PRECAST CONCRETE BUILDING SYSTEM

SCIB INDUSTRIALISED BUILDING SYSTEM SDN BHD

Company No: 554894-A

(A Wholly Owned Subsidiary of Sarawak Consolidated Industries Berhad - A member of Bursa Malaysia Securities Berhad)

QUALITY SYSTEM

SIRIM

UKAS QUALITY MANAGEMENT

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MS ISO 9001 REG. NO AR 1476

Quality Systems • Model for Quality Assurance in Production, Installation and Servicing introduction

Sarawak Concrete Industries Berhad

PRECAST CONCRETE BUILDING SYSTEM

Also one type of Industrialized Building System (IBS)

Advantages

Speed of Construction

In our current environment, speed is a critical aspect of any construction project. The use of precast allows not only the speedy erection of the structure, but also flexibility and overall program shortening. This is achieved by allowing the production of components at the same time the footing system is being prepared.

A minimum amount of propping allows the subsequent trades to commence work on the structure earlier than conventional construction methods.

Shorter construction period using precast system will enable owners to utilize and generate extra value from an earlier commissioning of building.

Off-site Manufacture

The manufacturing of the major components of the building off-site reduces the site labour component dramatically, which in turn, reduces site costs and time.

The erection crew, necessary for precast construction, will usually consist of only about 5-6 people, rather than the several dozen required for in-situ construction.

Quality Control

Quality control is an ever-increasing requirement in all construction. The production of components off-site, in a factory environment allows each of the facets involved in manufacturing to be strictly controlled, and hence, optimum quality to be maintained.

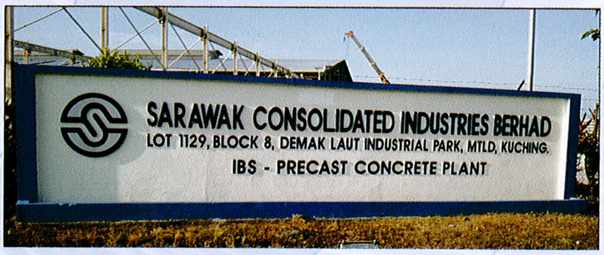
Appearance and Finishes

It is widely known that factory produced precast components can be produced with a wide range of finishes. Architectural finishes including colours, surface finishes and carefully moulded surfaces allow the designer considerable flexibility in the overall aesthetic appearance of a structure compared with conventional methods.

Other Advantages

- Reduced Manpower at Site
- Longer span and greater load capacity
- Better sound insulation
- Low maintenance cost
- Durable due to higher strength of materials
- Less cleaning and clearing of construction debris
- Less exposure to stolen steel bars at site
- No plastering for bottom and side surfaces required
- Competitive cost when designed to optimum solution

Production process of Hollow Core Slab at our Sejingkat Factory, Kuching



Precast Design Concepts

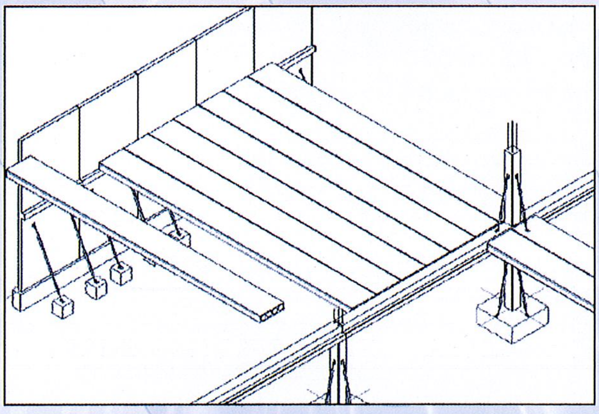
Preliminary Concepts

Probably the most critical aspect of successful precast design is the preliminary evaluation. Each design concept is evaluated to determine the most economical and efficient construction method. The design should be considered as a complete precast system and not simply as numerous individual components connected together.

Prefabrication does not mean to 'cut' an already designed concrete structure into manageable pieces... [**Bruggeling & Huyghe**]

The best result is obtained when the method of construction is evaluated as part of the design concept. The structural options to be considered include:

- ***Structural wall system***. This type of structure generally comprises structural precast walling and/or exposed spandrel beams and panels with the floor system spanning between walls.
- ***Structural precast skeletal frame***. This type of structure incorporates a structural precast frame of columns and beams with a precast floor system. The frame can be either moment resisting or pin jointed with lateral loads carried by shear walls.



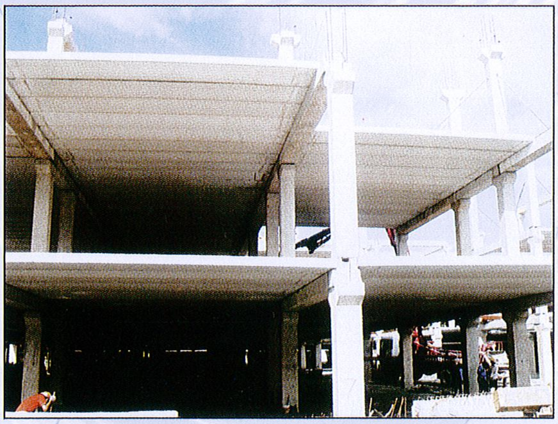
Left side: Structural wall system;
Right side: Structural precast skeletal frame

- ***Hybrid structure***. This term has been coined in Europe to describe combination structures that incorporate precast concrete combined with other structural materials. For example a structure with precast flooring supported on a steel frame or masonry walls or cast in-situ frame.
- ***Combination structure***. As the name suggests a building combining more than one of the above systems.

The first task, in precast design, is to establish the most **economical geometric layout** by minimizing the number of components. The cost of components should be considered, with the objective being to minimize the number of high cost components, and maximize the number of low cost components.

The optimum solution is generally found in a **rectangular grid**. The most economical solution, unlike traditional construction techniques, is usually found with the precast floor system spanning the longest dimension. This is due to the fact that with precast floors and in particular hollow-core systems the cost penalty of increasing the slab span from 8m to 12m is virtually insignificant. On skeletal frame structures this allows supporting beams to span the shorter dimension and the beam depth to be minimized.

It must be stressed, however, that the most economical solution is very much project defined and must be evaluated on a job-by-job basis.



Precast frame and hollow core slab for a shopping complex project in Kuching, Sarawak

Design Evaluation

When considering the design models for precast construction it is critical to evaluate the stability and safety of the structure during all phases of construction. With cast in-situ structures, the stability of the structure is generally not a critical aspect. With a precast structure, overall stability is not achieved until the connections are activated. It is, therefore, essential as part of the design evaluation to consider the stability of the structure not only in the final stage, but also during erection.

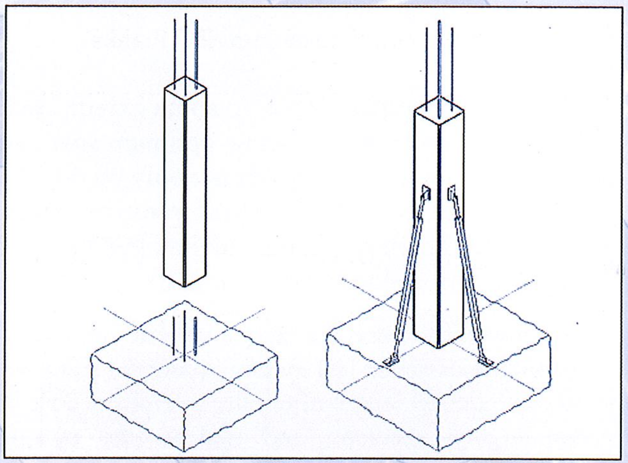
The design of the horizontal stability of a structure requires consideration of the method in which wind and other imposed loads can be transferred to the footing system. In its final form the entire structure must be designed to ensure overall stability. Stiff stabilizing components that are able to transfer horizontal loads to the footing system are vital for ensuring stability of the structure.

Multi-storey columns with corbels (office building for our precast factory at Sejingkat)

Components

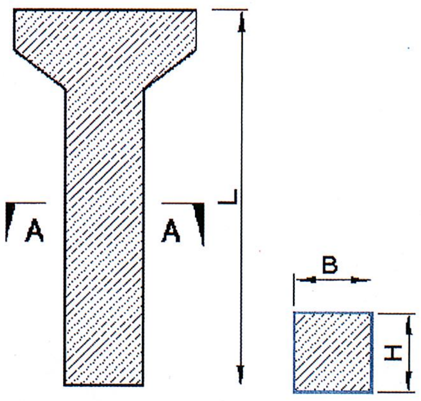
Columns

Precast columns can be produced as either multi-storey corbelled columns or single floor to floor elements. They may be either prestressed or reinforced. Single storey reinforced columns are simple to design, detail and construct.



Single storey columns

Single storey columns with corbels (A shopping complex project in Kuching)



SINGLE TIER COLUMN WITH CORBELS

Width (B):
300 ~ 900 at 50 mm increment

Depth (H):
300 ~ 900 at 50 mm increment

Height (L):
3.0 m ~ 14.0 m at 50 mm increment

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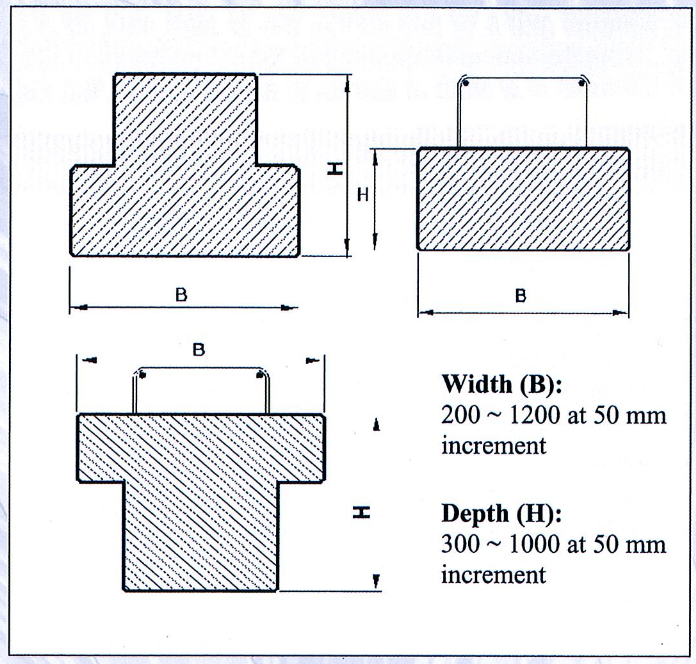
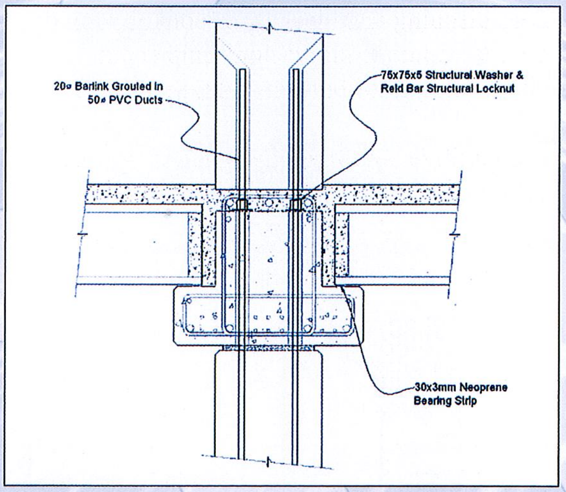
Beams

Precast beam details have been developed with simplicity and practicality in mind. Typically they are an inverted Tee profile and are designed as prestressed or partially prestressed. This type of component is designed as continuous for imposed loads in its final form, while being simply supported during the erection phase. They are also designed so that no propping is required during erection of the supported floor. The precast floor components sit directly on the ledge of the inverted Tee.





Typical details of inverted T-beam

Precast beam supported by column's corbel

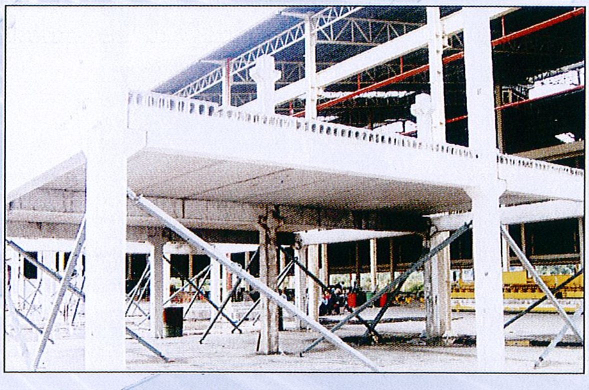
Precast Floor Systems

We offer numerous precast flooring components to choose from, including:

- Hollow core slabs
- Composite Prestressed/RC Planks

Although interchangeable, to some extent, each of these forms of flooring has an optimum span range. This optimum range depends not only on direct cost but indirect costs such as any requirements for temporary propping during erection and the method of support or connection to beams.

Hollow core slabs are manufactured on long line casting beds (over 100 meters in length) and saw cut to the required length after curing. Hollow core slabs are highly efficient, and due to the optimized profiles, are able to achieve span to depth ratios that other methods cannot compete with.



Hollow core slab for an office building

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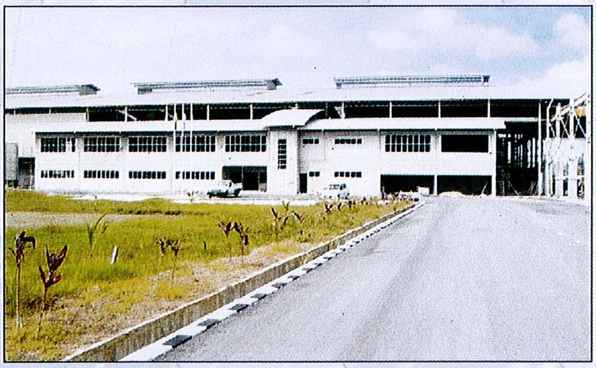
To tie the structure together and help provide diaphragm action in the floor system hollow core slabs are usually topped with a structural screed. The optimum thickness of the screed is about 60mm. The prestress induced hog in the slabs needs to be taken into account in setting the thickness.

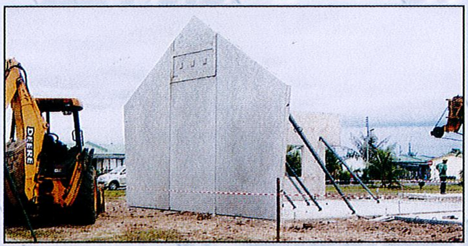
[Refer to our hollow core slab brochure for more details]

Other Components

Other components that are often incorporated into precast construction include items such as staircase flights, solid structural wall panels, spandrel beams and other variations to those already mentioned. They are commonly used in combination with the more basic structural wall system or skeletal frame structures.



Precast walls and staircases inside office building for our factory at Sejingkat, Kuching



Precast wall for single storey building, no column and roof beam required

Connections

The emphasis on connection design is simplicity. The main objective is to provide a connection that serves as many functions as possible while being simple and quick to secure. The simplest way of meeting this objective is to design precast structures with pin jointed connections.

The footing to column connection typically takes the form of dowel bars projecting from the footing with matching cast in grout tubes in base of the column. This allows the column to be lowered directly over the dowels onto preset leveling shims. The dowels act firstly as locating pins, and secondly, as a pin joint when the grout tubes and base are fully grouted.

The column to beam connection is usually made up of dowels projecting from the top of the column over which the beam, again with matching grout tubes, can be lowered directly onto preset leveling shims on the column. By using this type of connection the dowel can be projected above the top of the beam to enable the next level of column to be erected in a similar fashion to the footing to column connection.

The grout tubes used for the connections are kept reasonably large (typically 50mm diameter) to allow the use of high flow grout rather than requiring pressure grouting.

Similar to any cast in-situ structures, water proofing treatments are always required at critical connections of precast structures, e.g. washrooms.

Conclusion

'It is very important to realize that the best design for a precast concrete structure is arrived at if the structure is conceived as a precast structure from the very outset and is not merely adapted from the traditional cast in situ or masonry methods.'
[FIP Commission, 1998]

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