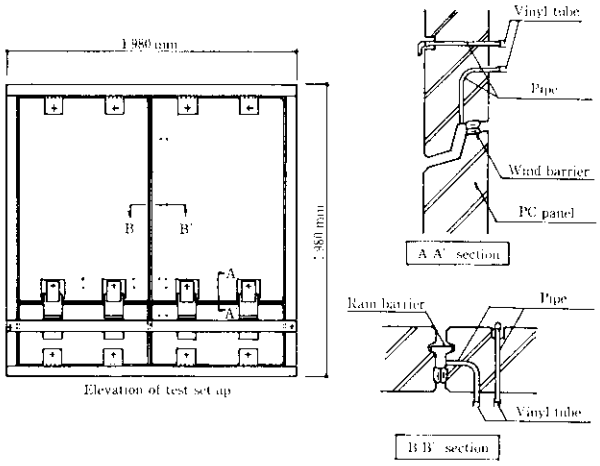

Fig. 3 Test set-up of water tightness test

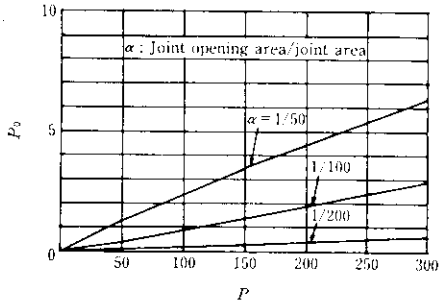

Fig. 4 Effect static wind pressure (P) on the pressure difference between outside and inside of open joints (P_0)

Table 1 Water-tightness test results

Dynamic wind pressure (kgf/m²)	Vertical joint	Horizontal joint
7 ~ 23	No leakage	No leakage
40 ~ 60	No leakage	No leakage
75 ~ 112	No leakage	No leakage
125 ~ 187	No leakage	No leakage
200 ~ 275	No leakage	No leakage

Note 1) Dynamic wind pressure period: 2 sec
2) Water spray: 4 l/min·m²

area of the wind barrier relative to the area of the joint. From these test results, the excellent effectiveness of the stainless rain barrier can be seen.

3.2 Fire Resistance

WALL 21 with almost the same specification as the drained joint has obtained the designation of one hour fire rating material for outside walls. The wind barrier is a silicon sponge gasket with excellent fire resistance and the rain barrier is made of stainless steel with 0.3 mm thickness and thus also functions as a flame barrier. The results of the fire test carried out at the General Bulding Research Corp. are shown in **Fig. 5**.

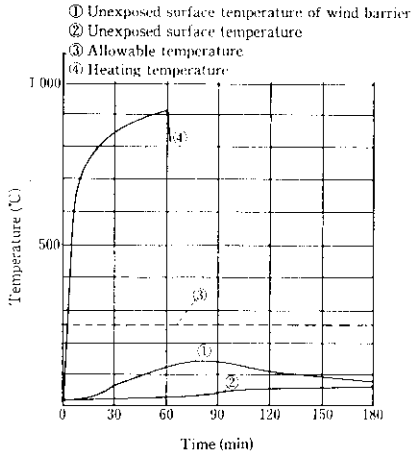

Fig. 5 Fire test results of WALL 21

The maximum temperature of the reverse side was 60°C~70°C, which indicates excellent fire resistance of the porous concrete.

3.3 Comparison of the Features with Other Materials

The typical characteristics of WALL 21 are shown in **Table 2** in comparison with those of materials for similar applications.

Table 2 Comparison of concrete characteristics

	WALL21	Lightweight concrete	ALC*2
Dry density*1 (kgf/m³)	1 100	2 000	650
Compressive strength (kgf/cm²)	130	320	40
Bending strength (kgf/cm²)	25	40	10
Young modulous (kgf/cm²×10⁴)	5.3	18	1.8
Thermal conductivity (kcal/m·h·°C)	0.19	0.7	0.13
Transmission loss (dB)	44	49	29

*1 Density including reinforcing steel bars
*2 Autoclaved lightweight cement (in steam of 180°C at 10 atm)

4 Concluding Remarks

WALL 21 is a pre-cast concrete curtain wall which offers improved functions and excellent performance, and is expected to be used effectively by customers.

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