

A Look at the Effects of Nonstandard Cylinder Strength Testing

The concrete industry relies heavily on the results of concrete compressive strength tests to determine specification compliance or to allow construction activities such as form removal or post-tensioning to take place. While testing the strength of concrete is a simple test and controlled by an ASTM standard, the measured results are very much dependent upon adhering strictly to the ASTM procedures. Violation of these procedures can lead to inaccurate results.

Fortunately, Richardson (“Review of Variables That Influence Measured Concrete Compressive Strength”, ASCE Journal of Materials Engineering, May 1991) was able to quantify the effect of nonstandard cylinder testing on the measured strength and summarized it into a Table. The background for this Table information can be found in Richardson’s paper and can be purchased for \$30 at <https://ascelibrary.org/doi/abs/10.1061/%28ASCE%290899-1561%281991%293%3A2%2895%29>. Next time a measured cylinder strength is reported low, consider if one of more of these variables might have reduced that strength.

TABLE 1. Measured Strength Reduction by Nonstandard Conditions

Variable (1)	Strength loss (%) (2)	Lab (L) or field (F) (3)
Convex ends	up to 75	L
Insufficient consolidation	up to 61	F
Immediate freezing for 24 hours	up to 56	F
Rubber cap, no restraint	up to 53	L
Weak, soft capping compound	up to 43	L
Flat particle vertical orientation	up to 40	F
Concave ends	up to 30	L
Rough end before capping	up to 27	F
Seven days in field, warm temperature	up to 26	F
Reuse of plastic molds	up to 22	L
Cardboard mold	up to 21	F
Seven days in field at 73° F, no added moisture	up to 18	F
Plastic mold	up to 14	F
Rough end, air gaps under cap	up to 12	F
Convex end, capped	up to 12	F
Eccentric loading	up to 12	L
Out-of-round diameter	up to 10	F
Ends not perpendicular to axis	up to 8	F
Rough handling	up to 7	F
Three days at 37° F, mixed at 73° F	up to 7	F
One day at 37° F, mixed at 46° F	up to 7	F
Excessive tapping	up to 6	F
Thick cap	up to 6	L
Sloped end, leveled by cap	up to 5	F
Wet mix subjected to vibrations	up to 5	F
Chipped cap	up to 4	L
Rebar rodding	up to 2	F
Insufficient cap cure	up to 2	L
Slick end cap	up to 2	L
Slow loading rate	up to 2	L