



What is the minimum required compressive strength for concrete masonry?

With the latest edition of the *Specification for Masonry Structures* (TMS 602-13/ACI 530.1-13/ASCE 6-13) in conjunction with the *Building Code Requirements for Masonry Structures* (TMS 402-13/ACI 530-13/ASCE 5-13) came a change of marked significance to the concrete masonry industry. For decades designers have been afforded two methods for qualifying the compressive strength of masonry assemblies. Those two forms of conformance have either been testing prisms (either prisms constructed at the jobsite or prisms removed from existing masonry) to evaluate compressive strength or the Unit Strength Method. The latter is typically the preferred method for many projects due to a relatively quick and easy process with minimal cost implications. While simple and convenient, the unit strength method has long been recognized as the more conservative of the two options.

What is the Unit Strength Method?

The unit strength method was developed utilizing compressive strength testing data compiled from as early as the 1950s on through the 1980s. Simply put, the resulting method derived from test data determined the overall assembly compressive strength based on the individual unit strength and the type of mortar to be used in design.

What has changed?

For years the unit strength method table published in TMS 602 had remained unchanged and relied upon the original historical data set. Realizing the restrictive conservatism in design values, a research project [1] was initiated to compile a new data set reflecting current test methods and material properties. This research in turn was adopted into the 2013 edition of TMS 402/602 as shown in the following table, which illustrates the correlation between unit compressive strength, mortar type, and assembly compressive strength.

Table 2 — Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction

Net area compressive strength of concrete masonry, psi (MPa)	Net area compressive strength of concrete masonry units, psi (MPa)	
	Type M or S mortar	Type N mortar
1,700 (11.72)	---	1,900 (13.10)
1,900 (13.10)	1,900 (13.10)	2,350 (14.82)
2,000 (13.79)	2,000 (13.79)	2,650 (18.27)
2,250 (15.51)	2,600 (17.93)	3,400 (23.44)
2,500 (17.24)	3,250 (22.41)	4,350 (28.96)
2,750 (18.96)	3,900 (26.89)	----
3,000 (20.69)	4,500 (31.03)	----

¹For units of less than 4 in. (102 mm) nominal height, use 85 percent of the values listed.

Increasing the final design strength of masonry assemblies has not been the only recent change. In 2014, ASTM C90 was revised to increase the minimum compressive strength of a unit from 1900 psi (13.1 MPa) to 2000 psi (13.8 MPa). When using the recalibrated unit strength table above, a concrete masonry unit complying with the minimum requirements of ASTM C90 and laid in Type S or M mortar produces an assembly compressive strength of 2,000 psi (13.8 MPa), which is substantially larger than

the historical default minimum of 1,500 psi (10.3 MPa) used for the specified compressive strength of concrete masonry.

TABLE 2 Strength, Absorption, and Density Classification Requirements

Density Classification	Oven-Dry Density of Concrete, lb/ft ³ (kg/m ³)		Maximum Water Absorption, lb/ft ³ (kg/m ³)		Minimum Net Area Compressive Strength, lb/in ² (MPa)	
	Average of 3 Units		Average of 3 Units	Individual Units	Average of 3 Units	Individual Units
	Lightweight	Less than 105 (1680)		18 (288)	20 (320)	2000 (13.8)
Medium Weight	105 to less than 125 (1680–2000)		15 (240)	17 (272)	2000 (13.8)	1800 (12.4)
Normal Weight	125 (2000) or more		13 (208)	15 (240)	2000 (13.8)	1800 (12.4)

How will these changes affect me?

With increases to not only unit strength and overall assembly compressive strength, concrete masonry can remain positioned competitively amongst other building materials used in building construction. Production of units remains virtually unchanged. The increase in strengths stem from reducing uncertainty in the data used to develop these design values and verifying strengths already present in contemporary concrete masonry units.

References

1. *Recalibration of the Unit Strength Method for Verifying Compliance with the Specified Compressive Strength of Concrete Masonry*, MR37, National Concrete Masonry Association, 2012. (www.ncma.org)
2. *Standard Specification for Loadbearing Concrete Masonry Units*, ASTM C90-14. ASTM International, 2014.