Concrete works at construction site

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Outlines

• Batching
• Mixing
• Transporting
• Placing
• Compacting
• Finishing
• Curing
Batching

**Volume Batching.**
- All materials measured by volume.
- Expressed in relative ratios
- Difficult to ensure quality.

**Weigh Batching**
- Materials quantities by weight
- Simple and accurate
Mixing

• **Hand Mixing**
  • Small jobs
  • Inferior mixing
  • Low quality concrete

• **Machine Mixing**
  • Good mixing
  • Large works

• **Concrete mixers**
  • Tilting mixers
  • Non-tilting mixers
  • Reversing drum mixers
  • Pan type or stirring mixers
  • Transit mixer
Mixing time

- Mixer speed is 15 to 20 rpm
- 25 to 30 revolutions are adequate.
- Lesser mixing result in poor concrete.
- Over mixing is uneconomical.
- Mixing beyond 2 mins does improve strength of concrete.
- Mixing time is mixer capacity dependent.
Mixing time - affect on Strength

![Graph showing the relationship between compressive strength and mixing time. The graph illustrates the maximum, mean, and minimum values over different mixing times.](image-url)
## Mixing time

<table>
<thead>
<tr>
<th>Capacity of mixer (m³)</th>
<th>Mixing time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>1.5</td>
<td>1 ¼</td>
</tr>
<tr>
<td>2.3</td>
<td>1 ½</td>
</tr>
<tr>
<td>3.1</td>
<td>1 ¾</td>
</tr>
<tr>
<td>3.8</td>
<td>2</td>
</tr>
<tr>
<td>4.6</td>
<td>2 ¼</td>
</tr>
<tr>
<td>7.6</td>
<td>3 ¼</td>
</tr>
</tbody>
</table>
Ready Mix Concrete

- Ready mixed concrete is proportioned and mixed off the project site and is delivered to the construction area in a freshly mixed and unhardened state
Ready Mix Concrete

- Central-mixed concrete
  - mixed completely in a stationary mixer
  - delivered in
    - a truck mixer
    - a truck mixer operating at agitating speed
    - a non-agitating truck
Ready Mix Concrete

• Shrink-mixed concrete
  • mixed partially in a stationary mixer and completed in a truck mixer
• Truck-mixed concrete
  • mixed completely in a truck mixer
Transporting and Handling

- Mortar pan
- Wheel barrow
- Chutes
- Dumper
- Bucket and Rope
- Belt conveyor
- Skip and Hoist
- Pumping

Belt conveyor
Buckets
Transporting and Handling

- Mortar pan
- Wheel barrow
- Chutes
- Dumper
- Bucket and Ropeway
- Belt conveyor
- Skip and Hoist
- Pumping

Direct chute discharge from a truck mixer
Transporting and Handling

- Mortar pan
- Wheel barrow
- Chutes
- Dumper
- Bucket and Ropeway
- Belt conveyor
- Skip and Hoist
- Pumping

Cranes and Buckets
Transporting and Handling

• Mortar pan
• Wheel barrow
• Chutes
• Dumper
• Bucket and Ropeway
• Belt conveyor
• Skip and Hoist
• Pumping

Pumps
Placing concrete

- Preserve concrete quality
  - Water-cement ratio
  - Slump
  - Air-content
  - Homogeneity
- Avoid separation of aggregate and mortar
- Avoid excessive horizontal movement
- Consolidate adequately
- Maintain sufficient placement capacity
- Choose the right equipment for the concrete
Placing concrete
Placing concrete: Horizontal Construction Joints

(a) Dimension varies
30 mm
20 mm – Varies with wall thickness

(b) Dimension varies
50 mm
40 mm
20 mm – Varies with wall thickness

Construction joint here

Construction joint here
Compacting

- Air gets entrapped while placing concrete.
- To achieve dense concrete for better strength air must be expelled.
- This process is called consolidation or compaction
Compacting

- Internal Vibration
- External Vibration

Radius of Action
## Compacting

<table>
<thead>
<tr>
<th>Diameter of head, mm</th>
<th>Recommended frequency, vibrations per minute</th>
<th>Approximate radius of action, mm</th>
<th>Rate of placement, m³/h</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-40</td>
<td>9000-15,000</td>
<td>80-150</td>
<td>0.8-4</td>
<td>Plastic and flowing concrete in thin members. Also used for lab test specimens.</td>
</tr>
<tr>
<td>30-60</td>
<td>8500-12,500</td>
<td>130-250</td>
<td>2.3-8</td>
<td>Plastic concrete in thin walls, columns, beams, precast piles, thin slabs, and along construction joints.</td>
</tr>
<tr>
<td>50-90</td>
<td>8000-12,000</td>
<td>180-360</td>
<td>4.6-15</td>
<td>Stiff plastic concrete (less than 80-mm slump) in general construction.</td>
</tr>
</tbody>
</table>
Compacting

**CORRECT**

- Vertical penetration a few cm into previous lift (which should not yet be rigid) of systematic regular intervals will give adequate consolidation

**INCORRECT**

- Haphazard random penetration of the vibrator at all angles and spacings without sufficient depth will not assure intimate combination of the two layers
Compacting

**External Vibration**

- Form vibrators
- Vibrating tables
- Surface vibrators
  - Vibratory screeds
  - Plate vibrators
  - Vibratory roller screeds
  - Vibratory hand floats or trowels
Compacting

**Inadequate consolidation can result in:**

- Honeycomb
- Excessive amount of entrapped air voids (bugholes)
- Sand streaks
- Cold joints
- Placement lines
- Subsidence cracking
Finishing

WHAT IS FINISHING

Finishing is screeding, floating or trowelling the concrete surface to densify and further compact the surface of concrete, as well as giving it the look you want.

Finishing takes place in two stages:

1. INITIAL finishing.
2. FINAL finishing.
**Finishing**

1. **INITIAL FINISHING:**

   Concrete is first screeded to the level of the formwork, then bullfloated and left to set.

   - In some cases screeding leaves a good enough finish, especially if floor coverings are to be used over the concrete.
   - Water then appears on the surface of the concrete.
   - This water is called bleed water.
   - No final finishing can begin until the bleed water has dried up.
   - Mixing bleed water with the surface paste will weaken it, possibly resulting in a dusty surface.
Finishing

FLOATING

There may be two stages in floating:

1. The **BULLFLOAT**, which is part of the initial float.
2. The **POWER** or **HAND FLOAT** which is part of the final float.

Floating helps compact and level the surface and close minor cracks.

Floating can be done by hand or with a power float.

Power floating leaves a better finish than hand floating.
Finishing

2. FINAL FINISHING:

- This involves floating, trowelling, edging, jointing or patterning the concrete.
- Special finishes such as brooming, colouring or patterned finishes can be applied to the surface.
- Trowelling leaves a dense, hard, smooth adurable surface.
- The surface should be trowelled TWICE.
- A well trowelled surface will be very smooth and can be slippery when wet.
- Trowelling can be done by hand or power trowel.
Finishing

**Edging and Grooving:**

- All the edges of a slab should be finished with a special edging tool.
- This gives a neater and stronger edge, less prone to chipping. Joints should be planned before placing and are usually formed into the concrete during finishing.
- Once any surface has been finished it MUST be cured.
Curing

- Curing may be defined as the operation of maintaining humidity and temperature of freshly placed concrete during some definite period following placing, casting or finishing to assure satisfactory hydration of cement and proper hardening of the concrete.

- If the curing is neglected in early period of hydration, the quality of concrete will experience some irreparable loss.
Curing

Methods of curing

• Water curing
  • Immersion
  • Ponding
  • Spraying or fogging
  • Wet covering
• Membrane curing
• Application of heat
• Miscellaneous
Curing

Water curing

• This is the best method of curing as it satisfies all the requirement of curing, namely, promotion of hydration, elimination of shrinkage and absorption of heat of hydration.

• It is pointed out that even if the membrane method is adopted it is desirable that a certain extent of water curing is done before the concrete is covered with membrane.

Immersion
Ponding
Spraying or fogging
Wet covering
Curing

Membrane (kalvo) curing

• Sometimes concrete work is carried out at a place where there is shortage of water.
• Therefore lavish application of water in curing is not possible it has been pointed out that curing does not means application of water ,it also means to create uninterrupted and progressive hydration
Curing

Application of heat curing

• The development of strength of concrete is a function of not only time but also temperature.

• When concrete is subjected to higher temperature it accelerates the hydration process resulting in faster development of strength.

• Concrete cannot be subjected to dry heat to accelerate the hydration process as presence of moisture is also essential in concrete.

• Steam curing at ordinary pressure

• Steam curing at high pressure

• Curing by infra-red radiation

• Electrical curing
Curing

Application of heat curing

High pressure steam curing

Steam curing at ordinary pressure
Curing

**Duration of curing**

- The concrete should not be allowed to dry fast in any conditions.
- This condition should be maintained for 24 hours.
- The best practice is to keep the concrete in gunny bags for 24 hours and then commence water curing by ponding or sprinkling method.
- The concrete cured for the long time will show superior strength and show other good properties.
- However, curing for long time will be a costlier process.
- The curing period varies for different structures, situation and different atmospheric temperature.
- So for general it is cured for 7 days.