4. Delivery, Handling & Storage

In general, all materials should be delivered, stored and handled in a manner that protects them from damage, moisture, dirt and intrusion of foreign materials. Ordering and delivery of materials should be planned according to the work progress to minimise storage on site, where there are higher possibilities of damages and deterioration of materials.

Materials delivered should be checked against the specifications and approved samples. The following are some verification to be carried out on the delivered materials:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precast components</td>
<td>Structural defects, dimensional tolerances, surface finishes and physical damage</td>
</tr>
<tr>
<td>Bricks</td>
<td>Type, grade and size</td>
</tr>
<tr>
<td>Pre-packed mortar</td>
<td>Type and condition of packaging</td>
</tr>
<tr>
<td>Site mix mortar</td>
<td>Quality of sand and silt content</td>
</tr>
<tr>
<td>Bonding agent, Waterproofing admixtures, Liquid applied waterproofing materials, and Sealant</td>
<td>Delivered in original packaging, shelf life from date of production and batch reference</td>
</tr>
</tbody>
</table>

4.1 PRECAST COMPONENTS

The following quality control checks should be carried out on the delivered precast components:
- structural defects;
- dimensional tolerances;
- surface finishes; and
- physical damage.

Figure 4.1: Quality control checks for precast elements

- Laitance and exposed aggregates
- Chipped corners
All precast components should be handled in a manner that avoids excessive stresses, damages and cracks to the components, especially during demoulding and handling in site precast yards. Young immature concrete is more prone to cracks, which may cause future watertightness problems.

The location of the lifting device should be situated at the downstand of the joggled profile of panels to prevent excessive stress and cracks around this area (see Figure 4.2).

**Figure 4.2: Location of lifting device (Cross-section view)**

CP 81:1999 recommends that the following be considered when handling precast units on site:

- minimum concrete strength;
- size and weight of precast unit;
- adequacy of reinforcement to resist handling stresses;
- number, size and location of lifting points;
- method of lifting and type of lifting equipment; and
- proper supports and support location.

The rigging system selected should ensure safety and equal load distribution to all lifting points. Two common rigging configurations are the 2 x 1 and 2 x 2 configurations as shown in Figure 4.3.
Precast components should be placed on strong and level supports. The supporting points should be positioned such that the precast components are not subject to excessive stress. Stacking should be done in a manner that ensures stability, safety and avoids damage to the components.

4.2 BRICKS, CEMENT, SAND AND OTHERS

Proper packaging, delivery, handling and storage of bricks help to prevent breakage, cracking, chipping, spalling and other damages. Bricks should be stored on a flat surface and should avoid direct contact with the ground. They should be placed in a manner that facilitates easy handling and allows adequate air circulation around the bricks.
Bricks should not be stacked higher than 2 pallets. They should be hoisted in pallets or transported using a pallet jack. Transportation of bricks using wheelbarrow should be avoided, unless absolutely required, such as in narrow spaces.

**Figure 4.6: Transport and storage of brick pallets**

- Bricks stacked on 3 pallets
- Bricks stacked on 2 pallets
- Transporting bricks with a pallet jack
- Hoisting bricks in pallets

Aggregates for the mortar mix should be stored with good drainage provision and protected from dirt, intrusion of foreign matter and excessive high temperatures. Sand should be stored in a manner free from contamination by other site materials, for example, by providing a containment with proper base and kerb. A sand pump could be used to transport sand, where needed.
Cement and pre-packed mortars should be stored off the ground in a clean and dry area. Materials affected by dampness should be discarded.

Flexible DPC materials should be stored in a dry area, with proper cover and protected from physical damage. In addition, the materials should be handled with care during storage:

a) rolls of DPC should be stored upright on their ends on level surface;

b) rolls of DPC should not be stacked up to more than three packs or beyond 1m high;

c) bitumen and other thermoplastic materials should be kept away from direct heat source; and

d) materials should be stored in a manner that protects them from distortion.

Reinforcement materials should be properly stored and protected from soil, dirt, loose rust scale or other coatings. Bonding agents, waterproofing additives or waterproofing membrane systems should be stored at room temperature and kept away from direct sun.

Figure 4.7: Transportation and storage of sand

Provide a good base (e.g., plywood or lean concrete) to store sand

Using sand pump to transport sand to required location

Figure 4.8: Store materials above the ground

Storage of pre-packed materials

Storage of liquid materials