6. Quality Inspection

6.1. GENERAL

It is important to have quality inspections as part of the integral process in managing quality of precast concrete elements. Close supervision should be provided for both critical in-process and finished works so as to achieve high workmanship quality.

Quality assurance and control starts with good planning and management. It is a good practice to prepare an Inspection and Test Plan, ITP (see Appendix A) which summarises the projects’ inspection, acceptance criteria and frequency of inspections. Checklists for the in-process and final inspection of precast concrete elements should also be prepared (as in Appendix B) to detail the checks required at critical stages.

Quality inspections for the in-process works are highlighted in Chapter 3 – Fabrication Process. This section will only cover quality inspections for the finished precast concrete elements delivered and erected on site.

6.2. INSPECTION OF PRECAST CONCRETE ELEMENTS

The finished precast concrete elements and works should be inspected to ensure they meet the client’s requirement and standards. Table 6.1 shows the recommended checklist for final inspection of the precast concrete elements based on CONQUAS 21 quality assessment criteria.

Table 6.1 Checklist for final inspection of precast concrete elements

<table>
<thead>
<tr>
<th>Inspection checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CONQUAS 21 Assessment – Dimension for elements / opening for services</td>
</tr>
<tr>
<td>1.1. Tolerance of cross sectional dimensions of precast elements : +10mm / -5mm</td>
</tr>
</tbody>
</table>

**Note:** It is common to have the actual dimensions of a precast concrete element to be slightly different from its designed dimensions. However, the variation in cross sections should be within acceptable tolerances.

Maximum dimension:
- $A_1 + 10\text{mm}$ OR $A_2 + 10\text{mm}$

Minimum dimension:
- $A_1 - 5\text{mm}$ OR $A_2 - 5\text{mm}$
1.2. Tolerance for penetration/opening for services: +10mm for size and ±25mm for location

Note: It is important to ensure that the penetration/opening for services are within tolerances for proper connection and linkages of the M & E services.

1.3. Tolerance for length of precast members (major dimension of unit):
- Up to 3m: ±6mm
- 3m to 4.5m: ±9mm
- 4.5m to 6m: ±12mm
- Additional deviation for every subsequent 6m: ±6mm

Dimensional length of precast members:
- $L \leq 6\text{mm}$ for $L \leq 3\text{m}$
- $L \leq 9\text{mm}$ for $3\text{m} < L \leq 4.5\text{m}$
- $L \leq 12\text{mm}$ for $4.5\text{m} < L \leq 6\text{m}$
1.4. Straightness or bow (deviation from intended line) of precast member:
- Up to 3m: 6mm
- 3m to 4.5m: 9mm
- 4.5m to 6m: 12mm
- Additional deviation for every subsequent 6m: 6mm

1.5. Squareness of precast member – Difference between the greatest and shortest dimensions should not exceed the following:

   Length of the shorter sides
   - Up to and including 1.2m: 6mm
   - Over 1.2m but less than 1.8m: 9mm
   - 1.8m and over: 12mm

Note: When considering the squareness of a corner, the longer of two adjacent sides being checked should be taken as the baseline. The difference between the greatest and least dimensions of the shorter sides could then be used to check if the precast member is within tolerances specified.
1. CONQUAS 21 Assessment – Dimension for elements / opening for services (cont’d)

1.6. Twist of precast member – Any corner should not be more than the deviation stated from the plane containing the other 3 corners:

a. Up to 600mm wide and 6m in length : 6mm
b. Over 600mm wide and for any length : 12mm

Note: Flatness refer to the variation or smoothness of the element surface. Under this criteria, the maximum deviation from a 1.5m straight edge placed in any position on a nominally plan surface should not exceed 6mm.
Inspection checklist

2. CONQUAS 21 Assessment – Alignment, plumb and level

2.1. Tolerance for departure of any point from its position: ± 10mm

2.2. Tolerance for plumb: 3mm/m, maximum 20mm for floor to floor height and 40mm for entire building height


## Inspection checklist

### 2. CONQUAS 21 Assessment – Alignment, plumb and level (cont’d)

2.3. Maximum deviation of mean level: ± 10mm

*Note: This requirement is applicable for slab and precast beam elements. The mean level taken from any of the three points on the same element should not deviate by 10 mm.*

---

### 2.4. Camber at mid-span: according to specifications

*Note: This is applicable to precast prestressed concrete elements such as prestressed slab, planks, hollow core slab and beams. The predicted camber of prestressed units is usually specified and stated in the drawings. As a general rule, the actual camber should not exceed the predicted camber by more than 50% as recommended in CP 65: Part 1: 1998*
<table>
<thead>
<tr>
<th>3. CONQUAS 21 Assessment – Exposed surface conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. No honeycomb – should not have visual exposure of groups of coarse aggregates resulting from grout leakage</td>
</tr>
<tr>
<td><img src="image1.jpg" alt="correct例1" /> <img src="image2.jpg" alt="incorrect例2" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.2. Cold joint &amp; formwork joint must be smooth</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.jpg" alt="correct例3" /> <img src="image4.jpg" alt="incorrect例4" /></td>
</tr>
</tbody>
</table>
3. CONQUAS 21 Assessment – Exposed surface conditions

3.3. No bulging of structural elements

3.4. All formwork, nails, zinc strips, etc must be removed
3. CONQUAS 21 Assessment – Exposed surface conditions (cont’d)

3.5. No cracks or damages

4. CONQUAS 21 Assessment – Lifting points and inserts

4.1. Tolerance for position: ± 20mm from centre line location in drawing
Inspection checklist

4. CONQUAS 21 Assessment – Lifting points and inserts

4.2. Lifting devices and inserts free from damages

5. CONQUAS 21 Assessment – Sleeve system / connections

5.1. Tolerance for position: ± 6mm from centre line location in drawings

5.2. Bar protrusion length according to requirements. No bending, cranking or damages to bars
### Inspection checklist

<table>
<thead>
<tr>
<th>5. CONQUAS 21 Assessment – Sleeve system / connections (cont’d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3. Bars free from concrete droppings or corrosion</td>
</tr>
</tbody>
</table>

![Image of bars free from concrete droppings or corrosion]

<table>
<thead>
<tr>
<th>5.4. Sleeves, grout holes, grout tubes not congested with debris</th>
</tr>
</thead>
</table>

![Image of grout holes not congested with debris]
| Inspection checklist |

### 6. CONQUAS 21 Assessment – Interface / joint requirements

#### 6.1. Joint Taper:
- Over 3m length: 6mm
- Maximum for entire length: 9mm

#### 6.2. Alignment of horizontal and vertical joint: ± 6mm

Note: This item refers to panel alignment.
6. CONQUAS 21 Assessment – Interface / joint requirements (cont’d)

6.3. Jog in alignment of matching edges : 6mm

Note : This item refers to panel alignment.

6.4. Sitting of elements : according to specifications

Note : It is important to ensure that the sitting of the elements is in accordance with the design requirement to pre-empt spalling at support.
6. CONQUAS 21 Assessment – Interface / joint requirements (cont’d)

6.5. Installation of sealant and waterproofing: according to specifications

Note: It is important to ensure that the backer rods required are properly installed to pre-empt leakage of grout shown.

7. CONQUAS 21 Assessment – Cast-in steel items / welded & bolted connections

7.1. Tolerance for position of cast-in steel items: ± 6mm from centre line location in drawings

Note: Examples of cast-in steel items are inserts for temporary support as shown. The accuracy of these inserts’ position is important in facilitating the installation process.
7. CONQUAS 21 Assessment – Cast-in steel items / welded & bolted connections (cont’d)

7.2. Tolerance for position of openings for bolt connections: ± 3mm from centre line location in drawings

7.3. Relevant requirements in CONQUAS steelwork standards to be used where applicable