Troubleshooting

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Problem Honeycomb and Voids

Honeycomb: Area containing primarily coarse aggregate
Voids: Areas containing no concrete

Causes

Honeycomb forms when mortar fails to fill voids between coarse-aggregate particles. The defect may be purely cosmetic or, depending on the location and extent of honeycombing, may be structural and require repair. For instance, honeycombing behind post-tensioning anchors may require repair so the post-tensioning forces don't cause compressive failure of concrete in the bearing area.

Voids form when concrete fails to fill areas in a form, typically those under large blockouts, in very deep placements, or that are heavily reinforced. Voids are almost always structural defects requiring repair.

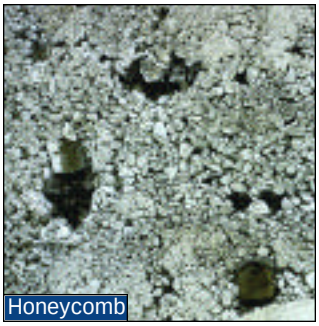
Causes of honeycomb and voids include stiff or unworkable concrete, segregation, congested rebar, insufficient consolidation, and improper placing practices.

Prevention

Preventing honeycomb and voids starts with attention to concrete mix proportions. Proper techniques for forming, rebar placement, and concrete placement also are important.

Concrete proportions:

■ Provide enough paste. Concrete not containing enough cementitious material and fine sand will be prone to segregation and won't flow well. Consider adding a blend sand or additional portland cement or fly ash to increase the amount of fines. Increasing the ratio of fine-to-coarse aggregate will increase workability only if 5% to 10% of the sand passes the No. 100 sieve.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Honeycomb

■ Increase slump. Even with the correct amount of paste, a mix can lack workability and won't flow into place. To improve flow, increase slump to 6 to 8 inches by adding a water reducer or superplasticizer.

■ Reduce aggregate size. If closely spaced reinforcement or other obstacles hinder concrete flow, consider reducing coarse-aggregate size below the maximum allowed by ACI 318-99, "Building Code Requirements for Structural Concrete." Such a change requires an overall review of mix proportions.

■ Control setting rate. Slow placement rates and high ambient and concrete temperatures can cause concrete to stiffen, reducing its flowability. Adding a retarder may help, but retarders don't necessarily prevent slump loss.

Forming and rebar placement:

■ Review reinforcement details. Closely spaced rebar, insufficient clearance between the rebar and forms, and closely spaced lap splices all interfere with concrete flow and vibration. Work with the steel detailer to minimize these problems.

■ Provide access to forms. Narrow or tall forms prevent observation and access during concrete placement. Consider reducing lift heights or using flexible tremie hose. You may have to cut placing ports into forms containing heavily reinforced sections.

■ Build tight form joints. Mortar loss through form joints may cause honeycomb, particularly with wetter mixes. Tighten or tape form joints as necessary.


Voids

Concrete placement:

■ Vibrate properly. Workers must be trained to vibrate concrete correctly to ensure that it flows around reinforcing steel, embedments, and blockouts.

■ Ensure flow under blockouts. Build up a head of concrete on one side of small blockouts, and vibrate the concrete until it appears on the other side. Large blockouts require concrete to flow many feet laterally, so you may need to use pour pockets beneath these blockouts. Drill holes in the bottom of a blockout to allow displaced air to escape.

■ Avoid delays. If the placement is not going as fast as planned, ready-mix trucks may have to wait before discharging material and the concrete will start to stiffen. You can reduce stiffening by using retarding admixtures, but a better approach is to alert the concrete producer when unavoidable placing delays occur.

References

"Guide to Consolidation of Concrete in Congested Areas," ACI 309.R-92, American Concrete Institute, Farmington Hills, Mich., 1992.

Bruce Suprenant and Kim Basham, "Placing and Vibrating Poured Concrete Walls," CONCRETE CONSTRUCTION, February 1993, pp. 131–134.