



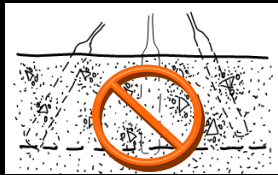
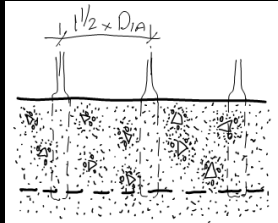
Approximate vibration time:
 Very Stiff Concrete: 18-32 sec
 Stiff Concrete: 5-10 sec
 Stiff/Plastic Concrete: 3-5 sec
 Plastic Concrete: up to 3 sec

When placing concrete, including floors, walls, foundations, footings, etc., in order to avoid unsightly and potentially weak concrete, we must properly consolidate and vibrate correctly. We typically refer to ACI 309R-Guide for Consolidation of Concrete as our reference. The following Quality Technical Bulletin describes the reasons for the need of consolidation / vibration the guidelines set forth by ACI 309R. This bulletin discusses the internal, poker type units that we typically see on our projects.

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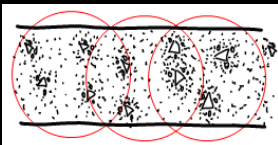
Always insert vibrator vertically...



Do not push the vibrator down, allowing the vibrator to sink under its own weight.

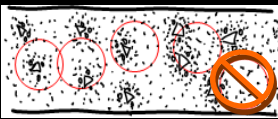
Go into the previous concrete lift to knit the two layers

The vibrators area of influence should be wider than the forms for proper overlapping

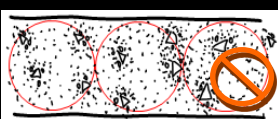


Avoid area of no vibration in the placement of the vibrator...

Too small and separated

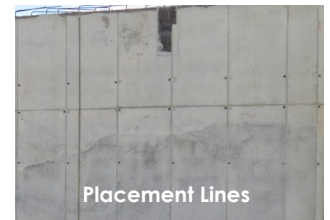


Too small (the size of the forms) and no overlapping



Consequences of improper consolidation / vibration

- The most serious problems resulting from undervibration, faulty vibrators, improper vibrator insertion, or rebar congestion ARE honeycombing, excessive entrapped air voids (bugholes), sand streaks, and placement lines.
- **Honeycombing** occurs when the mortar does not fill the space between the coarse-aggregate particles. ... Per ACI... To correct this condition, it is necessary to chip out the area and make a repair. **Do Not just fill the voids.**
- **Excessive entrapped-air voids (bugholes)** in concrete that is largely a function of the vibratory equipment and procedure, however, concrete free of honeycomb will still contain some entrapped-air voids, which is not a defect.
- **Sand streaking** is caused by heavy bleeding and mortar loss along the form, resulting from the character and proportions of the materials and method of depositing the concrete.
- **Placement lines** are dark lines on formed surfaces at the boundary between adjacent batches of concrete which generally indicate the vibrator was not lowered enough to penetrate the layer below the one being vibrated.



Proper consolidation / vibration

- There is no fully reliable indicator to determine the adequacy of consolidation of the freshly placed concrete other than by the surface appearance of each layer. This is why only well-trained operators should operate the vibrator. The vibrator operator should have the ability to determine the time and placement necessary to ensure proper consolidation.
- Listen to the pitch or tone of the vibrator...when first inserted, the frequency drops...when the frequency becomes more consistent, it is likely time to remove the head.
- Consolidation of concrete happens in two steps...leveling and de-aeration. It is important that the operator completes both steps of the operation. (Unfortunately, It is NOT uncommon for the operator to only complete step one (leveling) without the de-aeration stage) We need to verify both stages are being properly performed.
- Vibration liquefies the concrete mix, consolidating the concrete by removing voids.
- Freshly placed unconsolidated concrete contains excessive and detrimental entrapped air (5-20% by volume) if allowed to harden in this condition, the concrete will likely have:
 - High permeability ■ Poorly bonded reinforcement ■ Lower than tested strength ■ Poor resistance to deterioration ■ Poor appearance
- The negative and often reality is that it is practically impossible to make repairs to the surface that are inconspicuous.
- When appearance of the concrete is important, form joints should be reviewed for tight joints, prior to the pour. If holes, open joints, or cracks occur in the form sheathing, pressure will cause the concrete mortar to flow out when vibration momentarily converts it to a fluid consistency. The leaked mortar will cause rock pockets or sand streaks.
- Make sure that the vibrator is not used to move the concrete laterally, as this could cause segregation.
- Concrete should be deposited in layers compatible with the work being done and should be nearly equal to the vibrator head length. In walls and columns, the layer depths should generally not exceed 20 in.
- The vibrator should be systematically inserted vertically at a uniform spacing over the entire placement area.
- The distance between insertions of the vibrator should be approximately 1-1/2 times the radius of influence of the vibrator head and should overlap adjacent just-vibrated area.
- The vibrator should sink into the concrete by itself (do not push down on the unit) 3-10 seconds per plunge depending on the type of concrete (see sidebar).
- The vibrator should go into the previous lift in order to knit the two layers to help prevent lift or layer lines.
- Withdraw the vibrator slowly until the head is visible, then remove rapidly, this will close the area where the vibrator was inserted.
- Well-proportioned concrete is not readily susceptible to overvibration...undervibration is far more common.