

4) Shuttle crane (automatic materials conveyor)

This overhead traveling crane is capable of traveling, boom turning, boom shuttle, hook turning, and hoisting. It has a lifting capacity of 10 tons with turning radius of 6 to 10 meters and a hoisting reach of 120 meters.

The optimum conveying is by the central computer, which automatically determines delivery route from material stockyard to mounting position, and individual materials are automatically transported to its installation places. Even for extremely long items, the lifting position of the suspended materials can be precisely controlled by turning the two hook-lifting beam. This eliminates the possibility of collision with frames and completed structures.

Design alterations for FACES

In order to apply this highly adaptable system to the project, the following primary alterations had been required.

- 1) Joint allocations for steel columns
 - Column joints set at every 3 stories had been changed as follows:
 - Supporting columns (10 nos.) at every 1 story
 - Normal columns (19 nos.) at every 2 stories
- 2) Alteration of girder joint
 - To support the frame load, the girder joints at supporting columns had been modified from no-bracket to bracket type.

On the other hands, we had proposed and applied the following alterations to improve quality, productivity, labor saving and waste disposal.

- 1) Unitized glass curtain wall
- 2) Multiple window and ornamental stone panels
- 3) System toilet unit
- 4) Pre-fabricated sprinkler pipe



Fig.5 Unitized glass curtain wall

Achievements of FACES

As a result of construction by FACES, we had gained the following beneficial achievements for the project.

1) Effect of all-weather features

Revision of work sequence due to climatic changes that always occur in an ordinary open site can affect the actual construction schedule and other activities on site. The adoption of an all-weather system has resulted in minimizing disruption of works due to adverse weather conditions. The disruption and rearrangement of the work plan is minimized thereby achieving effective labor saving in the site progress management.

2) Quality of works

The quality of the building has been improved, in terms of welding, exterior wall sealing work, floor concreting and other related works, due to a more favorable working condition.

3) Reduction of construction time

Since works could be continued under the all-weather shelter, the progress of constructing high-rise building was completed by approximately one month earlier from the target completion schedule.

4) Labor saving at site

As a result of unitizing different building components and the active use of side-shelter scaffolds, labor cost saving has been achieved in the actual work as shown in Table 2.

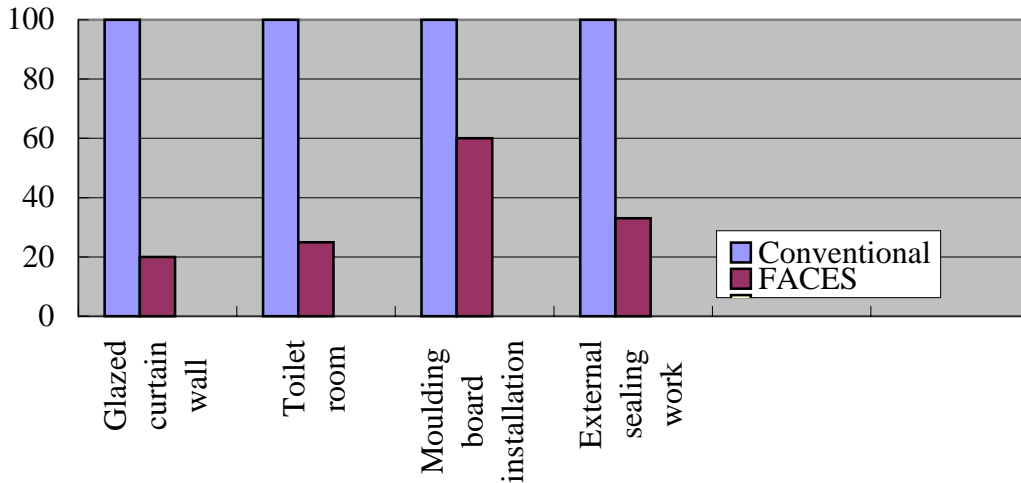


Table 2. Labour saving results

Automated Building Construction System “SEIJU” for HDB Project in Singapore

Penta-Ocean is going to apply another different type of automated construction system (“SEIJU”) to a residential building project in Singapore.

Automated building construction system “SEIJU”

In 2000, Housing Development Board of Singapore (“HDB”) planned to develop a high-rise and high quality residence in an urban area of Singapore to provide the accommodation near the office area. This project is one of their new concept projects and is a pilot scheme of using automated construction system. These requirements have been specified since pre-qualification stage.

Penta-Ocean has proposed a new type of “Sheltered and Automated Construction System” for this project. After the tender evaluation, our proposal was accepted. Tender schedule for this project is shown in Table 3.

	2000				2001												2002							
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	
Pre-qualification	■																							
Tender				■	■	■	■	■																
Interview & Evaluation							■	■	■	■														
Contact Award																								
Commencement of Work																								
Basic Plan of System		■	■	■	■																			
Actual Plan & Design of System																								
System Assembly																								
System Operation Commencement																								▼

Table 3. Schedule of Tender and Planning of System

Project outline

Project title: Toa Payoh Redevelopment contract 30

- Scope:
- 4 residential blocks comprising:-
 - Block 1 & 2 - 40 stories (building area - 776 m², gross floor area - 31,050 m²)
 - Block 3 & 4 - 40 stories (building area - 780 m², gross floor area - 31,200 m²)
 - 1 car park block
 - Block 2A: 4~5 stories (building area - 5,285m², gross floor area – 28,980 m²)
 - Total Floor Area: 153,480 m²

Structure: Pre-cast concrete is used for 80% of the structural elements for residential blocks. Number of pre-cast elements is more than 300 pieces for one typical floor, and over 50,000 pieces for whole project.

Fig 6 shows the completion image of this project and Fig. 7 to 11 show pre-cast concrete components at typical floors.



Fig 6. Project completion image

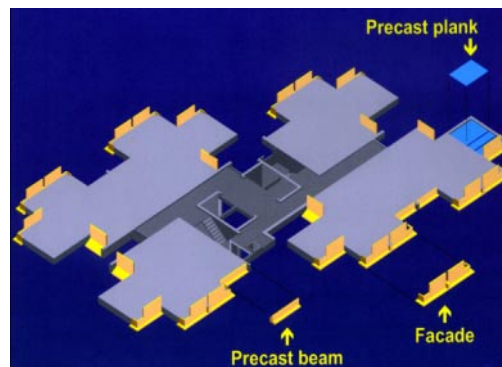


Fig 7. Pre-cast elements (1)

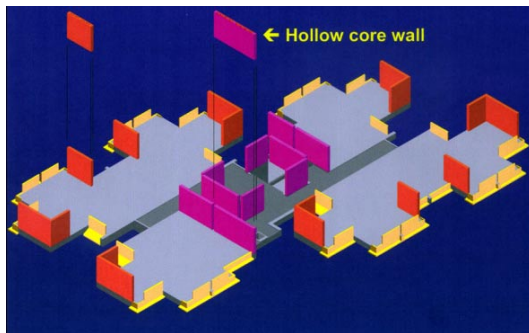


Fig 8. Pre-cast elements (2)



Fig 9. Pre-cast elements (3)

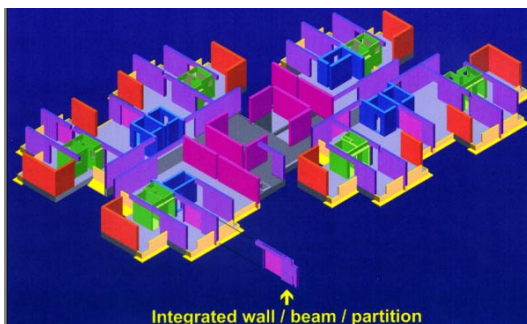


Fig 10. Pre-cast elements (4)

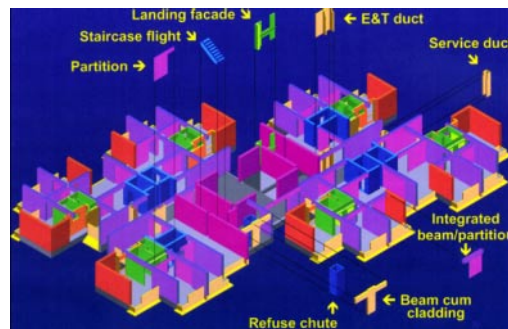


Fig 11. Pre-cast elements (5)