Chapter 4 CONSTRUCTION METHOD FOR PRECAST SYSTEM

The main factor that contributes to the success of a precast building project is 'integration' of all building professionals. Professionals stated here include architects, engineers, clients, contractors and sub-contractors. The involvement of all players at an early stage is critical to a precast project.

The fundamental mindset of all professionals has to be changed to achieve "Total Building Performance". Conventionally, consultants are more concerned with meeting clients' needs, regulatory requirements, design soundness and functionality while clients are more concerned with cost and the end product. Contractors, on the other hand, are more concerned with the building process.

Very often, contractors are tasked to convert a traditional cast in-situ (Architectural and Structural) design to a precast design. The design development will involve modification to the consultants' design intent. As such, it is not uncommon for the contractor to face strong resistance from the consultant team. This is to be predicted as any player tends to be defensive if his 'professional' views are being challenged.

Today, the fragmentation approach towards design and construction among the professionals within a project is evident in most projects. A shift in paradigm is crucial to achieve success in any project. This section attempts to provide a guide for the construction of a precast project. The reader should refine the contents by consultation with professionals and precasters.

4.1 CONSTRUCTION CONSIDERATIONS

The contractor should consider the following:

- All safety issues on site when handling precast elements, especially so when working within a tight site
- The lifting capacity of the crane used
- The working boom-radius of the crane
- The suitability of construction materials for the purpose of use, i.e. sealant, grouting, shim plate, propping etc
- Co-ordination with the precaster and specialist supplier to achieve the best performance and working method - precaster often provide relevant technical requirements to the contractor during the design development phase to avoid discrepancy

Figure 4.1 Precast walls are propped before casting of joints – proper planning is required for perfect alignment

Figure 4.2 The pour strip between 2 pieces of precast walls are cast

Figure 4.3 Precast planks are installed in place

Figure 4.4 Preparation for casting of landing slab to precast staircase

Figure 4.5 Preparation of welded mesh and services for cast in-situ topping

Figure 4.6 Concreting to topping

4.2 SEQUENCE OF WORK

A Quick Check

- Ensure the correct panel before hoisting
- Ensure the crane lifting capacity before hoisting the panel
- Ensure the desired crane's working radius
- Ensure the anchorage for the propping does not damage cast-in building services
- Ensure the desired Reduced Level (R.L.) of panel-base by adjusting the shim plate. Shim plate to be at an interval of 500mm c/c
- Ensure the desired verticality/position is achieved
- Estimated time to install a typical precast element is 1/2 to 3/4 hour

Construction Requirements

- **Elements of control**

  Alignment, Verticality and Levels

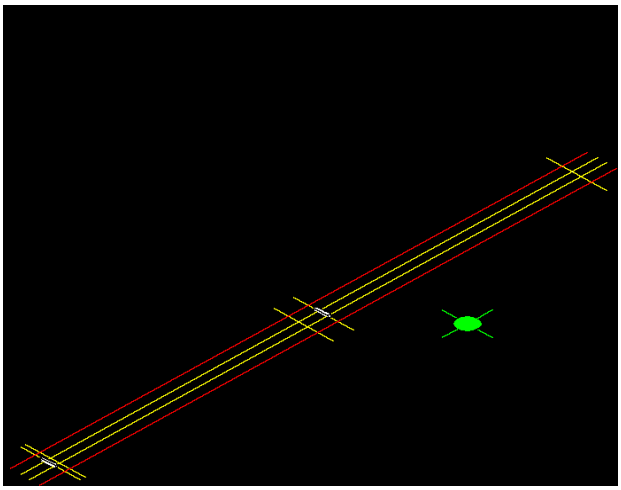
- **Tolerance level**

1. For Wall
   - Vertical deviation +2 mm, -2 mm
   - Horizontal deviation 0 mm

2. For Beam & Slab
   - Departure from intended horizontal position, +2 mm or –2 mm
   - Departure from intended vertical position, +2 mm or – 2 mm

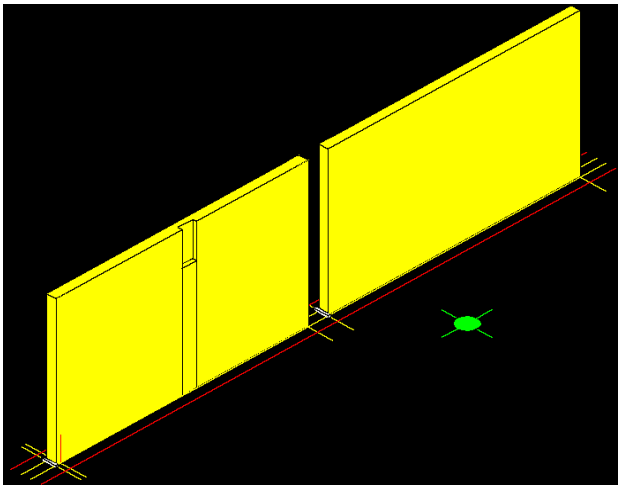
The diagrams below illustrated the sequence of installation for the precast beam-slab system:

The Procedure



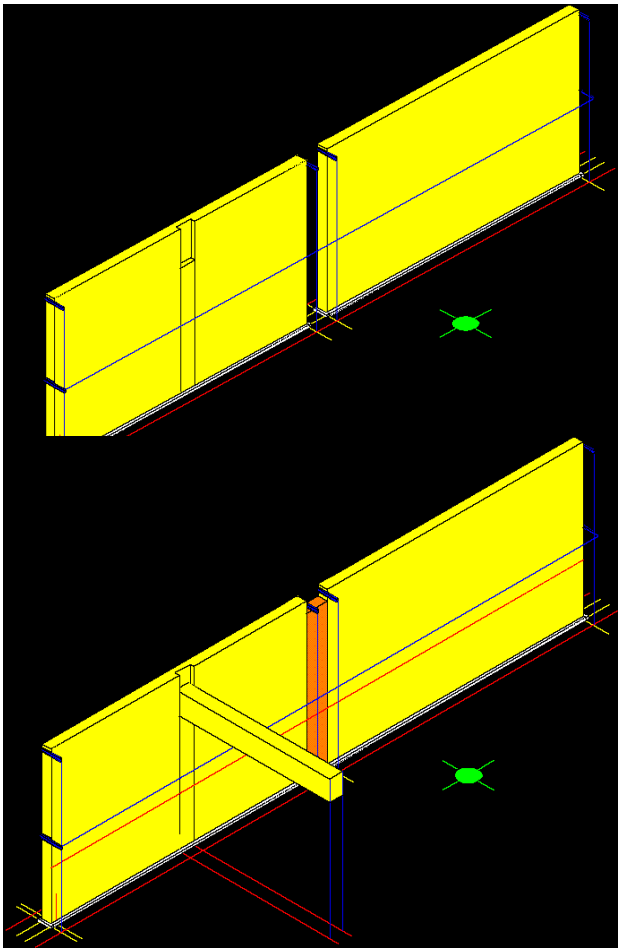
- Setting Out

1. Surveyor to set cross reference.
2. Transfer grid and mark wall position on slab.
3. Mark 100mm offset line from rear building edge.
4. Offset wall position by 200 mm.
5. Secure 2x2 timber to the floor at wall edge to guide wall.



- Wall Positioning

1. The first wall in place has to be the partition wall at the rear.
2. Mark a line parallel to and 100mm from the external edge of the wall.
3. Place shim plate @~500 c/c on the floor and level to wall soffit. Shim plate may also be placed on Non-shrink mortar bed and allow to set.
4. Adjust position of the dowel bar.

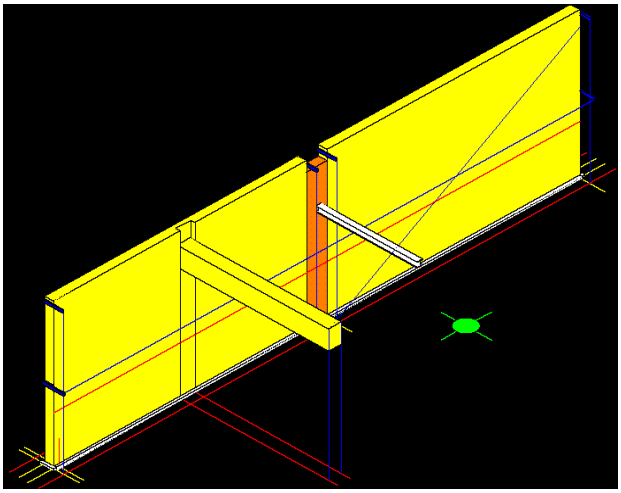


- Wall Adjustment

1. Position adjacent walls and plumb wall corners at 200 mm offset
2. Adjust verticality until within +2 or –2 mm
3. Ensure the four faces of every walls are adjusted
4. Position string 250 mm from face of walls
5. Walls within the same line are to be adjusted within same tolerance
6. Ensure air-pocket is fully grouted.

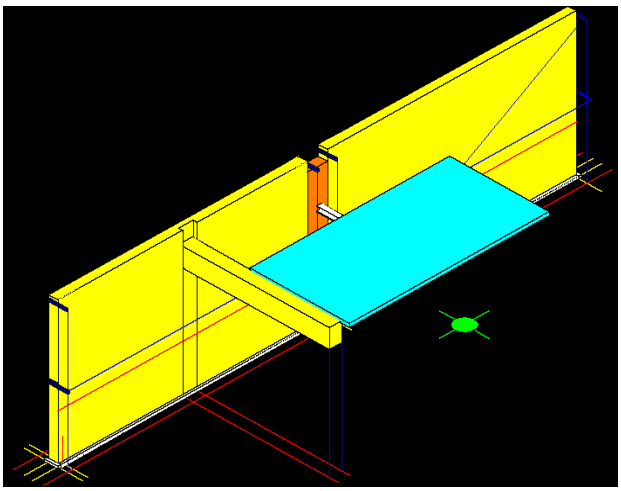
- Beam Setting Out

1. Cast wall joint.
2. Mark 1 m reference line.
3. Confirm pocket level. Position shim plate to correct beam soffit level if required.
4. Mark position of beam on floor.
5. Hoist beam in place and check top level.
6. Plumb beam to verify position on floor below.
7. Ensure beam verticality with a spirit level.
8. Wedge beam against pocket and grout the gap between the beam and the wall.



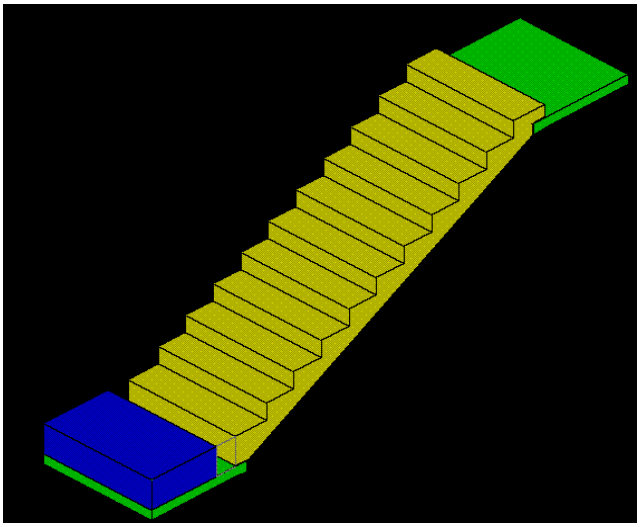
- Slab Setting Out I

1. Position the slab temporary supports and adjust the slab soffit level approximately.
2. Raise the height of the supports about 5 mm above slab soffit level.



- Slab Setting Out II

1. Hoist slab in place on top of beam and support.
2. Verify level of every plank soffit at four corners and center.
3. Adjust level of temporary support accordingly.



- Staircase

1. Position landing or slab and verify soffit level at four corners.
2. Adjust level to within tolerance.
3. Position shim plates at staircase support location to correct level.
4. Verify level difference between pegs on top and below.
5. Hoist staircase in place.
6. 10mm gap between precast plank and staircase

Precaution

1. Specify items which cannot be compromised
    - Zero tolerance on partition walls.
    - Dividing boundary line between units.
    - External building lines.
    - Staircase dimension.
    - HS internal dimensions.

2. Alignment Priority
    - Alignment of grooves.
    - Uniformity of grooves.
    - Horizontality of architectural treatment ie. Brick Tile

Post Installation

1. Verify alignment and verticality of every wall.
2. Verify cast slab level at 1m grid.
3. Report deviation and rectify if required.

4.3 CONSTRAINTS AND SOLUTIONS

4.3a Access

CONSTRAINTS	SOLUTIONS
❖ Small road in front of site may not allow crane and delivery trailers up to 3.5m wide to park.	❖ Use smaller crane and trailers to deliver and install small components.
❖ Crane and trailer are unable to negotiate small turning radius at junctions of small roads.	❖ Study the locality and look for available space for turning. Have one worker direct traffic while crane and trailer is turning.
❖ Diversion of existing services such as lamp-posts, fire hydrants and overhead electrical cables may be necessary.	❖ Diversion must be done before installation of precast components begins.
❖ Existing trees and shrubs in front of site require National Parks Board approval before they can be removed and later reinstated.	❖ The consultants must write in to National Parks Board for approval much earlier before construction begins.

4.3b Crane Capacity and Reach

CONSTRAINTS	SOLUTIONS
❖ Lifting capacity of small crane not enough to lift heavy and far components.	❖ Hire bigger crane with longer boom to lift heavy and far components. Alternatively, plan the sequence such that the crane can park nearer to the heavier components.

4.3c Coordination

CONSTRAINTS	SOLUTIONS
❖ Wrong components delivered to site. ❖ Wrong sequence of delivery (such as planks arrive first before the beams on the same day)	❖ Provide clear labels on components and drawings to avoid confusion. ❖ Person ordering must maintain good communication with person delivering.

4.3d Installation

CONSTRAINTS	SOLUTIONS
❖ Lifting over neighbour's roof may cause anxiety over safety and damage to existing properties. ❖ Starter bars do not match with grouting holes or clashing of bars at connections between beams and columns.	❖ Crane and trailer can be parked strategically to avoid such lifting. Crane operator can make use of boom angle to keep lifting within site boundary. ❖ Equipment and workers to crank or bend the starter bars will be provided on site.

4.3e Handling

CONSTRAINTS	SOLUTIONS
❖ Damage such as cracks and corners chipped-off occurred due to knocking during handling.	❖ If damage is minor, cracked components can be repaired using approved epoxy resin. Non-shrink grout can be used for chipped-off corners.

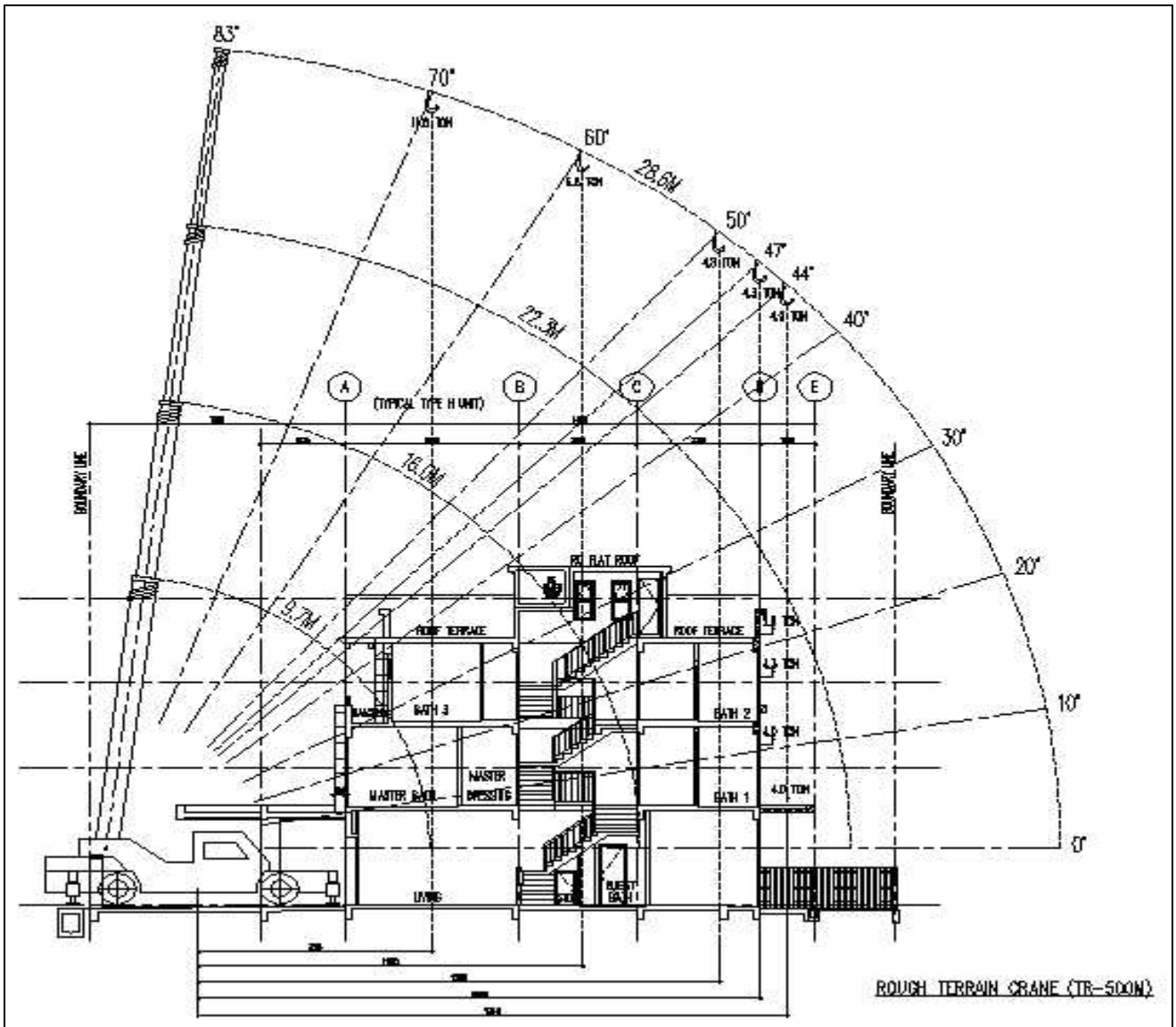


Figure 4.7 Optimisation of crane usage (50 tonne crane) and weight of components