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WHAT IS THE MINIMUM REQUIRED COMPRESSIVE STRENGTH FOR CONCRETE MASONRY?

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 (those 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. The unit strength method underwent a significant revision for the 2013 version of the Specification for Masonry Structures (TMS 602-13/ACI 530.1-13/ASCE 6-13) and Building Code Requirements for Masonry Structures (TMS 402-13/ACI 530/ASCE 5-13) [1]. This change is also reflected in subsequent versions of TMS 402/602 in 2016 and 2022.

WHAT IS THE UNIT STRENGTH METHOD?

The unit strength method was developed utilizing compressive strength testing data compiled from research as early as the 1950s up to 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 [2] 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 and is contained in the more recent 2016 and 2022 versions. The unit strength method from the 2022 TMS 402 is shown in Table 1, which illustrates the correlation between unit compressive strength, mortar type, and assembly compressive strength.

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) that is reflected in C90-22 [3]. When using the recalibrated unit strength table, 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) common in earlier version of the code.

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.

Revised June 30, 2023

Table 1—Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction (Ref TMS 602)

Net area compressive strength of concrete masonry, psi(MPa) ¹	Net area compressive strength of ASTM C90 concrete masonry units, psi(MPa)	
	Type M or S mortar	Type N mortar
1,750 (12.07)	---	2,000 (13.79)
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.

REFERENCES

1. Building Code Requirements and Specification for Masonry Structures, TMS 402 and TMS 602, The Masonry Society 2013, 2016, and 2022 versions, www.masonrysociety.org.
2. 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)
3. Standard Specification for Loadbearing Concrete Masonry Units, ASTM C90-22. ASTM International, 2022, www.astm.org.

ABOUT CMHA

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