

January 10, 2022

Mr. Art Ludwig
Quail Springs ("Client")
35070 California 33
Maricopa, California 93252

RE: ENGINEERING EVALUATION OF ASTM E119 TESTING OF MONO-DENSITY COB WALL ASSEMBLY (PROJECT NO. QS032921-80)

Dear Mr. Ludwig:

An engineering evaluation has been performed regarding ASTM E119 testing of a Mono-Density Cob Wall Assembly and the allowance for a superimposed load rating for the fire-resistance rated assembly, other than the superimposed load tested and reported in ICC NTA Test Report QS032921-80, dated December 16, 2021.

The allowance shall justify the intended superimposed load that was client-specified based on the performance of the testing to ASTM E119, as well as additional compressive load testing performed post-fire and hose stream test.

This evaluation aims to provide evidence and render sound engineering judgements to justify the allowance of the client's originally intended superimposed load of 1,875 plf in lieu of the superimposed load rating tested and reported in ICC NTA Test Report QS032921-80.

Description:

The Mono-Density Cob Wall Assembly consisted of a singular density cob type material (composed of a combination of soil and straw) and constructed in accordance with ASTM E119, as detailed in ICC NTA Test Report QS032921-80.

Prior to the testing of the wall assembly, the client requested a superimposed load of 1,875 plf (pounds per linear foot) be applied during the testing, however, due to an incorrect calculation of the hydraulic pressure to be applied, the superimposed load resulted in a reduced superimposed load of 25 plf. The assembly was tested for the 2-hour fire resistance period and subsequently tested under hose stream in accordance with ASTM E2226. The wall assembly met the conditions of acceptance per ASTM E119 Section 8.2.4, thus passing the testing for the 2-hour fire-resistance rated wall assembly under a restricted load condition in accordance with ASTM E119.

Additionally, approximately 3 hours after the hose stream testing was completed and the wall assembly had cooled, it was tested to a superimposed load of 66,818 lbs. (or 6,682 plf based on the 10-foot length of the test specimen) per client request. It is important to note that ASTM E119 Commentary Section X5.8.3 is no longer a requirement, however, the data obtained by testing can be used to support the validity of the rated superimposed load.

Evaluation:

The justification for the allowance of a greater superimposed load rating than what was applied during the fire testing is based on the performance of the wall assembly under the additional compressive load testing performed post-fire and hose stream tests. Per ASTM E119 Commentary Section X5.8.3, "loadbearing walls and partitions also sustain twice the specified superimposed test load after cooling but within 72 h of the test period...". Based on this commentary, an applied ultimate superimposed load of 66,818 lbs. (or 6,682 plf based on the 10-foot length of the test specimen) would correspond to a specified superimposed test load of approximately 33,409 lbs. (or 3,341 plf), as shown in the following table.



Compressive Loading (Post Fire & Hose Stream Testing)	
Hydraulic Pressure Applied for each Actuator (<i>psig</i>)	2350
No. of Actuators	3
Actuator Effective Area (<i>sq. inches</i>)	11.04
Ultimate Applied Load by all Actuators (<i>lbs.</i>)	77,832
Dead Load - Estimated Weight of Wall (<i>lbs.</i>)	8,408
Dead Load - Weight of Load Beam & Bricks (<i>lbs.</i>)	2,606
Weight of Top Beam (<i>lbs.</i>)	207
Ultimate Superimposed Load (<i>lbs.</i>)	66,818
Specified Superimposed Test Load (<i>lbs.</i>)	33,409
Wall Length (<i>feet</i>)	10
Specified Superimposed Load per Wall Length (<i>plf</i>)	3,341

$$\text{Specified Superimposed Test Load} = \text{Ultimate Superimposed Load} / 2$$

It is understood that the allowance of the 3,341 plf superimposed load rating on the 2-hour fire-resistance rated assembly cannot be justified solely on the compressive load testing performed post-fire and hose stream test. However, instead of using 50% of the ultimate superimposed load from the additional compressive load testing, the intended superimposed load of 1875 plf would be 28% of the ultimate superimposed load.

The allowance of the 1,875 plf superimposed load (instead of the 25 plf superimposed load applied during the fire resistance testing and reported in ICC NTA Test Report QS032921-80) is justified based on the load-carrying capability of the wall post-fire and hose stream testing and the conservative justification described herein.

Conclusion:

It is my professional opinion that the allowance for the 1,875 plf superimposed load rating in the 2-hour fire-resistance rating of the Mono-Density Cob Wall Assembly, in lieu of the superimposed load rating tested and reported in ICC NTA Test Report QS032921-80, is justified based on the evidence provided in this evaluation.

My opinions are based upon a careful review of applicable test reports and data which was limited to guidance that was available at the time this evaluation was rendered. Consequently, if at a later time additional information is provided regarding the items used for this review, I reserve the right to adjust the findings of my review accordingly.

If you have any questions or comments regarding this matter, please contact me at your convenience at (574) 773-7975.

Prepared by:

Reviewed by:

Luke R. Snyder, P.E.
Evaluation Engineer
ICC NTA, LLC

Michael E. Luna
Sr. Director of Building Products
ICC NTA, LLC

Referenced Documents:

1. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
2. ICC NTA Test Report for ASTM E119 Fire Resistance Performance – Mono-Density Cob Wall (ICC NTA Test Report No. QS032921-80). Report dated December 16, 2021.